



Proceedings

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

5th – 7th October 2015

ICAR-Indian Institute of Spices Research
Kozhikode, Kerala



**ICAR-ALL INDIA COORDINATED
RESEARCH PROJECT
ON SPICES**

ICAR-INDIAN INSTITUTE OF SPICES RESEARCH
Kozhikode - 673012, Kerala



Coriander - Susthira



Fenugreek-
Narendra Methi 2



Fenugreek - RMt 354



Fennel - RF 157

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

November 2015

Complied & Edited by

Ms. Akshitha, H. J.

CONTENTS

1. Programme	:	1-9
2. Inaugural Session	:	10-12
3. Presentation of Research Report	:	13-19
Action Taken Report 2014	:	19-26
Technical Sessions		
Technical Session I	: Genetic Resources & Crop Improvement	27-32
Technical Session II	: Crop Management	33-36
Technical Session III	: Crop Protection	37-42
Technical Session IV	: Varietal Release	43-44
Technical Session V	: Transfer of Technology	45-46
Technical Session VI	: Plenary Session	51
4. Brain Storming on Small Cardamom	:	47-49
5. Scientist Industry Interface	:	50
6. List of New Projects	:	52-74
7. List of Participants	:	75-78

PROGRAMME

5th October 2015

INAUGURAL SESSION

10.30 am – 12.00 pm

Rapporteurs : Dr. Lijo Thomas, ICAR-IISR, Kozhikode
Mr. Narendra Chowdary, ICAR-IISR RS, Appangala

ICAR song

10.35 am – 11.00 am	Welcome	Dr. K. Nirmal Babu Project Coordinator, AICRP on Spices
	Coordinators report & Action Taken Report	K. Nirmal Babu Project Coordinator, AICRP on Spices
11.00 am-11.10 am	Address by Guest of Honour	Prof. P. N. Jagadev Director of Research, OUAT, Bhubaneshwar
11.10 am-11. 20 am	Address by Guest of Honour	Dr. Homey Cheriyan Director, DASD, Kozhikode
11.20 am-11.30 am	Presidential Address	Dr. M. Anandaraj Director, ICAR-IISR, Kozhikode
11.30 am -11.55 am	Inauguration and Inaugural address by Chief Guest Release of Publications	Dr. V. A. Parthasarathy Former Director, ICAR-IISR, and National Coordinator, Bioversity International
11.55 am -12.00 pm	Vote of Thanks	Ms. Akshitha, H. J. Scientist, AICRP on Spices
	National Anthem	
12.00 – 12.30 pm	Tea	

5th October 2015

SESSION I : Genetic Resources & Crop Improvement

12.30 pm – 5.30 pm

Chairpersons : Prof. P. N. Jagadev, Director of Research, OUAT, Orissa
Dr. V. P. Neema, Professor and Head, PRS, Panniyur

Rapporteurs : Dr. S. Suryakumari, Dr. YSRHU, Guntur
Dr. R. Chitra, TNAU, Coimbatore

Presentations

- | | | |
|----|----------------|--|
| 1 | Black pepper | Dr. P. M. Ajith, Pepper Research Station, Panniyur |
| 2 | Large cardamom | Dr. S. Sreekrishna Bhat, ICRI Regional Station, Gangtok |
| 3 | Cardamom | Dr. K. Pradip Kumar, ICRI Regional Station, Sakleshpura |
| 4 | Ginger | Dr. Parshuram Sial, High Altitude Research Station, Pottangi |
| 5 | Turmeric | Dr. R. Chitra, TNAU, Coimbatore |
| 6 | Tree spices | Dr. Gargi D. Shirke, Dr. BSKKV, Dapoli |
| 7 | Coriander | Dr. K. Giridhar, Dr. YSRHU, Guntur |
| 8 | Cumin | Dr. K. Giridhar, Dr. YSRHU, Guntur |
| 9 | Fennel | Dr. D. G. Patel, SDAU, Jagudan |
| 10 | Fenugreek | Dr. R. K. Kakani, NRCSS, Ajmer |

Project Mode centres

- | | | |
|---|--------|--|
| 1 | Nutmeg | Dr. Mini Raj, KAU, Vellanikkara |
| 2 | Cumin | Dr. Jansi Rani, HC&RI, TNAU, Periyakulam |

2.00 pm -2.30 pm

Lunch

4.00.4.15 pm Tea

5th October 2015

SESSION II : Crop Management	5.30 pm - 8.30 pm
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Chairpersons : Dr. James George, Project Coordinator (AICRPTC), ICAR-CTCRI, Trivandrum
Dr. T. J. Zachariah, Head, Crop Production And PHT, ICAR-IISR, Kozhikode

Rapporteurs : Dr. K. Giridhar, HRS (Dr. YSRHU), Guntur
Dr. S. Sreekrishna Bhat, ICRI RS (Spices Board), Gangtok

Presentations

- | | | |
|---|--------------|---|
| 1 | Black pepper | Dr. Laxminarayan Hegde, HRS (UHSB), Sirsi |
| 2 | Cardamom | Dr. K. M. Devaraju, ZAHRS (UAHS), Mudigere |
| 3 | Ginger | Dr. C. Chandrasekhara Rao, HRS (Dr. YSRHU), Chintapalle |
| 4 | Turmeric | Dr. R. S. Mishra, NDUAT, Kumarganj |
| 5 | Coriander | Dr. T. P. Malik, CCSHAU, Hisar |
| 6 | Cumin | Dr. A. C. Shivran, SKNAU, Jobner |
| 7 | Fennel | Dr. A. C. Shivran, SKNAU, Jobner |
| 8 | Fenugreek | Dr. S. Suryakumari, Dr. YSRHU, Guntur |

New Proposal: Dr. K. Umesha, COH (UHSB), Bengaluru

6th October 2015

SESSION III :	Crop Protection	09.00 am – 01.30 pm
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Chairpersons : Dr. G. Satyanarayana Reddy, Director of Research, SKLTSHU, Hyderabad
Dr. S. Devasahayam, Head, Division of Crop Protection, ICAR-IISR, Kozhikode

Rapporteurs : Dr. (Mrs.) Meenu Gupta, Dr. YSPUHF, Solan
Dr. C. Ushamalini, TNAU, Coimbatore

Presentations

- | | | |
|---|----------------|--|
| 1 | Black pepper | Dr. C.R. Rini, PRS, Panniyur |
| 2 | Large cardamom | Dr. A. K. Vijayan, ICRI, Gangtok, Sikkim |
| 3 | Cardamom | Dr. K. B. Deepthy, CRS (KAU), Pampadumpara |
| 4 | Ginger | Dr. (Mrs.) Meenu Gupta, Dr. YSPUHF, Solan |
| 5 | Turmeric | Dr. C. Ushamalini, TNAU, Coimbatore |
| 6 | Coriander | Dr. A.K. Singh, IGKV, Raigarh |
| 7 | Cumin | Dr. A. U. Amin, CRSS (SDAU), Jagudan |
| 8 | Fennel | Dr. A. U. Amin, CRSS (SDAU), Jagudan |

11.00-11.30 am **Tea**

1.30-2.00 pm **Lunch**

6th October 2015

SESSION IV :	VARIETAL RELEASE	02.00 pm – 5.00 pm
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Chairpersons : Dr. Balraj Singh, Director, ICAR-NRCSS, Ajmer
Dr. H.P. Maheshwarappa, Project Coordinator (Palms), ICAR-CPCRI, Kasargod
Dr. L. Naram Naidu, Principal Scientist, Zonal Head, South Coastal Zone
(Dr.YSRHU), Guntur

Rapporteurs : Dr. R. Praveena, ICAR-IISR, Kozhikode
Dr. B. Mahender TRS, SKLTSHU, Kammarpalli

1. Black Pepper-Panniyur 9 – PRS, Panniyur
2. Nutmeg – Acc.No.1, Acc. No. 5, Acc. No. 13, Acc. No. 15 - Thrissur
3. Coriander – LCC 219 (Susthira) – Guntur
4. Fennel – RF 157 – Jobner
5. Fennel – Ajmer Fennel-2 - Ajmer
6. Fenugreek – RMt 354 – Jobner
7. Fenugreek – Narendra Methi 2 (NDM 69) - Kumarganj

5.00-5.30 pm – Tea

6th October 2015

SESSION V	:	TRANSFER OF TECHNOLOGY	5.30 pm – 7.30 pm
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Chairpersons : Dr. Homey Cheriyan, Director, DASD, Kozhikode
Dr. Gopal Lal, Principal Scientist, ICAR-NRCSS, Ajmer

Rapporteurs : Dr. Ajit Kumar Singh, IGKV, Raigarh
Dr. Vikas Singh, CAU, Pasighat

1. Standardization of water requirement for turmeric through drip irrigation – Dr. S. Suryakumari, HRS, Dr.YSRHU, Guntur
2. Micro irrigation management in fennel – Dr. A. C. Shivran, SKNAU, Jobner
3. Micro irrigation management in fenugreek - Dr. A. C. Shivran, SKNAU, Jobner
4. Management of *Phytophthora* foot rot of Black Pepper in new plantation in Kerala – Dr. C. R. Rini, PRS, Panniyur
5. Management of seed midge of fennel - Dr. B. G. Prajapathi, CRSS (SDAU), Jagudan
6. Management of pseudostem rot of small cardamom in Kerala - Dr. N. Murugan, CRS, Pampadumpara

7th October 2015

Brain Storming on Small Cardamom

ICAR-ALL INDIA COORDINATED RESERACH PROJECT ON SPICES
& ICAR-INDIAN INSTITUTE OF SPICES RESEARCH, KOZHIKODE

Date: 7th October 2015

Venue: ICAR-IISR, Silver Jubilee Hall

- Chairperson** : Dr. M. Anandaraj, Director, ICAR-IISR, Kozhikode
- Co-chairperson** : Dr. M. N. Venugopal, RAC Member, ICAR-IISR, Kozhikode
- Conveners** : Dr. S. J. Ankegowda, Head, ICAR-IISR RS, Appangala
Dr. T. K. Jacob, Principal Scientist, ICAR_IISR, Kozhikode
- Rapporteurs** : Dr. M. Alagupalamuthirsolai, ICAR-IISR RS, Appangala
Mr. Mohammed Faisal, ICAR-IISR RS, Appangala

Schedule	Talk on	Resource Person
9.00 am	Introduction	Dr. K. Nirmal Babu, Project Coordinator, AICRP on Spices, Kozhikode
9.05 am	Inauguration	Dr. M. Anandaraj Director, ICAR-IISR, Kozhikode
9.15 am	Varietal Wealth	Dr. D. Prasath, Senior Scientist, ICAR-IISR, Kozhikode
9.30 am	Plant nutrition, soil health, and climate change – protected cultivation	Dr. V. Krishnakumar, Head, CPCRI Regional Station, Kayamkulam
9.45 am	Plant health management a. Insect pests	Dr. S. Varadarasan, Former Entomologist ICRI, Spices Board
10.00 am	b. Diseases	Dr. M. N. Venugopal, RAC Member, ICAR-IISR, Kozhikode
10.15 am	Tea	
10.30 am	Post harvest and Product development, High value compounds	Dr. T. John Zachariah, HOD, Crop Production and PHT, ICAR-IISR, Kozhikode and Dr. E. Jayashree, Sr. Scientist, ICAR-IISR, Kozhikode
10.45 am	Industry view	Dr. Philip Kuruvilla, Chairman, WSO & Jayanthi International
11.00 am	Trade of cardamom and Planters issues	Dr. Gopalakrishnan, Dy. Director Development, Spices Board
11.15 am	Action Plan and Way forward	Dr. S. J. Ankegowda, Head, ICAR-IISR RS, Appangala

Cardamom workers from IISR, Spices Board, KAU, UAHS (Shimoga) will attend.

11.15-11.30 am **Tea**

7th October 2015

Scientist-Industry Interface

ICAR-ALL INDIA COORDINATED RESERACH PROJECT ON SPICES & ICAR-INDIAN
INSTITUTE OF SPICES RESEARCH, KOZHIKODE

Date: 7th October 2015

Venue: ICAR-IISR, Silver Jubilee Hall

Chairperson : Dr. M. Anandaraj, Director, ICAR-IISR, Kozhikode

Co-chairperson : Mr. Philip Kuruvilla, Chairman, WSO & Jayanthi International

Rapporteur : Dr. C. M. Senthil Kumar, ICAR-IISR, Kozhikode

Schedule	Talk on	Resource Person
11.30 am	Introduction	Dr. K. Nirmal Babu, Project Coordinator, AICRP on Spices, Kozhikode
11.35 am – 12.00 pm	Issues Related to Food Safety and Pesticide Residues	1. Mr. Philip Kuruvilla, Chairman, WSO & Jayanthi International 2. Mr. Ram Kumar Menon, WSO
12.00-12.10 pm	Initiatives in increasing the production of black pepper and the spices in Assam (NE)	Mr. Prabir Banerjee, COO, Amalgamated Plantations Pvt. Ltd. (A Tata Enterprise), Kolkata
12.10-1.00 pm	Technologies to mitigate the food safety issues and industry concern	1. Dr. Gopalakrishnan, Dy. Director Development, Spices Board 2. Dr. Homey Cheriyan, Director, DASD 3. Dr. Jitendra Kumar, Director, ICAR- DMAPR 4. Dr. Balraj Singh, Director, ICAR-NRC SS 5. Dr. M. Anandaraj, Director, ICAR-IISR
1.00-1.30 pm	Concluding Remarks	Dr. M. Anandaraj, Director, ICAR-IISR, Kozhikode

7th October 2015

SESSION VI	Plenary Session	2.00 pm-3.45 pm
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Chairperson : Dr. M. Anandaraj, Director, ICAR-IISR, Kozhikode

Co-chairpersons : Dr. Balraj Singh, Director, ICAR-NRCSS, Ajmer
Dr. Jitendra Kumar, Director, ICAR-DMAPR, Anand

Rapporteurs : Dr. C. N. Biju, Scientist, ICAR-IISR, Kozhikode
Ms. S. Aarthi, Scientist, ICAR-IISR, Kozhikode

2.00 pm ICAR Song

2.02 pm Welcome address **Dr. K. Nirmal Babu,**
Project Coordinator, AICRP on Spices

2.05 pm Remarks on the group meeting **Dr. Balraj Singh,** Director, ICAR-NRCSS, Ajmer
Dr. Jitendra Kumar, Director, ICAR-DMAPR, Anand

2.15 pm Research Highlights and New programmes of AICRPS **Dr. K. Nirmal Babu**
Project Coordinator, AICRP on Spices

2.30 pm Presentation of session reports and recommendation **Rapporteurs**

3.00 pm Comments **Dr. B. K. Pandey**
Principal Scientist, Horticulture Science Division, ICAR, New Delhi

3.10 pm Address by the Chairperson **Dr. M. Anandaraj,** Director, ICAR-IISR, Kozhikode

3.30 pm Vote of Thanks **Dr. Utpala Parthasarathy**
Chief Technical Officer, AICRP on Spices

National Anthem

INAUGURAL SESSION

Rapporteurs : Dr. Lijo Thomas, ICAR-IISR, Kozhikode
Mr. Narendra Chowdary, ICAR-IISR RS, Appangala

The inaugural ceremony of XXVI workshop of ICAR-All India Coordinated Research Project on Spices (AICRPS) started with the welcome address by **Dr. K Nirmal Babu**, Project coordinator, AICRPS. **Dr. V. A. Parthasarathy**, former Director ICAR-Indian Institute of Spices Research, Kozhikode inaugurated the workshop by lighting the lamp.

