Proceedings of XXX Workshop

ICAR-All India Coordinated Research Project on Spices

14-16 NOVEMBER 2019

Tamil Nadu Agricultural University,
Coimbatore

ICAR-ALL INDIA COORDINATED RESEARCH PROJECT ON SPICES
INDIAN INSTITUTE OF SPICES RESEARCH
Kozhikode - 673012, Kerala

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Tamil Nadu Agricultural University, Coimbatore, Tamil Nadu

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

December 2019

Complied & edited by

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XXX Workshop of ICAR-All India Coordinated Research Project on Spices

Date: 14 – 16 November 2019 (13 November - Pre workshop meeting)

Organized by: TNAU, Coimbatore & ICAR-AICRPS

14 November 2019

Venue: Anna Auditorium, TNAU

INAUGURAL SESSION

Rapporteurs: 1. Dr. Ravinder Singh, ICAR-NRCSS, Ajmer
2. Dr. P. Umadevi, ICAR-IISR, Kozhikode

Registration : 08.30-09.30 am

Inauguration : 10.00 am – 11.15 am

10.00 am – 10.03 am	Invocation	
10.03 am – 10.05am	ICAR song	
10.05 am - 10.10 am	Welcome address	**Dr. K. S. Subramanian** Director of Research TNAU, Coimbatore
10.10 am- 10.15 am	Co-ordinator's report	**Dr. K. Nirmal Babu** Project Co-ordinator (Spices) ICAR-IISR, Kozhikode
10.15 am - 10.25 am	Address by guest of Honour	**Dr. T. Janakiram** Asst. Director General (HS II) ICAR, New Delhi
10.25 am - 10.40 am	Felicitations	**Dr. Homey Cheriyan** Director, DASD Kozhikode **Dr. Gopal Lal** Director ICAR-NRC on Seed Spices, Ajmer
10.40 am – 10.50 am	Presidential address	**Dr. N. Kumar** Vice-chancellor TNAU, Coimbatore
11.10 am - 11.15 am	Vote of Thanks	**Dr. L. Pugalendhi** Dean (Hort.), HC&RI TNAU, Coimbatore

14 November 2019

SESSION I : Genetic Resources & Crop Improvement	**11.30 am - 4.00 pm**

Chairpersons: 1. Dr. A.H. Prakash, Project Co-ordinator, AICRP on Cotton, Coimbatore
2. Dr. J. Rema, Head, Division of CI&B, ICAR-IISR, Kozhikode
3. Dr. Dhirendra Singh, Sr. Breeder, SKNAU, Jobner

Rapporteurs: 1. Dr. Ashuthosh Gautam, ICRI Regional Station, Gangtok
2. Dr. M.S. Shivakumar, ICAR-IISR, Kozhikode

Presentations:

1	Black pepper	Dr. P. M. Ajith, Pepper Research Station, Panniyur
2	Large cardamom	Dr. Ashuthosh Goutam, ICRI Regional Station, Gangtok
3	Small cardamom	Dr. K. Pradip Kumar, ICRI Regional Station, Myladumpara
4	Ginger	Dr. Parshuram Sial, High Altitude Research Station, Pottangi
5	Turmeric	Dr. B. Senthamizh Selvi, TNAU, Coimbatore
6	Tree spices	Dr. J.P. Devmore, Dr. BSKKV, Dapoli
7	Coriander	Dr. K. Giridhar, Dr. YSRHU, Guntur
8	Cumin	Dr. Surabhi S Chauhan, SDAU, Jagudan
9	Fennel	Dr. R.S. Meena, ICAR-NRCSS, Ajmer
10	Fenugreek	Dr. K. Giridhar, Dr. YSRHU, Guntur
11	Ajwain	Dr. R.S. Meena, ICAR-NRCSS, Ajmer
12	Nigella	Dr. Anupam Pariari, BCKV, Mohanpur

Project Mode centres:

1	Nutmeg	Dr. Mini Raj, KAU, Vellanikkara
2	Saffron	Dr. M.H. Khan, Sher-e-Kashmir University of Agricultural Science and Technology, Kashmir

15 November 2019

SESSION II : Variety Release	**10.00 AM–12.00 PM**

Chairpersons : 1.Dr. T. Janakiram, Asst. Director General (HS), ICAR, New Delhi
2. Dr. Homey Cheriyan, Director, DASD, Calicut

Rapporteurs : 1. Dr. S. S. Meena, ICAR-NRCSS, Ajmer
2. Dr. M.S. Shivakumar, ICAR-IISR RS, Appangala

Sl. No.	Crop	Name of the variety	Organization
1.	Fennel	RF-290	SKNAU, Jobner
2.	Ajwain	Ajmer Ajwain-73	ICAR-NRCSS, Ajmer
3.	Nigella	Ajmer nigella-1	ICAR-NRCSS, Ajmer
4.	Fenugreek	HM-257	CCSHAU, Hisar
5.	Ajwain	LS 14-3	YSR HU, Guntur

15 November 2019

SESSION III : Transfer of Technology	**12.00 PM – 1.30 PM**

Chairpersons: 1. Dr. Homey Cheriyan, Director, DASD, Calicut
2. Dr. Hameed Khan, Former Project Coordinator, Palms

Rapporteurs: Dr. M. Alagupalamuthirsolai, ICAR-IISR, Kozhikode
Mr. A Prashantha, Assistant Professor, UAS, Sirsi

Name of the technology proposed and centre

1 Biological management of root mealy bug in black pepper (Panniyur centre)

2 Black pepper based mixed cropping system in the initial years of plantation (Dapoli centre)

3 Biological management of slow decline in black pepper (Dapoli centre)

4 Technology for the management of bacterial wilt in ginger caused by *Ralstonia pseudosolanacearum* (ICAR-IISR, Calicut)

5 Response of coriander varieties to various levels of fertilizer management under different cutting management (Jagudan centre)

6 Bio efficacy of various molecules of insecticides against coriander aphid (*Hydaphis coriandri* (Das) (Jagudan centre)

7 Micro irrigation and fertigation management in cumin (Jobner)

8 Management of coriander powdery mildew using new generation fungicides (Jobner)

9 Organic nutrients and pest management in cumin (Jobner)

10 Bio-efficacy of newer molecules of insecticides against cumin aphid (Jobner)

15 November 2019

SESSION IV :	**Crop Management**	**2.30 PM –4.30 PM**

Chairpersons: 1. Dr H.P. Maheshwarappa, Project Coordinator, Palms, ICAR-CPCRI, Kasaragod
2. Dr. S.J. Anke Gowda, Principal Scientist & Head, ICAR-IISR RS, Appangala
3. Dr. C. K. Thankamani, Head, Crop Production & PHT, ICAR-IISR

Rapporteurs: 1. Dr. V. Sivakumar, Dr. Y.S.R.H.U, Chintapalle
2. Dr. K. Giridhar, Dr. YSRHU, Guntur

Presentations:

1	Black pepper	Dr. M. Shivaprasad, ZAHRS (UAHS), Mudigere
2	Ginger	Dr. V. Sivakumar, Dr. YSRHU, Chintapalle
3	Turmeric	Dr. B. Mahender, SKLTSHU, Kammarpally
4	Coriander	Dr. T. P. Malik, CCSHAU, Hisar
5	Cumin	Dr. A. C. Shivran, SKNAU, Jobner
6	Saffron	Dr. M.H. Khan, Sher-e-Kashmir University of Agricultural Science and Technology, Kashmir

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SESSION IV :	**Crop Protection**	**4.30 PM-6.30 PM**

Chairpersons: 1. Dr. Santhosh J. Eapen, Head, Crop Protection, ICAR-IISR, Kozhikode
2. Dr. Krishna Kant, Principal Scientist, ICAR-NRCSS, Ajmer

Rapporteurs: 1. Dr. R. Praveena, ICAR-IISR, Kozhikode
2. Dr. Meenu Gupta, Dr. YSPUHF, Solan

Presentations:

1	Black pepper	Dr C.K. Yamini Varma, PRS, Panniyur
2	Small cardamom	Dr. K. A. Saju, ICRI, Myladumpara
3	Large cardamom	Dr. R. Chandramani Raj, ICAR , Gangtok
4	Ginger	Dr. Meenu Gupta, Dr. YSPUHF, Solan
5	Turmeric	Dr. S. Sundravadana, TNAU, Coimbatore
6	Coriander	Dr. Ajit Kumar Singh, IGKV, Raigarh
7	Cumin	Dr. N.R. Patel, SDAU, Jagudan

16 November 2019

SESSION VI	Plenary Session	10.00 AM – 12.30 PM

Chairpersons:

Dr. N. Kumar, Vice-Chancellor, TNAU, Coimbatore
Dr. P. Rethinam, Former Director, ICAR-IIOPR and Former ADG (Hort)
Dr. T. Janakiram, Asst. Director General (HS), ICAR, New Delhi

Rapporteurs : Dr. Anamika Debnath, UBKV, Pundibari
Dr. K. A. Saju, ICRI, Myladumpara

10.00 am	Presentation by Rapporteurs of different sessions	
10.30 am	Presentation of new trials	**Dr. K. Nirmal Babu** Project Co-ordinator, AICRPS
11.15 am	Address by the Chairpersons	**Dr. N. Kumar** Vice-Chancellor TNAU, Coimbatore **Dr. P. Rethinam** Former Director ICAR-IIOPR & Former ADG (Hort.) **Dr. T. Janakiram** Asst. Director General (HS) ICAR, New Delhi
12.15 pm	Vote of Thanks	**Dr. K. S. Krishnamurthy** Principal Scientist ICAR-IISR, Kozhikode
	National Anthem	

INAUGURAL SESSION

The XXX Workshop of All India Coordinated Research Project on Spices held at Tamil Nadu Agricultural University, Coimbatore was inaugurated by Dr T. Janakiram, ADG (Hort. Sci.) ICAR, New Delhi. Dr. K.S. Subramanian, Director of Research, TNAU, Coimbatore welcomed the gathering. Dr. K. Nirmal Babu, Director, ICAR-IISR & Project Coordinator (Spices), Kozhikode in his Co-ordinator's report highlighted that, the focus to be given for high value compounds present in spices & value addition in spices. Dr N. Kumar, Hon'ble Vice-Chancellor, TNAU presided over the function and in his presidential address, he opined that the productivity of spices can be increased with little modification in cultivation practices and adoption of scientific practices. He emphasized the need for the introduction of novel breeding strategies such as speed breeding to develop elite hybrids in spices, he also pointed that the selection techniques should not be the ideal way for varietal development. He suggested to strengthen the organic production of spices, as the demand for the organic spices are high in the market. The high density planting, post harvest handling and the exploitation of possibilities to get the GI tag for important spices to compete with the world market.

The chief guest, Dr. T. Janakiram, ADG (HS II) ICAR, New Delhi emphasized the identification of technologies to achieve doubling farmers' income & revisiting the mandate of spices AICRP to avoid repetition in progress among the centers. He also insisted to explore the off season market avenues for spices.

During the inaugural session 8 publications were released from various centers and felicitation of retired scientists was also done. Dr. Homey Cheriyan, Director, DASD was the guest of honor in the function In his address, he insisted the need for strengthening the exports with quality spices & percolation of technologies to the farmers. Dr. Gopal Lal, Director, NRCSS, Ajmer in his special address mentioned that there are 27 varieties of seed spices were released from NRCSS, and the development of elite, quality spices will continue. The inaugural session came to an end with the vote of thanks by Dr. L. Pugalendhi, Dean (Hort) HC & RI, TNAU, Coimbatore.

