

**Proceedings of XXIV Workshop**  
**All India Coordinated Research Project on Spices**



**24<sup>th</sup>-26<sup>th</sup> October 2013**

**Centre for Research on Seed Spices (CRSS)**

**Sardar Krushinagar Dandiwada Agricultural University Jagudan, Gujarat**



**ALL INDIA COORDINATED RESEARCH PROJECT ON SPICES**

**Indian Institute of Spices Research**  
*(Indian Council of Agricultural Research)*

**KOZHIKODE -673 012, KERALA**

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All India Coordinated Research Project on Spices**

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Compiled & Edited by

Dr. C. K. Thankamani  
Principal Scientist (Agronomy)  
AICRP on Spices

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## PROGRAMME

24<sup>th</sup> OCTOBER 2013

INAUGURAL SESSION

10.00 AM – 11.00 PM

10.00-10.05 hrs	Invocation	ICAR song
10.05-10.15 hrs	Welcome	<b>Dr. R. N. Chouhan</b> Director of Research, SDAU
10.15-10.25 hrs	Floral welcome & lighting of lamp	
10.25-10.30 hrs	Address by Chief guest	<b>Dr. K. Sreedharan</b> Hon. Vice Chancellor, SDAU
10.25-10.35 hrs	Address by Guest of Honour	<b>Dr. Balraj Singh</b> Director, NRC for Seed Spices
10.35-10.45 hrs	Presidential Address	<b>Dr. S. K. Malhotra</b> Assistant Director General ( Hort.), ICAR & Horticulture Commissioner, New Delhi
10.45-10.55 hrs	ATR on 23 <sup>rd</sup> AICRPS	<b>Dr K. Nirmal Babu</b> Project Coordinator All India Coordinated Research Project on Spices.
10.55-11.00 hrs	Vote of Thanks	<b>Dr. A. V. Agalodiya</b> Research Scientist Centre for Research on Seed Spices, SDAU, Jagudan
11.00 hrs	Tea	

**Chairpersons:** Dr. N. Kumar, Professor & Former Dean, TNAU, Coimbatore

Dr. J.P.Singh, Director of Research, GBPUAT, Pantnagar

**Rapporteurs:** Dr. R. Chitra, TNAU, Coimbatore

Mrs. K. Rajalakshmi, RARS, Ambalavayal.

***Presentations***

- |                   |   |
|-------------------|---|
| 1. Black pepper   | Dr. Nagesh Naik, UHS, Sirsi                             |
| 2. Large Cardamom | Dr. Utpal Gupta, ICRI Regional Station, Gangtok, Sikkim |
| 3. Cardamom       | Dr. K.B. Deepthy, CRS, Pampadumpara                     |
| 4. Ginger         | Dr. Happy Dev, Dr. YSPUH & F, Solan                     |
| 5. Turmeric       | Prof. B.C. Saha, Jr. Breeder, UBKV, Pundibari           |
| 6. Tree Spices    | Dr. J. Prem Joshua, HRS, Pechiparai                     |
| 7. Coriander      | Dr. K. Giridhar, Dr. YSRHU, Guntur                      |
| 8. Cumin          | Dr. Dharendra Singh SKRAU, Jobner                       |
| 9. Fennel         | Dr. D.G. Patel, SDAU, Jagudan                           |
| 10. Fenugreek     | Dr. K. Giridhar, Dr. YSRHU, Guntur                      |

13.30-14.30 hrs

Lunch

**Chairpersons :** **Dr. A. V. Agalodiya**, Research Scientist, CRSS, Jagudan  
**Dr. B. Krishnamoorthy**, Head, CI&B, IISR, Calicut

**Rapporteurs :** Dr. U.B. Pethe, KKV, Dapoli  
Dr. K.B. Deepthy, Pampadumpara

***Presentations***

1. Black pepper Dr. P.M. Ajith, KAU, Panniyur
2. Cardamom Dr. Sreekrishna Bhat, CRS, Sakleshpur
3. Ginger Dr. Parshuram Sial, HARS, Pottangi
4. Turmeric Dr. Uma Masheswari, TRS, Kammarpally
5. Tree Spices Dr. B.S. Prakash, KKV, Dapoli
6. Coriander Dr. Dharendra Singh, SKRAU, Jobner
7. Cumin Dr. S.K. Tehlan, CCS HAU, Hisar
8. Fennel Dr. S.K. Tehlan, CCS HAU, Hisar
9. Fenugreek Dr. R. K. Kakani, NRCSS, Ajmer

13.30-14.30 Lunch

- Chairperson :** **Dr. T.J. Zachariah**, Head, Crop Production, IISR, Kozhikode  
**Dr. Gopal Lal**, Principal Scientist, NRCSS, Ajmer
- Rapporteurs :** Dr. B.S, Prakash, KKV, Dapoli  
Dr. K. Giridhar, Dr. YSRHU, Guntur

***Presentations***

1. Black pepper Dr. T.V. Anupama, PRS, Panniyur
2. Cardamom Dr. M. Murugan, CRS, Pampadumpara
3. Ginger Dr. Parshuram Sial, HARS, OUAT, Pottangi
4. Turmeric Dr. Uma Maheswari, APHU, Kammarpally
5. Tree Spices Dr. U.B. Pethe, KKV, Dapoli
6. Coriander Dr. T. P. Malik, CCS HAU, Hisar
7. Cumin Dr. D.G. Patel, SDAU, Jagudan
8. Fennel Dr. T.P. Malik, CCS HAU, Hisar
9. Fenugreek Dr. S. Suryakumari, Dr.YSRHU, Guntur



25<sup>th</sup> OCTOBER 2013

SESSION IV :	CROP PROTECTION	09.00 AM - 11.00 AM
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**Chairpersons :** **Dr. S. Devasahayam**, Head, Crop Protection, IISR, Kozhikode  
**Dr. K. Nirmal Babu**, Project Coordinator, AICRPS, Kozhikode

**Rapporteurs :** Dr. A.K. Mishra, Dholi  
Dr. (Mrs.) Meenu Gupta, Dr. YS PU H & F, Solan

***Presentations***

1. Black pepper Dr. C.R. Rini, PRS, Panniyur
2. Large Cardamom Dr. Utpal Gupta, ICRI Regional Station, Gangtok, Sikkim
3. Cardamom Dr. S.D. Rangaswamy, UHS, Mudigere
4. Ginger Dr. Meenu Gupta, Dr. YSPUH & F, Solan
5. Turmeric Dr. D. Saravanakumar, TNAU, Coimbatore
6. Tree Spices Dr. B.S. Prakash, KKV, Dapoli
7. Coriander Dr. A.K. Singh, IGAU, Raigarh
8. Cumin Dr. K.D. Patel, SDAU, Jagudan
9. Fennel Dr. A. K. Mishra, RAU, Dholi
10. Fenugreek Dr. A. K. Mishra, RAU, Dholi

- Chairpersons :** **Dr. Homey Cheriyan**, Director, DASD, Calicut  
**Dr. James George**, Project Coordinator , Tuber Crops, CTCRI
- Rapporteurs :** Dr. A.K. Singh , IGKVV, Raigarh  
Dr. Nagesh Naik, UHS, Sirsi

**Presentation crop wise:**

1. Turmeric:
  1. Rapid multiplication of turmeric through single bud rhizome in protray  
Dr. (Mrs.) R. Chitra, Asst. Professor (Horticulture), TNAU, Coimbatore
2. Nutrient management in turmeric  
Mr. S. Bandyopadhyay, Jr. Pathologist and in charge, AICRP on Spices, UBKVV, Pundibari
3. Ginger:
  1. Management of soft rot of ginger  
Dr. Meenu Gupta, Jr. Plant Pathologist, Dr. YSPUH & F, Solan
4. Coriander
  1. Nutrient management in Coriander grown under shade net  
Dr. K. Giridhar, Jr. Breeder, Dr. YSRHU, Guntur

- Chairpersons :** Dr. N.K. Krishnakumar, DDG (Hort.), ICAR, New Delhi  
Dr. S.K. Malhotra, ADG (Hort.), ICAR, New Delhi
- Rapporteurs :** Dr. R. Senthil Kumar, IISR, Calicut  
Dr. S.K. Tehlan, CCS HAU, Hisar

**Presentation crop wise**

- |                 |  |
|-----------------|--|
| 1. Black pepper | 1. Cul.5308 Dr. P. M. Ajith, KAU, Panniyur   |
| 2. Cardamom     | 1. PS 27 Dr. K B, Deepthy, CRS, Pampadumpara   |
| 3. Coriander    | 1. LCC 234- Dr. Giridhar. K, Dr . YSRHU, Guntur<br>2. Narendra Dhania-2 (K-Sel), Dr. R.K. Mishra,<br>NDUAT-Kumarganj<br>3. RCr 475, Dr. Dharendra Singh, SKRAU, Jobner |
| 4. Fenugreek    | 1. HM 348, Dr. S. K. Tehlan, CCSHAU, Hisar<br>2. LFC (103) Dr. Giridhar. K, Dr. YSRHU, Guntur  |
| 5. Turmeric     | 1. Duggirala Red- Dr. Uma Maheshwari,<br>Dr. YSRHU, Kammarpally  |
| 6. Nutmeg       | 1. Keralashree- Sh. B. Krishnamoorthy, IISR, Kozhikode   |

26<sup>th</sup> OCTOBER 2013

<b>SESSION VII</b>	<b>PLENARY SESSION</b>	<b>10.00 AM – 2.00 PM</b>
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	<b>Chairpersons :</b>	<b>Dr. N.K. Krishnakumar</b> , DDG (Hort.), ICAR, New Delhi <b>Dr. K. Sreedharan</b> , Vice Chancellor, SDAU, Jagudan
	<b>Rapporteurs :</b>	Dr. D. Prasath , IISR Calicut Dr. Srikrishna Bhat, ICRI, Sakleshpur
10.00 hrs	Prayer	
10.05 hrs	Welcome address	Dr. C. K. Thankamani, IISR, Kozhikode
10.10 hrs	Floral welcome & lighting of lamp	
10.20 hrs	Presidential Address	<b>Dr. K. Sreedharan</b> Hon'ble Vice Chancellor, SDAU, Jagudan
10. 30 hrs	Research highlights and new programmes of AICRPS	<b>Dr. K. Nirmal Babu</b> Project Coordinator, AICRP on Spices
10. 35 hrs	Recommendations and Suggestions	Rapporteurs of each session 1. Dr. R. Chitra, TNAU, Coimbatore 2. Dr. K.B. Deepthy, CRS, Pampadumpara 3. Dr. K. Giridhar, Dr. YSRHU, Guntur 4. Dr. Meenu Gupta, Dr. YSPUH & F, Solan
11.20 hrs	Remarks on the group meeting	<b>Dr. S. K. Malhotra</b> Assistant Director General (Hort.), ICAR & Horticulture Commissioner, New Delhi
11.30 hrs	Address by Guest of Honour	<b>Mr. Gaurang Patel</b> Chairman, APMC, Unjha
11.40 hrs	Comments	<b>Dr. Balraj Singh</b> Director, NRC for Seed Spices
11. 50 hrs	Comments	<b>Dr. M. Anandaraj</b> Director, Indian Institute of Spices Research, Kozhikode
12.00 hrs	Release of CRSS Publication	<b>Dr. N. K. Krishna Kumar</b> Hon'ble Deputy Director General (Hort.) Indian Council of Agricultural Research, New Delhi
12.05 hrs	Address by the Chief Guest	
12.30 hrs	Vote of Thanks	<b>Dr. A. V. Agalodiya</b> Research Scientist, CRSS, SDAU Jagudan
12.35 hrs	National Anthem	
12. 40-13.40 hrs	Lunch	
14.00-16.00 hrs	Post Workshop Field visit	

## INAGURAL SESSION

**Rapporteurs:** Dr. C. K. Thankamani, Pricipal Scientiest, IISR,Kozikode  
Dr. Parshuram Sial, Sr. Breeder & OIC, OUAT, Pottangi

At the outset Dr. R. M. Chauhan, Director of Research, CRSS, Sardar Krushinagar Dandiwada Agricultural University welcomed the dignitaries in the dias and also to all the participants present in the 24<sup>th</sup> AICRPS workshop held at CRSS, SDAU, Jagudan, Gujarat. He recounted how, CRSS, Jagudan was established in 1960 and AICRP on Seed Spices is working since 1980. This station has 31 ha of land of which 11 hectares under drip and sprinkler irrigation for the efficient water use. It maintains more than 500 accessions in seed spices germplasm. He highlighted the research achievements on 16 high yielding varieties of seed spices and 45 technologies relating to seed spices production and protection from this center for the farming community.