Welcoming the delegates from various centres, Dr. Nirmal Babu reiterated the need to focus on addressing challenges in sustainability, quality and food safety in spices to develop appropriate technologies for various mandate crops. After the welcome, he presented the coordinators report and the action taken report on the suggestions of the previous workshop.

Project coordinator stressed the following emerging challenges and issues which require more focus of the research personnel of the project

- Supply of quality and disease free planting material and maintaining the varietal purity.
- Strengthening research on enhancing resource use efficiency and resource conservation technologies for major spices.
- Identifying and documenting food safety issues with respect to pesticide residue in spice products and develop suitable protocols for their detection and amelioration.
- Identify industry and cultivation zones suitable for production of premium quality of specific spices offering better comparative advantage.
- Exploring the possibility for enhancing tribal livelihood security and tribal development through cultivation of spices, especially in states like Odisha, Chattisgarh *etc.*
- Create a repository of systematic research information on spice crops accessible to the network of spice researchers and development of online module for field experimental data entry.

Guest of honour, **Dr. P N Jagdev**, Director of research, OUAT, Bhubaneshwar highlighted the importance and continued relevance of AICRPS and urged the spice researchers to take up the challenges faced by the spice crop sector. He further elucidated the potential of spice crops in Odisha to transform the rural economy of the state and hoped that such potential areas will receive high priority in the activities of the project.

Citing the increasing per capita consumption of spices, Guest of Honour, **Dr. Homey Cheriyan**, Director DASD, stressed the need to be more vigilant about food safety issues. He said that the use of agro-chemicals needs to be rationalized in the cultivation of spices. Increased production of spices with reduced use of agrochemicals should be targeted by the project in the medium term.

The presidential address was delivered by **Dr. M Anandaraj**, Director, ICAR-Indian Institute of Spices Research. Dr. Anandaraj said that the various institutions working in the spices sector need to integrate their research programmes to enhance their efficiency and output. A close networking and sharing of resources, both in terms of manpower and facilities can lead to better synergy in the research efforts and provide a clear focus to the research agenda. He also urged the researchers to critically evaluate the programme with a view to its further improvement. He hoped that the meeting would deliberate on the key research and development issues in spice crops and come out with concise and actionable suggestions for improvement.

In his inaugural address, **Dr. V. A. Parthasarathy** pointed out that the potential for spices cultivation in North Eastern states and East coast of the country still remains untapped. A concerted effort is required to exploit this latent potential and AICRPS is well positioned to take up this responsibility. The other salient points are given below

- Adopt philosophy of “more crop per drop of water” in designing research agenda.
- Formulate strategy to meet growing domestic and international demand for spices, mainly through productivity and quality enhancement.
- The project should accord special focus on the NEH states which has tremendous potential, both in area expansion, productivity increase and default organic farming.
- Food safety is most important particularly for spices.
- Special emphasis on transfer of technology and skills to the clientele.
- More research efforts on production technology of organic spices, which has considerable market potential.
- Develop a professional approach to germplasm management and utilization.
- Steps may be taken to de-notify obsolete varieties and place strong institutional checks and balances in considering new varieties for release.
- Create a strong network of accredited nurseries, both in public and private sector to ensure easy availability of quality planting material. Only notified and certified varieties should be multiplied.
- Strict internal quarantine measures need to be adopted to prevent spread of pest and diseases within the country.
- Strengthening of research on major pest and diseases of spice crops with a focus on developing organic plant protection modules.
- Skill development
- Scientist must be vigilant about invasive pest and diseases particularly in NE region.
- There must be greater coordination with MIDH so that successes translated into productivity.
- Address specific issues through voluntary/project mode centres with additional funds.

18 publications in local languages and english on package of practices of spices and technologies/varieties developed by the centres were released during the workshop.

The inaugural session of the workshop concluded with a formal vote of thanks proposed by Ms. Akshitha, H. J., Scientist, AICRP on Spices.

PROJECT COORDINATOR'S REPORT

K. Nirmal Babu

Project Coordinator

ICAR-All India Coordinated Research Project on Spices

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

All India Coordinated Research Project on Spices with its headquarters at ICAR-IISR, Kozhikode is a coordinating unit with 38 centres (19 regular, 10 co-opting and 9 voluntary centres) supplemented by 3 more centres through project mode funding, spreading over 12 agro climatic zones in 23 states of the country. Black Pepper, Small Cardamom, Large Cardamom, Ginger, Turmeric, Cinnamon, Nutmeg, Clove, Coriander, Cumin, Fennel and Fenugreek are the mandate crops. Annual budget for the year 2014-15 was Rs. 462 lakhs as ICAR share and 150.31lakhs as state share.

New Initiatives

To meet the increasing demand for hastening the spices research in the North East, 2 centres *viz.*, Nagaland and Kahikuchi were started in co-opting mode. A project mode program was also undertaken to see the possibility of cultivating cumin in Periyakulam of Tamil Nadu.

We had initiated pepper intensification program in East coast at Kolli and Yercaud hills of Tamil Nadu and Koraput district in Orissa, by introducing high yielding black pepper varieties into coffee garden for increasing production and income, especially in Tribal areas.

We also initiated intensification of large cardamom in Arunachal and Nagaland when disease free material will be introduced. Accordingly IARI Regional centre at Kalimpong was supported in project mode funding to generate virus indexed plants material and this will be made available to DASD under MIDH as well as Spices Board for further multiplication and distribution. We also surveyed Anjaw district in Arunachal and Mon district of Nagaland to understand the problems of large cardamom farmers in the region.

Varieties recommended for release in 25th AICRPS workshop

Five high yielding varieties of spices were recommended for release in 25th AICRP on Spices workshop held at UBKV, Pundibari. Two cardamom varieties Appangala – 2 (First hybrid resistant to *Katte* virus) from ICAR-IISR Regional Station, Appangala and PV-3 (Moderately resistant to drought) from Cardamom Research Station, Pampadumpara, 2 coriander varieties RCr 475 (Bushy and erect plant type) from SKN college of Agriculture (RAU), Jobner and Narendra Dhanja 2 (Dual purpose variety) from NDU&T, Kumarganj and a high yielding variety of fenugreek LFC-103 suitable for both irrigated and rainfed conditions from Horticulture Research Station, Dr. YSRHU, Guntur are the varieties recommended for release.

Black Pepper

During the year 99 accessions of black pepper were added to black pepper germplasm maintained at various black pepper centres of AICRPS. Some unique varieties like high yielding Karimunda, Balankotta and Arakalumunda were collected and added to the germplasm.

At Yercaud in a germplasm evaluation trial PN 57 (4.08 kg vine⁻¹) recorded highest yield. At Panniyur, the hybrids PRS160 and PRS 161 were found to be promising with maximum green berry yield of 4.2 kg vine⁻¹ and 4 kg vine⁻¹ respectively.

As per the observations recorded in the organic farming trial at Chintapalle, vines treated with inorganic fertilizers have recorded higher yields (2.51 kg vine⁻¹) compared to vines treated with organic source of nutrients (1.831 kg vine⁻¹). Drip irrigation trial at Panniyur revealed that application of 50% RDF with 8 l of water through drip help in obtaining good yield (4.89 kg vine⁻¹).

In a trial to manage *Phytophthora* foot rot of black pepper in new plantation at Sirsi IISR Thevam recorded highest growth (2.49 m) and it was statistically on par with IISR Shakti (2.09 m) whereas in Panniyur minimum disease incidence was observed in Panniyur-1 (11.1%). IISR Thevam showed the least disease incidence and the treatment of potassium Phosphonate 0.3% spray along with the basal application of *Trichoderma harzianum* @ 50 g vine⁻¹ was the best at Pampadumpara.

Black pepper standard *Erythrina subumbrans* tolerant to *Erythrina* gall wasp is being multiplied at Mudigere and is distributing the material to the farmers and the institutions.

Small Cardamom

A total of 309 germplasm accessions are maintained at Mudigere and Pampadumpara centres. In evaluation of promising lines of cardamom, PS 27 performed well in terms of number of tillers (21.56), panicles per tiller (1) as well as productive tillers (2.33).

In an fertigation trial in small cardamom at Mudigere application of irrigation at 9 l/clump/day with 100% RDF through drip recorded the highest capsule yield (207.41 kg ha⁻¹) and this is on par with irrigation at 9 lt./clump/day with 75% RDF (201.23kg ha⁻¹).

Application of organics with bio-fertilizers recorded significantly higher yield at Mudigere than only organics. Application of Jeevamruta + *Azospirillum* (10g/clump) + Phosphate solubilising bacteria (10g/clump) + *Trichoderma* (10/clump) resulted in the highest fresh (220.27g plant⁻¹) and dry capsule yield (42.89 g plant⁻¹) at Pampadumpara.

Lowest disease incidence (13.67 %) of pseudostem rot was observed in the application of Carbendazim at 2g l⁻¹ as foliar spray as well as basal application at Pampadumpara.

Large Cardamom

In large cardamom 271 germplasm accessions are maintained at ICAR and ICRI, Gangtok centres.

A survey was undertaken in the Anjaw district in Arunachal and Mon district of Nagaland to understand the problems of large cardamom farmers in the region.

Adoption of phytosanitation and application of bioagents in large cardamom has resulted in controlling the incidence pests (shoot fly and leaf caterpillar) and diseases (blight, chirke and foorkey) in farmers field at Singhik, North Sikkim.

Ginger

10 Bold types of ginger and one unique black ginger (*Kaempferia parviflora*) were collected from Nagaland. Jamaican ginger and Singapore ginger were collected from local farmer's fields of Kerala and Tamil Nadu respectively.

One hundred and eighty three ginger collections were evaluated for rhizome yield and other horticultural traits at Solan. The yield range varied from 100.63 q ha⁻¹ (SG-865) to 141.20 q ha⁻¹ (SG-857) whereas at Kumarganj NDG-55 (317.80 q ha⁻¹) recorded highest yield followed by NDG-28 (138.30 q ha⁻¹) and NDG-6 (132.40 q ha⁻¹).

In source sink relationship trial, variety Mahima produced the highest fresh yield of 4.68 kg plot⁻¹ (9.43 t ha⁻¹) and highest dry yield of 1.21 kg plot⁻¹ at Pundibari.

Foliar spray with Hexaconazole (0.1%) first at disease appearance and then 2 times at 20 days interval was found to be effective in controlling the leaf spot disease incidence at Pundibari and Solan but at Dholi foliar spray of Propiconazole (0.1%) first at disease appearance and subsequently 2 sprays at 20 days interval after 1st spray recorded less disease incidence.

Turmeric

Three *Curcuma* species were collected from Nagaland and Arunachal Pradesh and Jamaican turmeric is collected from local farmer's field in Kerala.

NDH-98 recorded maximum rhizome yield at Pasighat (36.41 t ha⁻¹), Chintapalle (590.0 g plant⁻¹), Kumarganj (31.66 t ha⁻¹) and Raigarh (16.67 t ha⁻¹) in an turmeric CVT trial.

In an drip irrigation trial, drip once in a day at 80% PE recorded highest rhizome yield at Kammarpally (38.32 kg plot⁻¹), Guntur (51.1 t ha⁻¹) and also at Coimbatore whereas in Pundibari surface irrigation 5 cm at 0.90 IW/CPE recorded highest rhizome yield of 11.40 kg plot⁻¹.

In a trial to manage foliar diseases using tolerant lines at Coimbatore CL-32 and CL-34 recorded least incidence of leaf spot and leaf blotch respectively. At Dholi NDH – 128 and at Kumarganj

CL-34 were least affected by both the diseases. At Pundibari TCP 129 recorded least incidence of both the foliar diseases.

Tree Spices

Germplasm of nutmeg, cassia, cinnamon and clove is maintained at Pechiparai and Dapoli. This year dwarf clove, king clove and extra bold Madagascar clove (for the first time) from Simpson and Rajan estates of Nagarcoil were collected and added to the germplasm.

Nutmeg collection survey was also conducted by project mode centre at KAU, Thrissur and unique collections in terms of tree shape, branching pattern, leaf size, sex form, fruit, mace and kernel characters, yield, reaction to biotic and abiotic stress were looked into. 15 different accessions were located from Pathanamthitta, Kottayam, Ernakulam, Thrissur, Malappuram, Palakkad and Kozhikode.

In a nutmeg germplasm evaluation trial at Dapoli average dry nut yield (1505.0 g) and dry mace yield (315.0 g) was recorded in genotype DBSKKVMF 29 in years 2006 to 2014. The genotype DBSKKVMF 29 is found promising considering its fruit wt., nut wt. and mace wt.

Coriander

In an MLT of coriander at Coimbatore among 70 genotypes seed yield of genotypes varied from 325 to 656 kg ha⁻¹ and the genotype LCC-168 registered maximum seed yield (6.56 q ha⁻¹) which was on par with DH 246, LCC 144, CS 66, ND 80 and ND 82.

In a CVT trial genotype LCC 219 has recorded significantly higher yield at Coimbatore (573.20 kg ha⁻¹), Guntur (12.95 q ha⁻¹), Jabalpur (4.143 q ha⁻¹) and Navsari (11.04 q ha⁻¹). Whereas JCr 404 (17.40 q ha⁻¹) at Jagudan, JCr 379 (23.47 q ha⁻¹) at Jobner, ND Cor 10 (15.27 q ha⁻¹) at Kumarganj.

PGPR evaluation trial revealed that seed treatment with FK 14 resulted in increasing the seed yield at Coimbatore and study at Guntur revealed that *Pseudomonas putida* FK14 and *Macrobacterium paraoxydans* FL18 strains found not only in improving the yield but also in management of wilt in coriander at Guntur.

A trial to test the efficacy of new generation fungicides for the management of coriander powdery mildew was laid out at Coimbatore. In this trial the incidence of powdery mildew was less (5.14 PDI) in propiconazole sprayed plants and these plants also recorded higher grain yield of 663.33 kg ha⁻¹ and was followed by Tebuconazole, Difenconazole (11.67 PDI), while in control the disease incidence was 91.55 PDI with grain yield of 5.56 q ha⁻¹.

Cumin

Germplasm of cumin is maintained at Jagudan and Jobner, at present there are about 148 germplasm accessions including the exotic collections.

At Jobner in an CVT trial CUM-23 recorded maximum seed yield of 6.37 q ha⁻¹ followed by RZ-345 check (6.33 q ha⁻¹), CUM-24 (6.26 q ha⁻¹) and CUM-25 (6.00 q ha⁻¹), while lowest seed yield of 3.43 q ha⁻¹ was recorded in CUM-22.

Fennel

In a CVT trial the top yielders at various centres are as follows: AJ Fnl 2 (20.58 q ha⁻¹) at Jabalpur, JF -674-1 (14.26 q ha⁻¹) at Jagudan, UF 157 (24.05 q ha⁻¹) at Jobner.