TECHNICAL SESSION: I

GENETIC RESOURCES AND CROP IMPROVEMENT

General recommendations

- Compiled/pooled data of all location should be presented.
- Coding of entries has to be made compulsory
- Proposal for release at national level should go through PC, AICRPS.
- Unique type must be registered with NBPGR
- Scientific confirmation has to be done before claiming any resistance/tolerance.

Black pepper

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

- Promising accession may be included in trial

PEP/CI/2.1 Inter-varietal hybridization to evolve high yielding varieties

- Hybridization should be taken up at institute level and promising results may be brought at AICRPS.

PEP/CI/2.2 Hybridization to evolve varieties tolerant to biotic and abiotic stresses

- Scientific confirmation has to be done before claiming any resistance/tolerance.

PEP/CI/3.3 CVT 2006 - Series VI

- Identification of genotypes (numbers) for release as varieties in next five years. Piperine content (7-8%) need to confirmed at IISR

Large cardamom

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

- Priority of Gangtok is to provide mother planting material.
- Quality analysis of promising lines need to be done.
- Registration of unique lines (long peduncle and green capsule).

Small cardamom

CAR/CI/2.2 Evaluation of promising small cardamom (*Elettaria cardamom* L. Maton) cultivars/varieties for organic cultivation in the high ranges of Idukki district

- Project may be closed and final report has to be submitted to PC Unit.

CAR/CI/3.7 CVT of drought tolerance in Cardamom – Series VII

- One more year confirmation under drought is needed before release proposal

Turmeric

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

- Unique types may be registered with NBPGR

TUR/CI/2.6 - CVT on Turmeric – 2016

- Curcumin % of accessions in trial may be verified at IISR and Spices Board.
- Project may be closed and final report has to be submitted to PC Unit.

TUR/CI/3.7 - Initial Evaluation Trial 2015

- Three years data from Pottangi and Pundibari may be pooled and best two varieties may be taken for new CVT with other centres and IISR.

TUR/CI/3.8 - Initial Evaluation Trial 2016

- Project may be closed and final report has to be submitted to PC Unit.

Tree spices

TSP/CI/1.1 - Germplasm collection, characterization, evaluation and conservation of clove, nutmeg and cinnamon

- SV -3 has to be sent for state release.

TSP/CI/2.2 - CVT 2001-Nutmeg

- Proposal for release of A9-150 may be drafted in consultation of IISR.

TSP/CI/2.2 - Coordinated Varietal Trial on farmer's varieties of Nutmeg

- In-situ data to be recorded for release under participatory approach.

Coriander

- Faizabad, Dholi and Kota are hot spot for disease so may be included in screening for stem gall and Jagudan for powdery mildew screening.

Cumin

- Mutation breeding may be taken up for creating variability.
- GC-4 and GC-5 may be checked for disease tolerance and GC-4 may be purified.
- A blight tolerant line may be developed.

Fennel

FNL/CI/3.5 Initial Evaluation Trial 2015

- The programme may be concluded and final report has to be submitted to PC Unit.
- A new CVT may be initiated

Fenugreek

FGK/CI/1.3 - Identification of drought tolerance source in fenugreek

- The drought tolerant lines may be registered with NBPGR

Ajwain

AJN/CI/2.1 Coordinated Varietal Trial of ajwain 2016

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

Nigella

NGL/CI/2.1 Coordinated Varietal Trial of nigella 2016

- The programme may be concluded and final report has to be submitted to PC Unit

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, Sirsi, Panniyur, Pundibari, 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/3.5	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
PEP/CI/3.7	CVT 2018 on black pepper - Series IX	Ambalavayal, Chintapalle, Sirsi, Panniyur, Kozhikode, Dapoli, Yercaud	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 (*Elettaria cardamomum* L. Maton) cultivars / varieties for organic cultivation in the high ranges of Idukki district	Pampadumpara	Concluded
CAR/CI/3	**Coordinated Varietal Trial**		
CAR/CI/3.7	CVT of drought tolerance in cardamom – Series VII	Appangala, Mudigere, Sakaleshapur, Myladumpara Pampadumpara	Continued
CAR/CI/3.8	CVT 2015 on Farmers varieties of cardamom-Series VIII	Appangala, Mudigere, Pampadumpara, Sakleshpur Myladumpara,	Continued

CAR/CI/3.9	CVT on hybrids of small cardamom-2018 – Series IX	Appangala, Mudigere, Sakaleshapura, Myladumpara,	Continued
CAR/CI/4	**Varietal Evaluation Trial (VET)**		
CAR/ CI/4.3	Initial Evaluation Trial – 2012	Pampadumpara	Continued
CAR/CI/4.4	Multi Location Evaluation of thrips tolerant cardamom lines	Appangala, 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/2.5	CVT on disease tolerance in ginger	Barapani, Chintapalle, Kozhikode, Pundibari, Pottangi, Nagaland,	Continued
GIN/CI/3	**Varietal Evaluation Trial**		
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
GIN/CI/4.3	Evaluation of genotypes of ginger for vegetable purpose (observational trial)	Kozhikode, Mizoram, Gangtok, Chintapalle, Pottangi, Pundibari, Nagaland	Continued
Turmeric			
TUR/CI/1	**Genetic Resources**		
TUR/CI/1.1	Germplasm collection, characterization, evaluation and conservation	Barapani, Coimbatore, Dholi, Guntur, Kammarpally, Kumarganj, Solan Pasighat, Pottangi, Pundibari, Raigarh	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	Concluded
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	Concluded
TUR/CI/3.9	Initial Evaluation Trial 2018	Guntur	Continued
TUR/CI/2.7	CVT on mango ginger	Ambalavayal, Pottangi, Kozhikode, Dholi, Barapani, Pundibari, Raigarh, Navsari	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/2.4	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/2	**Coordinated Varietal Trial**		
COR/CI/2.7	Coordinated Varietal Trial on coriander 2018-Series X	Ajmer, Coimbatore, Dholi, Guntur, Hisar, Jabalpur, Kota, Jagudan, Jobner, Kumarganj, Navsari, Pantnagar, Raigarh	Continued
COR/CI/3	**Varietal Evaluation Trial**		
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/1.3	Identification of drought tolerance	Jobner	Continued
CUM/CI/2	**Coordinated Varietal Trial**		
CUM/CI/2.4	Coordinated Varietal Trial – 2017	Ajmer, Jagudan, Jobner, Mandor	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/2	**Coordinated Varietal Trial**		
FNL/CI/2.7	Coordinated Varietal Trial on Fennel 2018 – Series X	Ajmer, Dholi, Hisar, Jabalpur, Jagudan, Jobner, Kumarganj, Pantnagar	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/1.3	Identification of drought tolerance source in fenugreek	Jobner	Continued
FGK/CI/2	**Coordinated Varietal Trial**		
FGK/CI/2.4	Coordinated Varietal Trial of fenugreek 2018 – Series X	Ajmer, Coimbatore, Dholi, Guntur, Hisar, Jagudan, Jabalpur, Jobner, Kumarganj, Pantnagar, Navsari, Raigarh, Kota	Concluded
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
Ajwain			
AJN/CI/2	**Coordinated Varietal Trial**		
AJN/CI/2.1	Coordinated Varietal Trial-2016	Ajmer, Guntur, Hisar, Jobner, Jagudan, Kumarganj, Raigarh	Concluded
Nigella			
NGL/CI/2	**Coordinated Varietal Trial**		
NGL/CI/2.1	Coordinated Varietal Trial-2016	Ajmer, Hisar, Kota, Kalyani, Kumarganj, Raigarh, Pantnagar	Concluded
Saffron			
Project mode	Conservation, evaluation and utilization of exotic and indigenous saffron germplasm lines	Pampore	Continued
Kalazeera			
Project mode	Exploration, collection and conservation of kalazeera from high altitudes of northern Himalayas	Pampore	Continued

TECHNICAL SESSION II
VARIETY RELEASE

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

Sl. No.	Crop	Name of the variety	Organization
1.	Fennel	RF-290	SKNAU, Jobner
2.	Ajwain	Ajmer Ajwain-73	ICAR-NRCSS, Ajmer
3.	Nigella	Ajmer Nigella-1	ICAR-NRCSS, Ajmer
4.	Fenugreek	HM-257	CCSHAU, Hisar
5.	Ajwain	LS 14-3	YSR HU, Guntur

General recommendations:

- List of varieties released in particular crop and their salient features must be studied before submitting the proposal.
- Detailed information on breeding methods and evolution of variety must be included in proposal.
- Role of developers and collaborators should be mention clearly in the proposal.
- All persons involved in varietal release should sign in varietal release proposal.
- Trails must be taken up in disease hotspots area or should be screened artificially for claiming resistance and certificate from pathologist/entomologist must be obtained for claiming resistance in variety release.
- Stability analysis should be made compulsory for all CVT data.
- Varietal release proposal should reach PC cell one month before the workshop

The recommendations of the committee is as follows

1. Crop: Fennel
Variety: **RF-290**
Centre: SKNAU, Jobner

Recommended for release in states of Rajasthan, Gujarat, Bihar, Haryana and Uttar Pradesh

- Line diagram (detailed description) for recurrent selection must be included.
- Photographs must be of high resolution and depict the important features.

2. Crop: Ajwain
Variety: **Ajmer Ajwain-73**
Centre: ICAR-NRCSS, Ajmer

Recommended for Rajasthan, Gujarat, Chhattisgarh, Haryana Andhra Pradesh and Uttar Pradesh

- Multiplication trial data should be provided in varietal release proposal.
- Detailed description of breeding method- mass selection should be included in proposal.

- Quality analysis parameters must be included in proposal.
- Molecular profiling- DNA fingerprinting must be included in proposal.

3. Crop: Nigella
Variety: **Ajmer Nigella-1**
Centre: ICAR-NRCSS, Ajmer

Recommended for Rajasthan, Chhattisgarh, Haryana West Bengal, Uttarkand and Uttar pradesh

- Recommended for release as it is identified as high yielding by considering IET data along with CVT data
- IET data should be included in proposal.
- Detailed description of breeding method- mass selection should be included in proposal.
- Molecular profiling- DNA fingerprinting must be included in proposal.

4. Crop: Fenugreek
Variety: **HM-257**
Centre: CCSHAU, Hisar

Not recommended because of following reasons

- Data submitted for claiming resistance is not sufficient, hence it is recommended to resubmit the proposal with additional data for resistance and application is not submitted through proper channel.

5. Crop: Ajwain
Variety: **Ajwain LS 14-3**
Centre: YSR HU, Guntur

Not recommended because of following reasons

- The oil content data of all entries in CVT across locations need to be provided.
- For claiming variety for rainfed condition- support with meteorological (rainfall) data.
- Photographs must be included in proposal.
- Application must be submitted through proper channel.

TECHNICAL SESSION III

TRANSFER OF TECHNOLOGY

General recommendations

- All the technologies identified may be demonstrated through KVKs of the respective regions for adoption.
- The approved technologies are to be incorporated in the package of practices of the state.
- The recommended technologies must be prepared in a brochure form covering application methodology, preparation of materials/chemicals, ingredients and sources of availability in detail and submitted to PC cell.