The workshop was inaugurated by Hon'ble Vice Chancellor, Dr K. Sreedharan, CRSS, SDAU and Dr. S. K. Malhotra, ADG (Hort.), ICAR, New Delhi by lighting the lamp. The dignitaries in the dias were honoured by offering flower bouquets. The Hon'ble Vice chancellor has complimented the scientific team of CRSS, Jagudan for being forefront in seed Spices and playing a major role in increasing the production, productivity and post harvest of Seed Spices.

Dr. K. Nirmal Babu, Project Coordinator, AICRPS, presented the action taken report for 2012-13 in the workshop and 15 pamphlets on important technologies developed by AICRPS were released. 7680 Accessions of germplasm (7680) are being maintained by AICRPS in all crops. During 2012-13, 20 cardamom, 65 Black pepper and 3 nutmeg germplasm accessions were collected by AICRPS. Turmeric yield in Bihar is high 45-50 t/h but he expressed his concern on poor price obtained for the produce due to lack of marketing facility. Project Coordinator also requested to concerned centres to send replicated data of G x E for quality in ginger to Project Coordinator's unit for analysis and report preparation. CB ratio in all the completed experiments may be given by concerned centres in the technology transfer session.

The Assistant Director General (Horticulture), Dr. S. K. Malhotra in his presidential address mentioned that AICRPS is a unique system where a lot of location specific technologies can be generated. CRSS is not only the centre of excellence but also the centre of relevance. Production of spices has been increased to 3 times in 3 decades. It is a major challenge for us to further increase the production, productivity with quality assurance keeping on view of population rise, health protection, products for export. He mentioned that ICAR has launched a consortium programme and opined the scientists to submit projects. He also urged scientists from all the centers to submit projects and to participate actively in generation and dissemination of technologies.

Assistant Director General (Horticulture), emphasized the soft rot in ginger as a major problem, in increasing the ginger production in India. He wanted the AICRPS Scientist to prepare pamphlets on different released varieties along with packages of practices and display in the website of AICRPS.

Dr. Balraj Singh, Director, NRC Seed Spices, in his special address has said the country has progressed a lot in the last 3-4 decades in horticultural sectors and very good infrastructure was developed. Viable seedling production in horticultural crops is going on in protected cultivation systems. Cultivation of ginger and turmeric in protected cultivation system can double the yield especially when red shade net

is used. Quality of our released varieties of our seed spices is very good for export. However production technology, control measures of diseases and pests of off season cultivation of coriander and cumin need to be improved.

Project Coordinator also highlighted the contribution of AICRPS, Panniyur 8 hybrid having drought tolerance, Ponmani a high yielding farmers variety of black pepper, ICRI-5 with drought resistance in cardamom, Konkan Sungandh nutmeg with bisexual flowers. He also presented protected cultivation in ginger has great future in India.

It was felt that the present focus include, in addition to regular continuing programmes, collection of bold, low fiber vegetable ginger for Sikkim and North east involving NE centers, collection of farmers varieties of Nutmeg from Kerala in a participating breeding approach, preparation of catalogue of all the released varieties, fertigation in black pepper, turmeric, ginger and registration of unique spices genotypes.

The Hon'ble Vice chancellor, Dr. K. Sreedharan, CRSS, SDAU, congratulated the AICRPS scientists for their good achievements. He addressed them to work for value addition, medicinal and aromatic aspects of spices and eradication of malnutrition in India.

Lastly, Dr. A. V. Agalodia , Research scientist, proposed vote of thanks.

# PROJECT COORDINATOR'S REPORT

**K. Nirmal Babu**

Project Coordinator

All India Coordinated Research Project on Spices  
Indian Institute of Spices Research, Calicut - 673 012, Kerala

## I. Executive Summary

The All India Coordinated Research Project on Spices (AICRPS) located in Kerala with its head quarters at IISR, Kozhikode is giving emphasis on 12 major spices at (19 regular, 8 co opting and 7 voluntary centers ) spread over 21 states of the country representing various agro climatic zones suitable for spices. The number of centers working in mandatory crops include black pepper (10 centers, small cardamom (4 centers), large cardamom (2 centers), ginger (14 centers), turmeric (13 centers), coriander (12 centers), fennel (9 centers), fenugreek (11 centers), tree spices nutmeg, clove, cinnamon (3 centers each). The annual budget for the year, 2012-13 was Rs 625 lakhs as ICAR share. There are 97 projects handled by scientists supported by technical /auxiliary staff working on major areas of genetic resources, crop improvement, crop production, crop protection, post harvest technology and technology demonstration.

### Research achievements during the year

#### *New initiatives*

This being severe drought year severely drought affected areas were surveyed, 2 drought escapes in black pepper, 1 each in cardamom and nutmeg were collected. Collection surveys were also undertaken to collect promising farmers varieties and 3 of black pepper, 1 of clove and 6 of nutmeg were collected. The unique promising collections were planted in a separate plot to establish 'Specialty gardens' especially in tree spices. The nucleus germplasm concept was introduced in ginger and turmeric so that all the released varieties are maintained at respective centers without possible mix-up. There was a good exchange of germplasm between the centers and NAG sites.

A draft varietal descriptor with pictorial diagrams for quick identification of varieties is being prepared which will help in checking adulteration in planting material. In seed spices seed village/ clusters are being popularized to avoid mixing up of varieties.

Micro irrigation/ fertigation experiments are yielding good results with increased yield in turmeric and seed spices, saving about 30% water while reducing disease incidence and farm labour. Protected cultivation of bush peppers was initiated as it can form an important input in urban horticulture.

#### *Varieties recommended for release in 23 AICRPS workshops*

Improved cardamom variety ICRI-8 from Sakleshpur centre, NDH-9 turmeric variety from Kumarganj, PPI (CL) 1, the first ever clove variety from Pechiparai, DH220 and suguna coriander variety from Hisar and Guntur respectively, HF143 and RF281 fennel varieties from Hisar and Jobner respectively, Ajmer fenugreek -3, RMT-365 fenugreek varieties from Ajmer and Bikaner respectively, Haj 18 ajowain variety from Hisar were recommended to release during the XXIII AICRPS workshop held at IISR, Kozhikode.

### ***Collaboration***

Similar initiative in protected cultivation of ginger in private sector is being monitored for its efficacy.

In collaboration with DASD and NHM efforts are being made to include only released varieties, preferably with resistance to diseases and pests in the seed multiplication programme. The standard nursery practices were being enforced to ensure only healthy planting materials are distributed to minimize the disease spread.

Protray soil less propagation of micro rhizomes for multiplication of ginger and turmeric planting materials is being transferred to Nagaland University with the help of DBT.

### ***Monitoring***

The QRT has reviewed the work of all the AICRPS centers and the members were appreciated the work done. The programmes of various centers were monitored by 6 monthly reports and field visits to the centers. The Project Coordinator has visited 17 centers (Coimbatore, Jagudan, Hisar, Jobner, Kammarpally, Guntur, Pampadumpara, Panniyur ICRI, Myladumpara, NRCSS Ajmer) during the year 2012- 13 and reviewed the work.

### ***Black pepper***

During the year 65 accessions were added to the germplasm of black pepper maintained at various centers viz. Panniyur, Amblavayal, Chintapally, Dapoli, Pechiparai, Pundibari, Sirsi and Yercaud. Preliminary evaluation of black pepper germplasm at Panniyur indicated the cultivar PRS 64 ranked first with 2.57 kg green berry yield and 1045 spikes /vine. (P8 an inter varietal hybrid with a tolerant drought was released this year for Kerala state). Accession 53 with tolerance to *Phytophthora*, has been accepted for adoption and to release as a farmer's variety- 'Ademane Pepper' in the Karnataka region. Dry berry yield in this line is more than double when compared with the state average yield of 1 kg/vine/year and the national average yield of <1 kg/vine/year, respectively.

Under inter-varietal hybridization the hybrids PRS 160 and PRS 161 have been found to be promising. In a CVT trial in black pepper cul 5489 was the best and recorded maximum yield 2.51 kg/vine at Panniyur. At Sirsi grafts of Panniyur-1 runner shoots on *Piper nigrum* var IISR Shakthi as rootstock recorded maximum height.

Under organic farming at Yercaud application of FYM at 10 kg coupled with *Azospirillum* 50 g, Phosphobacteria 50g and VAM 200g per vine resulted in maximum dry berry yield (4.78 kg/vine). Under drip fertigation experiment in Black pepper at Panniyur, 50% RDF through drip (81) at weekly interval recorded maximum spike yield (5.88 kg /vine).

At Sirsi, the black pepper tolerant varieties, IISR Shakti and IISR Thevam recorded significantly less disease incidence (10.98 and 13.72 respectively) of *Phytophthora* foot rot and were on par each other. Black pepper vines treated with consortium of bacteria (@ 1%) (for growth, nematode and *Phytophthora* suppression IISR 6 and IISR 859) as spraying (@2l<sup>-vime</sup>) and drenching (@3l<sup>-vime</sup>) and soil application along with *Trichoderma harzianum* (MTCC 5179) @ 50 g per vine with one kg of neem cake to the root zone during pre monsoon (June 2012) and post monsoon (Aug 2012) recorded least disease incidence (10.45 %). Application of new fungi toxicant molecules @ 0.1 % Fenamidone (10 %) + Mancozeb (50%) (Section) alone and Fenamidone (10 %) + Mancozeb (50 %) (Sectin) as spraying (@ 2 l<sup>-vime</sup>) and drenching (3 l<sup>-vime</sup>) along with bioagent *Trichoderma harzianum* (MTCC 5179) 50 g with one kg of



neem cake as soil application separately during first week of June, 2012 and third week August, 2012 recorded statistically significant reduction in the disease with respect to leaf infection (6.06 % and 4.24 %), reduced yellowing of vines (7.88 PDI and 6.67PDI), least defoliation (8.50 PDI and 6.06 PDI), least death of vines (7.27 % and 4.86%) and recorded highest green berry yield (2.93 kg/vine and 3.16 kg/vine) respectively at Sirsi.

### **Cardamom**

In a CVT at Pampadumpara one genotype PS 27 recorded maximum yield (597g/pl) followed by MHC 26306 g/pl and in Mudigere CL -722 (232 kg /ha) recorded maximum yield followed by PS 27(275.58 kg/ha). In another CVT at Sakaleshpur, maximum yield per plant was recorded by SKP 164 (1106.50 g/pl) whereas at Appangala IC349545 recorded maximum yield (957 kg/ha).