Of the ten entries evaluated under IET at Jobner, entry UF-286 recorded maximum seed yield of 23.96 q ha⁻¹ followed by UF-287 (22.61 q ha⁻¹), UF-288 (22.35 q ha⁻¹), RF-205 check (21.48 q ha⁻¹), and UF-283 (20.64 q ha⁻¹), while lowest seed yield of 15.81 q ha⁻¹ was recorded in UF-281. In another IET 2012 at Jagudan pooled over data of 3 years indicated that the entries JF-576 (14.36 q ha⁻¹) and JF-2012-9 (14.01 q ha⁻¹) recorded significantly higher seed yield over GF-12.

Fenugreek

Fenugreek CVT 2012 revealed that at Coimbatore genotype LFC-98 is the performing good with seed yield of 4.31 q ha⁻¹ whereas at Guntur UM 202 (16.69 q ha⁻¹), UM 354 (16.27 q ha⁻¹), LFC 98 (15.36 q ha⁻¹) and AFg 5 (14.76 q ha⁻¹) recorded significantly higher yield. AFg 5 (19.66 q ha⁻¹), JFg 245 (18.88 q ha⁻¹) and NDM 69 (18.69 q ha⁻¹) recorded higher yield at Jagudan.

In a PGPR trail *Pseudomonas putida* FK14 and *Macrobacterium paraoxydans* FL18 strains found effective in increasing the yield as well as in management of dry root rot at Guntur.

Production and distribution of quality planting material

- Produced and supplied about 20 t of pure seed material of high yielding high curcumin turmeric variety Roma in tribal areas of Andhra Pradesh and 100 t of Megha turmeric in Meghalaya for establishing areas of high quality turmeric for industrial use.

Distribution of Planting and seed material

- The AICRPS centres along with DASD have multiplied and distributed 2.5 lakh rooted cuttings of black pepper, 10,000 seedlings/suckers of cardamom, 148 t of turmeric (includes Roma and Megha produced in Andhra Pradesh and Meghalaya), 20 t of ginger, 600 grafts of nutmeg and 2500 air layers of cinnamon.
- In seed spices 10 quintals each of cumin, coriander, fennel and fenugreek seed material is produced and distributed

Transfer of Technology

As “Seeing is believing” to make the technologies visible to farming sector scientists are actively involved in the demonstration of the technologies/varieties developed by the centre. Following are some of the technologies demonstrated during the year.

- ✓ Integrated organic farming in turmeric (Kammarpalli)
- ✓ Seed treatment in turmeric (Kammarpalli)
- ✓ Processing of cardamom and drip irrigation in cardamom (Mudigere)
- ✓ Promising Ginger genotype IC-593889 (SG-26-04) (Solan)
- ✓ Biofumigation using cabbage for the control of soft rot and bacterial wilt diseases in ginger (Pundibari)
- ✓ Yield potential of Panniyur varieties under proper IPDM and High yielding capacity of Panniyur varieties under abiotic stress (Panniyur)
- ✓ Bush pepper cultivation (Sirsi)
- ✓ FLD on ginger and turmeric organic cultivation (Pottangi)
- ✓ Use of *Trichoderma viride* in pepper cultivation (Yercaud)
- ✓ FLD on Suguna variety of turmeric (Guntur)
- ✓ Processing of black pepper and turmeric, Pro tray technology of turmeric and ginger, Cinnamon peeling, soft wood grafting and Bush pepper technology (Dapoli)
- ✓ Demonstration of high yielding Turmeric variety CO-2 (Coimbatore)
- ✓ Demonstration of high yielding varieties of coriander (GCor-2) and fennel (GF-12) (Jagudan)

Scientists are also involved in transfer of technology by conducting and attending as resource persons in trainings, seminar and also through media (news paper, radio talks and TV programs).

Success stories

Black Pepper grafted on resistant root stock - *Piper colubrinum* an eco friendly way to manage *Phytophthora* foot rot, reducing excessive use of fungicides. This grafted pepper cultivation is already spread to about 80 ha in Uttara Kannada district in Karnataka.

Highly efficient single node protrait technology in ginger and turmeric, was successfully demonstrated in over 20 acres in many farmers field and over 20 awareness and training programmes were conducted by TNAU in Tamil Nadu, Andhra Pradesh, Maharashtra and Orissa. A similar program was also done in Telangana and Andhra Pradesh conducted by Chintapalli and Kammarpalli centres respectively.

Single bud soilless cultivation of ginger under protected condition in Kerala.

Tribal welfare measures

Trainings at Pottangi, Chintapalle and Raigarh were conducted and distributed the planting material to the farmers.

New initiatives in North East

Introduced 24 varieties of Turmeric, 8 varieties of ginger to Nagaland. Training on portray technology of ginger and turmeric was given to Central Institute of Horticulture and Nagaland University.

Combating natural disasters and mitigating climate change

The AICRPS centres at various states have been providing periodical advisories regarding the drought, pest and disease outbreak.

Collaboration

In addition to IISR-Kozhikode, NRCSS-Ajmer and State Agricultural Universities we have collaboration with DASD, Spices Board, Central Institute of Horticulture. We also helped Amalgamated plantations in Assam and coffee planters association Koraput in Orissa for improving and establishing black pepper plantations and increasing the productivity in these regions.

Monitoring

Monitoring of projects and programs undertaken by the centres is monitored by Project Coordinator's visit to the centres and the experimental plots. This year Project Coordinator has visited 18 centres which includes regular, co-opting, voluntary and project mode centres. Monitoring was also done by monthly reports, annual report sent by the centres.

ACTION TAKEN REPORT 2014-15

Sl. No.	Decision/Recommendations	Centres	Action Taken
TECHNICAL SESSION I: GENETIC RESOURCES			
1.	Trait specific germplasm should be collected and evaluated	All centres	This year many trait specific germplasm accessions were collected. For eg extrabold clove, nutmegs with excellent fruit characters, high oil type ginger, white and black gingers, high yielding black peppers etc. the results will be presented during the WS
2.	Unique genetic resources need to be registered in NBPGR, New Delhi	All centres	Many unique lines were identified this year. Registration will be done soon
3.	Stability analysis may be done for the germplasm trials conducted for more than five years and core grouping may be done.	All centres	Stability analysis has been completed in turmeric and coriander genotypes and the results will be presented during XXVI workshop

			(Coimbatore)
4.	Uniform methodology may be followed for pest and disease scoring.	All centres	The methodologies standardized at IISR & NRCSS were being used for disease screening.
5.	Status report may be submitted for pollination problem in cumin	Jagudan	This could not be done this year but the will be collected and submitted in 3 months.
6.	In indigenous collection of spice crops like Black pepper, Cardamom, Ginger and Turmeric germplasm should be effectively screened for the major disease resistance.	Black pepper, Cardamom, Ginger and Turmeric centres	This process is on and tolerant genotypes were identified for leaf diseases in turmeric, large cardamom, small cardamom etc
7.	DNA finger printing of unique germplasm may be done.	All centres	This will be done with the help of national institutes
8.	Material of CUL 5308 of black pepper may be sent to IISR for verifying the tolerance level to biotic and abiotic stress	Chintapalle	his variety was found to be susceptible to Phytophthora and thrips. Tolerance to abiotic stress will be done this year.
9.	<i>Piper arboreum (colubrinum)</i> used as rootstock at Sirsi may be confirmed for tolerance to abiotic stresses	Sirsi	<i>P. colubrinum</i> is susceptible to drought
10.	Nucleus planting material may be provided to low altitude areas apart from Sikkim. Virus indexing should be done before distribution of the materials	IARI RS, Kalimpong & Spices Board, Gangtok	The Kalimpong center has assembled the facilities. The serum is available at IARI will be used from this year.
11.	UBKV and Nagaland University may be involved for joint exploration for collection of the germplasm with the help of Spices Board from the unexplored areas in North East and West Bengal.	UBKV, Pundibari and Nagaland University	Two collections of large cardamom from Arunachal, 3 unique collection 2 black and 1 red ginger, 9 collections of local ginger and 3 piper were collected from NE.
12.	Wild type ginger collection may be identified with the help of taxonomist	Pottangi	All our ginger collection were identified based on Prof. Sabu Calicut University, an expert on Zingiberaceae. The new gingers were identified as <i>Zingiber malaysianum</i> & <i>Kaempferia parviflora</i>
13.	Mace recovery and oil content of unique genotypes of nutmeg may be analyzed	KAU, Thrissur	This was done and will be presented in the work shop
14.	Unique genotypes may be grafted and supplied to various centres for establishing	Dapoli, KAU, Pechiparai (Tree	This year a total of 10 nutmeg varieties from Dapoli and

	mother gardens in tree spices centres.	spices centres)	KAU were grafted and were distributed to all Tree spices centers
15.	A set of coriander germplasm lines may be evaluated and others may be deposited in repository at NAGS <i>i.e.</i> , NRCSS, Ajmer	Coimbatore	Indigenous collection of coriander genotypes (100 Nos.) has been deposited at NRCSS, Ajmer.
16.	Multilocation trial of coriander, cumin, fennel and fenugreek will be continued for one more year	Seed spices centres	This was continued and the results are presented in this WS
TECHNICAL SESSION II: CROP IMPROVEMENT			
17.	Popular article/ Tech. bulletin may be published from the results obtained from the completed trials.	All centres	This year over 15 technical bulletins were published in various languages and are being released in this WS.
18.	Promising black pepper entries PRS-160 and PRS-161 may be promoted to the forthcoming CVT and sufficient planting material has to be generated before the initiation of the CVT to distribute among the participating centers.	Panniyur	A new CVT with these varieties along with Vijay and Coorg excel was proposed this year.
19.	The centres must generate sufficient quantity grafts and re-initiate the trial on Evaluation of grafts on different root stocks in black pepper	All pepper centers	The grafts are being produced this trial will be made uniform from this year onwards
20.	Closure report of the trial cardmom CVT 2007/2009 – Series VI at Appangala and Sakleshpur centers should be submitted to the PC unit and other centers will continue the trial.	Appangala, Sakleshpura, Mudigere, Myladumpara and Pampadumpara	This is being presented in this WS.
21.	G X E interaction on quality ginger trial is continued till the replication wise data on quality attributes has to be obtained and submitted to the PC unit	All G X E centres	This was done and Analysis is in progress by Pottangi center. This will be ready in another 3 months
22.	In all the trials on turmeric, dry recovery, curcumin content and essential oil should be recorded.	All turmeric centres	This was done by Solan center for all the CVT. The results are being presented in the WS
23.	In nutmeg the promising seedling trees may be promoted for MLT in Maharashtra state and sufficient plant materials are to be generated to initiate a new CVT at different centre.	Dapoli	Sufficient materials were generated and the trial will be planted in next planting season. Another new trial on unique farmers varieties were

			requested by NIF and this will be laid as soon as the grafts were received.
24.	Coumarin content in the promising accession D3 of cassia should be recorded.	Dapoli	The samples were sent to IISR and analysis is being completed.
25.	A new IET is to be initiated at the Hisar centre on Coriander, Fennel and Fenugreek	Hisar	A trial is in progress and the results will be presented in this WS
TECHNICAL SESSION III: CROP MANAGEMENT			
26.	Black pepper based mixed cropping system for sustainable productivity and food security - Dapoli & Sirsi are the extended centers for the trial	Dapoli, Sirsi	Dapoli & Sirsi have also planted the trial on Black pepper based mixed cropping system
27.	Effect of fertigation on yield of cardamom through drips - Crop management should be given more importance to get better treatment effect	Mudigere, Pampadumpara	A trial is in progress at Mudigere and the results will be presented in this WS
28.	Nutrient composition of Jeevaamrutha may be examined critically	Pampadumpara, Mudigere	Yet to be done
29.	Weed density and weed bio mass must be recorded in different treatments in the trial to evaluate herbicide for the effective control of weed in ginger	Chintapalle	This is being recorded
TECHNICAL SESSION IV: VARIETAL RELEASE			
30.	Within one year of identification of varieties in the AICRPS Workshop, the proposal should be submitted to CVRC (Central Varietal Release Committee) for notification, along with IC numbers, DNA finger print profiles and high resolution photographs	All centres	This is being seriously attempted but getting DNA finger prints is delaying this process.
31.	If DUS guidelines are notified in the particular crop, it needs to be registered with PPVFRA, New Delhi.		DUS guidelines were notified for pepper, cardamom, ginger and turmeric coriander and fennel were notified. Most of the released varieties in these crops are being evaluated at Notified DUS centers for notification.
32.	In case of collection of germplasm from custodian farmers/ planters credit should be given to them.	All centres	This is being strictly implemented and three trials on farmer's varieties in black pepper, cardamom and

			nutmeg are being initiated upon the request of NIF so that farmers will get most of the credit.
33.	Status report of the coriander varieties released from Jobner centre may be presented in the next workshop.	Jobner	A booklet was prepared and being released in this WS
34.	All the scientists involved in the development/evaluation of the particular variety should also be given due credit.	All centres	This is done in all the varieties proposed this year.
35.	Sufficient planting material needs to be generated before submission of the proposal.	All centres	This is given highest importance and only varieties with sufficient planting materials were recommended for release.
TECHNICAL SESSION VI: CROP PROTECTION			
36.	<i>Erythrina subumbrans</i> plants should be multiplied and distributed to all other centres.	Mudigere	This was done every year and the materials were distributed in Kerala and Karnataka
37.	Evaluation of new insecticides/biopesticides in cardamom against thrips and shoot and capsule borer - Experiment running at AICRP centre, Calicut having organic management with bioagents should be taken up by all centres.	AICRPS	This was done as mentioned earlier at various places including AICRPS center Pampadumpara which is a hot spot for thrips under the supervision of IISR
38.	Survey and identification of disease causing organisms in turmeric and screening of turmeric germplasm against diseases - The experiment may be continued with new title on disease surveillance and record weather parameters, GIS, etc.	Coimbatore, Pundibari, Dholi, Raigarh	Survey was conducted in turmeric growing areas. Weather parameters and GIS were recorded in surveyed areas (Coimbatore)
39.	Accepted common names of foliar diseases should be followed such as leaf blotch	Coimbatore	Followed as per instruction
40.	Kumarganj centre should give their turmeric entries to Coimbatore again as it was missed	Kumarganj / Coimbatore	NDH lines are included in this trial during 2015-16 (Coimbatore)
41.	Causes of yellowing symptoms in cumin should be further studied.	Jagudan	Plants having yellowing symptoms of cumin were sent for indexing for any viral presence at Anand Agricultural University. Virus could not be located so far.