Technologies proposed with recommendations

1 Biological management of root mealy bug in black pepper (Panniyur)

- It is a recommended technology by KAU, hence need not be presented in AICRPS

2 Black pepper based mixed cropping system in the initial years of plantation (Dapoli)

- Due to insufficient data on impact on main crop (black pepper), the technology is not recommended.

3 Biological management of slow decline in black pepper (Dapoli)

- Since IISR-6 strain is not available, it is suggested to use other *Pseudomonas* strain and not recommended to use IISR-6 strain.

4 Technology for the management of bacterial wilt in ginger caused by *Ralstonia pseudosolanacearum* (Calicut)

- The technology is recommended for control of *Ralstonia* wilt in ginger

5 Response of coriander varieties to various levels of fertilizer management under different cutting management (Jagudan)

- The technology is recommended and may be included in package of practices of Gujarat Agricultural University and the title may be modified suitably.

6 Bio efficacy of various molecules of insecticides against coriander aphid (*Hydaphis coriandri* (Das) (Jagudan)

- Suggested to test in minimum three locations
- The data on pesticide residue need to be collected

7 Micro irrigation and fertigation management in cumin (Jobner)

- The technology is recommended
- Simplify irrigation schedule from farmers point of view and calculate the amount of water required (litres) for every month/location.

8 Management of coriander powdery mildew using new generation fungicides (Jobner)

- The technology may be recommended after the pooled analysis

9 Organic nutrients and pest management in cumin (Jobner)

- Recommended as technology with following suggestions
- Title may be rephrased with respect to the aim and results of the experiment
- Recommendation may be modified as suggested

10 Bio-efficacy of newer molecules of insecticides against cumin aphid (Jobner)

- The experiment has to be evaluated in multi location

TECHNICAL SESSION IV

CROP MANAGEMENT

General recommendations

- Soil and quality analysis data may be included in all nutrient management trials.
- The centres should restrict to the treatments as per the approved technical programme without deviation.
- New trials in crop management are to be formulated in cumin and fenugreek jointly by Jobner, Jagudan and ICAR-NRC on Seed spices centres.

Black pepper

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

- Economics may be included for each treatment.
- Growth and yield parameters should be recorded for black pepper.
- Performance of crops in mixed cropping system may be verified by the Scientists, ICAR-IISR Kozhikode.
- Pest and disease incidence in intercrop as well as black pepper should be recorded.

PEP/CM/4.8 Management of *Phytophthora* foot rot by mulching

- The project may be concluded and the final report has to be submitted to the Project Coordinator's cell, ICAR-IISR, Kozhikode.

Ginger

GIN/CM/5.6 Organic production of ginger

- The programme may be concluded and the final report has to be submitted to the Project Coordinator's cell, ICAR-IISR, Kozhikode.

GIN/CM/5.7 Effect of micronutrients on growth and yield of ginger (Demonstration trial)

- The project may be concluded and the final report has to be submitted to the Project Coordinator's cell, ICAR-IISR, Kozhikode.

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

- The project may be concluded and the final report has to be submitted to the Project Coordinator's cell, ICAR-IISR, Kozhikode.

GIN/CM/5.9 Organic production of ginger

- The programme will be continued only at Ambalavayal due to lack of three years data
- The project may be concluded in the remaining centres and the final report has to be submitted to the Project Coordinator's cell, ICAR-IISR, Kozhikode.

GIN/CM/5.10 Effect of micronutrients on growth and yield of ginger

- The programme will be continued only at Ambalavayal due to lack of three years data

- The project may be concluded in the remaining centres and the final report has to be submitted to the Project Coordinator's cell, ICAR-IISR, Kozhikode.

Turmeric

TUR/CM/5.10 Organic production of turmeric

- The programme may be concluded and the final report has to be submitted to the Project Coordinator's cell, ICAR-IISR, Kozhikode.

TUR/CM/5.14 Organic production of turmeric-2016

- The project may be concluded and the final report has to be submitted to the Project Coordinator's cell, ICAR-IISR, Kozhikode.

TUR/CM/5.15 Effect of micronutrients on growth and yield of turmeric

- The project may be concluded and the final report has to be submitted to the Project Coordinator's cell, ICAR-IISR, Kozhikode.

Coriander

COR/CM/5.5 Response of coriander varieties to various levels of fertility under multi cut management practice

- The programme may be continued at Dholi and concluded at Jagudan. The Jagudan centre may submit final report to the Project Coordinator's cell, ICAR-IISR, Kozhikode.

Cumin

CUM/CM/5.2 Organic nutrient and disease management in cumin

- The programme may be concluded and the report to be submitted to the Project Coordinator's cell, ICAR-IISR, Kozhikode.

CUM/CM/5.4 Standardization of drip irrigation and fertigation in cumin

- The programme may be concluded and the report to be submitted to the Project Coordinator's cell, ICAR-IISR, Kozhikode.

Fennel

FNL/CM/5.5 Standardization of fertigation in fennel

- The programme may be concluded and final report may be submitted to the PC cell, AICRP on Spices.

Project code	Title	Centres	Comments
Black pepper			
PEP/CM/4	**Nutrient Management Trial**		
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 *Phytophthora* foot Rot by mulching	Sirsi	Concluded
Small cardamom			
CAR/CM/5	**Nutrient Management Trial**		
CAR/CM/5.5	Effect of micro nutrients on growth and yield of small cardamom	Appangala, Mudigere, Pampadumpara, Myladumpara, Sakleshpur	Continued
Ginger			
GIN/CM/5	**Nutrient Management Trial**		
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	Concluded
GIN/CM/5.8	Effect of organic manures and bio-fertilizers on partitioning of dry matter in ginger	Dholi	Concluded
GIN/CM/5.9	Organic production of ginger	Ambalavayal	Continued
GIN/CM/5.10	Effect of micronutrients on growth and yield of ginger	Ambalavayal	Continued
Turmeric			
TUR/CM/5	**Nutrient Management Trial**		
TUR/CM/5.10	Organic production of turmeric	Barapani, Mizoram	Continued
TUR/CM/5.14	Organic production of turmeric	Barapani, Solan. Dholi, Chintapalle, Coimbatore, Guntur, Kammarpally, Kumarganj, Mizoram, Pantnagar, Raigarh, Pasighat, Pottangi, Pundibari	Concluded

TUR/CM/5.15	Effect of micronutrients on growth and yield of turmeric	Chintapalle, Solan, Dholi, Coimbatore, Kammarpally, Kumarganj, Pantnagar, Pasighat, Pottangi, Pundibari, Raigarh	Concluded
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	Dholi	Continued
Cumin			
CUM/CM/5	**Nutrient Management Trial**		
CUM/CM/5.2	Organic nutrient and disease management in cumin	Jobner	Concluded
CUM/CM/5.4	Standardization of drip irrigation and fertigation in cumin	Jobner, Jagudan, Mandor	Concluded
CUM/CM/ 5.5	Micro nutrient management in cumin	Jobner, Jagudan, Mandor, Ajmer	Continued
Fennel			
FNL/CM/5	**Nutrient Management Trial**		
FNL/CM/5.5	Standardization of drip fertigation in fennel	Jobner	Concluded
Fenugreek			
FGK/CM/5.9	Standardization of drip irrigation interval and method of micro nutrient fertigation in fenugreek	Ajmer, Coimbatore, Hisar, Jagudan, Jabalpur, Jobner, Kumarganj, Kota, Pantnagar, Navsari, Raigarh	Continued

TECHNICAL SESSION: V

CROP PROTECTION

Black pepper

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

- The programme may be concluded and the report to be submitted to the Project Coordinator's cell, ICAR-IISR, Kozhikode.

PEP/CP/5.6 Biological management of slow decline in black pepper

- The programme may be concluded and the report to be submitted to the Project Coordinator's cell, ICAR-IISR, Kozhikode.

PEP/CP/5.7 Studies on management of *Phytophthora* causing foot rot in black pepper

- The programme may be concluded and the report to be submitted to the Project Coordinator's cell, ICAR-IISR, Kozhikode.

Small cardamom

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

- Trial concluded and the final report has to be submitted to the Project Coordinator's cell, ICAR-IISR, Kozhikode.

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

- The trail may be concluded. Pooled data need to be presented and and the final report has to be submitted to the Project Coordinator's cell, ICAR-IISR, Kozhikode.

CAR/CP/6.10 MLT on leaf blight tolerant lines of small cardamom

- The trial may be shifted to Session on genetic resources and crop imrprovement

Large cardamom

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

- Trial may be concluded. Technology need to be prepared by next year and the final report has to be submitted to the Project Coordinator's cell, ICAR-IISR, Kozhikode.

Ginger

GIN/CP/6.11 Eco-friendly management of rhizome rot of ginger

- The trial may be concluded and the final report has to be submitted to the Project Coordinator's cell, ICAR-IISR, Kozhikode.

GIN/CP/6.13 Effect of biocapsules on growth and yield of ginger

- Continue the trial for 2019-20. Conclude the trial in 2020 and present the pool data for 3yrs and the final report has to be submitted to the Project Coordinator's cell, ICAR-IISR, Kozhikode.

GIN/CP/6.14 Management of bacterial wilt of ginger through chemicals and bioagents

- Trial may be concluded and the final report has to be submitted to the Project Coordinator's cell, ICAR-IISR, Kozhikode.

Turmeric

TUR/CP/7.1 Survey and identification of disease causing organisms in turmeric and screening of turmeric germplasm against diseases (Disease Surveillance)

- Trial may be concluded and the final report has to be submitted to the Project Coordinator's cell, ICAR-IISR, Kozhikode.

TUR/CP/7.3 Assessment of fungicide and biological control agents against foliar disease of turmeric

- The trail may be concluded and the final report has to be submitted to the Project Coordinator's cell, ICAR-IISR, Kozhikode.
- Consolidate the data from three centres and come out with a recommendation

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

- The trail may be concluded and the final report has to be submitted to the Project Coordinator's cell, ICAR-IISR, Kozhikode.

TUR/CP/7.5 Eco-friendly management of foliar diseases of turmeric

- The trail may be concluded and pool the data for 3yrs and the final report has to be submitted to the Project Coordinator's cell, ICAR-IISR, Kozhikode.

TUR/CP/7.7 Effect of biocapsules on growth and yield of turmeric

- The trial may be continued for the current year (2019-2020) and conclude the trial in 2020 and present the pool data for 3 years

Coriander

COR/CP/6.4 Studies on the management of coriander powdery mildew using new generation fungicides

- All the raw data need to be sent to IISR for pooled analysis and field recommendation

COR/CP/6.5 Eco-friendly management of stem gall of coriander (Observational trial)

- Trial may be concluded and the final report has to be submitted to the Project Coordinator's cell, ICAR-IISR, Kozhikode.

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

- Trial may be concluded and the final report has to be submitted to the Project Coordinator's cell, ICAR-IISR, Kozhikode.

COR/CP/6.7 Integrated pest and disease management in coriander

- Navsari and Kota centre did not attend the workshop. Data from Navsari, Kota and Ajmer centres not reported.

Cumin

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

- Trial may be concluded and the final report has to be submitted to the Project Coordinator's cell, ICAR-IISR, Kozhikode.

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

- Trial may be concluded and the final report has to be submitted to the Project Coordinator's cell, ICAR-IISR, Kozhikode.