At Mudigere application of irrigation 9 liters/clump/day along with 100% recommended dose (125:125:250 NPK kg/ha) of fertilizer through drip recorded the maximum capsule yield (205.35 kg/ha) that was on par with irrigation 9 liters/clump/day with 75% recommended fertilizer dose (199.25 kg/ha). In a CVT, organic farming trial in the station, application of 30 t FYM+ recommended NPK (125 :125 :250 kg/ha) recorded maximum dry capsule yield (250.65 kg/ha ) whereas application of Jeevamritha + *Azospirillum* (10 g/clump) + 10 g PSB/clump + *Trichoderma* 10g / clump resulted in the maximum dry capsule yield (66.59 g plant<sup>-1</sup>) at Pampadumpara. Application of ground lime stone @ 2 kg/plant in cardamom increased the yield 208% over control (without liming) at Pampadumpara.

For management of rhizome and Panicle rot in new cardamom plantation at Mudigere, spraying and drenching of copper oxichloride 0.3 % resulted in less panicle infection and maximum yield (1085.30 kg) in Njallani gold that was on par with combined application of *Trichoderma harzianum* and consortium of bacteria.

Application of Methomyl (1.5 g/l) of water and Imidacloprid @ 0.5 ml found to be effective to control thrips and capsule borer at Mudigere whereas application of Imidacloprid resulted in lowest thrips infestation at Pampadumpara. Effective management of shoot borer due to application of poneem was observed at Pampadumpara.

### **Large Cardamom**

Fourteen disease escapes of blight caused by *Colletotrichum gloeosporioides* were collected from Sikkim and Darjeeling hills of west Bengal. Six units of each of these accessions were planted in ICRI Research farm at Kabi for further multiplication and evaluation.

Treating suckers with bio agents (*Pseudomonas Fluorescens* + *Bacillus subtilis* 3% each showed less incidence of blight as compared to control.

Two sprayings of Petroleum Servo Agrospray @ 7 ml/L was effective to control the population of mealy bug (72.54 % population reduction over control) and aphids (79.76 % population reduction over control) at ICAR, Gangtok. Application of garlic bulb extract @10% as both spray and drench showed less incidence of blight compared to control (30.51%) at the same station.

### **Ginger**

Wide variation in yield (4.5 t/ha to 34.38 t/ha) was noticed in G x E interaction trial at various centers with different varieties performing better at different centers. Variety Nadia (22.75 t/ha) performed best at Chintapalle, Himgiri (15.43 t/ha) at Mizoram, Varada (34.83 t/ha) at Kalyani, V3S18 (4.5 t/ha) at

Barapani, GCP-5 (11.48 t/ha) at Pundibari, Surabi (23.34 t/ha) at Pasighat, Suprabha (33.5 t/ha) at Kanke and SG-26/04 at Solan (20 t/ha) were the top yielders. The variety suruchi (10.5%) at Barapani and surabhi (8.5%) at Pasighat recorded maximum oleoresin content. Maximum oil content was noticed in Mahima (2.65%) at Barapani whereas suruchi registered maximum essential oil (1.97 %) at Pasighat.

In a trial nutrient management through organic manures for growth and yield of ginger, recommended nutrient of (120:80:80 NPK kg/ha) registered maximum yield (135.0 q/ha) at Kumarganj.

A trial with the objective of reducing cost of cultivation in ginger by weed management was initiated at Chintapalle. Application of herbicide oxyflurofen 23.5 % EC (0.3 kg a. i/ha) recorded maximum yield (24.50 t/ha) that was on par with weed free check (25.45 t/ha).

Survey conducted in Vaishali district of Bihar by Dholi center indicated higher incidence of bacterial wilt (23.89 %) compared to soft rot (8.89 %) caused by *Pythium aphanidermatum*.

In an experiment on management of soft rot of ginger caused by *Ralstonia solanacearum*, (biofumigation using mustard), this year also the application of metalaxyl mancozeb recorded lowest rhizome rot incidence (2.45 %) whereas maximum yield was recorded by mustard biofumigation (15 t/ha). In Kumarganj, maximum rhizome germination, lowest soft rot incidence and maximum yield (21.2 t/ha) was recorded by Metalaxyl mancozeb followed by biofumigation using mustard. In another experiment management of soft rot of ginger (biofumigation using cabbage) maximum yield and lowest soft rot incidence was noticed due to cabbage biofumigation at Solan, Pundibari and Ambalavayal whereas in Kumarganj rhizome treatment with Metalaxyl mancozeb recorded maximum yield and lowest soft rot incidence. Biofumigation using mustard in ginger resulted in maximum yield (15 t/ha) and low bacterial wilt incidence (2.25 %) whereas at Pundibari cabbage biofumigation resulted in maximum yield and lowest bacterial wilt incidence (5.92 %).

### **Turmeric**

The accession CL 101 with high yield was released this year for Tamil Nadu. Apart from collection and cataloguing turmeric germplasms, evaluation of germplasm was also carried out at various centers. Promising genotypes identified based on yield at Dholi was RH 427 (68.0 t/ha), CHFT 36 (30.4 t/ha) at Pasighat, Duggirala red (27.9 t/ha) at Kammarpally, PTS 21 (24 t/ha) at Pottangi, TCP 168 (52.42t/ha) at Pundibari, IT 38 (13.72 t/ha) at Raigarh. At Kumarganj promising entries identified under early maturity group was NDH-74 and NDH-79 (35 t/ha) respectively. In medium maturity entries identified was, NDH-98 (42 t/ha) and NDH-7(35 t/ha) was the entry identified in the late maturity group.

In a CVT on turmeric RH 80 (42 t/ha) at Chintapalle, CL I01 (45.64 t/ha) at Coimbatore, RH 80 (6.70 t/ha) at Dholi, RH 9/90 (31t/ha) at Kammarpally, PTS 55 (14.8 t/ha) at Pottangi, TCP 70 at Pundibari and Raigarh (14.25 t/ha, 17.46 t/ha respectively), RH 50 (5 t/ha) at Pasighat, RH 9/90 (22.22 t/ha) at Navasari recorded maximum yield. In an IET on turmeric PT5 (35.58 t/ha) at Pantnagar recorded maximum yield (35.58 t/ha) followed by PT-6 (29.12 t/ha).

In G x E interaction study turmeric varieties TCP II (13.9 t/ha) at Pottangi, RH 9/90 (30.3 t/ha) at Kammarpally, RCT -1(29 t/ha) at Mizoram, Meghaturmeric (30.5 t/ha) at Kalyani recorded maximum yield.

Integrated nutrient management registered maximum turmeric yield (17.52 t/ha and 19.68 t/ha) at Pundibari and Raigarh whereas organic management recorded maximum yield (27.2 t/ha) at Pottangi.

In a trial standardization of water requirement for turmeric through drip irrigation, drip irrigation once in a day at 80 % PE recorded maximum yield at Coimbatore (64.2 kg/plot) and Kammarpally (29.8 t/ha) whereas at Kumarganj surface irrigation 5 cm, I/W CPE ratio 0.09 recorded maximum yield (32 t/ha).

In a fertigation trial in Coimbatore, maximum yield (59.11 kg per 10 m<sup>2</sup>) was recorded by the treatment 100% RDF through drip using weekly once.

Soil application of micro-nutrients @ 25kg ha<sup>-1</sup> and two foliar sprays of micro-nutrients @ 0.5% at 60 and 90 days after sowing gave significantly higher yield 55.18 , & 55.96 t ha<sup>-1</sup> compared to control at Dholi (43.99 t ha<sup>-1</sup>) whereas soil application of Boron recorded the yield 20.61 t/ha at Pundibari.

At Coimbatore, planting of mother rhizomes (35-40 g) directly into the field recorded maximum yield (67.64 kg/plot) followed by planting of mother rhizome pieces (10-15 g) in the field (4 pieces) 61.51 kg/plot whereas in Chintapalle maximum fresh rhizome yield was recorded by T9 mother rhizomes (35-40 g) directly planting into the field (28.53 t/ha) followed by T7 Primary full length rhizome 25-30g directly planting in the field (24.57 t/ha) that was on par with transplanted seedlings raised from 2 nodes.

Curing of turmeric for 60 min by steam cooking was considered optimum to produce quality dried turmeric with minimum losses and also there was no significant difference in the drying time compared to that dried by water boiling process, which is very critical.

Foliar spray of Propiconazole (0.1%) on 45 and 50 days was the best treatment in reducing the leaf spot intensity (19.33 PDI) and leaf blotch intensity (13.34PDI) as compared to untreated control (61.56 PDI) and recorded maximum yield at Coimbatore. Same treatment was effective and recorded lowest incidence of leaf spot (28.40) and leaf blotch (28.5) and treatment Hexaconazole (0.10 %) at 45 and 90 days of sowing recorded maximum rhizome yield (15.16 t/ha) at Kumarganj.

### ***Tree Spices***

Germplasm of tree spices consisting of nutmeg, cinnamon, cassia and clove are collected, maintained characterized and catalogued at Dapoli and Pechiparai, the accession SA-13 in clove at Pechiparai was superior and recorded maximum height (8.43m), dry bud yield (4.50 kg/ tree) and bud oil (6.78 %) compared to local check. Among the nutmeg accessions evaluated at Pechiparai, MF4 recorded maximum number of fruits/tree (940.25), height, weight (75.30g) and maximum dry mace yield (419.59 kg/tree).

In a CVT at Pechiparai, out of nine genotypes of clove, type SA3 was found to be promising in terms of dry buds/tree (2.95 kg/tree). In case of nutmeg, among the six accessions, A9/150 recorded the maximum plant height (2.12 m), stem girth (11.96 cm) and recorded maximum number of shoots (20.50). At Pechiparai among the cinnamon accessions CV-5 recorded maximum dry bark yield 545g per plant. In a CVT on cassia, the genotype KKVCTSH1 recorded significantly maximum girth (36.25 cm) and oil percentage (7.34 %) followed by KKVCT SH2 (35.50 cm and 7.12 %) respectively.

### ***Cumin***

In a CVT at Jagudan entries CUM-11, CUM-9 and CUM-10 gave higher yield ( *i.e.* 840, 743 and 736 kg ha<sup>-1</sup> ), which was 47.37, 30.35 and 29.12 % higher over check GC-2 whereas at Ajmer the entry cumin 10 (486 kg/ha) recorded maximum yield. Based on the pooled mean over three years (2009-2012), the mean volatile oil content was found to be highest in CUM 13 (3.57 %), followed by CUM 9 (3.56 %) and RZ 209 (3.43 %)

### ***Fennel***

The germplasm accession RF 27 at Dholi, NDF 46, NDF 51 and NDF 67 at Kumarganj were reported as top yielders. Two high yielding fennel entries in IET HF 151(2104 kg/ha) and HF 212 (1978 kg/ha) showing an increase of 27.1 and 14.9% over HF-33 (check) at Hisar may be promoted to CVT. In a CVT at Jobner FNL 43 (1825 kg/ha) and FNL 52(1985 kg/ha) at Hisar were found to be promising based on yield. In a new CVT trial initiated during 2012, maximum yield was recorded by FNL51 (3043 kg/ha) at Pantnagar, FNL 47 at Kumarganj, Ajmer and Jabalpur (yield 1336 kg/ha, 4347 kg/ha, 1618 kg/ha respectively) and FNL 55 at Jagudan (1299 kg/ha). Significant beneficial effect of PGPR bioformulation was obtained in fennel by treating the seeds with FK14 (1020 kg/ha) at Raigarh. In a quality evaluation trial in fennel maximum volatile oil 2.43 % was recorded in FNL 26. Application of Thiamethoxam 25 WG@ 0.0084 % found to be effective for reducing the seed wasp damage (7.44 %) at three and seven days after spraying and at harvest and recorded a yield of 2029kg/ha at Jagudan.