TECHNICAL SESSION VII: PLENARY SESSION			
42.	Research on Ajowain and Dill may be initiated in AICRPS	AICRPS	This year a evaluation trial on Ajowain will be taken up using the selections contributed by various seed spices centers
43.	Certified planting material production for ginger and turmeric in collaboration with DASD need to be scaled up to meet the emerging demand	AICRPS	AICRP centers have significantly increased their capacity and are producing over 50 tonnes of turmeric and 30 tonnes of ginger seed which is high.
44.	Implementing good nursery practices and get the nurseries of AICRPS accredited as early as possible	AICRPS	Instructions were given to all centers. DASD is the certifying agency. We will comply once the accreditation guidelines were issued and the process starts.
45.	Compile the technologies developed by AICRPS for commercialization	AICRPS	This is being done. Another 6 more months are need as digitization is in progress.
46.	DASD may provide support to establish large cardamom nursery at Kalimpong	AICRPS	A large cardamom nursery is already in existence at IARI. Space for new poly house will be constructed with DASD help in the area allotted by UBKVV.
47.	A meeting will be organized by the Horticulture Commissionerate, New Delhi and DASD to develop strategies to intensify large cardamom cultivation in NE states	AICRPS	A national WS was organized in September involving all concerned along with officials of NE states. A road map was prepared. A large cardamom guide prepared by SB was released. A Short report will be presented in this WS. The detailed report will be submitted in a months' time.
48.	New program of introducing of cumin to Tamil Nadu – TNAU station at Periyakulam will take up under project mode funding.	Periyakulam	This was initiated and preliminary results will be presented. The results indicate cumin is growing well in some place but the seed set is yet to come.
49.	Cataloguing of existing germplasm is to be completed in a phased manner	AICRPS	This is taken up with all seriousness. The first set of some crops will be made available in 6 months' time.
50.	High priority need to be given to	Panniyur	This was given highest

	breeding/selection for <i>Phytophthora</i> resistance in black pepper, thrips in small cardamom, stem gall in coriander and blight in cumin		<p>importance.</p> <p>Two genotypes reported to be field tolerant to <i>Phytophthora</i> is being evaluated.</p> <p>Selfed progenies of inter specific hybrid are being screened for segregation of resistance, in addition to crosses involving all tolerant genotypes and more crosses involving <i>P. colubrinum</i> and black pepper.</p> <p>A genotype tolerant to thrips is being evaluated in cardamom.</p> <p>3 coriander varieties from Jobner and one new variety from Ajmer are resistant to stem gall and are being popularize.</p> <p>No resistance cumin blight was so far found.</p>
51.	A program on micro irrigation in ginger may be initiated	AICRPS	This will be initiated in next season. This year observations were taken from farmers' fields in Coimbatore where successful cultivation of ginger under mist irrigation was reported.
52.	Use of root stock for resistance to <i>Phytophthora</i> need to be intensified and demonstration of grafted pepper on <i>Piper colubrinum</i> will be taken up to popularize in hotspots of <i>Phytophthora</i> where water will not be a limiting factor	Sirsi	This was done and the success story in Karnataka and Kerala was presented in International Symposium on <i>Phytophthora</i> . A short report will also be presented in this WS
53.	Training on protray technology in turmeric and ginger may be given to officials of various states to popularize the technology	Coimbatore	The turmeric protray technology has been disseminated through demonstration and trainings to farmers from various states viz., Rajasthan, Maharashtra, Andhra Pradesh and Kerala and department officials viz., AO's, HO's and ADH's. It is gaining tremendous popularity among farmers. Similarly ginger protray technology was also popularized in Kerala, Nagaland and Andhra A new problem was also noticed

			when large scale multiplication is being attempted plan let rot due to pathogens and excess moisture in coir pith used. A preliminary report will be presented in this WS .
54.	Bulletins on varieties released and technologies developed need to be prepared in local languages.	AICRPS	Over 5 bulletins in local languages were being released in this WS. Last year also 5 in local languages were released
55.	Crop specific institute should be identified for DNA finger printing	AICRPS	IISR for tropical spices and NRCSS for seed spices. The help of NBPGR can also be taken as per need.
56.	Expertise of IISR can be utilized to identify black pepper species in germplasm wherever necessary for varietal description	AICRPS	This was done with the help of Dr. K. V. Saji and Project Coordinator.
57.	Develop GAP for spices GAP for cardamom need to be reformed and finalized	AICRPS	GAPs in black pepper was finalized under the supervision of DASD. The cardamom and cumin are also in final stages of completion. The draft on cardamom is being discussed in the cardamom BS session in this workshop and will be utilized. The modalities will be decided in the Industry interface.
58.	A trial on organic disease management of seed spices has to be initiated	AICRPS	On management of Coriander powdery mildew using bio-inoculants <i>Pseudomonas sp.</i> and <i>Bacillus spp.</i> in Coimbatore were initiated.
59.	Pamphlet on micro irrigation of turmeric need to be provided	Coimbatore	This was prepared
60.	While preparing extension bulletins farmer friendly language should be used	All Centres	This was being implemented. Many pamphlets were also prepared in local languages and are being released in this WS

TECHNICAL SESSION: I

GENETIC RESOURCES AND CROP IMPROVEMENT

Chairpersons : Prof. P. N. Jagadev, Director of Research, OUAT, Orissa
Dr. V. P. Neema, Professor and Head, PRS, Panniyur

Rapporteurs : Dr. S. Suryakumari, Dr. YSRHU, Guntur
Dr. R. Chitra, TNAU, Coimbatore

Black pepper

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

- Unique genotypes should be registered in NBPGR, New Delhi (Action: Sirsi & Panniyur)

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

- Inter-varietal hybrids may be tested for biotic and abiotic stress tolerance with the help of IISR scientists (Action: Panniyur)

PEP/CI/3.3 - CVT 2006 Series VI

- Data to be generated on all aspects of biotic and abiotic stress from the centres before submission of variety release proposal.

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

- Grafting may be done with Panniyur on *P.nigrum* as an alternative of *P.colubrinum*

Large cardamom

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

- Unique germplasm may be forwarded to CVT
- ICRI-1 and ICRI-2 may be tested in large cardamom growing areas.
- To identify the virus free genotypes from the established mother stocks and distributed to the large cardamom growing areas.

Small cardamom:

CAR/CI/3.6 - CVT 2007/2009-Series VI

- The trial may be continued one more year and concluded for variety release (Action: Mudigere)

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

- The trial may be conducted at Pampadumpara and Myladumpara during 2015-16

Ginger

GIN/CI/3.4 - Initial Evaluation Trial of bold/vegetable ginger

- The varieties *viz.*, Nadia and Baise may be added in this trial.

GIN/CI/4.2 – Evaluation of germplasm from other centres

- Collect white coloured ginger and included in germplasm trial.
- Collect the genotypes based on the characters viz., resistant to soft rot, vegetable ginger types and high oil yielding genotypes.

Turmeric

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

- Confirm the curcumin content of the genotypes those having more than 7.9% (Action: Raigarh)

TUR/CI/3.3 - Initial Evaluation Trial 2010 and TUR/CI/3.5 - Initial Evaluation Trial 2012

- Two high yielding genotypes from each trial may be identified and may be forwarded to CVT 2016 with national check (Prathibha) and one local check.

Coriander

COR/CI/3.6 - Initial Evaluation Trial 2012

- Different check varieties may be included for rainfed and irrigated trials.

Cumin

CUM/CI/3.5 – IET on Cumin 2013

- Quality evaluation may be done at Gujarat and Rajasthan to find out the facts of market acceptance/industry acceptance.

Project Mode centres

1. Nutmeg – KAU, Thrissur

- Farmer's unique varieties may be registered as per PPVFR act.
- The funding to the centre is increased by another Rs. 1.00 lakh as requested.

2. Cumin - Periyakulam

- It was suggested that to select the suitable cumin growing area in Tamil Nadu based on the GIS data (NICRA)
- Recommended package of practices need to be followed
- White coloured shadenet may be used over the cultivation plots.
- Gujarat and Rajasthan centres are requested to provide the seeds of rainfed cumin varieties to Periyakulam centre.

Project mode proposal on “Studies on the performance of the Nutmeg (*Myristica fragrans* Houtt) ecotypes in coconut based cropping system in Tamil Nadu” from HC & RI, TNAU, Coimbatore is approved for project mode funding for 2 years

Project code	Title	Centres	Comments
Black Pepper			
PEP/CI/1	Genetic Resources		
PEP/CI/1.1	Germplasm collection, characterization, evaluation and conservation	Ambalavayal, Chintapalle, Dapoli, Panniyur, Pundibari, Sirsi, Yercaud	Continued
PEP/CI/2	Hybridization trial		
PEP/CI/2.1	Inter-varietal hybridization to evolve high yielding varieties	Panniyur	Continued
PEP/CI/3	Coordinated Varietal Trial (CVT)		
PEP/CI/3.3	CVT 2006 Series VI	Chintapalle, Dapoli, Panniyur, Pampadumpara, Pechiparai, Sirsi, Yercaud	Continued
PEP/CI/3.4	Evaluation of grafts, orthotropic and runner shoots in black pepper	Ambalavayal, Panniyur, Sirsi, Yercaud	Continued
PEP/CI/3.5	CVT 2015 on Farmers varieties of black pepper – Series VII	Chintapalle, Sirsi, Panniyur, 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 (<i>Elettaria cardamom</i> L. Maton) cultivars/varieties for organic cultivation in the high ranges of Idukki district	Pampadumpara	Continued
CAR/CI/3	Coordinated Varietal Trial		
CAR/CI/3.6	CVT 2007/2009-Series VI	Mudigere, Myladumpara, Pampadumpara	Continued
CAR/CI/3.7	CVT of drought tolerance in Cardamom – Series VII	Appangala, Mudigere, Sakaleshapura, Pampadumpara, Myladumpara	Continued
CAR/CI/3.8	CVT 2015 on Farmers varieties of cardamom-Series VIII	Appangala, Mudigere, Pampadumpara, Myladumpara	Continued
CAR/CI/4	Varietal Evaluation Trial (VET)		
CAR/CI/4.1	Initial Evaluation Trial – I	Mudigere	Continued
CAR/CI/4.2	Initial Evaluation Trial – II	Mudigere	Continued
CAR/CI/4.3	Initial Evaluation Trial – 2012	Pampadumpara	Continued
Large Cardamom			
LCA/CI/1	Genetic Resources		
LCA/CI/1.1	Germplasm collection and evaluation of large cardamom	ICAR Regional Station, Gangtok, ICRI Regional	Continued

		Research Station, Gangtok	
Ginger			
GIN/CI/1	Genetic Resources		
GIN/CI/1.1	Germplasm collection, characterization, evaluation and conservation	Dholi, Kammarpally, Kumarganj, Pundibari, Pottangi, Raigarh, Solan	Continued
GIN/CI/2	Coordinated Varietal Trial (CVT)		
GIN/CI/2.3	CVT 2013-Series VIII	IISR, Dholi, Pottangi, Pundibari, Solan	Continued
GIN/CI/2.4	CVT 2015 – Series IX	IISR, Dholi, Pottangi, Pundibari, Kalyani, Solan, Nagaland	Continued
GIN/CI/3	Varietal Evaluation Trial		
GIN/CI/3.3	Initial Evaluation Trial – 2012	Kumarganj, Pottangi	Continued
GIN/CI/3.4	Initial Evaluation Trial of bold/vegetable ginger	Pottangi	Continued
GIN/CI/4	Quality Evaluation Trial		
GIN/CI/4.1	Evaluation of germplasm for quality	Solan	Continued
GIN/CI/4.1	Evaluation of germplasm from other centres	Solan	Continued
Turmeric			
TUR/CI/1	Genetic Resources		
TUR/CI/1.1	Germplasm collection, characterization, evaluation and conservation	Barapani, Coimbatore, Dholi, Kammarpally, Kumarganj, Pasighat, Pottangi, Pundibari, Raigarh, Solan	Continued
TUR/CI/2	Coordinated Varietal Trial		
TUR/CI/2.5	CVT on Turmeric 2013	Chintapalle, Coimbatore, IISR, Kammarpally, Kumarganj, Pundibari, Pottangi, Raigarh, Navsari, Pasighat	Continued
TUR/CI/3	Varietal Evaluation Trial		
TUR/CI/3.3	Initial Evaluation Trial 2010	Pantnagar, Raigarh	Concluded
TUR/CI/3.5	Initial Evaluation Trial 2012	Dholi, Kumarganj	Concluded
TUR/CI/3.6	Initial Evaluation Trial 2013	Pottangi	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/2.2.1	CVT 1992-Clove	Pechiparai	Continued
TSP/CI/2.2	CVT 2001-Nutmeg	Dapoli, Pechiparai	Continued
TSP/CI/2.3	CVT-2001-Cassia	Dapoli, Pechiparai	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, Kumargunj, Raigarh	Continued
COR/CI/1.2	Multilocation evaluation of germplasm in coriander	Ajmer, Coimbatore, Dholi, Guntur, Hisar, Jagudan, Jobner, Kumargunj	Concluded
COR/CI/1.3	Identification of drought/alkalinity tolerant source in coriander	Jobner	Continued
COR/CI/2	Coordinated Varietal Trial		
COR/CI/2.5	Coordinated Varietal Trial on coriander 2012-Series IX	Ajmer, Coimbatore, Dholi, Guntur, Hisar, Jabalpur, Jagudan, Kota, Jobner, Kumarganj, Navsari, Pantnagar	Concluded
COR/CI/3	Varietal Evaluation Trial		
COR/CI/3.6	Initial Evaluation Trial 2012	Guntur, Jagudan, Kumarganj	Continued
COR/CI/3.7	Initial Evaluation in coriander	Dholi, Hisar, Jobner	Continued
COR/CI/4	Quality Evaluation Trial		
COR/CI/4.1	Quality Evaluation in coriander	Jobner	Continued
Cumin			
CUM/CI/1	Genetic Resources		
CUM/CI/1.1	Germplasm collection, characterization, evaluation, conservation and screening against diseases	Jagudan, Jobner, Mandor, Sanand	Continued
CUM/CI/1.2	Multilocation evaluation of cumin germplasm	Ajmer	Continued
CUM/CI/1.3	Identification of drought tolerance	Jobner	Continued
CUM/CI/2	Coordinated Varietal Trial		
CUM/CI/2.4	Coordinated Varietal Trial – 2013	Ajmer, Jagudan, Jobner	Continued
CUM/CI/3	Varietal Evaluation Trial		
CUM/CI/3.4	IET on Cumin 2012	Jobner	Continued
CUM/CI/3.5	IET on Cumin 2013	Jagudan	Continued
CUM/CI/4	Quality Evaluation Trial		
CUM/CI/4.1	Quality Evaluation in Cumin	Jobner	Continued
Fennel			
FNL/CI/1	Genetic Resources		
FNL/CI/1.1	Germplasm collection, characterization, evaluation, conservation and screening against	Dholi, Hisar, Jagudan, Jobner, Kumarganj	Continued

	diseases		
FNL/CI/1.2	Multilocation evaluation of fennel germplasm	Ajmer, Jobner, Kumarganj, Hissar	Continued
FNL/CI/2	Coordinated Varietal Trial		
FNL/CI/2.5	Coordinated Varietal Trial on Fennel 2012 Series VIII	Ajmer, Dholi, Hisar, Jabalpur, Jagudan, Jobner, Kumarganj, Pantnagar	Concluded
FNL/CI/3	Varietal Evaluation Trial		
FNL/CI/3.3	Initial Evaluation Trial 2012	Dholi, Jagudan, Kumarganj	Continued
FNL/CI/3.4	Initial Evaluation Trial 2014	Jobner, Pantnagar, Hisar	Continued
FNL/CI/4	Quality Evaluation Trial		
FNL/CI/4.1	Quality Evaluation in Fennel	Jobner	Continued
Fenugreek			
FGK/CI/1	Genetic Resources		
FGK/CI/1.1	Germplasm collection, characterization, evaluation, conservation and screening against diseases	Dholi, Guntur, Hisar, Jagudan, Jobner, Kumarganj, Raigarh	Continued
FGK/CI/1.2	Multilocation evaluation of fenugreek germplasm	Ajmer, Jobner, Hisar, Kumarganj	Continued
FGK/CI/1.3	Identification of drought tolerance source in fenugreek	Jobner	Continued
FGK/CI/2	Coordinated Varietal Trial		
FGK/CI/2.3	Coordinated Varietal Trial 2012 Series VIII	Ajmer, Coimbatore, Dholi, Guntur, Hisar, Jagudan, Jabalpur, Jobner, Kumarganj, Pantnagar, Navsari, Raigarh, Kota	Concluded
FGK/CI/3	Varietal Evaluation Trial		
FGK/CI/3.4	Initial Evaluation Trial 2012	Guntur, Kumarganj, Jagudan, Jobner	Continued
FGK/CI/3.6	Initial Evaluation Trial 2014	Dholi, Hisar	Continued

TECHNICAL SESSION II

CROP MANAGEMENT

Chairpersons : Dr. James George, Project Coordinator (AICRPTC), ICAR-CTCRI, Trivandrum
Dr. T.J. Zachariah, Head, Crop Production and PHT, ICAR-IISR, Kozhikode

Rapporteurs : Dr. K. Giridhar, Dr.YSRHU, Guntur
Dr. S. Sreekrishna Bhat, ICRI RS (Spices Board), Gangtok

General recommendations

- In all nutrient management trials soil analysis data to be provided with the results for better and accurate interpretation.
- The results of all the concluded projects must be made available for technology transfer and demonstrated in farmers' fields.
- In all the production trials quality parameters must be recorded along with yield and yield attributes for better interpretation of results.
- Planting material production and exchange among the centers must be taken up in time for implementing programmes as per approved schedule.
- In projects pertaining to micronutrient management, analysis of soil macro and micro nutrient status is mandatory.