CUM/CP/6.8. Integrated pest and disease management in cumin (IPDM)

- Data has to be submitted by Ajmer centre

Saffron and kalazeera

Crop protection trials presented are not approved as AICRP trials, hence need not be presented.

Projectcode	Title	Centres	Comments
Black pepper			
PEP/CP/5	**Disease Management Trial**		
PEP/CP/5.3	Trial on management of *Phytophthora* foot rot of black pepper in new plantation	Chintapalle, Mudigere, Dapoli	Concluded
PEP/CP/5.6	Biological management of slow decline in black pepper	Panniyur, Sirsi, Dapoli	Concluded
PEP/CP/5.7	Studies on management of *Phytophthora* causing foot rot in black pepper	Panniyur, Sirsi, Dapoli, Mudigere	Concluded
Small cardamom			
CAR/CP/6.8	Comparison of effect of chemical treatments as well as bio-control agents against pseudostem rot of cardamom	Mudigere	Concluded
CAR/CP/6.9	Evaluation of new insecticides for thrips control	Mudigere, Myladumpara, Pampadumpara	Concluded
CAR/CP/6.10	MLT on leaf blight tolerant lines of small cardamom 2018	Appangala, Mudigere, Pampadumpara, Myladumpara, Sakaleshapura	Continued
Large cardamom			
LCA/CP/1.2	Integrated pest and disease Management in Large cardamom	ICRI Regional Station, Gangtok, ICAR Regional station, Gangtok	Concluded
Ginger			
GIN/CP/6.11	Eco-friendly management of Rhizome rot of ginger	Kumarganj	Concluded
GIN/CP/6.12	Field screening of different Varieties of ginger against leaf spot and rhizome rot	Dapoli	Concluded
GIN/CP/6.13	Effect of PGPR biocapsule on growth and yield of ginger	Ambalavayal	Continued
GIN/CP/6.14	Management of bacterial wilt of ginger through chemicals and bio agents	Kozhikode, Pottangi, Dholi, Pundibari, Solan, Kalyani, Nagaland, Pasighat, Gangtok	Concluded
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	Coimbatore, Pundibari, Dholi, Raigarh	Concluded

TUR/CP/7.3	Assessment of fungicide and biological control agents against foliar disease of turmeric	Raigarh, Coimbatore	Concluded
TUR/CP/7.4	Management of foliar diseases in Turmeric using tolerant lines	Dholi, Kumarganj, Solan, Pundibari, Raigarh, Kammaraplly	Concluded
TUR/CP/7.5	Eco-friendly management of foliar Diseases of turmeric	Kumarganj	Concluded
TUR/CP/7.7	Effect of PGPR biocapsule on growth and yield of turmeric	Chinthapalle, Coimbatore, Dholi, Kumarganj, Pantnagar, Pasighat, Pottangi, Pundibari, Raigarh, Solan	Concluded
Coriander			
COR/CP/6	**Disease Management Trial**		
COR/CP/6.4	Studies on the management of coriander powdery mildew using new generation fungicides	Coimbatore, Raigarh, Jobner, Jagudan, Kumarganj	Concluded
COR/CP/6.5	Eco-friendly management of stem gall of coriander (Observational trial)	Kumarganj	Concluded
COR/CP/6.6	Integrated management of stem gall disease of coriander	Dholi	Concluded
COR/CP/6.7	Integrated pest and disease management in coriander	Ajmer, Coimbatore, Dholi, Hisar, Jabalpur, Raigarh, Jobner, Jagudan, Kumarganj, Navsari, Pantnagar, Kota	Continued
Cumin			
CUM/CP/6.6	Bio-efficacy of newer molecules of Insecticides against cumin aphid	Jagudan, Jobner, Ajmer	Concluded
CUM/CP/6.7	Management of powdery mildew in Cumin through new chemicals	Jobner	Concluded
CUM/CP/6.8	Integrated pest and disease management in cumin	Ajmer, Jobner, Jagudan, Mandor	Continued

PLENARY SESSION

Dr P. Rethinam, Former ADG (Hort. Sci.) and Former Director, ICAR-IIOPR was the chief guest during the plenary session. Dr. T. Janakiram, ADG (HS-II), New Delhi presided over the function. Dr K. Nirmal Babu, Project Coordinator, AICRPS and Director, ICAR-IISR welcomed the gathering.

Dr K.S. Krishnamurthy, Principal Scientist, ICAR-IISR presented the major recommendations emanated during various technical sessions of the XXX Workshop including varietal release and transfer of technology sessions.

Dr K. Nirmal Babu, Project Coordinator highlighted on the significant contributions made by AICRPS during the last one year. He also spoke on the new initiatives by AICRPS for the coming year.

Dr P. Rethinam appreciated the efforts of AICRPs in general and AICRP on spices in particular in conducting multi location trials and also for developing location specific cost effective technologies which can be easily adopted by farmers. He highlighted the importance of spices in cropping system and advised to utilize the high density multi species cropping system model to enhance the income of farmers.

Dr T. Janakiram, ADG (HS-II) in his remarks appreciated AICRPS centres and congratulated Pottangi and Kumarganj centres for having won Best AICRPS centre award and also congratulated the scientists involved in developing new varieties & technologies which were approved in the workshop. He remarked that spices fit well in Prime Minister's flagship programmes such as doubling farmers income, women empowerment and employment generation. He stressed the role of spices in export earnings and stressed on GAPs, organic certification and pesticide free product to enhance the acceptability of our spices in global market. He praised the efforts of Project Coordinator Dr K. Nirmal Babu in making AICRPS a very sincere, dedicated and a very cohesive group. He also expressed his gratitude to Dr. P. Rethinam, former ADG (Hort. Sci.) for his proactive role in shaping the spices research of the country which has lead to very productive spices group.

Dr K.S. Krishnamurthy, Principal Scientist, ICAR-IISR proposed vote of thanks. The XXX Workshop was concluded with National Anthem.

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 with 38 centres (19 regular, 11 co-opting and 8 voluntary centres) spread over 14 agro climatic zones in 25 states of the country coordinates the research activities on spice crops like black pepper, large cardamom, small cardamom, ginger, turmeric, mango ginger, cinnamon, nutmeg, clove, coriander, cumin, fennel, fenugreek, ajwain, nigella, saffron and kalazeera. Annual budget for the year 2018/19 was Rs. 607.76 lakhs as ICAR share.

AICRP on spices has won the prestigious Chaudhary Devi Lal outstanding AICRP award for the best AICRP for the year 2017-18. Pepper Research Station, Panniyur under Kerala Agricultural University has been awarded for the Best Centre under AICRPS. Dr. K. Nirmal Babu, the Project Coordinator and Dr. P. M. Ajith, Breeder, Pepper Research Station, Panniyur received the award from Hon'ble Union Minister of Agriculture and Farmers welfare, Shri. Radha Mohan Singh in the Award Ceremony held during ICAR Foundation Day at NASC Complex, New Delhi.

New initiatives

- New crops like mango ginger, saffron and kalazeera are added and initiated collection and conservation of germplasm of new crops.
- In line with food safety assurance and minimization of the pesticide residue in spices, good agricultural practices project on integrated pest & disease management was initiated in cumin and coriander at various seed spices centres of AICRPS.
- For the evaluation of genotypes for specific traits, various AICRPS centres have undertaken co-ordinated varietal trials in spice crops like black pepper, mango ginger, ginger cardamom, coriander, cumin, fennel and fenugreek.

Varieties recommended for release in XXIX AICRPS workshop

Eleven varieties of spices for specific traits (1 in ginger, 1 in turmeric, 1 in nutmeg, 4 in coriander, 1 in fennel, 2 in fenugreek and 1 in cumin) were recommended for release in XXIX AICRP on Spices workshop held at Horticultural Research Station, Dr. Y. S. Parmar University of Horticulture & Forestry, Solan, Himachal Pradesh.

Varieties

1. **Solan Giriganga**: Ginger variety from Dr. Y S Parmar University of Horticulture & Forestry, Solan. Plumpy and bold rhizomes with high dry matter recovery of 21.01%, 1.45% essential oil, 4.69% oleoresin, 4.47% crude fibre and < 10% incidence of rhizome rot.
2. **TCP 129:** Turmeric variety from UBKV, Pundibari, West Bengal. Tolerant to leaf spot and leaf blotch and with curcumin content of 5.1% and high dry recovery of 26.51%.
3. **Konkan Sanyukta**: Nutmeg variety from Dr BSKKV, Dapoli. Monoecious nutmeg bearing 500 fruits per plant per year with bold nuts (9.20 g), mace wt (1.07 g), high nut oil (27%) and mace oil (17.75%).

4. **Rajendra Dhania 3**: Coriander variety released from Dr RPCAU, Dholi. Climatic resilient coriander variety with high yield (14.09 q ha-1) and high oil (0.52%), recommended for national release.
5. **JD (SI) 1**: Coriander variety released from JNKVV, Jabalpur, High oil type coriander (0.67%) with high yield potential (14.14 q ha-1) suitable for Madhya Pradesh.
6. **Ajmer Coriander 3**: Coriander variety released from ICAR-NRCSS, Ajmer. Coriander variety with high volatile oil (0.55%), high linalool (75.42%), high (13.09 q ha^{-1}) and stable yield.
7. **Chhattisgarh Sri Chandrahasini Dhania-2**: Coriander variety from IGKV, Raigarh. climate resilient coriander variety suitable for both leafy and seed purpose, moderately resistant to powdery mildew and aphids.
8. **Ajmer fennel 3**: Fennel variety from ICAR-NRCSS, Ajmer. High yielding (21.43 q ha^{-1}) and high oil (1.9%) fennel resistant to *Ramularia* blight, suitable for fennel growing regions of the country.
9. **HM 425**: Fenugreek variety released from CCSHAU, Hisar. High yielding (20-22 q ha^{-1}) powdery mildew and downey mildew resistant fenugreek suitable for fenugreek growing regions of the country.
10. **Narendra Richa (NDM 79)**: Fenugreek variety released from NDUA&T, Kumarganj. Dual purpose alkaline tolerant fenugreek with moderate resistance to powdery mildew suitable for Uttar Pradesh and Andhra Pradesh.
11. **Gujarat cumin 5:** Cumin variety released from SDAU, Jagudan. High yielding wilt resistant cumin with short duration and high yield (38% higher yield than GC 4) suitable for cumin growing regions of the country.

Technologies recommended during XXIX AICRPS workshop

Six location specific technologies in different spice crops for various states developed during the year were recommended during XXIX Annual workshop of AICRPS.

Water use efficiency (more crop per drop)

Drip irrigation and fertigation in coriander: Fertigation with water equal to 80% of actual evaporation (0.8 IW/CPE ratio) at an interval of 2-3 days and recommended dose of fertilizers through soluble fertilizers at different growth stages (20, 40, 60 & 80 DAS) is recommended for improving the yield and WUE in coriander in light textured soils of India.

Drip fertigation in fennel: Fertigation with water equal to 80% of actual evaporation (0.8 IW/CPE ratio) at an interval of 2-3 days and 75% recommended dose of fertilizers through soluble fertilizers at different growth stages (20, 40, 60, 80 & 100 DAS) is recommended for improving the yield and WUE in fennel in light textured soils of India.

Organic nutrient management- for sustainable spice production

Organic farming in cardamom: Monthly application of Jeevamrutha (20 l/plant) along with 10 g each of biofertilizers (*Azospirullum* and PSB) and bio-control agent (*Trichoderma viride*) and 30 tonnes of compost are recommended as an organic production practice for the Cardamom Hill Reserves, Kerala.