### ***Fenugreek***

In a CVT accession FGK 48 recorded maximum yield at Ajmer (2295 kg/ha), Pantnagar (1805 kg/ha), Navsari (1104 kg/ha), Raigarh (978 kg/ha) whereas FGK 49 recorded maximum yield at Jagudan (2049 Kg/ha), Udaipur (1562 kg/ha) and Dholi (1750 kg/ha). FGK 39 with a yield of 1492 kg/ha at Kumarganj was also promising in this trial. In an IET at Jobner superior performance of the fenugreek accession UM- 126 (2376.92 kg/ha) over a period of three years was observed. In another IET at Hisar HM 425 (3015 kg/ha) recorded maximum yield followed by HM 257(2895 kg/ha) where as PM (C) -1 2798.99 (kg/ha) was the top yielder at Pantnagar. In Jobner Fenugreek accessions UM 301and UM 112 were identified as drought tolerant genotypes. Significant beneficial effect of PGPR bio formulations was obtained in fenugreek by treating the seeds with FGK 14 + FL 18 at Guntur, Kumarganj and Hisar 1117.5 kg/ha, 1591 kg/ha, 1963 kg/ha respectively.

### ***Coriander***

In the CVT initiated during 2012 the yield of coriander varied from 1220 to 2868 kg/ha, promising entries identified in coordinating centers were COR 46 at Guntur (1233 kg/ha), COR 44 (1589 kg/ha) at Ajmer, COR 38 at Kumarganj (1527 kg/ha), COR 56 at Navsari (1220 kg/ha), COR 48 at Udaipur (1423 kg/ha), COR 40 at Jabalpur (2868 kg/ha),COR 41 at Hisar and COR 54 (2105 kg/ha) at Dholi.

In the CVT of coriander for leaf purpose (over a period of 3 years) maximum yield was recorded by the genotype CS 38 (4.28 kg per plot) at Coimbatore whereas LCC-232 recorded maximum green leaf yield (2.59 t/ha) at Guntur. In an IET of coriander for seed purpose at Hisar (over a period of three years) DH-281 and DH 314 were the promising entries. In an IET started at Jobner UD 123 (2071 kg/ha) recorded maximum yield. New IET in coriander was initiated during 2012 at Jagudan, Guntur, Kumarganj and maximum yield was recorded by the JCR 389 (1301kg/ha), LCC 268 (1174 kg/ha), ND cor101 (1527 kg/ha) respectively at various centers. In a quality evaluation trial in coriander at Jobner entry COR -48 ranked first in terms of volatile oil content (0.6 %) followed by COR 44 (0.58 %). In an IET trial at Jobner maximum volatile oil of 0.45% was observed in UD 411 followed by 0.40% in UD 61 and UD 82. Based on drought indices TOL, SSI and STI UD 13, UD-112, UD-436 and RCr-684 were found to be the desirable entries for drought conditions at Jobner. ND cor 37 (27.73 g/pl) and ND cor 36 (27.63g/pl) were the alkalinity tolerant lines identified at Kumarganj.

At Dholi out of 144 germplasm, 110 germplasm were found highly resistant against stem gall disease under natural condition and organism associated with the disease identified were *Protomyces macrospora* in farmer's plot.

At Kumarganj and Dholi seed treatment of coriander with Propiconazole @ 0.2 % along with three foliar sprays was a technology to control stem gall disease in coriander whereas seed treatment with Hexaconazole @ 0.2 % along with three foliar sprays was the effective technology to control stem gall disease at Raigarh.

In a trial, nutrient supplementation through organic manures in coriander, integrated nutrient management recorded maximum yield at Raigarh and Dholi (1610 kg/ha). At Guntur application of NPK 45:40:20 kg/ha + spraying with GA 10 ppm at 20 DAS recorded maximum coriander leaf production in off season whereas application of NPK 30: 40: 20 kg/ha + GA 15 ppm at 20 DAS registered maximum leaf yield at Coimbatore. The bioformulation FK14 recorded maximum yield 1166.5 kg/ha at Guntur, 990 kg/ha at Raigarh, 700 kg/ha at Coimbatore, whereas cultivation of local popular variety (Hisar Anand) recorded maximum yield (1745 kg/ha) at Hisar and no beneficial effect due to application of bio formulations was noticed on Jagudan and Ajmer.

**Technologies recommended for transfer to extension agencies during the XXIII Workshop.**

1. Application of entomopathogenic nematodes in the management of cardamom root grub small cardamom (Pampadumpara)
2. Management of scale insects of black pepper with organic products (Pampadumpara)
3. Fertigation technology for turmeric (Coimbatore)
4. Organic nutrient management in turmeric (Dholi)
5. Integrated nutrient management in turmeric (Dholi)
6. Nutrient supplementation through organic manure in coriander (Coimbatore & Guntur)
7. Micronutrient requirement in coriander (Coimbatore)
8. Promotion of micro irrigation in coriander (Guntur)
9. Integrated nutrient management in coriander (Dholi)
10. Management of cumin wilt and blight (Jagudan)
11. Integrated nutrient management in fenugreek (Dholi)

## ACTION TAKEN REPORT- on XXIV AICRPS Workshop 2013 at CRSS, Jagudan

SL. No.	Decision	Action Taken
<b>GENERAL</b>		
1	In completed experiments the recommendations should be translated into technology and popularized through technical bulletins.	Followed accordingly. Few technical bulletins are being released.
2	Seeds for trials should be sent in sufficient quantity and good quality.	Followed accordingly.
3	Germplasm should be freely exchanged between centers for evaluation.	Followed accordingly. All the released varieties of turmeric, nutmeg, cinnamon were shared.
4	All the released varieties (extant) in black pepper, cardamom, ginger and turmeric may get registered with PPV & FRA, New Delhi.	Followed accordingly. A few proposals were sent for registration.
5	All the variety release proposals should be submitted in a prescribed format with all the necessary data along with Package of Practices under which the variety were tested.	Being followed.
6	Technology demonstration of turmeric variety NDH-1 at farmers field.	Turmeric varieties demonstrated in farmers field.
<b>GENETIC RESOURCES</b>		
7	The germplasm accessions having unique characters may be registered with NBPGR for their unique characters.	Unique characters of promising germplasm has been recorded and steps are being taken to register released varieties and promising accessions.
8	Proforma with minimum descriptors for avoiding duplicates in germplasm of spices may be prepared and data maintenance record on germplasm may be provided to the PC and NAG center for compilation.	The compilation is in progress.
9	Unique accessions and farmer varieties need to be collected and conserved especially in perennial tree and tropical spices and if needed with a project mode funding.	About 20 farmers varieties of cardamom, 3 varieties of black pepper and 3 varieties of nutmeg were collected.
10	The G × E Trial of ginger may continue since all centers do not have 3 years data.	It has been done accordingly.

11	Promising entries from the experiment IET-2005.	A new CVT with 2 entries each from IISR, Dholi, 1 entry each from Pottangi and Pundibari, one national check and one local check has been initiated in 2013-14 season. Similarly New CVT in turmeric was started with accession from IISR, Pottangi, Pundibari and Kumarganj.
<b>CROP IMPROVEMENT</b>		
12	All the centers will provide complete replicated data for all the treatments while submitting the reports to the Co-ordinator.	Most of the centres are following the instruction.
13	Varietal release proposal for black pepper Acc.5308 may be prepared and submitted in variety release session.	The revised proposal has been prepared and will be considered once again this year.
14	The trial IET 2006: TUR/CI/3.2 The promising varieties viz. four entries from IISR, two from Pundibari, two from Kumarganj and two from Pottangi will form new CVT. IISR will be one of the center for AICRPS trial.	A new CVT as proposed has been started in the 2013 – 2014 season.
15	The IETs of coriander, cumin and fennel at different centers completed three years. The promising entries from different centers will be included in a new CVT.	Done accordingly.
16	The present IET in cumin CUM/CI/3.4: will be discontinued as the centers reported low yield than checks. A new IET may be initiated.	New IET with 6 new entries has been initiated.
17	The CVT CUM/CI/3.2 may continue for one more year as the trial was partially damaged by wilt.	The trial completed three years and may be concluded.
<b>CROP MANAGEMENT</b>		
18	Recommendations on the experiment on irrigation management for sustainable coriander production may be brought out.	Recommendation was included in the proceedings of the XXIII Workshop of AICRPS. This is being demonstrated by Guntur center in farmers field.
19	In all experiments yield data units may be presented uniformly. Benefit: Cost ratio should be worked out for all concluded experiments. In completed experiments the recommendations should be translated in to technology and popularized through technical bulletins.	Since followed

CROP PROTECTION		
20	GIN/CP/6.7 Management of soft rot of ginger (Bio fumigation using cabbage). The experiment may be concluded except at Ambalavayal, Pampadumpara and Pundibari.	Followed accordingly.
21	GIN/CP/6.8 Management of bacterial wilt of ginger (Bio fumigation using mustard). The experiment may be concluded except at Pundibari and the promising treatments may be demonstrated in farmer's fields.	It has been concluded in 2011-12 crop season at Pundibari centre. Pooled data has been presented in the Annual report 12- 13.
22	PEP/CP/5.3 Trial on management of <i>Phytophthora</i> foot rot of black pepper in new plantation - Pechiparai centre will start the experiment during the current year and other centers will continue the experiment.	Trial being continued as per the recommendation
23	The promising turmeric tolerant lines against leaf spot and leaf blotch may be evaluated in CVT at respective centers.	A new experiment on Evaluation of Turmeric for tolerance to foliar diseases with 4 entries from Coimbatore, 3 each from Dholi and Pundibari and one local check has been initiated in 2013-14 crop season.
24	Management of foliar diseases of turmeric The experiment may be concluded and the promising treatments may be demonstrated in farmer's fields.	The recommendations have been disseminated through demonstration and trainings at Coimbatore
25	CUM/CP/6.1 Management of wilt and blight disease in cumin. The experiment is concluded and the best treatments may be demonstrated in farmer's fields.	The best treatment "seed treatment of <i>Pseudomonas fluorescens</i> @ 10g/kg seed + soil application of <i>Trichoderma harzianum</i> @ 25 kg/ha + <i>Pseudomonas fluorescens</i> as spray at 60 DAS will be demonstrated in farmers field this year.
26	FNL/CP/6.2 Field evaluation of different insecticides, botanicals against seed midge <i>Systole albipennis</i> . The treatment with endosulfan may be substituted with a suitable insecticide.	The treatment endosulfan 0.07% substituted with the treatment of acephate 0.075% and the same was communicated to respective centers.