Ginger

GIN/CM/5.4 – Evaluation of herbicide for effective control of weeds in ginger

- Final report with data on changes in weed biomass and weed control efficiency is to be submitted to the PC cell (Action: Chintapalle).
- The salient findings must be made available for farmers through technology transfer.

GIN/CM/5.5 – Source sink relationship in ginger

- Plant material exchange must be completed well before the planting season (Action: All the centres).
- Crude fibre data also to be included in the quality analysis report (Action: IISR).

GIN/CM/5.6 – Organic production of ginger

- Pre-sowing soil nutrient status data is to be acquired (Action: Barapani, Mizoram)

GIN/CM/5.7 – Effect of micronutrients on growth and yield of ginger

- Pre-planting soil macro and micro nutrient status must be recorded for proper interpretation of the results (Action: Pottangi, Chintapalle)

Turmeric

TUR/CM/5.9 – Source sink relationship in turmeric

- Timely submission of samples for analysis and analysis of quality parameters is to be taken up. (Action: All centers).
- All the participating centres must have approved genotypes (BSR-2, Rajendra Sonia, Duggirala Red, Mydukur and Prathibha) in the project (Action: All centres).

Fennel

FNL/CM/5.3 – Micro irrigation for fennel

- A recommendation for farmers to be provided as a technical bulletin with all the required parameters (Action: Jobner).

FNL/CM/5.4 – Effect of ferrous and zinc enriched FYM on yield and quality of fennel

- Changes in the soil pH should be monitored in the project (Action: Jagudan).

Fenugreek

FGK/CM/5.3 – Micro-irrigation management in fenugreek

- A recommendation for farmers to be provided as a technical bulletin with all the required parameters (Action: Jobner).

Project mode centre proposal

A project on evaluation of seed spices genotypes in Bengaluru conditions was presented by Dr. K. Umesha of College of Horticulture (UHSB), Bengaluru and was approved by the house for project mode funding of Rs.1.00 lakh per year.

New Projects

1. Organic nutrient and disease management in cumin (Action: Jobner)
2. Standardization of drip irrigation and fertigation in coriander (Action: Jobner, Kumargunj, Guntur)
3. Standardization of drip irrigation and fertigation in cumin (Action: Jobner, Jagudan, Mandor)
4. Standardization of drip fertigation in fennel (Action: Jobner)

Project Code	Title	Centres	Comments
Black Pepper			
PEP/CM/4	Nutrient Management Trial		
PEP/CM/4.6	Standardization of drip fertigation in black pepper	Panniyur	Continued
PEP/CM/4.7	Black pepper based mixed cropping system for sustainable productivity and food security	Ambalavayal, Sirsi, Panniyur, Dapoli	Continued
Small Cardamom			
CAR/CM/5	Nutrient Management Trial		
CAR/CM/5.2	Effect of fertigation on yield of cardamom through drips	Mudigere, Pampadumpara	Continued
CAR/CM/5.3	Organic farming in cardamom	Mudigere, Pampadumpara	Continued
CAR/CM/5.4	Liming in cardamom	Pampadumpara	Continued
Ginger			
GIN/CM/5	Nutrient Management Trial		
GIN/CM/5.4	Evaluation of herbicide for the effective control of weeds in ginger	Chintapalle	Continued
GIN/CM/5.5	Source sink relationship	IISR, Kanke, Mizoram, Pundibari, Solan	Continued
GIN/CM/5.6	Organic production of ginger	Barapani, Mizoram	Continued
GIN/CM/5.7	Effect of micronutrients on growth and yield of ginger (Demonstration trial)	Pottangi, Chintapalle	Continued
GIN/CM/5.8	Effect of organic manures and bio-fertilizers on partitioning of dry matter in ginger	Dholi	Continued
Turmeric			
TUR/CM/5	Nutrient Management Trial		
TUR/CM/5.9	Source sink relationship in turmeric	Coimbatore, Guntur, Kammarpalli, Dholi, Barapani, IISR	Continued
TUR/CM/5.10	Organic production of turmeric	Barapani, Mizoram	Continued
TUR/CM/5.11	Screening of post-emergent herbicides for selectivity in turmeric	Guntur	Continued
TUR/CM/5.12	Mechanical planting in turmeric (Observational trial)	Coimbatore	Continued
Coriander			
COR/CM/5	Nutrient management trial		
COR/CM/5.5	Response of coriander varieties to various levels of fertility under multicut management practice	Jagudan	Continued
COR/CM/5.6	Effect of using varying levels of NPK	Dholi	Continued

	and bio-fertilizers on growth and yield of coriander		
Cumin			
CUM/CM/5	Nutrient Management Trial		
CUM/CM/5.2	Organic nutrient and disease management in cumin	Jobner	Continued
CUM/CM/5.3	Response of sulphur and bio regulators on yield and quality of cumin	Mandor	Continued
Fennel			
FNL/CM/5	Nutrient Management Trial		
FNL/CM/5.3	Micro irrigation management in fennel	Jobner	Concluded
FNL/CM/5.4	Effect of ferrous and zinc enriched FYM on yield and quality of fennel	Jagudan	Continued
Fenugreek			
FGK/CM/5	Nutrient Management Trial		
FGK/CM/5.3	Micro irrigation management in fenugreek	Jobner	Concluded

TECHNICAL SESSION III

CROP PROTECTION

Chairpersons : Dr. G. Satyanarayana Reddy, Director of Research, SKLTSHU, Hyderabad
Dr. S. Devasahayam, Head, Division of Crop Protection, ICAR-IISR, Kozhikode

Rapporteurs : Dr. Meenu Gupta, Dr. YSPUHF, Solan
Dr. C. Ushamalini, TNAU, Coimbatore

General Recommendations

- Pesticide residue data is to be generated before recommending promising pesticides.
- Uniformity in treatments should be followed in experiments undertaken in various centres.
- Single location experiments may be avoided to the extent possible.
- New project proposals should be submitted by including treatments in which preliminary information is available.

Crop specific recommendations

Black Pepper

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

- The experiment is to be concluded and the results presented in Transfer of Technology Session.

PEP/CP/5.4 Effectiveness of new molecules of fungi toxicants against *Phytophthora* foot rot of black pepper in existing plantation

- The compatibility of Fenamidone with *Trichoderma* sp. may be tested at ICAR-IISR, Kozhikode / PRS, Panniyur.

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

- The trial may be continued.

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

- The treatments may be modified and the trial may also be conducted at Panniyur, Sirsi, Dapoli and Mudigere.

New Programmes

Management of *Phytophthora* foot rot by mulching (Sirsi)

- The programme may be discussed with agronomists / soil scientists and included under Crop Management.

Management of root mealy bugs of black pepper (Pampadumpara)

- The programme may be initiated as an observational trial after finalizing the treatments

Large Cardamom

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

- Varlangey (susceptible variety) should be included in the trial as control.

- Plants showing no symptoms of viruses may be indexed at IARI RS, Kalimpong to confirm the absence of viruses.

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

- Demonstrations on cultivation of large cardamom may be conducted in Arunachal Pradesh and Nagaland in collaboration with other AICRPS centres in the region.

Small Cardamom

CAR/CP/6.7 Evaluation of new insecticides / biopesticides in cardamom against thrips and capsule borer

- The promising biopesticide / biocontrol agent identified by ICAR-IISR against thrips may be evaluated.

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

- The correct identity of the pathogen may be determined by sending disease affected samples to ICAR-IISR, Kozhikode.
- The trial may be concluded at Pampadumpara but continued at Mudigere.

New Programme: Management of nematodes of cardamom (Pampadumpara)

- The programme may be initiated as an observational trial.
- *Pochonia chlamydosporia* and carbosulfan may be included in the treatments.

Ginger

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

- The work done under the experiment may be consolidated and submitted to the PC Unit.

GIN/CP/6.10 Efficiency of different fungicides including new molecules against leaf spot disease of ginger

- The trial may be concluded at Pundibari and Dholi and the results presented in Transfer of Technology Session.
- The pathogen may be sent for confirmation of identity to ICAR-IISR, Kozhikode by the Dholi centre.

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

- The trial may be continued.

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

- The trial may be continued.
- Good agronomic practices should be followed in the experimental plots

New Programme: Effect of intercropping and local formulation of *Trichoderma* on incidence of rhizome rot of ginger (Solan)

- An observational trial may be undertaken after taking into consideration the occurrence of diseases in the intercrops selected as treatments.
- An integrated approach in which intercropping is one of the components may be adopted in the observational trial.

New Programme: Evaluation of natural products for the management of rhizome rot of ginger (Pundibari)

- The programme may be considered only after obtaining preliminary data on the efficacy of the treatments selected.

Turmeric

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

- The yield reduction due to the incidence of the disease may be recorded in the surveyed areas.

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

- The trial may be continued in Raigarh and concluded in Dholi.
- The experiment may be initiated at Coimbatore centre.

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

- The trial may be initiated in Guntur, Kammarpalli, Solan and Raigarh.
- The experiment may be concluded at Coimbatore centre.

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

- The trial may be continued.

TUR/CP/7.6 Field screening of different varieties of turmeric against leaf spot and rhizome rot

- The trial may be continued.

Coriander

COR/CP/6.2 Survey to identify the disease incidence, collection and identification of causal organism in coriander

- The causal organism of stem gall disease may be confirmed by NRCSS, Ajmer.

COR/CP/6.3 Studies on the management of coriander powdery mildew using bioinoculants (Observational trial)

- The experiment may be concluded.

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

- The trial may be initiated at Coimbatore, Raigarh, Jobner, Jagudan and Kumarganj.
- Since Calyxin is not available it should be replaced with Dinocap.
- Prophylactic sprays should be given in experiment.

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

- The trial may be continued.

Cumin

CUM/CP/6.5 Management of blight and powdery mildew by spacing and potash application

- Due to crop failure, no results were presented.

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

- The trial may be continued

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

- Due to crop failure, no results were presented.

Fennel

FNL/CP/6.2 Field evaluation of different insecticides/botanicals against seed midge *Systole albipennis* Walker infestation in fennel

- The experiment may be concluded and the results presented in Transfer of Technology Session.

Monitoring committee for Seed Spices: This committee helps Project Coordinator in monitoring the programs

1. Dr. G. Lal, NRCSS, Ajmer
2. Dr. R.K. Kakani, NRCSS, Ajmer
3. Dr. Dharendra Singh, SKNAU, Jobner
4. Dr. A.U. Amin, CRSS, SDAU, Jagudan

Project code	Title	Centres	Comments
Black Pepper			
PEP/CP/5	Disease Management Trial		
PEP/CP/5.3	Trial on management of <i>Phytophthora</i> foot rot of black pepper in new plantation	Chintapalle, Mudigere, Dapoli, Sirsi, Panniyur, Pampadumpara & Pechiparai	Concluded at Panniyur, Sirsi, Pampadumpara and continued in other centres.
PEP/CP/5.4	Effectiveness of new molecules of fungi toxicants against <i>Phytophthora</i> foot rot of black pepper in existing plantation	Chintapalle, Mudigere, Sirsi	Continued
PEP/CP/5.6	Biological Management of Slow Decline in Black Pepper	Panniyur, Sirsi, Dapoli	Continued
PEP/CP/5.7	Studies on management of <i>Phytophthora</i> causing foot rot on black pepper	Panniyur, Sirsi, Dapoli, Mudigere.	Continued
Small Cardamom			
CAR/CP/6	Pest and Disease Management Trial		
CAR/CP/6.7	Evaluation of new insecticides / biopesticides in cardamom against thrips and capsule borer	Mudigere, Pampadumpara	Continued
CAR/CP/6.8	Comparison of effect of chemical treatments as well as bio-control agents against pseudostem rot of cardamom	Pampadumpara, Mudigere	Concluded at Pampadumpara and continued at Mudigere