Bio-fertilizers for yield enhancement of coriander: Soil application of Phosphate Solubilizing Bacteria (PSB) @15 kg ha^{-1} or *Azospirillum* @15 kg ha^{-1} along with NPK @ 60:40:30 kg ha^{-1} is recommended for improving the productivity of coriander.

Management of diseases

Chemical management schedule for cumin blight: Spraying of kresoxym methyl 44.3 SC (1 ml/lit), mancozeb 75% WP (3.7 g/lit) and difenaconazole 25 EC (0.5 ml/lit) at 40, 50 and 60 days after germination is recommended for effective management of blight in cumin growing regions of Gujrat.

Bio-efficacy of newer molecules of insecticides against cumin aphid: For effective and economical management of cumin aphid, first foliar spray of thiamethoxam 25WG (25g a.i./ha; 2.5 g/10 lit.water) at 10% umbels infestation of aphids followed by thiacloprid 21.7SC (25g a.i/ha ; 2.88 g/10 lit. water) spray after 10 days is recommended for cumin growing regions of Gujarat.

Black pepper

During 2018-19, Pepper Research Station, Panniyur collected 15 new accessions of black pepper and HRS, Sirsi collected 15 accessions of black pepper and Pundibari centre collected 12 accessions, bringing the total germplasm holding of black pepper to 840 accessions. During the year 2018-19 at Panniyur, the genotypes PRS 64, PRS 136 and PRS 154 were the top yielders. PRS 64 ranked first with 4.98 kg green berry yield and 1260 spikes/vine. Spike length was maximum in PRS 155 (15.1 cm), the number of developed berries/spike in PRS 137 (75.0), 100 berry weights in PRS 154 (12.4 g) and the dry recovery in PRS 136 (38%). In CVT Kumpukkal recorded the highest green berry yield of 2.20 kg and was on par with Panniyur 1. Average spike length was highest in Panniyur 1 (17.03 cm) which was on par with Panniyur 5 (16.6 cm). Number of berries/ spike was more in Panniyur 1 (84.66). Highest dry recovery % was recorded in Zion Mundi, Panniyur 5 and Panniyur 1 (35%).

Among the germplasm lines maintained at Chintapalle, Panniyur -1 recorded the highest number of spikes per vine (639), fresh berry yield/ vine (4.04 kg), dry yield (1.29 kg), fresh yield/ha (4.13 t ha^{-1}) whereas the highest no. of berries per spike was recorded in Neelamundi and highest dry recovery was recorded in Perambramundi (32.65%).

At Dapoli HB 20052 recorded the highest green berry yield of 5.20 kg/vine followed by Acc. No. 53 (4.97 kg/ vine). The highest plant height was recorded for Panniyur 1 (5.17 m). Plant height of

all the varieties ranged between 2.20 to 5.02 m. The ACC. No. 106 recorded maximum plant height (5.02 m) while lowest plant height was recorded by HP- 39.

At Yercaud, during 2018-19, the maximum number of spikes per meter square (48.0) was recorded in IISR Shakthi and the lowest in the Acc. No.106 (15.0). The number of berries per spike (68) and green berry and dry berry yield (0.580 kg and 0.169 kg respectively) were also highest in the same genotype.

Small cardamom

CVT trial on drought tolerance at Sakleshpur revealed that under moisture stress the genotype, IC 349537 registered more number of bearing tillers (10.83), number of panicles (5.39) and long panicles (35.65 cm) and number of capsules per racemes (4.30). Same genotype registered more number of bearing tillers (17.10), number of panicles (7.55) and long panicles (50.41 cm) and number of capsules per racemes (5.10) under control also. At Mudegere, maximum plant height was found in IC-584078 (248.30cm) and more number of suckers / per plant was observed in IC-349537 (46.30) followed by HS-1 (41.60).

Farmers varieties trial at Myladumpara revealed that, number of tillers were significantly more in Wonder cardamom (68) followed by Thiruthali (54.33). Plant height was significantly more in Thiruthali (285.67) followed by Panikulangara I (250.67). Number of leaves of the tallest tiller was highest in Panikulangara I (13.67) followed by Thiruthali (13.33). Numbers of vegetative buds were highest in Arjun (4) followed by PNS Vaigai (3.67). Panicle initiation started after 9 months of planting. Significantly more panicles were found in Thiruthali (43) followed by Panikulangara I (16.33).

Fipronil 5 SC @ 0.005% applied plants showed highest per cent reduction of thrips infestation at Mudigere and Pampadumpara. At Sakleshpur, the thrips damaged capsules (%) were least in spinosad, imidacloprid and fipronil treatments 15 days after spray and were on par with each other.

Large cardamom

Studies on evaluation of organic treatments against major soil borne diseases of large cardamom revealed that , COC 2 g/litre + soil application of Trichoderma (4 ml/l) (10 days after planting) during sowing & COC 2 g/litre near clump followed by Trichoderma (4 ml/l) (10 days after COC application) each month) showed less incidence of disease (9.52%).

Ginger

At Barapani, forty three genotypes of ginger were maintained and evaluated. Among them, IC-584354 recorded the highest yield with 20.95 t/ha. Crude fibre was highest in IC 584335 and IC 584347 (6.15%). Highest dry matter content of 25.09% was recorded in IC-584353 and highest oleoresin content (7.07%) was recorded in IC-584343.

Combined treatments of *Trichoderma* and GRB 35 talc formulation was found superior in increasing the plant growth parameters and reducing the incidence of rhizome rot over other

treatments. The talc formulation of *Trichoderma* in combination with talc formulation of GRB-35 performed better at Solan and Raigarh.

Turmeric

During 2018-19, Coimbatore centre evaluated 275 turmeric genotypes which revealed wide variations for growth, yield and quality parameters. The genotypes were further grouped into (i) high yielding genotypes and (ii) high curcumin yielding genotypes. 280 turmeric germplasm accessions are maintained at Kammarpally centre. Among the accessions, Nizamamabd Local (62.34 t ha^{-1}), Chennur Local (62 t ha^{-1}), NDH-4 (61.69 t ha^{-1}), NDH-9 (62.13 t ha^{-1}) and JTS-332 (60.69 t ha^{-1}) performed better compared to Local check Duggirala Red (43.25 t ha^{-1}) and IISR Prathibha- National check (59.92 t ha^{-1}). Out of 67 accessions maintained at Dholi, only fourteen accessions recorded higher yield ranging from 50.25 to 54.17 t ha^{-1} compared to check variety Rajendra Sonia (49.83 t ha^{-1}) Among the fourteen promising accessions, RH-421 recorded highest yield (54.17 t ha^{-1}) followed by RH-2 (53.33 t ha^{-1}).

At Kumarganj, a total 180 germplasm accessions are maintained. All the 180 accessions were evaluated and among them NDH-74 (275 g/plant) & NDH-86 (265 g/plant) in early, NDH-98 (290 g/plant) & NDH-78 (268 g/plant) in medium and NDH-8 (270 g/plant) & NDH-2 (265 g/plant) in late maturing types were the top yielders. The Guntur centre has maintained 280 turmeric germplasm accessions out of which 48 were evaluated. At Pasighat, 52 diverse genotypes of turmeric collected from entire NE region and were evaluated. At HARS, Pottangi, 179 accessions were evaluated in 2018-19 and 86 germplasm accessions are maintained at CARS, Raigarh. At present, total germplasm holding of turmeric with AICRPS is 1621.

In the Coordinated Varietal Trial of turmeric, twelve genotypes along with two checks (IISR Prathibha and BSR 2) were evaluated at different centres. The genotype LTS- 2 performed better at Coimbatore (40.92 t ha^{-1}) and Guntur (48.9 t ha^{-1}). At Kammarpally NDH-11 (37.50 t ha^{-1}) recorded highest fresh rhizome yield. At Chintapalle, PTS-2 (27.87) recorded highest yield. At Pundibari, the highest projected yield was recorded in TCP-191 (39.78 t ha^{-1}) and at Pottangi, PTS-18 (15.2 t ha^{-1}) was the top yielder. At Kumarganj, maximum rhizome yield was recorded in LTS-1 (26.11 t ha^{-1}) and at Raigarh IT 36 recorded maximum rhizome yield (36.7 t ha^{-1}). At Dholi, RH-9/90 and RH-80 (57.98 t ha^{-1} and 53.13 t ha^{-1} respectively) were the highest yielders.

In surveys conducted by Pundibari centre in Mathabanga area, two major diseases of turmeric were found to be prevalent viz., leaf blotch (*Taphrina* spp.) and *Colletotrichum* leaf spot (*Colletotrichum* spp.) Most of the area is covered with local varieties which are highly susceptible to these diseases. In the survey it was found that average leaf blotch disease severity in Mathabhanga was 18.35 PDI and for leaf spot it was 20.53.

At Coimbatore, the maximum incidence of leaf spot (14.3 PDI) was noticed in Perunthurai area of Erode district and maximum leaf blotch was noticed in Gobi (24.6 PDI) followed by Perunthurai (22.9 PDI) area of Erode district. In Coimbatore district, maximum leaf blotch (25.7 PDI) incidence was noticed in Thondamuthur and the leaf spot incidence was 8.9 PDI in Karamadai. In the Bhikhari Mal village of Raigarh developmental block, 43.78 % disease intensity of *Colletotrichum*

leaf spot and 38.78 % *Taphrina* leaf blotch and in Amalidih village, 34.78% intensity for *Colletotrichum* leaf spot and 22.57% for *Taphrina* leaf blotch were noticed.

Tree spices

Among the nutmeg accessions conserved at Pechiparai, MF- 1 recorded maximum tree height (9.14 m) and stem girth (58.55 cm) and MF 4 recorded maximum leaf length (20.14 cm), leaf breath (9.15 cm), no. of fruits (667), single fruit weight (53.0 g) and mace yield (286 g/ tree). At Dapoli, the genotype DBSKKVMF 29 (972), DBSKKVMF 9772 (507) and DBSKKVMF 22 (498) recorded maximum average number of fruits respectively. The genotype DBSKKV 29 recorded maximum dry nut yield (9817.20 g) and dry mace yield (2721.60 g).

Among the germplasm of clove planted during the year 1996-97 at Dapoli, four promising genotypes were selected. The plant height varied from 5.89 to 7.15 m, girth ranged from 35-40 cm and spread varied from 2.50 m to 3.05 m. Among the 24 accessions at Pechiparai, SA-1 recorded the highest tree height of 11.78 m, followed by SA-3 (11.63 m) compared with local check tree height (9.31 m). The accession SA-13 was significantly superior than other accessions and recorded highest stem girth (49.59 cm) compared with local check (40.57cm). The accession SA-3 recorded the highest leaf length (12.47cm), leaf breadth (7.46 cm), number of branches (16 nos) and dry bud yield (1.52 kg/tree/year).

Among the twelve accessions of cinnamon evaluated at Pechiparai, CV-5 recorded maximum tree height (2.81 m), number of shoots (10) and stem girth (16.84 cm).

Coriander

In rabi, 2018-19, twenty one (CVT) entries of coriander from Jobner were screened against powdery mildew disease. Among the tested lot, two entries viz., COR-190 and COR-192 showed moderate resistance and ten entries viz., COR-176 to COR-180, COR-185 to COR-187, COR-191 and RCr-728 entries were susceptible and rest of the entries showed highly susceptible reaction against the disease.