<b>VARIETY RELEASE</b>		
27	The centers may provide required additional data within three weeks to PC for consideration in totality.	Noted and Implemented
28	Proposals of some varieties were differed for want of additional data.	The proposals with required data are being resubmitted this year.
<b>TRANSFER OF TECHNOLOGY AND ON FARM TRIALS</b>		
29	The use of Rhizobacterium in seed spices should go as a technology from AICRPS	This was submitted to NRDC for commercialization.
30	Technologies to be transferred or OFT should be highlighted while presenting the results of the experiment in future presentations.	This will be done during the presentations.
31	Seed treatments of <i>pseudomonas florescence</i> @10 g/ kg seed + soil application of <i>Trichoderma harzianum</i> @2.5 kg/ha and <i>pseudomonas florescence</i> (IISR6) 10 <sup>8</sup> cfu as a spray at 60 DAS is recommended .	Recommendation is approved for farmer practices by AGRESKO sub-committee of State Govt.
32	Recommendation/Technologies generated may be communicated to SAU's/KVK's for inclusion in Package of practice recommendation.	The list of technologies are being communicated to SAU/DASD/ KVK and these technologies were also included in the recommendation booklet of some universities.
<b>PLENARY SESSION</b>		
33	List of all released varieties may be prepared and obsolete varieties may be identified. Sufficient quantity of planting materials should be made available.	List prepared and available in AICRP website. Planting materials of these varieties will be made available with the help of DASD.
34	Status report on Ajowan may be prepared.	Prepared and submitted.
35	Technologies developed at AICRPS need to be compiled.	Draft of technologies developed so far were compiled and uploaded in AICRPS website. The revised version will be uploaded soon.

## **TECHNICAL SESSION: I**

### **GENETIC RESOURCES**

**Chair persons** : **Dr. N. Kumar**, Professor and Former Dean (Hort.), TNAU, Coimbatore  
**Dr. J. P. Singh**, Director of Research, GBPUAT, Pantnagar

**Rapporteurs** : Dr. R. Chitra, TNAU, Coimbatore  
Mrs. K. Rajalekshmi, RARS, Ambalavayal

#### **General recommendations**

Maintenance of germplasm should have label with original name from where they are collected and the germplasm yield should be given in gram per plant.

During the preparation of annual report and presentation, IC number must be used along with accession number.

PC cell may circulate the pattern of presentation from CRSS, Jagudan (ppt) to all the centres for uniform presentation in future.

In indigenous spice crops like black pepper, cardamom, ginger and turmeric, germplasm should be effectively screened for their major disease resistance.

In seed spices, efforts should be made to enrich the germplasm with exotic genotypes.

Monitoring team will visit the AICRPS centers periodically and all the centers will submit the half yearly reports with relevant data as per the proceedings.

For genetic resources trial, characterization of biometrical traits should be done. For IET and CVT trials, statistical analysis must be done.

Vegetable bold gingers may be collected from North Eastern Region Pasighat, Mizoram, Sikkim, Barapani & Nagaland.

The unique farmer's varieties of nutmeg and clove will be collected by Pampadumpara, Coimbatore, Pechiparai and Dapoli centers. Jodhpur area of Rajasthan and Sanand area of Gujarat are becoming more important regions of seed spice cultivation in the respective states. It was proposed to initiate germplasm evaluation programmes in Mandor and Sanand representing these regions for identifying genotypes suitable for this region in a voluntary mode. A contingent amount of Rs.2.00 lakhs per year may be provided to each of these 2 centers depending upon the availability of funds. Mandor & Sanand centre will be provided at least 50 accessions of seed spices by Jobner & Jagudan centers respectively.

Huge diversity was observed in nutmeg in farmer's fields and many farmers varieties are now coming up. These unique farmer's varieties of nutmeg and clove need to be collected. KAU Centre at Trichur will work on Project mode for collection, multiplication (grafts) and supply of about 15 nutmeg varieties identified by them for evaluation in AICRPS centers. The morphological and yield data will also to be

collected for next 3 years from the superior mother trees. An amount of contingency grant of Rs. 1 lakh/year may additionally be given to KAU, Trichur to meet the contingency expenditure.

The nutmeg collection programme by KAU and germplasm seed spice evaluation programmes at Sanand and Mandor along with the budget provision in a project/voluntary mode was agreed in principle by Asst. Director General (Hort.) and has recommended by AICRPS Workshop. However a formal proposal for the above may be sent to the Council for approval.

For next workshop the Project leaders identified are requested to present properly compiled information project wise from all the centers.

### **Crop specific recommendations**

#### **Black pepper:**

- Botanical identification of wild species collected at Panniyur should be done with the help of IISR scientists.
- IISR and Panniyur centers may be identified as lead centre for plains while Yercaud and Ambalavayal centers may act as lead centre for higher altitude to maintain the germplasm.

#### **Large cardamom:**

- Nagaland, Arunachal Pradesh and Meghalaya should be added as additional germplasm centers to avoid loss of good types in view of organic cultivation followed.
- Collection of genotypes with small flowers may be initiated so as to have pollination by bees. Indigenous bumble bees from Solan centre as pollinators may be tried.

#### **Small cardamom:**

- Shoot borer tolerant varieties should be grown in large area to get more relevant results.
- Seeds from shoot borer tolerant varieties IISR may be raised to identify further shoot borer tolerant lines (pre-breeding).

#### **Ginger:**

- Ginger genotypes from North East regions may be collected and trials may be conducted in Solan and Assam centre.
- Trial on "Collection and evaluation of vegetable ginger" may be initiated in (Solan, Pasighat, Barapani, Mizoram and Sikkim).
- The genotypes claimed to be resistant to soft rot and bacterial wilt may be sent to IISR for further screening and confirmation.

#### **Turmeric:**

- Each centre with two high yielding genotypes from germplasm trial may be identified and may be conducted as IET with national check (Prathibha) and one local check.

#### **Tree species:**

- Collect seeds from dwarf clove type and evaluate in farmers field.
- The data regarding flower characters and quality of fruit in nutmeg may also be provided.

**Coriander:**

- In MLT, apart from yield data, other biometric observations should also be reported.

**Cumin:**

- Seeds from early flowering lines from Jagudan may be collected and distribute to Jobner centre and NRCSS, Ajmer for evaluation.
- Mandor and Anand centers may also be added as additional centers for conducting the MLT on *fusarium* wilt resistance.
- Mandor and Sanand centers may also be added as additional centers for evaluation of Cumin germplasm.

**Fennel:**

- Bloomless types may be aptly described as waxy types.

**Fenugreek:**

- In MLT, data from all the centers should be collected, compiled and presented.

Project code	Title	Centers	Comments
<b>BLACK PEPPER</b>			
PEP/CI/1	<b>Genetic Resources</b>		
PEP/CI/1.1	Germplasm collection, characterization, evaluation and conservation	Chintapalli, Dapoli, Panniyur, Pundibari, Sirsi, Yercaud & Ambalavayal	continued
<b>CARDAMOM</b>			
CAR/CI/1.1	Germplasm collection, characterization, evaluation and conservation	Mudigere & Pampadumpara	continued
<b>LARGE CARDAMOM</b>			
LCA/CI/1.1	Germplasm collection & Evaluation of large cardamom	Gangtok (ICAR), Nagaland, Arunachal Pradesh, Meghalaya	continued
<b>GINGER</b>			
GIN/CI/1.1	Germplasm collection, characterization, evaluation and conservation	Dholi, Kammarpally, Kumarganj, Pundibari, Solan, Pottangi & Raigrah	continued
<b>TURMERIC</b>			
TUR/CI/1.1	Germplasm collection, characterization, evaluation and conservation	Coimbatore, Dholi, Kammarpally, Kumarganj, Pottangi, Pundibari, Raigarh, Solan, Pantnagar & Pasighat	continued

<b>TREE SPICES</b>			
TSP/CI/1.1	Germplasm collection, characterization, evaluation and conservation of clove, nutmeg and cinnamon	Dapoli & Yercaud/ Pechiparai	continued
TSP/CI/1.2	Collection of Unique germplasm in tree spices	Dapoli, KAU, Pechiparai & IISR	continued
<b>CORIANDER</b>			
COR/CI/1.1	Germplasm collection, description, characterization, evaluation, conservation and screening against diseases	Coimbatore, Dholi, Guntur, Hisar, Jagudan, Jobner & Kumarganj	continued
<b>CUMIN</b>			
CUM/CI/1.1	Germplasm collection, characterization, evaluation, conservation and screening against diseases.	Jagudan, Jobner & Mandor*	continued
<b>FENNEL</b>			
FNL/CI/1.1	Germplasm collection, characterization, evaluation, conservation and screening against diseases	Dholi, Hisar, Jagudan, Jobner & Kumarganj	continued
<b>FENUGREEK</b>			
FGK/CI/1.1	Germplasm collection, characterization, evaluation, conservation and screening against diseases	Dholi, Hisar Jagudan, Jobner, Kumarganj & Guntur	continued

\*The experiment started during 2013-14.

## TECHNICAL SESSION: II

### CROP IMPROVEMENT

**Chair person** : Dr. A. V. Agalodiya, Research Scientist, CRSS, Jagudan  
 Dr. B. Krishnamoorthy, Head, CI&B, IISR, Calicut

**Rapporteurs** : Dr. K.B Deepthy, CRS, Pampadumpara  
 Prof. U. B Pethe, KKV, Dapoli

In this session 9 scientists presented reports of 38 trials on 11 spice crops

#### General recommendations

- The replicated data of G x E interaction trials of ginger may be sent to PC unit and the compiled data would be presented during the next workshop.
- In the case of the trials, which is conducted for three years, every center should send three years replicated data to PC unit for compilation.
- Local materials are not to be included in the trial. For IET trial, include only one national check decided by PC and one local check which is released /popular variety of that region.
- For all trials CD and CV must be calculated and reported accordingly.
- Don't generalize as biotic and abiotic stress resistance, specify the stress condition.
- Only unique accession with some variability should be projected.

#### Black Pepper

- CVT 2000- series 5 (Black pepper)  
 Cul – 5308 giving highest yield. Other drought parameters should also be compared.
- In New hybridization programme instead of the word 'culture' it should be mentioned as inter specific hybrid .

#### Tree Spices

Accession numbers should be given instead of local names.

#### Seed spices

All the seed spice workers should have group meeting for finalizing the effective method of conducting the IET and AVT trials.