Large Cardamom			
LCA/CP/1.1	Evolving disease and pest tolerant lines in large cardamom	ICRI Regional Station, Gangtok, ICAR Regional station, Gangtok	Continued
LCA/CP/1.2	Integrated pest and disease management in large cardamom	ICRI Regional Station, Gangtok, ICAR Regional station, Gangtok	Continued
Ginger			
GIN/CP/6	Disease Management Trial		
GIN/CP/6.1	Disease surveillance and etiology of rhizome rot in ginger	Dholi	Continued
GIN/CP/6.10	Efficiency of different fungicides including new molecules against leaf spot disease of ginger	Dholi, Pundibari, Solan, Raigarh	Concluded at Pundibari and Dholi and continued in other centres
GIN/CP/6.11	Eco-friendly management of rhizome rot of ginger	Kumarganj	Continued
GIN/CP/6.12	Field screening of different varieties of ginger against leaf spot and rhizome rot	Dapoli	Continued
Turmeric			
TUR/CP/7	Disease Management Trial		
TUR/CP/7.1	Survey and identification of disease causing organisms in turmeric and screening of turmeric germplasm against diseases (Disease Surveillance)	Coimbatore, Pundibari, Dholi, Raigarh	Continued
TUR/CP/7.3	Assessment of fungicide and biological control agents against foliar disease of turmeric	Dholi, Raigarh, Coimbatore	Concluded at Dholi and continued in Raigarh and can be taken up in Coimbatore
TUR/CP/7.4	Management of foliar diseases in turmeric using tolerant lines	Coimbatore, Dholi, Kumarganj, Pundibari, Raigarh, Kammarpally, Solan, Guntur	Concluded at Coimbatore and continued in other centres and can be taken up in Sola, Kammarpally, Guntur
TUR/CP/7.5	Eco-friendly management of foliar diseases of turmeric	Kumarganj	Continued
TUR/CP/7.6	Field screening of different varieties of turmeric against leaf spot and rhizome	Dapoli	Continued

	rot		
Coriander			
COR/CP/6	Disease Management Trial		
COR/CP/6.2	Survey to identify the disease incidence, collection and identification of causal organism in coriander	Dholi	Continued
COR/CP/6.3	Studies on the management of coriander powdery mildew using bioinoculants (Observational trial)	Coimbatore	Concluded
COR/CP/6.4	Studies on the management of coriander powdery mildew using new generation fungicides (Observational trial)	Coimbatore, Raigarh, Jobner, Jagudan and Kumarganj	Continued
COR/CP/6.5	Eco-friendly management of stem gall of coriander (Observational trial)	Kumarganj	Continued
Cumin			
CUM/CP/6	Disease Management Trial		
CUM/CP/6.5	Management of blight and powdery mildew by spacing and potash application	Jagudan	Continued
CUM/CP/6.6	Bio-efficacy of newer molecules of insecticides against cumin aphid	Jagudan, Jobner, Ajmer	Continued
CUM/CP/6.7	Management of powdery mildew in cumin through new chemicals	Jobner	Continued
Fennel			
FNL/CP/6	Pest Management Trial		
FNL/CP/6.2	Field evaluation of different insecticides/botanicals against seed midge <i>Systole albipennis</i> Walker infestation in fennel	Jobner	Concluded

TECHNICAL SESSION IV

VARIETAL RELEASE

Chairpersons: Dr. Balraj Singh, Director, ICAR-NRCSS, Ajmer
Dr. H. P. Maheshwarappa, Project Coordinator (Palms), ICAR-CPCRI, Kasargod
Dr. L. Naram Naidu, Principal Scientist, Zonal Head, South Coastal Zone

Rapporteurs: Dr. Praveena, R., ICAR-IISR, Kozhikode
Dr. B. Mahender, TRS, SKLTSHU, Kammarpalli

There were 10 varietal release proposals and the recommendations are as follows

1. Crop: Coriander
Variety: **LCC 219 (Susthira)**
Centre: Horticultural Research Station (DrYSRHU), Guntur
Variety with high yield, suitability for rainfed and irrigated condition and high essential oil content was recommended for release in Andhra Pradesh, Telangana and Tamil Nadu.
2. Crop: Fennel
Variety: **Ajmer Fennel-2 (AF-2)**
Centre: ICAR-NRCSS, Ajmer
The variety (AF-2) with high essential oil content and moderate resistance to *Ramularia* blight is recommended for release at national level.
3. Crop: Fennel
Variety: **RF-157**
Centre: Sri Karan Narendra Agriculture University, Jobner, Rajasthan
The Fennel variety (RF-157) with high yield potential and better seed quality is recommended for release in Rajasthan, Gujarat and Haryana.
4. Crop: Fenugreek
Variety: **RMt-354**
Centre: Sri Karan Narendra Agriculture University, Jobner, Rajasthan.
The Fenugreek variety (RMt-354) with high yield potential and moderately resistant to powdery mildew and downy mildew is recommended for release at national level.
5. Crop: Fenugreek
Variety: **Narendra Methi 2 (NDM 69)**
Centre: Narendra Dev University of Agriculture and Technology, Kumarganj
Centre has to supplement the data on downy mildew and salinity tolerance as early as possible. Supplementary information on downy mildew through screening may also be provided. This variety was recommended for release based on clarification given during plenary session.

6. Crop: Black Pepper

Variety: **Panniyur-9**

Centre: Panniyur Research Station, (KAU), Panniyur

The committee deferred the variety release for next year due to inadequate data on *Phytophthora* resistance and drought tolerance.

7. Crop: Nutmeg

Variety: **Acc. No.1, Acc. No.5, Acc. No.13, Acc. No.15**

Centre: Kerala Agricultural University, Thrissur

The committee suggested submitting the variety proposal in the prescribed proforma. It is suggested it is better to register with PPV&FRA, New Delhi as sufficient data couldn't be provided for variety release..

TECHNICAL SESSION V

TRANSFER OF TECHNOLOGY

Chairpersons: Dr. Homey Cheriyan, Director, DASD, Kozhikode
Dr. Gopal lal, Principal Scientist, ICAR-NRCSS, Ajmer

Rapporteurs: Dr. Ajit Kumar Singh, IGKV, Raigarh
Dr. Vikas Singh, CAU, Pasighat.

General Recommendations:

- Technology should increase production, productivity with food safety.
- Technology should be farmers friendly and easy to understand

1. Standardization of water requirement for turmeric through drip irrigation – Dr. S. Suryakumari, HRS, Dr.YSRHU, Guntur

Application of water through drip once in two days at 80% pan evaporation with 4 l/hr increases 10-15 % yield in turmeric. The laterals spaced at 1 m which emits water at 60 cm with an average working time of 35- 40 min. This technology was recommended for Andhra Pradesh, Telangana, Uttar Pradesh and North Bengal

2. Micro irrigation management in fennel – Dr. A. C. Shivran, SKNAU, Jobner

Application of irrigation water by drip at 0.8% IW/ CPE ratio on alternate days with paired row planting resulted in increase in seed yield and along with 19% saving irrigation water in comparison to surface irrigation

3. Micro irrigation management in fenugreek - Dr. A. C. Shivran, SKNAU, Jobner

Application of irrigation water by drip at 0.6% IW/ CPE ratio on alternate days with paired row planting of fennel resulted in higher seed yield along with 35% saving irrigation water in comparison to surface irrigation.

4. Management of *Phytophthora* foot rot of Black Pepper in new plantation in Kerala – Dr. C. R. Rini, PRS, Panniyur

Soil application of *Trichoderma harzianum* (MTCC 5179) @ 50 g/vine and drenching and spraying with Potassium phosphonate @ 0.3% during May – June and August – September

5. Management of seed midge of fennel - Dr. B. G. Prajapathi, CRSS (SDAU), Jagudan

Two foliar sprays of acetamiprid 0.004% (2 g/10lit. water; 20g a.i. /ha) or thiamethoxam 0.0084% (3.36 g/10lit. water; 42g a.i. /ha). First foliar spray should be made at appearance of seed midge damage and subsequent spray should be applied at 10 days after first spray. The PHI of both the insecticides is 66 days and pesticide residues detected were far below MRLs.

The experiment was conducted at Jagudan and Jobner and similar results were obtained at both the centres.

6. Management of pseudostem rot of small cardamom in Kerala - Dr. N. Murugan, CRS, Pampadumpara

Chemical control by drenching of Carbendazim @ 2 g/l (5 l/ plant) at monthly intervals from Feb-May or biological control by combined application of *Trichoderma harzianum* (50 g with 1 kg neemcake) + *Pseudomonas fluorescens* (2 % spray).

Brain Storming on Small Cardamom

Chairperson	: Dr. M. Anandaraj, Director, ICAR-IISR, Kozhikode
Co-Chairperson	: Dr. M.N. Venugopal, RAC Member, ICAR-IISR, Kozhikode
Conveners	: Dr. S.J. Ankegowda, Head, ICAR-IISR, RS, Appangala : Dr. T.K. Jacob, Principal Scientist, ICAR-IISR, Kozhikode
Rapporteurs	: Dr. M. Alagupalamuthirsolai, Scientist, ICAR-IISR, RS, Appangala Dr. Mohammed Faisal Peeran, Scientist, ICAR-IISR, RS, Appangala

The session was inaugurated by Dr. M. Anandaraj, Director, ICAR-IISR, Kozhikode and mentioned that this session was the brain child of Dr. N.K. Krishna Kumar, DDG (Horticulture Science). In addition, chairperson addressed the issues faced by cardamom growers and industries, also suggested step to fine tune research programme and transfer to technology should be based on the needs of farmers.

Varietal wealth (Dr. D. Prasath, Senior Scientist, ICAR-IISR, Kozhikode)

Speaker suggested for establishment of global gene bank in cardamom with the proposed activities to identify the duplicates and characterizing the core collections.

Collection from other countries to study the interrelationship and develop genetic database.

Breeding approaches with available genotypes for short harvest, thrips tolerance and sustainable production

Development of molecular markers for varietal identification and linked to economically important characters. Whole genome sequencing for decoding the genome of cardamom and chemo profiling of important cardamom genotypes

Chairperson suggested that the available genetic diversity with the desirable characters have to be used in breeding programme based on industrial need.

Plant nutrition, soil health and climate change – protected cultivation (Dr. V. Krishnakumar, Head, CPCRI, RS, Kayamkulam)

Since cardamom is grown very close to forest ecosystem, conservation of ecosystem for enhanced production of cardamom was emphasized including impact of long term effect of monoculturing high yielding cardamom varieties. Indiscriminate use of plant protection chemicals, impact of climate change on pest/disease problem, sustainability of productivity in plantation. Issues related to soil health especially on microflora and soil nutrient dynamics was also addressed by the speaker.

Plant Health Management

Pest Management (Dr. S. Varadarasan, Former Entomologist, ICRI, Spices Board)

Presenter emphasized on evaluation of one insecticide molecule which can control both the thrips and borers. Developing formulation for Entomopathogenic nematodes for enhanced shelf life. Evaluation and use of mycopathogens on cardamom thrips management.

Use of locally available organic materials to reduce the usage of chemical fertilizers and pesticide. Case studies of fields where the external input usage and pest and disease problem.

Diseases (Dr. M. N. Venugopal, RAC Member, ICAR-IISR, Kozhikode)

The speaker emphasized on popularising ecofriendly disease management, screening lines with multiple disease resistance, large scale multiplication of disease tolerant varieties, development of “*Kokke Kandu*” tolerant lines and characterizing its causal agent. Developing rapid diagnostic tools for *Katte* and *Kokke Kandu* disease to ensure healthy planting materials supplied to the farmers.

Germplasm line No. 892 found to be tolerant to *Kokke Kandu* which could be used for resistant breeding. Training and creating awareness among the farmers to follow the available technology.

Postharvest Management (Dr. T. John Zachariah, Head, Division of Crop Production and PHT, ICAR-IISR, Kozhikode)

The presenter suggested that there is a need to exploit high value compounds in cardamom which is useful for medicinal purpose and aroma. Advised to do quality evaluation of cardamom by e-nose method without destroying the sample.

Industry view (Mr. Phillip Kuruvilla, WSO)

The speaker suggested that there is a need for uniform package of practice (POP) for all cardamom growing regions, need of common platform for deeds and actions including POP.

Trade of cardamom and planters issues (Dr. Gopalakrishnan, Dy. Director – Development, Spices Board)

The presenter emphasized on ensuring availability of Biocontrol agents in enough quantity and quality. Price regulation in cardamom markets, create demonstration plots in farmers field to check the pesticide residue with adopted POP. Supply of mother culture of biocontrol agents to farmers and asking them to produce in enough quantity.

Illegal entry of banned pesticides should be stopped from adjacent state borders. Fix reasonable price for thrips affected cardamom rather than rejecting or fixing lower price. Mechanization of cardamom cultivation was also addressed.

General Recommendations from the house

Multiple disease resistant variety (PV1) shown to be resistant to clump rot and capsule rot has been already cultivated in Shivagiri hills which can be used for developing new varieties.

Alternate source of energy need to be found out instead of firewood for drying cardamom capsule to reduce deforestation.

Use the herbicidal properties of component 1, 8 cineole in cardamom essential oil. Scientist and pesticide industry needs to get collaborated for demonstration in farmers holdings for new molecules developed.

Use of recent available pesticides which is recommended in gram per hectare to reduce the pesticide load. Increase use of botanical pesticides and *Arbuscular mycorrhizae* formulation with FYM.

Building confidence level among the farming community about the technology developed by research institutes in farmers holding.

Action Plan and Way forward (Dr. S. J. Ankegowda, ICAR-IISR, RS, Appangala)

Supply of healthy planting materials, IISR Vijetha and Appangala 2 - *Katte* resistant variety, ICRI 9 - *Katte* tolerant variety and IISR - Avinash for Rhizome rot resistant. Follow IPM package to manage major pests. In order to reduce the abiotic stress, create awareness for establishment of rain water harvesting structures and maintaining adequate shade level.

Increased planting material production and timely supply. Demonstration in planters field. Financial assistance from Spices board for replanting of old cardamom gardens.

Training to growers on planting material production, location specific disease management strategy, eco-friendly approaches for nutrition, pest and disease management and post harvest technology was also emphasized by speaker.

Finally the session was ended with concluding remarks delivered by Dr. M. Anandaraj, Director, ICAR-IISR, Kozhikode.

Scientist-Industry Interface

Chairperson : Dr. M. Anandaraj, Director, ICAR-IISR, Kozhikode
Co-Chairperson : Mr. Philip Kuruvilla, Chairman, WSO & Jayanthi International
Rapporteurs : Dr. C. M. Senthil Kumar, ICAR-IISR, Kozhikode

Scientist Industry interface meeting started with the welcome by **Dr. K. Nirmal Babu**, Project Coordinator, AICRPS. **Dr. M. Anandaraj**, Director, IISR stressed the need for an action plan for cumin, black pepper, cardamom and chilli in his introductory remarks. **Mr. Philip Kuruvilla** explained the problems faced by spice producers. He mentioned that though there are 52 spices in the Indian spice basket, the major problems lie with four spice crops like cumin, black pepper, cardamom and chilli. In addition to the problems faced with production and productivity of spice crops he stressed that food safety problems, which includes physical, chemical and microbial issues are a cause of concern and need to be addressed. He stressed the need for finding alternatives to harmful pesticides.

Mr. Ramkumar Menon and Dr. Homey Cheriyan expressed their views on establishing quality standards for both domestic as well as export market. **Dr. Balraj Singh** described the pest and disease problems of seed spices and the available technologies to overcome these challenges. **Dr. Jitendra Kumar** emphasized the need for using pollinator safe pesticides.

Mr. Prabir Banerjee, Amalgamated Plantations, Assam mentioned the scope of organic black pepper production in Assam. He thanked IISR team for imparting “Pepper mitra” training and for its continued support in sharing technologies to improve spice productivity in North-East India. **Dr. Gopala Krishnan** in his remarks mentioned about the issues of pesticide residues in cardamom and the need to educate farmers on IPM practices.

In the concluding session, **Dr. M. Anandaraj** emphasized the need for developing common POPs for spice crops in collaboration with Spices Board, NRCSS and AICRPS. He mentioned that for label claim expansion, evaluation trials with new insecticides will be taken up using AICRP centres. **Mr. Kuruvilla** in his concluding remarks stressed the need of conducting awareness programmes for farmers to avoid the use of banned pesticides. **Dr. Nirmal Babu** requested the corporate sector to step in for commercial production of spice crops. **Dr. Homey Cheriyan** in his concluding remarks emphasized the necessity to include the State extension machinery to reach the grass root level farmers.