The genotypes UD-35, UD-76, RCr- 436, UD-27 and UD-39 in normal conditions and UD-27, UD-86, UD-77, UD-73 and UD-87 under stress condition were the top yielders. Based on stress indices UD-87, RCr-20, UD-86, UD-77 and UD-30 were found to be the desirable entries for drought conditions.

Cutting management, varieties and fertility levels affected significantly the coriander seed equivalent yield at Jagudan. One cut at 45 DAS recorded significantly higher coriander seed equivalent yield over two cut and no cut. Variety GDLC 1 produced significantly higher coriander seed equivalent yield over GCo2. Application of 60:30:00 kg NPK/ha recorded significantly the highest coriander seed equivalent yield over rest of the treatments. GDLC 1 was more responsive than G Co2 under different fertility levels.

Cumin

Total thirty entries of cumin were screened for resistance against powdery mildew disease at Jagudan. The minimum disease intensity was noticed in JC 16-07 (5.0%), while the maximum disease intensity was recorded in the entry JC-18-02 and CVT-42 (15.0%). The powdery mildew incidence ranged from 5.0 to 15.0 per cent.

The results of the three year experimentation on drip irrigation and fertigation in cumin at Mandor showed that, the data that highest gross return (Rs. 1,80,9000 /ha), net return (Rs. 1, 21,700/ha) and benefit cost ratio (3.1) were recorded under drip irrigation at 0.6 IW/CPE ratio with 80% RDF through fertigation.

Fennel

Screening for resistance against *Ramularia* blight disease was conducted at Jagudan. None of the entries were found free from the *Ramularia* blight. The minimum intensity of ***Ramularia*** blight was noticed in FNL-118 and FNL-126 (25.00%) while the maximum intensity was recorded in entry FNL-129 (32.25%). The disease intensity ranged between 25.00 to 32.25 per cent.

The CVT trial at Jobner revealed that the seed yield ranged from 13.20 to 25.22 q ha^{-1}. Of the ten entries evaluated, entry UF-231 recorded maximum seed yield of 25.62 q ha^{-1} followed by UF-232 (24.69 q ha^{-1}), UF-230 (23.22 q ha^{-1}), RF-125 (22.95 q ha^{-1}), and RF-205 (22.84 q ha^{-1}) while lowest seed yield of 13.21 q ha^{-1} was recorded in UF-234. Mean performance of the entries evaluated in IET of fennel over 2017-18 and 2018-19 revealed superior performance of UF-231 yielding 26.71 q ha^{-1} followed by UF-230 (24.84 q ha^{-1}) and RF-205 check (23.64 q ha^{-1}), while lowest mean seed yield of 14.20 q ha^{-1} was recorded in UF-234.

Fenugreek

At Jobner, the genotypes UM 88, UM 87, UM 73, UM 71 and UM 69 in normal conditions and UM 80, UM 92, UM 89, UM 75 and UM 93 in stress conditions were top yielders. Based on stress indices UM 80, UM 75, UM 89, UM 92 and UM 93 were found to be the desirable entries for drought conditions.

Among seventeen entries and one check varieties in CVT trial evaluated at Dholi, none of the entries were found significantly superior regarding yield per plot and yield per ha compared to check Rajendra Kanti. However, FGK-137 and FGK-132 recorded the highest yield per hectare (26.27 & 25.53 q ha^{-1} respectively) compared to check variety Rajendra Kanti (23.51 q ha^{-1}) At Guntur, FGK-136 (21.68 q ha^{-1}), FGK-135 (19.50 q ha^{-1}), FGK-132 (18.77 q ha^{-1}), FGK-137 (18.57 q ha^{-1}) and FGK-127 (18.29 q ha^{-1}) recorded significantly higher yield over the check Lam Methi-3 (14.80 q ha^{-1}).

Ajwain

In CVT trial on ajwain, seed yield ranged from 6.54 to 12.88 q ha^{-1}. Of the fourteen entries evaluated, entry LS-14-3 recorded maximum seed yield of 12.88 q ha^{-1} followed by local (12.31 q ha^{-1}), NDAJ-10 (9.25 q ha^{-1}), AA-73 (8.94 q ha^{-1}) and AA-6 (8.39 q ha^{-1}) while lowest yield of 6.54 q

ha^{-1} was recorded in NDAJ-11. Mean performance of the entries revealed that superior performance of Local yielding 10.21 q ha^{-1} followed by LS-14-4 (9.94 q ha^{-1}) and IA-1 (9.24 q ha^{-1}), while lowest seed yield of 6.99 q ha^{-1} was recorded in HAJ-7 at Jobner.

Nigella

The CVT trial conducted on nigella at Kota revealed that, the seed yield ranged from 456-990 kg/ha. During its third and final year of evaluation, AN-1 was found to be the best performing entry in terms of seed yield (9.90 q ha^{-1}) followed by AN-23 (9.00 q ha^{-1}) and showing 8.14 per cent higher yield over the check AN-20. The mean days to flowering ranged from 96 days (AN-23) to 100 days (AN-20, NDBC-21, PK-2 and Pant Krishna); days to maturity from 139 days (Pant Krishna) to 151 days (AN-1); and test weight from 7.17 g (Pant Krishna) to 8.12g (HKL-7).

Mango ginger

Six germplasm of mango ginger was collected and evaluated at Raigarh centre. Indira Mango ginger 1 (IMG 1) recorded highest rhizome yield (28.6 t ha^{-1}) followed by IMG 2 (27.5) and IMG 4 (25.4 t ha^{-1}) over check (24.8 t ha^{-1}).

Saffron

Potential Saffron growing villages were surveyed in Kashmir and Chenab valley region to tap biodiversity and sampled corm collections (160 nos.) were planted for evaluation and characterization at Saffron Research Station.

Isolation, identification and population studies of soil fungi in rhizosphere from 18 samples at Pampore saffron growing areas revealed nine fungal populations (*Fusarium* spp., *Aspergillus* spp., *Penicillium* spp., *Trichoderma* spp., *Mucor* spp. & few unidentified fungi). Many soil samples had very fewer fungi. *Fusarium* spp. was predominant which is mainly responsible for saffron corm rot.

Kalazeera

Three districts Pulwama, Doda and Badipora were surveyed and 12 samples (tubers and seeds) were collected and conserved at Pampore.

Production and distribution of quality planting materials

The AICRPS centres have multiplied and distributed 4.16 lakh rooted cuttings of black pepper, 2374 suckers of cardamom, 16.98 tons of turmeric, 13.71 tons of ginger, 194 grafts of nutmeg, 1048 seedlings of nutmeg, 150 grafts of cinnamon and 250 seedlings of cinnamon. In seed spices 31.19 q of coriander, 30.5 q of fennel, 61.71 q of fenugreek and 10 kg of ajwain seed material were produced and distributed.

Transfer of technology

The scientists of various centres have taken earnest effort to popularize the latest technologies as the research is meaningful only when it reaches to farmers and are benefited out of that. Following are some of the technologies demonstrated during the year.

High yielding varieties- boon to farmers

- Popularisation of organic ginger cultivation at Koraput in 1ha at Dambarudhar Pujari (Pottangi)
- Six demonstration of Panniyur black pepper varieties (Panniyur)
- Demonstrated transplanting of turmeric cv. Rajendra sonia varieties of turmeric (Guntur)
- Three demonstration of high yielding turmeric variety CO 2 (Coimbatore)
- Technology demonstration of Narendra Saryu (NDH-8) at farmers field (Kumarganj)
- Technology demonstration of seed treatment with Ridomyl MZ @ 0.2% + monocrotophos @ 0.2% for 45 minutes (Kammarpally)
- Demonstration on preparation of enriched compost along with bio fertilizers and bio control agents in the Asambur village (Yercaud)
- Micro farming situation of fenugreek by adopting the recommended package of practices at different locations (Jobner)

Rapid multiplication of planting materials- for minimal expenditure

- Turmeric nursery with pro-tray technology under shade net was popularized (Kammarapally)
- Pro-tray technology in Paderu, Dumbriguda and Araku in collaboration with KVK, Kondempudi, Visakhapatnam (Chintapalle)
- FLD on performance of turmeric transplants in an area of 1.5 acres (Coimbatore)
- Demonstration of pro-tray propagation technique for ginger and turmeric, soft wood grafting technique in nutmeg and kokum, bush pepper production technology (Dapoli)

Organic farming- for nurturing Mother Nature

- Popularisation of organic ginger cultivation in the Eastern Ghat High Land Zone of Odisha.

Apart from the above field level demonstrations, the scientists popularised technologies conducting trainings and attending as resource persons in trainings and seminars and also through various media (newspaper, radio talks and TV programmes).

Success stories

Black pepper for income generation

Black pepper is one of the important spice crops of Kerala. Sri.Raghavan Nambiar, Kalyadankandi veedu, Pattanur has successfully cultivated and demonstrated the high yield potential of Panniyur varieties under drip irrigation system Mr. Ramesan P.E., Vayakkara, Sreekandapuram has conserved many valuable genotypes and successfully cultivated grafts of black pepper. Sri. George, Mankulathu, Kunnithala, Nalpady, Peravoor (P.O.) has planted one hectare of *Piper colubrinum* grafts and all the released Panniyur varieties under drip irrigation. Ali Parakkadavathu, Blathur has successfully demonstrated the yield potential of Panniyur varieties under IPDM.

Turmeric cultivation for prosperity

Sri Bakki Govardhan yadav, a turmeric farmer of Adilabad district, obtained more than 30 tonnes per acre rhizome yield and is cultivating six varieties (Rajendra Sonia, Rajendra sonali, Acc No. 48, Acc. No. 79, Salem and Duggirala Red) under the guidance of Kammarpally Research Station. He is nominated as RAC member in the PJTSAU, Hyderabad and has won state level award also. Sri Chinta Thirupathi Reddy of Maggidi village of Armoor also cultivated the same varieties and obrained 29 t/acre rhizome yield. Ramakrishna Reddy from Warangal, is another progressive farmer who produced 180 quintals of turmeric per acre cultivating Duggirala Red following the package of practice of Kamarpally Research Station.

Mixed cropping for doubling farmers income

The mixed cropping system ensures additional income to the farmers. In an experiment on mixed cropping, the yield obtained in different inter crops during 2018-19 were colocasia 4.02 tons, arrow root 4.11 tons, elephant foot yam 11.17 tons, tapioca 9.31 tons and greater yam 10.0 tons, per/ha respectively. The yield obtained in different mixed crop blocks for pineapple were 3.39 tons in colocasia 3.35 tons in arrow root 3.39 tons in elephant foot yam and 3.14 tons in tapioca blocks respectively. Monocrop black pepper did not produced additional yield as it is in pre bearing stage. It was observed that black pepper + elephant foot yam and pineapple and black pepper + greater yam proved most economical treatment in all four years of experiment with average B:C ratio 2.35 which indicates that the farmers income can be double with these combinations.

High yielding ginger and turmeric varieties- for income maximization

Young enterprising youths of Pottangi came forward for cultivation of ginger and turmeric with improved package of practices. They were supplied with high yielding varieties of ginger and turmeric and provided with all improved technology by the scientists of AICRPS, HARS, Pottangi. After they became successful in getting a very high return, many unemployed youth and progressive farmers were attracted towards the cultivation of ginger and turmeric.