Project code	Title	Centers	Comments
<b>Black Pepper</b>			
PEP/CI/2	<b>Hybridization Trial</b>		
PEP/CI/2.1	Inter varietal hybridization to evolve high yielding varieties	Panniyur	continued

<b>PEP/CI/3</b>	<b>Coordinated Varietal Trial (CVT)</b>		
PEP/CI/3.2	CVT 2000 – Series V	Pampadumpara, Panniyur, Sirsi & Ambalavayal	Closed. Final report to be submitted Technology may be presented and should be demonstrated
PEP/CI/3.3	CVT 2006 – Series VI	Chintapalle, Dapoli, Panniyur, Pampadumpara, Sirsi & Yercaud	continued
PEP/CI/3.4	Evaluation of grafts, orthotropic and runner shoots in black pepper	Ambalavayal, Panniyur, Sirsi Yercaud & Thadiyankudisai	continued
<b>Cardamom</b>			
<b>CAR/CI/2</b>	<b>Hybridization</b>		
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
<b>CAR/CI/3</b>	<b>Coordinated Varietal Trial</b>		
CAR/CI/3.6	CVT 2007/2009 -Series VI	Mudigere, Pampadumpara, Sakleshpur, Appangala & Myladumpara	continued
CAR/CI/3.7	CVT of drought tolerance in Cardamom -Series VII	Appangala, Mudigere & Sakleshpur	continued
<b>CAR/CI/4</b>	<b>Varietal Evaluation Trial (VET)</b>		
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
<b>Ginger</b>			
<b>GIN/CI/2</b>	<b>Coordinated Varietal Trial</b>		
GIN/CI/2.3	CVT 2013 – Series VIII	IISR, Dholi, Pottangi, Pundibari & Solan	continued

<b>GIN/CI/3</b>	<b>Varietal Evaluation Trial</b>		
GIN/CI/3.2	Initial evaluation trial -2011	Pundibari & Solan	continued
GIN/CI/3.3	Initial evaluation trial -2012	Kumarganj & Pottangi	continued
GIN/CI/3.5	Genotype X Environment interaction on quality of ginger	Barapani, Chintapalle, Kanke, Kalyani, Mizoram Pasighat, Pottangi, Pundibari, & Solan	Closed. Final report to be submitted Technology generated may be presented and should be demonstrated
GIN/CI/4.1	Evaluation of germplasm for quality	Solan	continued
GIN/CI/4.2	Evaluation of germplasm from other centers	Solan	continued
<b>Turmeric</b>			
<b>TUR/CI/2</b>	<b>Coordinated varietal trial</b>		
TUR/CI/2.4	CVT on Turmeric 2009	Pottangi, Kumarganj, Chintapalle, Coimbatore, Dholi, Kammarpally, Pundibari, Raigarh, Pasighat, Pantnagar & Navsari	Closed. Final report to be submitted Technology generated may be presented and should be demonstrated
TUR/CI/2.5	CVT on Turmeric 2013	IISR, Kumarganj, Pundibari & Pottangi	continued
<b>TUR/CI/3</b>	<b>Varietal evaluation trial</b>		
TUR/CI/3.3	Initial Evaluation Trial 2010	Pantnagar & Raigarh	continued
TUR/CI/3.5	Initial Evaluation Trial 2012	Dholi & Kumarganj	continued
TUR/CI/3.4	Genotype x Environmental interaction on quality	Kammarpally, Raigarh, Pottangi, Mizoram, Kalyani & Barapani	continued
<b>Tree Spices</b>			
<b>TSP/CI/2</b>	<b>Coordinated Varietal Trial</b>		
TSP/CI/2.1	CVT 1992 – clove	Pechiparai	continued
TSP/CI/2.2	CVT 2001- nutmeg	Dapoli & Pechiparai	continued
TSP/CI/2.3	CVT 2001 – cassia	Pechiparai & Dapoli	continued



<b>Coriander</b>			
COR/CI/1.2	Multilocation Evaluation of germplasm	Coimbatore, Hisar, Ajmer & Guntur	continued
<b>COR/CI/2</b>	<b>Coordinated Varietal Trial</b>		
COR/CI/2.5	Coordinated varietal trial on coriander 2012-Series IX	Ajmer, Dholi, Guntur, Hisar, Jabalpur, Jagudan, Jobner, Kumarganj, Navsari, Pantnagar & Udaipur, Coimbatore*	continued
COR/CI/2.6	Coordinated varietal trial on coriander (Leafy type during off season) CVT 2010	Guntur, Ajmer, Coimbatore & Periyakulam	Closed. Final report to be submitted Technology generated may be presented and should be demonstrated
<b>COR/CI/3</b>	<b>Varietal Evaluation Trial</b>		
COR/CI/3.4	Initial Evaluation Trial 2011	Jobner	continued
COR/CI/3.6	Initial Evaluation Trial 2012	Jagudan, Kumarganj & Guntur	continued
<b>COR/CI/4</b>	<b>Quality Evaluation Trial</b>		
COR/CI/4.1	Quality evaluation in coriander	Jobner	continued
<b>Cumin</b>			
CUM/CI/1.2	Multilocation Evaluation of germplasm	Ajmer	continued
<b>CUM/CI/2</b>	<b>Coordinated Varietal Trial</b>		
CUM/CI/2.3	Coordinated Varietal Trial – 2009	Jobner, Jagudan, Ajmer & Jabalpur	Closed. Final report to be submitted Technology generated may be presented and should be demonstrated
<b>CUM/CI/3</b>	<b>Varietal Evaluation Trial</b>		
CUM/CI/3.3	IET on cumin 2009	Jobner & Jagudan	continued
CUM/CI/3.4	IET on cumin 2012	Jobner	continued
<b>CUM/CI/4</b>	<b>Quality Evaluation Trial</b>		
CUM/CI/4.1	Quality evaluation in cumin	Jobner	continued

<b>Fennel</b>			
FNL/CI/1.2	Multilocation Evaluation of Germplasm	Hisar & Ajmer	continued
<b>FNL/CI/2</b>	<b>Coordinated Varietal Trial</b>		
FNL/CI/2.5	Coordinated Varietal Trial on Fennel 2012 Series VIII	Ajmer, Dholi, Hisar, Jabalpur, Jagudan, Jobner, Kumarganj & Pantnagar	continued
<b>FNL/CI/3</b>	<b>Varietal Evaluation Trial</b>		
FNL/CI/3.1	Initial evaluation trial 2010	Hisar	continued
FNL/CI/3.3	Initial evaluation trial 2011	Jobner	continued
FNL/CI/3.4	Initial evaluation trial 2012	Jagudan , Dholi & Kumarganj	continued
<b>FNL/CI/4</b>	<b>Quality Evaluation Trial</b>		
FNL/CI/4.1	Quality evaluation in fennel	Jobner	continued
FNL/CI/5.2	Identification of drought/alkalinity tolerant source in fennel	Kumarganj	Closed. Final report to be submitted Technology generated may be presented and should be demonstrated
<b>Fenugreek</b>			
FGK/CI/1.2	Multilocation Evaluation of Germplasm	Ajmer	continued
<b>FGK/CI/2</b>	<b>Coordinated Varietal Trial</b>		
FGK/CI/2.3	Coordinated varietal Trial 2012 Series VIII	Ajmer, Coimbatore, Dholi, Guntur, Hisar, Jagudan, Jabalpur, Jobner, Kumarganj, Pantnagar, Navsari & Raigarh.	continued
<b>FGK/CI/3</b>	<b>Varietal Evaluation Trial</b>		
FGK/CI/3.4	Initial evaluation trial 2010	Hisar, & Pantnagar	continued
FGK/CI/3.5	Initial evaluation trial 2012	Guntur, Kumarganj, Jagudan & Jobner	continued

\*Initiated during 2013-14

## **TECHNICAL SESSION: III**

### **CROP MANAGEMENT**

**Chairpersons** : **Dr. T.J. Zachariah**, Head, Crop Production, IISR, Kozhikode  
**Dr. Gopal Lal**, Principal Scientist, NRCSS, Ajmer.

**Rapporteurs** : Dr. B. S. Prakash, KKV, Dapoli.  
Dr. K. Giridhar, Scientist (Hort. ), Dr. YSRHU, HRS, Gutur.

#### **General recommendations**

- In all the crop management trials, supportive data from soil analysis may also be collected for better interpretation of results.
- New trials may be formulated on the role of micronutrients for ginger and seed spices.
- Evaluation of PGPR bio-formulations in seed spices is to be continued for one more year.
- Mandor is identified for taking up research on cumin. The centre is requested to identify suitable experiments and initiate the same during 2013-14.

#### **CROP SPECIFIC RECOMMENDATIONS**

##### **Black Pepper**

- In organic farming of black pepper, as there is a variation in the results due to the age of vines, standards and treatments, total available data to be compiled and may be presented in the next workshop.

##### **Cardamom**

- Percent saving of water in micro-irrigation over conventional methods may be documented scientifically.
- In liming trial, post treatment changes in soil pH should be documented.

##### **GINGER**

- Kumarganj centre should provide detailed data on effect of nutrient supplementation through organic manures for growth and yield of ginger.

##### **Turmeric**

- In the trial on “Effect of micronutrients on turmeric”, data should be supported with soil nutrient status. Based on the pooled data analysis recommendations should be passed on to the extension agencies.

##### **Fennel**

- Kumarganj centre may analyse the data on identification of alkalinity tolerance on Fennel and a new CVT may be initiated during 2014-15 involving other centers.

Project code	Title	Centers	Comments
<b>Black Pepper</b>			
PEP/CM/4	<b>Nutrient Management Trial</b>	Chintapalle, Sirsi,	continued
PEP/CM/4.4	Development of organic package for spices based cropping system – observational trial	Panniyur & Dapoli	
PEP/CM/4.5	Organic farming in black pepper - 2006	Panniyur, Dapoli, Pechiparai, Sirsi & Yercaud	continued
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 & Pampadumpara	continued
<b>Cardamom</b>			
CAR/CM/5	<b>Nutrient Management Trial</b>		
CAR/CM/5.1	Effect of different irrigation schedule and fertilizers on yield of cardamom	Mudigere	continued
CAR/CM/5.2	Effect of fertigation on yield of cardamom through drips	Pampadumpara	continued
CAR/CM/5.3	Organic farming in cardamom	Mudigere & Pampadumpara	continued
CAR/CM/5.4	Liming in Cardamom	Pampadumpara	continued
<b>Ginger</b>			
GIN/CM/5	<b>Nutrient Management Trial</b>		
GIN/CM/5.3	Nutrient supplementation through organic manures for growth and yield of ginger	Kumarganj & Dholi	Closed. Final report to be submitted Technology generated may be presented and should be demonstrated
GIN/CM/5.4	Evaluation of herbicide for the effective control of weeds in ginger	Chintapalle	continued
GIN/CM/5.5	Source sink relationship	Mizoram, Kanke, Solan, Pundibari & IISR	continued
<b>Turmeric</b>			
TUR/CM/5	<b>Nutrient Management Trial</b>		
TUR/CM/5.5	Standardization of water requirement for turmeric through drip irrigation	Coimbatore, Kammarpally, Kumarganj, Pundibari & Guntur	continued

TUR/CM/5.7	Effect of micronutrients on turmeric	Dholi, & Pundibari	Continued. Trial may be conducted in acidic condition
TUR/CM/5.8	Studies on the effect of rhizome size and nursery on growth and yield of turmeric	Chintapalle & Coimbatore	continued
<b>TUR/CM/6</b> TUR/CM/6.1	<b>Post Harvest Technology</b> Standardization of Processing in turmeric	IISR	Closed. Final report to be submitted Technology generated may be presented and should be demonstrated
<b>Coriander</b>			
<b>COR/CM/5</b>	<b>Nutrient Management Trial</b>		
COR/CM/5.3	Identification of drought/alkalinity tolerant source in coriander	Jobner	continued
COR/CM/5.4	Nutrient supplementation through organic manures for growth and yield of coriander	Jobner & Raigarh	continued
COR/CM/5.6	Irrigation management for sustainable coriander production	Guntur	continued
COR/CM/5.7	Nutrient management in off season coriander leaf production	Periyakulam, Guntur, Ajmer & Coimbatore	Closed. Final report to be submitted Technology generated may be presented and should be demonstrated
COR/CM/6.5	Evaluation of PGPR bioformulation on coriander	Coimbatore, Guntur, Hisar, Jagudan, Raigarh & Ajmer	continued
<b>Cumin</b>			
<b>CUM/CM/5</b>	<b>Nutrient management trial</b>		
CUM/CM/5.1	Identification of drought tolerance	Jobner	continued

<b>Fennel</b>			
<b>FNL/CM/5</b>	<b>Nutrient Management Trial</b>		
FNL/CM/5.3	Micro irrigation management in fennel	Jobner	continued
FNL/CM/6.3	Evaluation of PGPR bioformulation on fennel	Hisar, Jagudan, Raigarh & Ajmer	continued
<b>Fenugreek</b>			
<b>FGK/CM/4</b>	<b>Nutrient Management Trial</b>		
FGK/CM/4.2	Identification of drought/ tolerance source in fenugreek	Jobner	continued
FGK/CM/4.3	Microirrigation management in fenugreek	Jobner	continued
FGK/CM/4.5	Evaluation of PGPR bioformulation on fenugreek	Jagudan, Jobner, Guntur, Hisar & Kumarganj	continued

## TECHNICAL SESSION: IV

### CROP PROTECTION

**Chairman** : Dr. S. Devasahayam, Head, Crop Protection, IISR, Kozhikode

**Rapporteurs** : Dr. (Mrs.) Meenu Gupta, Solan (Dr. YSPUH & F, Solan)  
Dr. A. K. Mishra, Dholi (RAU, Pusa, Bihar)

In this session, results of 23 experiments were presented covering 9 crops by 9 resource persons. The major decisions taken in various experiments are highlighted here.