TECHNICAL SESSION VI

PLENARY SESSION

- Chairperson : Dr. M. Anandaraj, Director, ICAR – IISR, Kozhikode
Co-Chairpersons : Dr. K. Nirmal Babu, Project Coordinator, AICRP on Spices
Dr. B. K. Pandey, Principal Scientist, Horticultural Science Division,
ICAR, New Delhi
- Rapporteurs : Dr. C. N. Biju, Scientist, ICAR – IISR, Kozhikode
Ms. S. Aarthi, Scientist, ICAR – IISR, Kozhikode

Dr. K. Nirmal Babu welcomed the gathering and subsequently presented the new programmes with special emphasis on the addition of two new project mode centres, release of publications and varietal release and adoption of technologies. New programmes on organic packages of cardamom, ginger, micro-irrigation, demonstration of good agricultural practices were briefly narrated.

This was followed by presentations by rapporteurs on recommendations from various sessions.

During presentation of rapporteurs report the Director, ICAR-IISR suggested that, wherever analytical studies of biochemical constituents are carried out, the protocol adopted need to be specified and further need to be confirmed with respective centres of excellence. And also he mentioned that AICRPS name should be included in all the publications which are brought out from AICRPS centres. The Project Coordinator suggested that, while considering promising genotypes for release as varieties, confirmatory data need to be provided and incase of fenugreek variety Narendra Methi 2 (NDM 69) is recommended for release based on the clarification provided by concerned scientist. In case of black pepper variety Panniyur-9 supplementary data on resistance/tolerant to drought and *Phytophthora* may be provided for considering this variety. Dr. B. K. Pandey suggested submitting a copy of all the publications released to the SMD.

The Director, ICAR – IISR and Dr. Pandey made the final remarks and the session was concluded with the vote of thanks proposed by Dr. Utpala Parthasarathy, Chief Technical Officer, AICRP on Spices followed by National Anthem.

New Research Programs

Genetic Resources

Crop	Coriander
Title of the programme	Multilocation evaluation of coriander germplasm
Centres	Ajmer, Guntur, Coimbatore, Dholi, Hisar, Jobner, Jagudan, Kota, Kumarganj, Raigarh
Year of start	2015-16
Duration of the project	Two years (2015-16 to 2016-17)
No. of genotypes with details	100 (10 from each centre) Checks: Hisar Anand, Rcr-728, AD-1, Local Check Blocks: 5 (20 entries in each block)
Design	Augmented Block Design
Replications	Checks repeated in each block
Plot size	4 x 0.6 m (two rows of 4 m length)
Date of sowing/season	Rabi, 2015
Methodology & Procedure to be adopted	As per the recommended package of practices
Observations to be recorded in detail	<ol style="list-style-type: none"> 1. Plant height (cm) 2. Primary branches per plant 3. Secondary branches per plant 4. Days to 50 % flowering 5. Umbels per plant 6. Umbellets per umbel 7. Fruits per umbel 8. Test weight (g) 9. Grain yield (g plant⁻¹) 10. Disease and pest incidence, if any

Crop Improvement

Crop	Black pepper
Title of the programme	CVT 2015 on Farmers varieties of black pepper – Series VII
Centres	Chintapalle, Sirsi, Panniyur, Dapoli, Yercaud
Year of start	2015
Design	RBD
No. of treatments/genotypes with detail	<ol style="list-style-type: none"> 1. <i>Zion Mundi</i> 2. <i>Pepper Thekken</i> 3. <i>Kumpukkal</i> 4. Panniyur 1 (National Check)
No. of replications	3
Plot size/spacing	6 standards/plot (3×3 m) , 2 plants / standard
Observations to be recorded	<ul style="list-style-type: none"> ✓ Plant height (m) ✓ Number of branches per vine ✓ Average spike length (cm) ✓ Average number of berries/spike ✓ Fresh berry yield (kg/vine) ✓ Dry berry yield (kg/vine) ✓ Recovery (%) ✓ Incidence of pest and diseases

Crop	Black Pepper
Title of the programme	CVT on black pepper 2015 – Series VIII
Centres	Chintapalle, Sirsi, Panniyur, Dapoli, Yercaud, Kahikuchi
Year of start	2015
Design	RBD
No. of treatments/genotypes with detail	<ol style="list-style-type: none"> 1. Vijaya (KAU) 2. Arka Coorg Excel (IIHR) 3. PRS 160 (Panniyur) 4. PRS 161 (Panniyur) 5. SV 11 (Sirsi) 6. SV 17 (Sirsi) 7. IISR Thevam (Check) 8. Panniyur 1 (Check)
No. of replications	3
Plot size/spacing	6 standards/plot (3×3 m), 2 plants / standard
Observations to be recorded	<ul style="list-style-type: none"> ✓ Plant height (m) ✓ Number of branches per vine ✓ Average spike length (cm) ✓ Average number of berries/spike ✓ Fresh berry yield (kg/vine) ✓ Dry berry yield (kg/vine) ✓ Recovery (%) ✓ Incidence of pest and diseases

Crop	Cardamom
Title of the programme	CVT 2015 on farmers varieties of cardamom - Series VIII
Centres	Appangala, Mudigere, Pampadumpara, Myladumpara
Year of start	2015
Design	RBD
No. of treatments/genotypes with detail	<ol style="list-style-type: none"> 1. <i>Pappalu</i> 2. <i>Arjun</i> 3. <i>Elarajan</i> 4. <i>Thiruthali</i> 5. <i>Wonder cardamom</i> 6. <i>Njallani</i> 7. <i>Panikulangara green bold no.1</i> 8. <i>Patchaikai</i> 9. Local check (best performing variety of respective centre) 10. Green gold (National check)
No. of replications	3
Plot size/spacing	3×3 m, 12 plants/plot
Observations to be recorded	<ul style="list-style-type: none"> ✓ Plant height (m) ✓ Number of tillers ✓ Number of bearing tillers ✓ Number of panicles ✓ Panicle length (cm) ✓ Number of capsules ✓ Yield (kg/ha)

Crop	Ginger
Title of the programme	Initial Evaluation Trial 2016
Centres	Pundibari
Year of start	2016-17
Design	RBD
No. of treatments/genotypes with detail	7 Genotypes + 1 local check = 8 1. GCP 14 (IC-0614517) 2. GCP 30 (IC-0614533) 3. GCP 36 (IC-0614539) 4. GCP 39 (IC-0614542) 5. GCP 46 (IC-0614549) 6. GCP 51 (IC-0614554) 7. GCP 56 (IC-0614559) 8. GCP-5 (IC-0614510) 9. Gorubathan (Local check)
No. of replications	3
Plot size/spacing	3 m × 1 m & 30 cm × 20 cm
Number of plants/plot	40
Observations to be recorded	<ul style="list-style-type: none"> ✓ Plant height ✓ Number of leaves/plant ✓ Leaf length ✓ Leaf Breadth ✓ Pseudostem girth ✓ Number of tillers/plant ✓ Rhizome yield per plot (kg) ✓ Projected yield (t/ha) ✓ Disease incidence for rhizome rot and bacterial wilt disease ✓ Percent Disease Index (PDI) for leaf spot disease ✓ Percent disease reduction over control for all the diseases. ✓ Quality analysis

Crop	Ginger
Title of the programme	Coordinated Varietal Trial 2015 – Series IX
Centres	IISR, Dholi, Pottangi, Pundibari, Kalyani, Solan, Nagaland
Year of start	2015
Design	RBD
No. of treatments/genotypes with detail	7 genotypes + local check + National check 1. SE 86 40 (KAU) 2. SE 86 81 (KAU) 3. SE 86 131 (KAU) 4. SE HP 9 (KAU) 5. SG 26-04 (Solan) 6. Acc. 247 (IISR) 7. Acc. 578 (IISR) 8. Local check – Best performing variety of respective centre 9. Varada (National check)
No. of replications	3
Plot size/spacing	3×1 m, 25×30 cm
Number of plants/plot	40
Observations to be recorded	<ul style="list-style-type: none"> ✓ Plant height ✓ No. of tillers per plant ✓ No. of leaves per tiller ✓ No. of days to maturity ✓ Yield (t ha⁻¹) ✓ Pest and disease incidence ✓ Quality parameters

Crop	Turmeric
Title of the programme	Initial Evaluation Trial 2016 (IET 2016)
Centres	Pundibari
Year of start	2016-17
Design	RBD
No. of treatments/genotypes with detail	9 Genotypes + 1 local check = 10 1. TCP 28 (IC-0615102) 2. TCP 87 (IC-0615142) 3. TCP 90 (IC-0615144) 4. TCP 129 (IC-0615165) 5. TCP 137 (IC-0615169) 6. TCP 163 (IC-0615163) 7. TCP 168 (IC-0615189) 8. TCP 170 IC-(0615191) 9. TCP 176 (IC-0615196) 10. TCP 2 (Local Check)
No. of replications	3
Plot size/spacing	3 m × 1 m & 30 cm × 20 cm
Number of plants/plot	40
Observations to be recorded	<ul style="list-style-type: none"> ✓ Plant height ✓ Number of leaves/plant ✓ Leaf length ✓ Leaf Breadth ✓ Pseudostem girth ✓ Number of tillers/plant ✓ Rhizome yield per plot (kg) ✓ Projected yield (t/ha) ✓ Percent Disease Index (PDI) and Percent disease reduction over control for leaf blotch and leaf spot disease of turmeric ✓ Quality analysis

Crop	Coriander
Title of the programme	Initial Evaluation Trial 2015
Centres	Guntur, Jagudan, Kumargunj, Dholi, Raigarh
Year of start	2015-16
Duration of the project	Three years (2015-16 to 2017-18)
No. of genotypes with details	Promising entries of the centres
Design	RBD
Replications	3
Plot size/spacing	4 x 2.4 m; 30 cm x 10 cm dibbling
No of plants per plot	8 rows, 320 plants per plot
Date of sowing/season	Rabi, 2015
Methodology & Procedure to be adopted	As per the recommended package of practices
Observations to be recorded in detail	<ul style="list-style-type: none"> ✓ Plant height (cm) ✓ Primary branches per plant ✓ Secondary branches per plant ✓ Days to 50 % flowering ✓ Umbels per plant ✓ Umbellets per umbel ✓ Fruits per umbel ✓ Test weight (g) ✓ Grain yield (g plant⁻¹) ✓ Disease and pest incidence, if any ✓ Quality

Crop	Coriander
Title of the programme	Coordinated Varietal Trial on coriander 2015 – Series X
Centres	Ajmer, Coimbatore, Dholi, Guntur, Hisar, Jabalpur, Jagudan, Jobner, Kumarganj, Navsari, Pantnagar, Kota, Raigarh
Year of start	2015-16
Duration of the project	Three years (2015-16 to 2017-18)
No. of genotypes with details	JCr – 389, JCr-401, UD 856, UD 857, WFPS 48-1, WFPS 48-2, RKC 17-1, RKC-155, CS 211, CS 228, CS 245, LCC 200, LCC 275, LCC 276, ACr-4, ACr-5, NDCor-86, NDCor-100, DH-318, DH-281, RD-416, RD-417, ICS-4, PD-1, JD-1, JD-2 RCr 728 and Hisar Anand – National check + 1 Local check
Design	RBD
Replications	3
Plot size/spacing	4 x 2.4 m; 30 cm x 10 cm dibbling
Date of sowing/season	Rabi, 2015
Methodology & Procedure to be adopted	As per the recommended package of practices
Observations to be recorded in detail	<ul style="list-style-type: none"> ✓ Plant height (cm) ✓ Primary branches per plant ✓ Secondary branches per plant ✓ Days to 50 % flowering ✓ Umbels per plant ✓ Umbellets per umbel ✓ Fruits per umbel ✓ Test weight (g) ✓ Grain yield (g plant⁻¹) ✓ Disease and pest incidence, if any ✓ Quality parameters

Crop	Fennel
Title of the programme	Coordinated Varietal Trial on Fennel 2015 – Series IX
Centres	Ajmer, Dholi, Hisar, Jabalpur, Jagudan, Jobner, Kumarganj, , Pantnagar
Year of start	2015-16
Duration of the project	Three years (2015-16 to 2017-18)
No. of genotypes with details	JF 576, JF-2012-9, UF-290, UF-291, AF-205, AF-206, NDF-51, NDF-67, HF-151, HF-212, RF-15, RF-68, PF-1 RF-205 & RF 101 (National Check) + 1 local check
Design	RBD
Replications	3
Plot size/spacing	4.00×2.70 m ² ; 45 cm (drilling)
Date of sowing/season	Rabi, 2015
Methodology & Procedure to be adopted	As per the recommended package of practices
Observations to be recorded in detail	<ul style="list-style-type: none"> ✓ Plant height (cm) ✓ Primary branches per plant ✓ Secondary branches per plant ✓ No. of umbels/plant ✓ Test weight (g) ✓ Seed yield (g plant⁻¹) ✓ Disease and pest incidence, if any ✓ Quality parameters

Crop	Fenugreek
Title of the programme	Coordinated Varietal Trial on Fenugreek 2015 – Series IX
Centres	Ajmer, Coimbatore, Dholi, Guntur, Hisar, Jabalpur, Jagudan, Jobner, Kumarganj, Navsari, Pantnagar, Kota, Raigarh
Year of start	2015-16
Duration of the project	Three years (2015-16 to 2017-18)
No. of genotypes with details	JFg-224, JFg-268, UM-126, UM-294, LFC-72, LFC-90, AFG-7, AFG-8, NDM-79, NDM-82, HM-257, HM-425, RM-204, PM-1 RMt-361 & Hisal Sonali (National Check + 1 Local check
Design	RBD
Replications	3
Plot size/spacing	4 x 2.4 m; 30 cm x 10 cm dibbling
Date of sowing/season	Rabi, 2015
Methodology & Procedure to be adopted	As per the recommended package of practices
Observations to be recorded in detail	<ul style="list-style-type: none"> ✓ Plant height (cm) ✓ Primary branches per plant ✓ Secondary branches per plant ✓ No. of pods/plant ✓ No. of seeds per pod ✓ Pod length (cm) ✓ Test weight (g) ✓ Grain yield (g plant⁻¹) ✓ Disease and pest incidence, if any ✓ Quality

Crop	Fenugreek
Title of the programme	Chemo-profiling for identification of industrial types among the released varieties of fenugreek
Centres	Ajmer, Coimbatore, Guntur, Dholi, Hisar, Jobner, Kumargunj
Year of start	2015-16
Duration of the project	Four years (2015-16 to 2018-19)
No. of genotypes with details	Released varieties from each centre and other special types already known (30 varieties)
Design	Observational
Replications	-
Plot size/spacing	4 x 2.4 m
Date of sowing/season	Rabi, 2015
Methodology & Procedure to be adopted	<ol style="list-style-type: none"> 1. As per the recommended package of practices 2. Raise the crop under ideal conditions. 3. Send 1 kg seed of each variety immediately after harvest to nodal agency for quality evaluation.
Observations to be recorded in detail	<ul style="list-style-type: none"> ✓ Meteorological data (standard weeks, for entire rabi period). ✓ Maturity stage ✓ Soil physical and chemical properties ✓ Seed shape, seed colour and test weight. ✓ Quality parameters <ul style="list-style-type: none"> a. Mineral composition b. Ash c. Moisture d. Crude fat e. Crude protein f. Crude fiber g. Dietary fiber h. Total carbohydrate i. Fatty acid composition j. Trigonellin k. Diosgenin l. 4-Hydroxy isoleucine
Nodal agency for quality analysis	Jobner