Tribal welfare measures – Reaching the unreached

ICAR-AICRP on spices under Tribal Sub Plan has 3 centres viz., Pottangi in Odisha, Chintapalle in Andhra Pradesh and Raigarh in Chhattisgarh. These centres uplift the tribals through conducting Farmers training programmes on the following aspects benefitting 2008 tribal farmers. In addition to this, scheduled caste sub plan was also launched for the betterment of the SCSP population.

- The SCSP project was started since 2018-19
- Popularizing single bud propagation of turmeric and ginger developed by AICRPS, Coimbatore, Tamilnadu and Kondempudi, Visakhapatnam to reduce the seed cost.
- Ginger varieties Suprabha, Suravi and Suruchi, turmeric varieties Roma, Surama and Rasmi were released and notified and mango ginger variety Amba was released by Pottangi centre.

- Transforming livelihood of tribal farmers of Andhra Pradesh through introducing high yielding turmeric cultivar Roma and extending production of the seedling by using single node cuttings in turmeric in collaboration with KVK, Kondempudi, BCT-KVK, Yelamanchili and NGOs.
- Adopted TSP area by AICRP on Spices, Pottangi: TSP activities in the districts like Koraput (Pottangi, Semiliguda, Nandapur, Lamataput, Dasamantapur), Kandhamal (Daringibadi, Phulbani, Baliguda, G. Udayagiri), Gajapati (R. Udayagiri, Ramagiri, Nuagada, Lobasing, Raising, Jirang etc.). Major tribes in Koraput: 3(Gadaba, Jhadia Paraja, Parenga)
- Demonstrations of IPM technologies in horticultural crops
- Training on organic ginger and turmeric cultivation
- Off season coriander cultivation
- Demonstration of the performance of organic ginger cultivation in Jhankarguda, Pottangi and black pepper cultivation in Gajapati
- Produced 60,000 black pepper cuttings, 5 t of turmeric, 5.3 t of ginger and 1.5 q of coriander, cardamom suckers – 800 nos. for distributing to tribal farmers of the region.

North East- exploring the unexplored

At Nagaland, soil solarization trial combined with bioagents for the management of bacterial wilt of ginger revealed that plants under treatment T1 (CaCl2 @3%) and T2 (bio control agent) with solarization were not affected by bacterial wilt in comparison to other treatments in Nadia.

At Barapani, effect of biocapsule on growth and yield of ginger revealed that T4 (POP + GRB 35 capsule) recorded maximum yield of 29.92 t/ha. Oleoresin content was highest in T5 (POP) in Nadia (3.53%) and Hitching (5.04%). Organic production trial on ginger produced maximum yield of 25.51 t ha^{-1} (Hiching), 14.87 t ha^{-1} (Suprabha) and 13.58 t ha^{-1} (Jorhat) in T2 (recommended package by SAU). T1 (organic package developed by IISR) recorded higher oleoresin content in all the three varieties.

The experiment on organic production of ginger at Mizoram revealed that the maximum yield was recorded for T7 (recommended package by SAU; ginger-NPK100:90:90 kg ha-1), with an yield of 15.29 t ha^{-1}. The turmeric variety NDH-98 performed well and recorded highest yield in Pasighat centre for the past 4 years. To popularize this improved variety among the farmers, 30 kg rhizome of turmeric variety NDH-98 was distributed to three farmers. This variety performed better than local cultivars in terms of yield and resistance to pest and diseases in farmers' field. The average yield of turmeric variety NDH-98 was 30t/ha or 120 kg from 10 kg planting material.

Collaboration

AICRP on Spices centres works in collaboration with

- ICAR- IISR, Kozhikode and NRCSS, Ajmer (for technologies)
- Spices Board for popularization of technologies in tribal areas
- MIDH (Mission for Integrated Development for Horticulture) for providing and supplying quality planting material production
- NGOs for popularizing high production technologies in tribal areas

- State Department of Agriculture for increasing production, productivity and income for farmers
- Coffee Board for establishing coffee based black pepper cropping system wherever coffee is grown

Monitoring

The research projects and programs undertaken by the centres were monitored by Project Coordinator and Scientists from PC unit's visit to various centres and the experimental plots. During this year, 12 centres were visited which included regular, co-opting, voluntary and project mode centres. The activities of the centres were also monitored through monthly reports, quarterly, half yearly and annual report sent by the centres. The XXIX Workshop of ICAR-All India Coordinated Research Project on Spices was conducted during 4-6 October 2018 at Dr. Y.S. Parmar University of Horticulture and Forestry, Solan, Himachal Pradesh. The workshop was inaugurated by Dr. Hari C. Sharma, Hon'ble Vice Chancellor, Dr. YSPUH & F, Solan on 4 October 2018 Dr. J.N. Sharma, Director of Research, Dr. YSPUH & F, Solan presided over the function and Dr. A. K. Sharma, Professor and Head, Department of Vegetable Science, Dr YSPUH&F, Solan welcomed the gathering. Dr. K. Nirmal Babu, Director, IISR & Project Coordinator (AICRP on spices), Kozhikode highlighted the importance of spices in Indian economy and research accomplishments made in spices. Dr Gopal Lal, Director, NRC for Seed Spices, Ajmer and Dr. Rakesh Gupta, Dean, College of Horticulture, Dr. YSPUH & F, Solan were the Guest of Honour and offered felicitations. Luminaries like Dr. K.K Jindal, Former ADG (Hort.) and Former DoR, Dr. YSPUHF, Solan & CAU, Pasighat and Dr. Homey Cheriyan, Director, DASD, Kozhikode also participated in the workshop. During the inaugural session the "Best AICRPS Centre Award 2017-18" was presented to Pepper Research Station, Panniyur (KAU), Kerala.

ACTION TAKEN REPORT 2018-19

Sl. No	Decision/Recommendation	Centres	Action Taken
TECHNICAL SESSION I: GENETIC RESOURCES & CROP IMPROVEMENT			
1.	Utmost care has to be taken to avoid loss of germplasm accessions. Importance has to be given for quality and biotic resistance while evaluating germplasm	All centres	All important acc. are to be deposited in NAGs centers. Strictly followed parameters for quality and reaction to biotic and abiotic stress are indicated in release proposals
2.	The unique accession of cumin with hairy fruit, drought tolerant lines of fenugreek may be registered with NBPGR	Seed spices centres	This has been registered with NBPGR. After completion of the experiment, the identified moisture stress tolerant genotypes will be registered with NBPGR.
3.	Evaluation trials on mango ginger (*Curcuma amada*), saffron (*Crocus sativus*) and kalazeera (*Bunium persicum*) may be taken up	IISR & SRS Pampore	Mango ginger evaluation is taken up at ICAR-IISR and evaluation of saffron and kalazeera has started at SRS, Pampore.
TECHNICAL SESSION II CROP PRODUCTION			
4.	Performance of crops in mixed cropping system and organic experiments may be verified by the Scientists, ICAR-IISR Kozhikode	All centres	Partially completed
5.	Accessions having >2% oil, and low fibre (<4 should be short listed.	All coriander centres	Germplasm accessions will be evaluated and accessions with >2% oil and low fibre (<4%) will be shortlisted.
6.	Scientist involved in organic cultivation in IISR may visit Dholi centre to examine imposition of treatments	IISR	implemented
7.	Research on precision farming, vertical farming and nano-technology may be explored in spice crops in future programmes. Develop value chain in all spice crops.	All centres	Value chain development in turmeric has been taken up in Telangana. It will be taken up for other crops also on priority.
8.	Centres must ensure all technologies developed must be included in respective SAU POPs	All centres	Efforts are in progress

TECHNICAL SESSION III CROP PROTECTION			
9.	A new CVT on *Ralstonia* and *Pythium* tolerant lines may be initiated	All ginger centres	This trial has been initiated
10	A team of experts from IISR will visit all the ginger and turmeric disease management trials	All ginger centres	Data compiled and presented in technology session
11	Residue analysis data need to be used for fixing MRL values and label expansion.	All centres	A detailed programme for efficacy trials and data generation for label claims was worked out with AINPPR
12	Final report to be submitted on Field screening of different varieties of turmeric against leaf spot & rhizome rot	Dholi	Submitted
13	Effect of biocapsule on growth and yield of ginger Trial may be modified with disease component and rhizome rot incidence need to be recorded	All ginger centres	It has been modified as suggested
14	In disease surveillance project on turmeric Kammarpally and Guntur centers are to be included		Included
GENERAL RECOMMENDATION			
15	Digitization and online submission of AICRPS reports may be strengthened	All centres	AICRPS website has been revamped and is ready for online submission.
16	A training program on plant protection may be organized at IISR	IISR	Not implemented. Will be done this year.
17	The recommended technologies must be prepared in a brochure form covering application methodology, preparation of materials/ chemicals, ingredients and sources of availability in detail	All centres	Leaflets and pamphlets on each crop are available in PC cell. However, updation will be done
18	The best performing entries in the CVT can be recommended for the respective states even though it has not performed across the states.	All centres	Efforts have started to recommend them for region specific
19	All the technologies identified may be demonstrated through KVKs of the respective regions of adoption	All centres	All the centres are providing the identified technologies to nearby KVKs for adoption.

New Research Programmes

Crop Improvement

Crop	Turmeric
Title of the programme	CVT on high yield and high curcumin
Centre	Kozhikode, Coimbatore, Guntur, Kammarpally, Pottangi, Kanke, Nagaland, Raigarh, Navsari
Year of start	2020
No. of treatments/genotypes	11 genotypes 1. RRN1 (IISR) 2. CL 258 (TNAU) 3. CL 272 (TNAU) 4. PTS 47 (Pottangi) 5. PTS 6 (Pottangi) 6. IT 26 (Raigarh) 7. NVST 56 (Navsari) 8. NVST 84 (Navsari) 9. IISR Prathiba (control) 10. IISR Pragati (control) 11. CIM Pitamber (control)
Design	Randomized Block Design
No. of replications	Three replications
Plot size/spacing	3×1 m, spacing- 25x 25 cm
Observations to be taken	✓ 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 (%) ✓ Curcumin content (%) ✓ Oleoresin (%) ✓ Essential oil (%) Disease (rhizome rot) and pest (shoot borer) incidence, if any

Crop	Turmeric
Title of the programme	CVT on light yellow colour turmeric for speciality market
Centre	Kozhikode, Coimbatore, Guntur, Kammarpally, Pottangi, Kanke, Nagaland
Year of start	2020
No. of treatments/genotypes	11 genotypes 1. RRN 3 (IISR) 2. RRN 4 (IISR) 3. RRN 2 (IISR) 4. Acc 849 (IISR) 5. Acc 1545 IISR) 6. CL 223 (TNAU) 7. CL 21 (TNAU) 8. PTS 50 (Pottangi) 9. KPS 611 (Kammarpally) 10. IISR Prathiba (control) 11. Mydukur (control)
Design	Randomized Block Design
No. of replications	Three replications
Plot size/spacing	3×1 m, spacing- 25x 25 cm
Observations to be taken	✓ 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 (%) ✓ Curcumin content (%) ✓ Oleoresin (%) ✓ Essential oil (%) Disease (rhizome rot) and pest (shoot borer) incidence, if any