#### General recommendations:

1. All new experiments should be presented in the session for approval.
2. Pesticide residue data may be generated before recommending insecticides, after completion of respective experiments.
3. Recommendations of concluded experiments should be presented after statistical analysis with cost: benefit ratios.
4. The technologies developed after approval, should be demonstrated in farmer's fields.
5. The effect of insecticide treatments on pollinators may also be studied in the concerned crops.
6. Screening for thrips resistance may be intensified in cardamom.

#### Black pepper

PEP/CP/6.2: Management of *Erythrina* gall wasp, a popular standard of black pepper

1. The experiment may be closed. Mudigere centre should submit the full data on the resistance of *Erythrina subumbrans* to the PCs Cell.
2. Feedback from the farmers on the resistance of *E. subumbrans* may be obtained.

#### Large cardamom

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

1. ICAR Centre at Sikkim should be included as coordinating centre for the experiment.

#### Cardamom

#### Ginger

GIN/CP/6.7: Management of soft rot of ginger (biofumigation using cabbage)

1. The experiment may be concluded at Ambalavayal and Pundibari, and may be continued at Pampadumpara.

GIN/CP/6.8: Management of bacterial wilt of ginger (biofumigation using mustard)

1. The experiment may be concluded at Pundibari.

GIN/CP/6.9: Management of bacterial wilt of ginger (biofumigation using cabbage)

1. The experiment may be concluded at Pundibari, and may be continued at Pampadumpara.

GIN/CP/6.10: Efficacy of different fungicides against leaf spot disease of ginger including new Molecules

1. Solan and Raigarh centers may also be included for conducting the trial in addition to Dholi and Pundibari.

### Turmeric

TUR/CP/7.1 Survey and identification of disease causing organisms in turmeric and screening of turmeric germplasm against diseases.

1. Disease tolerant lines of turmeric from all centers may be included in the new experiment at Dholi, Pundibari and Coimbatore.
2. The experiment may be initiated under a new title.

### Coriander

COR/CP/6.3 Management of stem gall disease of coriander

1. The experiment may be concluded.

COR/CP/6.5 Evaluation of PGPR bioformulations in coriander

1. The experiment may be reported under crop management.

### Cumin

CUM/CP/6.2 Survey for identification of yellowing causing organisms in cumin.

1. The etiology of the disease may be confirmed by NRCSS, Ajmer before undertaking the management trials.

CUM/CP/6.4 Evaluation of PGPR bioformulations in cumin.

1. The experiment may be reported under crop management.

Project code	Title	Centers	Comments
<b>Black Pepper</b>			
<b>PEP/CP/5</b>	<b>Disease Management Trial</b>		
PEP/CP/5.1	Adaptive trial on management of <i>Phytophthora</i> foot rot of black pepper in farmers field	Ambalavayal	continued
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	continued
PEP/CP/6.2	Management of <i>Erythrina</i> gall wasp in a popular standard of black pepper	Mudigere & Pampadumpara	Closed. Final report to be submitted Technology generated may be presented and should be demonstrated



PEP/CP/5.4	Effectiveness of new molecules of fungi toxicants against <i>Phytophthora</i> foot rot of black pepper in existing plantation	Sirsi, Mudigere & Chintapalle	continued
PEP/CP/5.7	Evaluation of New insecticides/Bio pesticides against Pepper Mussel Scale, <i>Lepidosaphis piperis</i>	Mudigere	continued
PEP/CP/5.5	Screening of local cultivars of Black Pepper against <i>Phytophthora</i> foot rot	Sirsi	continued
PEP/CP/5.6	Biological management of Slow Decline in Black Pepper	Panniyur	continued
<b>Cardamom</b>			
<b>CAR/CP/6</b>	<b>Pest and Disease Management Trial</b>	Pampadumpara	continued
CAR/CP/6.5	Management of rhizome and panicle rot in cardamom (Existing plantation)	Mudigere	Closed. Final report to be submitted Technology generated may be presented and should be demonstrated
CAR/CP/6.6	Management of rhizome and panicle rot in cardamom (New plantation)	Mudigere & Pampadumpara	continued
CAR/CP/6.7	Evaluation of new insecticides/biopesticides in cardamom against thrips and capsule borer	Pampadumpara & Mudigere	Closed. Final report to be submitted Technology generated may be presented and should be demonstrated
CAR/CP/6.8	Comparison of effect of chemical treatments as well as bio-control agents against pseudostem rots of cardamom	Pampadumpara	continued

<b>Large Cardamom</b>			
LCA/CP/1.1	Evolving disease & pest tolerant lines in large cardamom	Gangtok	continued
LCA/CP/1.2	Integrated pest and disease management in large cardamom	Gangtok; ICAR, Sikkim	continued
<b>Ginger</b>			
<b>GIN/CP/6</b>	<b>Disease Management Trial</b>		
GIN/CP/6.1	Disease surveillance and etiology of rhizome rot in ginger	Dholi	continued
GIN/CP/6.6	Management of soft rot of ginger (Biofumigation using mustard)	Solan & Kumarganj	continued
GIN/CP/6.7	Management of soft rot of ginger (Biofumigation using cabbage)	Ambalavayal , Pundibari Pampadumpara, Solan & Kumarganj	continued
GIN/CP/6.8	Management of bacterial wilt of ginger (Biofumigation using mustard)	Pundibari	Closed. Final report to be submitted Technology generated may be presented and should be demonstrated
GIN/CP/6.9	Management of bacterial wilt of ginger (Biofumigation using cabbage)	Pampadumpara	continued
GIN/CP/6.10	Efficiency of different fungicide against leaf spot disease of ginger including new molecules	Dholi, Pundibari, Solan & Raigarh	continued
<b>Turmeric</b>			
<b>TUR/CP/7</b>	<b>Disease Management Trial</b>		
TUR/CP/ 7.1	Survey and identification of disease causing organisms in turmeric and screening of turmeric germplasm against diseases	Coimbatore, Pundibari, Dholi & Raigarh	Closed. Final report to be submitted Technology generated may be presented and should be demonstrated

TUR/CP/7.3	Assessment of Fungicide & Biological control agents against foliar disease of turmeric	Dholi	continued
TUR/CP/7.4	Evaluation of turmeric for tolerance to foliar diseases	Coimbatore, Kumarganj, Pundibari, Dholi* & Raigarh*	continued
<b>Coriander</b>			
<b>COR/CP/6</b>	<b>Disease Management Trial</b>		
COR/CP/6.2	Survey to identify the disease incidence, collection and identification of causal organism	Dholi	continued
COR/CP/6.3	Management of stem gall disease of coriander	Dholi, Kumarganj & Raigarh	Closed. Final report to be submitted Technology generated may be presented and should be demonstrated
<b>Cumin</b>			
<b>CUM/CP/6</b>	<b>Disease Management Trial</b>		
CUM/CP/6.2	Survey for identification of yellowing causing organisms in cumin	Jobner, Jagudan	Closed. Final report to be submitted Technology generated may be presented and should be demonstrated
CUM/CP/6.5	Management on blight and powdery mildew by spacing and potash application	Jagudan	continued
<b>Fennel</b>			
<b>FNL/CP/6</b>	<b>Disease Management Trial</b>		
FNL/CP/6.2	Field evaluation of different insecticides / botanicals against seed midge <i>Systole albipennis</i> walker fennel	Jagudan	continued

\*will be initiated during 2014-15.

## **TECHNICAL SESSION: V**

### **VARIETAL RELEASE**

**Chair persons** : **Dr. N.K. Krishna Kumar**, DDG. (Hort.), ICAR, New Delhi  
**Dr. S. K. Malhotra**, ADG. (Hort.), ICAR, New Delhi

**Rapporteurs** : **Dr. R. Senthil Kumar**, IISR, Calicut  
**Dr. S. K. Tehlan**, CCS, HAU, Hisar

#### **General recommendations**

- Sufficient quantity of breeder seeds need to be multiplied before submitting the proposals and should be clearly mentioned in the proposal.
- Varietal release proposals need to be submitted through concerned Director of Research (SAUs)/ Directors.
- DNA fingerprinting should be undertaken for all the proposed varieties wherever facilities are available or with the help of NBPGR.
- In the case of selection from farmer's field, the issue of farmer's right and benefit sharing need to be decided and IPR according to the guidelines
- Unique characteristics of all the released varieties should be available in the AICRPS website.
- Due credit should be given to all the scientists who contributed for the varietal development.
- Pre varietal release committee should follow clear cut guidelines by giving due weightage to the different parameters.
- The Hon. Dy. Director General (Hort.) and the Chairman emphasized the importance of proper submission of the varietal release proposals. The proposals in future should contain the history of the selection process from selection to the evaluation and the person involved in various crops. All data should be analyzed for variance year wise as well as pooled and proposal should have CD, CV etc. The proposal should also contains unique identifying features of the variety to distinguish it from the already released varieties and the amount of planting materials available, supplementary data, Package of Practices under which the evaluation was made, disadvantage of these variety if any, and methods to overcome etc.
- The varieties recommended for release with additional data required may be submitted to Central Varietal release committee at the earliest.
- The released varieties may be submitted to the PPV & FRA for registration. The IPR issues may be clearly sorted out between AICRPS and SAUs. Information on released varieties may be given to the National Biodiversity Authority.

#### **Specific recommendations**

Out of ten varietal release proposal submitted the following four varieties were approved

<b>Crop</b>	<b>Variety</b>	<b>Suggestions</b>
Turmeric	Duggrial Red (JTS-6), DR.YSRHU, Kammarpally	Recommended for release in Andhra Pradesh.
Nutmeg	Nutmeg (Keralashree), IISR, Kozhikode	Recommended for release in Kerala and Tamil Nadu as this is the 1 <sup>st</sup> spices variety developed in participatory breeding mode. The farmer who is involved in the development of this variety should be given first credit, and sufficient planting material should be made available to the AICRPS centers ( about 30 nos.) for evaluation.
Coriander	Off-season variety (LCC-234), Dr. YSRHU, Guntur	Recommended for release in Andhra Pradesh as variety suitable for protected cultivation in summer. The data on oil yield should be discussed with NRCSS, the final value should be given in the revised proposal.
Fenugreek	HM-348, CCSHAU, Hisar, Haryana	Recommended for Hisar, Uttar Khand and Coastal Andhra Pradesh

**The following proposals were differed due to following reasons**

<b>Crop</b>	<b>Variety</b>	<b>Reasons</b>
Black pepper	Panniyur-9 (Cul.5308), KAU-PRS, Panniyur	This variety differed for three years and may be resubmitted after realizing the potential yield.
Cardamom	P27 CRS-KAU, Pampadumpara	The data need to be statistically analyzed
Coriander	RCr- 475, SKN College of Agriculture, Bikaner, RAJAU	Data need to be statistically analyzed. The claim for stem gall and wilt resistance is not sufficiently supported with data.
Coriander	Narendra Dhanian-2 (K-Sel), NDUAT-Kumarganj	The claim for stem gall resistance is not sufficiently supported with data. Data need to be statistically analyzed, data incomplete, no pooled analysis.
Fenugreek	Lam Methi-3 (LFC-103), Dr. YSRHU, Guntur	The breeding methodology need to be clarified, as it is mentioned as mass selection. In the pooled data, many entries are out yielded the proposed entry and shall be clarified. It is claimed as resistant to dry root rot but data is not sufficient to support the claim.