Crop Management

Crop	Turmeric
Title of the programme	Comparative performance of turmeric entries under polyhouse and field conditions
Centre	Raigarh
Year of start	2015-16
Duration of the project	3 years
Design	RBD
No. of treatments with details	7 entries + 2 checks
Replications	3
Plot size/spacing	3 x 1 m, 30 x 10 cm
Date of sowing/season	Kharif
Methodology & Procedure to be adopted	Recommended package of practices
Observations to be recorded in detail	<ul style="list-style-type: none"> ✓ Plant height ✓ No. of tillers per plant ✓ No. of leaves per tiller ✓ No. of days to maturity ✓ Yield (t ha⁻¹) ✓ Pest and disease incidence ✓ Quality parameters ✓ Any other

Crop	Coriander
Title of the programme	Standardization of drip irrigation and fertigation in coriander
Centres	Jobner, Guntur, Kumarganj
Year of start	2015-16
Duration of the project	3 years
Design	RBD
No. of treatments with details	<ol style="list-style-type: none"> 1. Drip fertigation at 1.0 IW/CPE ratio 2. Drip fertigation at 0.8 IW/CPE ratio 3. Drip fertigation at 0.6 IW/CPE ratio 4. Drip fertigation at 0.4 IW/CPE ratio 5. Standard check (Surface irrigation with conventional fertigation)
Replications	4
Plot size/spacing	6 x 4 m, 30 x 10 cm
No. of plants per treatment	20
Date of sowing/season	Rabi, 2015
Methodology & Procedure to be adopted	Recommended package of practices
Observations to be recorded in detail	<ul style="list-style-type: none"> ✓ Plant height (cm) ✓ Branches per plant ✓ Umbels per plant ✓ Umbellets per umbel ✓ Seeds per umbel ✓ Test weight (g) ✓ Seed yield (kg/ha) ✓ Water used (mm) ✓ Water use efficiency ✓ Water saving (%)

Treatment detail:

1. Water applied at 1.0 IW/CPE ratio in surface irrigation when CPE reaches 50 mm at an interval of 10-20 days depending on daily PE during the season.
2. Water applied at different IW/CPE ratios in drip irrigation at an alternate days adding PE of 2 days.
3. Planting of crop in standard check at normal spacing of 30 x 10 cm whereas paired row planting in drip 20/40 means 20 cm between rows leaving 40 cm between pair.
4. RDF in surface irrigation as conventional practice followed. In drip, P and K will be applied as basal and N through drip at different stages.

Crop	Coriander
Title of the programme	Comparative performance of coriander entries under polyhouse, field and selfing net
Centres	Raigarh
Year of start	2015-16
Duration of the project	3 years
Design	RBD
No. of entries	8
Replications	3
Plot size/spacing	3 x 1 m, 30 x 10 cm
No. of plants per treatment	10
Date of sowing/season	Rabi, 2015
Methodology & Procedure to be adopted	Recommended package of practices
Observations to be recorded in detail	<ul style="list-style-type: none"> ✓ Days to flowering ✓ Days to maturity ✓ Plant height (cm) ✓ Branches per plant ✓ Umbels per plant ✓ Umbellets per umbel ✓ Seeds per umbel ✓ Test weight (g) ✓ Seed yield (kg/ha)

Crop	Cumin
Title of the programme	Standardization of drip irrigation and fertigation in cumin
Centres	Jobner, Jagudan, Mandor
Year of start	2015-16
Duration of the project	3 years
Design	RBD
No. of treatments with details	<ol style="list-style-type: none"> 1. Drip fertigation at 1.0 IW/CPE ratio 2. Drip fertigation at 0.8 IW/CPE ratio 3. Drip fertigation at 0.6 IW/CPE ratio 4. Drip fertigation at 0.4 IW/CPE ratio 5. Standard check (Surface irrigation with conventional fertigation)
Replications	4
Plot size/spacing	6 x 4 m, 30 x 5 cm
No. of plants per treatment	20
Date of sowing/season	Rabi, 2015
Methodology & Procedure to be adopted	Recommended package of practices
Observations to be recorded in detail	<ul style="list-style-type: none"> ✓ Plant height (cm) ✓ Branches per plant ✓ Umbels per plant ✓ Umbellets per umbel ✓ Seeds per umbel ✓ Test weight (g) ✓ Seed yield (kg/ha) ✓ Water used (mm) ✓ Water use efficiency ✓ Water saving (%)

Treatment detail:

1. Water applied at 1.0 IW/CPE ratio in surface irrigation when CPE reaches 50 mm at an interval of 10-20 days depending on daily PE during the season.
2. Water applied at different IW/CPE ratios in drip irrigation at an alternate days adding PE of 2 days.
3. Planting of crop in standard check at normal spacing of 30 x 5 cm whereas paired row planting in drip 20/40 means 20 cm between rows leaving 40 cm between pair.
4. RDF in surface irrigation as conventional practice followed. In drip, P and K will be applied as basal and N through drip at different stages.

Crop	Cumin
Title of the programme	Organic nutrient and disease management in cumin
Centre	Jobner
Year of start	2015-16
Duration of the project	3 years
Design	RBD
No. of treatments with details	<p>Treatments - 13</p> <ol style="list-style-type: none"> 1. FYM @ 6 t/ha + Seed treatment with <i>Trichoderma</i> @ 6 g/kg + Spray of NSKE @ 5% 2. FYM @ 6 t/ha + Seed treatment with Marigold extract @ 5 % + Spray of NSKE @ 5% 3. FYM @ 6 t/ha + Seed treatment with Aminobutyric acid @ 100 ppm + Spray of NSKE @ 5% 4. Vermicompost @ 2 t/ha + Seed treatment with <i>Trichoderma</i> @ 6 g/kg + Spray of NSKE @ 5% 5. Vermicompost @ 2t/ha + Seed treatment with Marigold extract @ 5%+Spray of NSKE @ 5% 6. Vermicompost @ 2 t/ha + Seed treatment with Aminobutyric acid @ 100 ppm + Spray of NSKE @ 5% 7. Poultry Manure @ 1t/ha + Seed treatment with <i>Trichoderma</i> @ 6 g/kg + Spray of NSKE @ 5% 8. Poultry Manure @ 1t/ha + Seed treatment with Marigold extract @ 5% + Spray of NSKE @ 5% 9. Poultry Manure @ 1 t/ha +Seed treatment with Aminobutyric acid @ 100 ppm+Spray of NSKE @ 5% 10. Neem cake @ 0.5 t/ha + Seed treatment with <i>Trichoderma</i> @ 6 g/kg + Spray of NSKE @ 5% 11. Neem cake @ 0.5 t/ha + Seed treatment with Marigold extract @ 5% + Spray of NSKE @ 5% 12. Neem cake @ 0.5 t/ha +Seed treatment with Aminobutyric acid @ 100 ppm+Spray of NSKE @ 5% 13. Control
Replications	3
Plot size/spacing	3x2.4 m spacing : 30x5 cm
Methodology & Procedure to be adopted	The aforesaid treatments will be applied. The observations will be recorded on the characters given below and will be evaluated.
Observations to be recorded in detail	<p>Morphological:</p> <ol style="list-style-type: none"> 1. Plant height 2. Umbels per plant 3. Test weight (g) 4. Seed yield(kg/ha) <p>Disease incidence:</p> <ol style="list-style-type: none"> 1. Wilt (%) 2. Blight (0-4) 3. Powdery mildew (0-4)

Crop	Fennel
Title of the programme	Standardization of drip fertigation in fennel
Centres	Jobner
Year of start	2015-16
Duration of the project	3 years
Design	RBD
No. of treatments with details	<ol style="list-style-type: none"> 1. Surface irrigation with CF (100% RDF) 2. Drip irrigation with CF (50% RDF) 3. Drip irrigation with CF (75% RDF) 4. Drip irrigation with CF (100% RDF) 5. Drip fertigation with 50% RDN 6. Drip fertigation with 75% RDN 7. Drip fertigation with 100% RDN 8. Drip fertigation with 50% RDF (N-P) 9. Drip fertigation with 75% RDF 10. Drip fertigation with 100% RDF <p>CF = Conventional fertilizer RDF = Recommended dose of fertilizer (90-40-0) RDN = Recommended dose of nitrogen</p>
Replications	4
Plot size/spacing	6 x 4 m, 67/33 x 20 cm
Date of sowing/season	Rabi, 2015
Methodology & Procedure to be adopted	Recommended package of practices
Observations to be recorded in detail	<ul style="list-style-type: none"> ✓ Plant height (cm) ✓ Umbels per plant ✓ Umbellets per umbel ✓ Seeds per umbel ✓ Test weight (g) ✓ Seed yield (kg/ha) ✓ Water used (mm) ✓ Water use efficiency ✓ Water saving (%)

Treatment detail:

1. Water applied at 1.0 IW/CPE ratio in surface irrigation when CPE reaches 50 mm at an interval of 10-20 days depending on daily PE during the season.
2. Water applied at 0.8 IW/CPE ratios in drip irrigation at an alternate days adding PE of 2 days.
3. Planting of crop in standard check at normal spacing of 50 x 20 cm whereas paired row planting in drip 67/33 means 33 cm between rows leaving 67 cm between pair.

Crop Protection

Crop	Black Pepper
Title of the programme	Management of <i>Phytophthora</i> foot rot by mulching
Centre	Sirsi
Year of start	2015-16
Duration of the project	3 years
Design	RCBD
No. of treatments with details	<ol style="list-style-type: none"> 1. Mulching the root zone with soft grass/dried leaves 2. Raising the root zone by application of soil + T₁ 3. Mulching the root zone banana sheets 4. Raising the root zone by application of soil + T₃ 5. Mulching the root zone with Polyethylene mulches 6. Raising the root zone by application of soil + T₅ 7. Control (where in root zone is exposed without any mulches)
Replications	3
Plot size/spacing	50 plants / treatment
Methodology & Procedure to be adopted	Recommended package of practices One round of Spraying and drenching of COC is common for all the treatment.
Observations to be recorded in detail	Intensity of <i>Phytophthora</i> foot rot disease <ul style="list-style-type: none"> • Yellowing • Leaf spot • Death of plant Yield of black pepper

Crop	Small Cardamom
Title of the programme	Nematode pest management in Cardamom using biocontrol agents and organic supplements (Observational trial)
Centre	Pampadumpara
Year of start	2015-16
Duration of the project	3 years
Design	RBD
No. of treatments and treatment details	<p>8 treatments</p> <ol style="list-style-type: none"> 1. <i>Paecilomyces lilacines</i> alone @ 10 g l⁻¹ (5 l plant⁻¹) at monthly interval 2. Application of neem cake @ 1 kg plant⁻¹ twice a year (before and after the first monsoon period) + <i>Paecilomyces lilacines</i> @ 10 g l⁻¹ (5 l plant⁻¹) once in two months 3. <i>Trichoderma harzianum</i> @ 10 g l⁻¹ (5 l plant⁻¹) at monthly interval 4. <i>Pochonia chlamydosporia</i> 5. Application of <i>Bacillus macerans</i> talc based formulation @ 10 g l⁻¹ (5 l plant⁻¹) at monthly interval 6. Chemical check Cartap hydrochloride 5 kg/ha 7. Carbosulfan 8. Control
Replications	3
	Recommended package of practices
Observations to be recorded in detail	<ul style="list-style-type: none"> ✓ Yield (kg/plant) ✓ Nematode population ✓ Symptoms of nematode infection

Crop	Small Cardamom
Title of the programme	Management of root mealy bugs in Cardamom and black pepper using biocontrol agents and organic supplements (Observational trial)
Centre	Pampadumpara
Year of start	2015-16
Duration of the project	3 years
Design	RBD
No. of treatments with details	7 treatments T1: <i>Paecilomyces lilacines</i> alone @ 50 g plant ⁻¹ at monthly interval T2: Application of VAM @ 50 g plant ⁻¹ twice a year (before and after first monsoon) + <i>Paecilomyces lilacines</i> @ 50 g plant ⁻¹ – once in two months T3: Application of <i>Verticillium lecanii</i> alone @ 50 g plant ⁻¹ at monthly interval T4: Application of VAM @ 50 g plant ⁻¹ twice a year (before and after first monsoon) + <i>Verticillium lecanii</i> @ 50 g plant ⁻¹ - once in two months T5: Cartap hydrochloride as check @ 1 g l ⁻¹ (5 l plant ⁻¹ as soil drenching) twice a year T6: Neem cake 0.5 kg plant ⁻¹ T7: Control
Replications	3
Methodology & Procedure to be adopted	Recommended package of practices
Observations to be recorded in detail	<ul style="list-style-type: none"> ✓ Symptoms ✓ Pest population ✓ Yield (kg/plant)

Crop	Coriander
Title of the programme	Studies on the management of coriander powdery mildew using new generation fungicides
Centre	Coimbatore, Raigarh, Kumarganj, Jobner, Jagudan
Year of start	2015-16
Duration of the project	3 years
Design	RBD
No. of treatments with details	T ₁ - Foliar spray of Tebuconazole 0.1% T ₂ - Foliar spray of Propineb 0.2% T ₃ - Foliar spray of Azoxystrobin 0.1 % T ₄ - Foliar spray of wettable sulphur 0.2% T ₅ - Foliar spray of Hexaconazole 0.1% T ₆ - Foliar spray of Propiconazole 0.1% T ₇ - Control Note: first spray immediately after the incidence of the disease and second spray at 15 days after first spray.
Replications	3
Plot size/spacing	3 x 1 m
Methodology & Procedure to be adopted	Recommended package of practices
Observations to be recorded in detail	<ul style="list-style-type: none"> ✓ Disease intensity ✓ Seed yield (q/ha) ✓ Residue analysis

Crop	Coriander
Title of the programme	Integrated Management of stem gall disease of coriander
Centre	Dholi
Year of start	2015-16
Duration of the project	3 years
Design	RBD
No. of treatments with details	<p>T₁ - Soil application with Trichoderma sp. @ 10 kg/ha T₂ - Soil drenching with Copper oxychloride @ 0.3% T₃ - Seed treatment with Carboxin+Thiram @ 0.4% T₄ - Foliar spray with Azoxystrobin+Tebuconazole @ 0.1% at 45, 60 & 75 DAS. T₅ - T₁ + T₃ T₆ - T₁ + T₄ T₇ - T₁ + T₃ + T₄ T₈ - T₂ + T₃ T₉ - T₂ + T₄ T₁₀ - T₂ + T₃ + T₄ T₁₁ - Seed treatment & foliar spray with hexaconazole @ 0.1% at 45, 60 & 75 DAS (existing recommendation). T₁₂ - Control</p>
Replications	3
Plot size/spacing	3 x 1 m; 30×20 cm
Methodology & Procedure to be adopted	Recommended package of practices
Observations to be recorded in detail	<ul style="list-style-type: none"> ✓ Per cent Disease Index (PDI) ✓ Yield (kg/ha)

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