Crop	Ajwain
Name of the programme	Coordinated Varietal Trial – 2019
Centres	Ajmer, Jobner, Jagudan, Raigarh, Hisar, Kumarganj, Guntur
Entries	11
Date/ Year of start	Rabi 2019
Duration of the project	Three years
Testing centres/ no. of treatments/ genotypes with details	1. JA-18-05 (Jagudan) 2. JA-17-06 (Jagudan) 3. AA-3 (Ajmer) 4. AA-27 (Ajmer) 5. AA-96 (Ajmer) 6. HAJ-24 (Hisar) 7. HAJ-29 (Hisar) 8. NDAJ-21 (Kumarganj) 9. NDAJ-30 (Kumarganj) Check varieties: Ajmer Ajwain-1, Ajmer Ajwain-2 and local check
Design	R.B.D
No. of replications	3
Plot size/ spacing	4.00 x 2.5 m^2 / Spacing- 50 x 20 cm
No of rows per plot	5 rows
Date of sowing/planting season	First week of Nov (rabi)
Methodology and procedure to be adopted	As per recommended package of practices Fertilizer: 40 + 20 + 20 NPK kg/ha
Observation to be recorded	1. Plant height (cm) 2. Primary branches per plant 3. Secondary branches per plant 4. Days to 50 % flowering (on plot basis) 5. Umbells per plant 6. Umbellets per umbel 7. Seeds per umbel 8. Test weight (g) 9. Seed yield (kg/ha) 10. Disease and pest incidence, if any 11. Quality (essential oil %)

Crop	Nigella
Name of the programme	Coordinated Varietal Trial – 2019
Centres	Ajmer, Raigarh, Hisar, Kumarganj, Kota, Kalyani, Pantnagar
Date/ Year of start	Rabi 2019
Duration of the project	Three years
No of treatments/ genotypes with details	1. PK 3 2. AN 19 3. AN 4 4. AN 9 5. HNL 14 6. NDBC 11 7. NDBC 7 Check varieties: Ajmer Nigella-1 and Pant Krishna
Design	R.B.D
No. of replications	3
Plot size/ spacing	4.00 x 2.5 m^2 / Spacing- 30 x 15 cm
No of rows per plot	8 rows
Date of sowing/planting season	First week of Nov (rabi)
Methodology and procedure to be adopted	As per recommended package of practices Fertilizer: 40 + 20 + 20 NPK kg/ha
Observation to be recorded	1. Plant height (cm) 2. Primary branches per plant 3. Secondary branches per plant 4. Days to 50 % flowering (on plot basis) 5. Capsules per plant 6. Seeds per capsule 8. Test weight (g) 9. Seed yield (kg/ha) 10. Disease and pest incidence, if any 11. Quality (essential oil %)

Crop Production

Crop	:	Cumin
Name of the programme	:	Micronutrient management in cumin
Centre	:	Jagudan, Jodhpur, Ajmer
Date/Year of start	:	2019-20
Duration of the project	:	Three years
Design	:	Factorial R. B. D.
No. of treatments/genotypes with details	:	Factor a: Micronutrient i. Control ii. Zn iii. Zn + Fe iv. Zn + Fe + Mn v. Zn + Fe + Mn + B Factor b: Method of application i. Soil application ii. Foliar application iii. Soil + foliar application
No. of replications	:	Three
Plot size/spacing	:	30 cm
No. of plants/plot/treatment	:	15X3=45
Date of sowing/planting and Season (Kharif/Rabi/Zaid)	:	*Rabi*, 2019-20
Lay-out	:	As per the requirement of the design
Methodology & procedure to be adopted	:	Recommended POP will be followed. Observations on the following characters will be recorded as per the standard procedure.
Observations to be recorded	:	1. Plant height (cm) 2. Umbels per plant 3. Umbellets per umbel 4. Seeds per umbel 5. Test weight (g) 6. Seed yield (kg/ha) 7. Biological yield (kg/ha) 8. Harvest index

Crop Protection

Crop	Black pepper
Title of the research programme	Evaluation of strobilurin fungicides and actinomycetes for the management of foot rot and slow decline in Black pepper
Centre	Panniyur, Dapoli, Sirsi, Yercaud, Appangala
Year of start	2020-21
Duration of the project	Three years
Details of crop	Existing plantation Variety: Panniyur 1
Plot size /spacing	3 x 3m
Replications	4 vines /treatment, 4 replications Total no. of vines: 80 vines
Design	Randomized block design
Treatment details	T1-Foliar spray with Bordeaux mixture (1%) and soil application of combination of Actinobacteria (Act 1+5+9) (@ 50 g /vine T2-Foliar spray with Bordeaux mixture (1%) and soil application of *Trichoderma harzianum* (MTCC 5179) and *Pochonia chlamydosporia* (MTCC 5412) @ 50g/vine T3-Foliar application of Ergon 44.3% (W/W) [Kresoxim methyl 500 G/L] and soil application of Ergon 7ml/lit + Carbosulfan 1ml /L @ 2-3 L/vine T4-Foliar application of metalaxyl-mancozeb @ 1.25g/L and soil application of metalaxyl-mancozeb @ 1.25g/L+ carbosulfan 1 ml/L T5- Recommended state package of practices
Time of application of treatments:	May/June and August/September
Observations to be recorded:	✓ CFU of pathogens, beneficial microbes and nematodes before and after imposing treatments. ✓ Regular monitoring and periodical observation on incidence of pathogens, nematodes and recording growth parameters (once in 6 months) ✓ Number of branches per vine ✓ Days to maturity ✓ Average spike length (cm) ✓ Average number of berries/ spike (observation to be taken in 50 spikes) ✓ Dry berry yield (kg/ vine) ✓ 100 berry weight (g) ✓ Dry recovery (%) ✓ Bulk density (g/L) ✓ Piperine content (%) ✓ Oleoresin (%) ✓ Essential oil (%)
General recommendation	Lime/dolomite application based on soil analysis (@500g/vine –before planting), fertilizer and micronutrient application, irrigation, mulching as per POP

Crop	Small cardamom
Title of the research program	Evaluation of fungicides against rhizome rot in small cardamom
Centre	Pampadumpara, Myladumpara, Mudigere, Appangala
Year of start	2020-21
Duration of the project	Two years
Details of crop	Existing plants of any Variety
Plot size /spacing	3 x 3 m, 12 plants /plot
Replications	4
Design	Randomized block design
Treatment details	T1- Spray and drench tebuconazole @1mL /L T2-Spray and drench fenamidone + mancozeb@2g /L T3-Spray and drench metalaxyl- mancozeb @1.25 g/L T4- Spray and drench copper oxy chloride @ 2g/ L T5 - Recommended package of practices
Time of application of treatments	Initiate first spray with the appearance of disease and subsequent sprays at monthly intervals (Total no of sprays limited to three).
Observations to be recorded	➢ Yield ✓ 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) ✓ PDI of rhizome rot ✓ PDI of leaf blight
General recommendation	Normal POP needs to be followed for all treatments (Application of FYM, N, P, K, micronutrients and plant protection chemicals)

Crop	Small cardamom
Title of the research program	Evaluation of fungicides against leaf blight in small cardamom
Centre	Pampadumpara, Myladumpara, Mudigere, Appangala
Year of start	2020-21
Duration of the project	Two years
Details of crop	Variety:-
Plotsize /spacing	3 x 3 m, 12 plants /plot
Replications	4
Design	Randomized block design
Treatment details	T1-Spray carbendazim +mancozeb@2g /L T2-Spray hexaconazole @2ml /L T3-Spray mancozeb @2 g/L T4 –Spray carbendazim @ 2g/ L T5- Recommended package of practices
Time of application of treatments	Initiate first spray with the appearance of disease and subsequent sprays at monthly intervals (Total no of sprays limited to three).
Observations to be recorded	➢ Yield ✓ 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) ✓ PDI of rhizome rot ✓ PDI of leaf blight
General recommendation	Normal POP needs to be followed for all treatments (Application of FYM, N, P, K, micronutrients and plant protection chemicals)

Crop	Ginger
Title of the research program	Priming of rhizomes for enhanced germination, vigour and storage rot suppression in ginger
Centre	Chintapalle, Dholi, Barapani, Kammarpally, Pundibari, Raigarh, Solan, Kalyani, Pasighat, Kanke, Nagaland, Ambalavayal, Pottangi
Year of start	2020-21
Duration of the project	Three years
Details of crop	Variety:- Disease free rhizomes of any variety
Bed size /spacing	3 x 1m, 40 plants /bed; 25 kg of seed
Replications	6
Design	Randomised block design
Treatment details	T1-Rhizome treatment with *Trichoprime* T2-Rhizome treatment with metalaxyl-mancozeb @ 1.25g/L+ Imidacloprid 0.5 ml/L for 30 minutes T3-Rhizome treatment with tebuconazole @ 1ml /L + Imidacloprid 0.5 ml/L for 30 minutes T4- Recommended state package of practices
Time of application of treatments	At the time of storage* (Prepare a slurry of trichoprime with water, dip the rhizomes in the slurry and dry under shade)
Observations to be recorded	✓ Sprouting (%) ✓ 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 (%) ✓ Storage rot (%) ✓ PDI – 30DAP,60 DAP, 90DAP (Rhizome rot) ✓ Boldness of rhizome ✓ Fiber content ✓ Oleoresin (%) ✓ Essential oil (%) ✓ Disease (bacterial wilt, rhizome rot) and pest (shoot borer) incidence, if any
General recommendation	Normal POP needs to be followed (application of fertilizers, micronutrients and plant protection chemicals)

Crop	Turmeric
Title of the research program	Priming of rhizomes for enhanced germination, vigour and storage rot suppression in turmeric
Centre	Chintapalle, Coimbatore, Dholi, Kammarpally, Pundibari, Raigarh, Solan, Pasighat, Ambalavayal, Mizoram, Kahikuchi, Kanke, Kumarganj
Year of start	2020-21
Duration of the project	Three years
Details of crop	Variety:- Disease free rhizomes of any variety
Bed size /spacing	3 x 1m, 40 plants /bed; 25 kg of seed
Replications	6
Design	Randomised block design
Treatment details	T1-Rhizome treatment with *Trichoprime* T2-Rhizome treatment with metalaxyl-mancozeb @ 1.25g/L+ Imidacloprid 0.5 ml/L for 30 minutes T3-Rhizome treatment with tebuconazole @ 1ml /L + Imidacloprid 0.5 ml/L for 30 minutes T4- Recommended state package of practices
Time of application of treatments	At the time of storage* (Prepare a slurry of trichoprime with water, dip the rhizomes in the slurry and dry under shade)
Observations to be recorded	✓ Sprouting (%) ✓ 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 (%) ✓ Storage rot (%) ✓ PDI – 30DAP,60 DAP, 90DAP (Rhizome rot) ✓ Curcumin content (%) ✓ Oleoresin (%) ✓ Essential oil (%) ✓ Disease (rhizome rot) and pest (shoot borer) incidence, if any
General recommendation	Normal POP needs to be followed (application of fertilizers, micronutrients and plant protection chemicals)

*the treated rhizomes should be stored for about 30 days prior to planting.

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83.	Dr. Mudasir H. Khan, Assistant Professor
Host centre :	20 participants
Progressive farmers :	6 participants
Total :	**115**

VARIETIES RECOMMENDED FOR RELEASE DURING 30TH AICRPS WORKSHOP

RF 290

Ajmer Nigella 1

Ajmer ajwain 73

ICAR-All India Coordinated Research Project on Spices (AICRPS)

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