## TECHNICAL SESSION: VI

### TRANSFER OF TECHNOLOGY

**Chairpersons** : **Dr. Homey Cheriyan**, Director, DASD  
**Dr. James George**, Project Coordinator, Tuber Crops, CTCRI

**Rapporteurs** : Dr. A. K. Singh, IGKVV, Raipur  
Dr. Nagesh Naik, UHSB, Karnataka, Sirsi

There were four presentations in the session

1. Rapid multiplication of turmeric through single bud rhizome in prostrays by TNAU, Coimbatore. The technology is aimed to reduce the quantity of seed rate requirement and for higher yield compared to traditional practices. After long discussion the chairman opined that the technology could be better continued exclusively as source of primary production of quality planting material. However, regarding the claim for higher yield, it was suggested to compare the yield of the farmers practice.
2. Report on nutrient management in off season technology of coriander was presented by TNAU, Coimbatore. The use of GA3 @ 5PPM 20 DAS yielded 4624 kg/ ha. It is suggested to include CV in analysed data, correlation of different growth parameters and quality parameters before finalization.
3. The Pundibari centre presented on nutrient management in turmeric, soil application of Borax @ 25 kg/ ha once at the time of planting and another at 90 days after planting for better result in the yield performance in acidic soil. It was suggested that parallel responses of other micronutrients Zn, Fe equally to the boron and also to the response of crop in acidic situation. It was also suggested to evaluate the treatment in acidic condition.
4. Management of soft rot of ginger was presented by Solan centre. The complete presentation will be made in next works shop as TOT in a compiled form with statistical analysis.
5. There were few more technologies listed. But they how to be presented in the next workshop with complete details and statistical analysis.

## TECHNICAL SESSION: VII

### PLENARY SESSION

**Chairpersons** : **Dr. N.K. Krishnakumar**, DDG (Hort.), ICAR, New Delhi  
**Dr. K. Sreedharan**, Vice Chancellor, SDAU, Jagudan

**Rapporteurs** : Dr. D. Prasath, IISR Calicut  
Dr. Srikrishna Bhat, ICRI, Sakleshpur

The Plenary Session was held on 26 Oct 2013, 10.00 AM. Dr. C. K. Thankamani, Principal Scientist, PC unit, Kozhikode welcomed the gathering. Dr. K. Nirmal Babu, Project Co-ordinator, Spices highlighted the achievements of co-ordinated research programme and thrust areas for XII plan. Dr. N. K. Krishna Kumar, DDG (Hort.), ICAR, New Delhi in his introductory remarks highlighted the following points.

- In large cardamom, the planting material free from 'chirke' disease in Sikkim needs to be multiplied and distributed.
- In seed spices, influence of soil and soil microbial factors on quality need to be studied by taking data from different agro-climatic regions.
- Programmes need to be formulated on effect of foliar spray of micro-nutrients on quality enhancement of spices.
- Priority should be given to pesticide residue aspects in spices.
- Drip irrigation and protected cultivation aspects need to be standardized for seed spices (NRCSS).
- Thrips resistant cardamom genotypes identified by IISR need to be tested under different AICRPS centers.
- Common plant protection schedule for thrips need to be developed (AICRPS, IISR, KAU, TNAU, Spices Board, UHS).
- A committee of Scientists with 2 each from IISR, NRC for Seed Spices and 3 from the AICRPS will be formed to help the Project Coordinator in monitoring the experiments going on at different centers.
- The Hon'ble Dy. Director General has urged the scientists to give importance to germplasm collection and evaluation, micro-irrigation, micronutrient requirements and organic spices production.

Mr. Gaurang Patel, Chairman, APMC, Unja, highlighted following points in his presidential remarks. Steps need to be taken for suitable price realization of seed spices at farmer's end. Also, efforts should be made to multiply the high yielding varieties of seed spices and the same should be available to farmers. In reply, DDG (Hort.) asked AICRPS and NRCSS to provide APMC link in their web pages. Efforts may be taken up to promote spices business through innovative promotional advertisements.

Dr. S. K. Malhotra, ADG (Hort.), ICAR, New Delhi emphasized following points.

Suitable cropping systems models for spices need to be developed. Explore possibilities of growing black pepper in oil palm based cropping system. Studies on Genotype x environmental interaction have to be initiated in other spices crops.

Dr. K. Sreedharan, Vice-Chancellor, SDAU, Jagudan, Dr. M. Anandaraj, Director, IISR, Kozhikode

and Dr. Balraj Singh, Director, NRCSS, Ajmer were also expressed their opinion in the plenary session. The proceedings of the different sessions were presented for approval and approved by the house.

The nutmeg collection programme by KAU and germplasm seed spices evaluation programmes at Sanand and Mandor along with the budget provision in a project/voluntary mode was agreed in principle by Asst. Director General (Hort.) and has recommended by AICRPS Workshop. However a formal proposal for the above may be sent to the Council for approval.

### **Genetic Resources**

- The germplasm of large cardamom may also to be evaluated at alternate centre at Kalimpong and ICAR RC, Barapani .
- New varieties and unique germplasm need to be registered with NBPGR/PPV&FRA, New Delhi.
- Chemo-profiling of released varieties of spices need to be developed.
- Marker assisted breeding should be initiated in seed spices.
- Suitable genotypes in response to organic farming may be identified

### **Crop Improvement**

- The reasons for resistance breaks down in cumin variety GC4 need to be studied. Also, measures to overcome the problem of yield loss to reddening in GC4 need to be developed.
- The available genotypes may be evaluated against reddening in cumin.
- Suitable management practices should be developed for managing gummosis/lack of pollination in fennel.
- Root stock breeding may be given emphasis in tree spices. The available different root stocks need to be collected and characterized.
- The Head of Division, Crop Improvement and Biotechnology may be provided available nucleus planting materials of low fibre bold ginger for multiplication and evaluation.

### **Crop Management**

- Formulate suitable new programmes on irrigation and fertigation requirement in ginger.
- Explore possibilities of organic certification through ITMUs of concerned institutes.
- Influence of micro-nutrients to quality of spices need to be tested.
- Project on organic farming may be formulated in seed spices.
- IISR and NRCSS will be part of AICRPS for post harvest technology experiments
- Post harvest technology work undertaken by different centers should be reported under AICRPS.

### **Plant Protection**

- Recommendations of the concluded projects need to mentioned in the proceedings.
- Special emphasis should be given to host-pathogen interaction in spices.

### **Varietal Release**

- Clear cut guidelines for benefit sharing need to be formulated in consultation with NBPGR and PPV&FRA.

The recommendation of the various sessions were presented in the workshop and approved in the plenary session.

The workshop concluded with vote of thanks by Dr. A.V. Agalodiya, Research Scientist, CRSS, SDAU, Jagudan.



**New Research Programme :1**

<b>Crop</b>	<b>Large Cardamom</b>
Title of the programme	Evaluation of large cardamom
Centre	SARD University Nagaland, Arunachal Pradesh**, Darjeeling***
Date/Year of start	2013-14
Duration of the project	Three years
No. of treatments/genotypes with details	SCC 213 Golsey* SCC 214 Glosey SCC 215 Golsey SCC 216 Ramla SCC 217 Ramla SCC 218 Hario Ramsay SCC 219 Rat o varlanges SCC 220 Ramsey SCC 221 Varlanges SCC 222 Asares SCC 223 Ramsey SCC 224 Chivesay SCC 225 Allied genera SCC 226 Hario Varlangey
Design/spacing	To be fixed by the centers
No. of replications	Three replications
Plot size/spacing	3 m x 3 m
Date of sowing/planting and season (Kharif/Rabi /Zhiad)	June – August
No. of plants/plot/treatment	10 plants / plot
Observation to be recorded in detail	1. Growth yield & Quality attributes 2. Plant height (cm) 3. No. of bearing suckers 4. No. of Panicle 5. Length of panicle 6. No. of capsules/plant 7. Yield & quality

\*Based on availability of the planting material.

\*\*Subjected to approval by planning commission

\*\*\*Supervised by ICRI, Gangtok

### New Research Programme : 2

<b>Crop</b>	<b>Ginger</b>
Title of the Programme	Standardization of fertigation in ginger
Centre	Pottangi, Chintapalle, Nagaland & Meghalaya
Date/ Year of start	2014-15
Duration of the project	Three years
Design	RBD
Number of treatments	<p>Treatment details Emitter@4 liter/hour will be used. Irrigation to be provided everyday through drip upto one month before harvest. But fertilizer application only as per the treatment. i.e. weekly or fortnightly. Starting from 10 days after emergence of shoot or one month before harvest.</p> <p>Treatments:</p> <ol style="list-style-type: none"> <li>1. 100% recommended dose of fertilizer (RDF) through conventional method of application control(No drip)</li> <li>2. 100% RDF through drip - Weekly once</li> <li>3. 100% RDF through drip - fortnightly once</li> <li>4. 75% RDF through drip - weekly once</li> <li>5. 75% RDF through drip - fortnightly once</li> <li>6. 50% RDF through drip - weekly once</li> <li>7. 50% RDF through drip - fortnightly once</li> </ol>
Number of replications	3 Geometry
Plot size/spacing	For drip irrigation, drip lines are normally laid out end-to-end. We may plant the crop at 30 x 15 cm spacing and plot size may be 5m x 4m.
Number of plants/plot/treatment	No. of plants = $\frac{5m \times 4m}{0.3 \times 0.15} = 444$ plants/400 plot
Observation to be recorded	<ol style="list-style-type: none"> <li>1. Plant population at 30 DAP</li> <li>2. No. of leavers at 150 days after planting (DAP)</li> <li>3. No of tiller</li> <li>4. Leaf area</li> <li>5. Plant height &amp; Dry matter production at harvest, Days to maturity</li> <li>6. Plant population at harvest</li> <li>7. Fresh weight of rhizomes (Mother, primary &amp; secondary)</li> <li>8. Volume of rhizome (Mother, Primary &amp; Secondary)</li> <li>9. Quality analysis.</li> </ol>

- Local variety Nadia in North East, Suprabha or Surabhi in Pottangi
- Planting material may be multiplied and trial will be started during 2014-15
- \*\*Subjected to approval by planning commision

**New Research Programme : 3**

Crop	<b>Cumin</b>
Title of the programme	Response of sulphur and Bio regulators on yield and quality of cumin.
Centre	Mandor, Rajasthan
Year of start	2013-14
Duration of the project	3 years
Design	Split plot
No. of treatments/genotypes with details	<ol style="list-style-type: none"> <li>1. Level of Sulphur (0 kg , 15 , 30, 45 kg S/ha)</li> <li>2. Bio regulators <ol style="list-style-type: none"> <li>a. Water spray at vegetative &amp; flowering stage</li> <li>b. Ascorbic acid (100 ppm) at vegetative &amp; flowering stage</li> <li>c. TGA (100 ppm) at vegetative &amp; flowering stage</li> <li>d. Salicylic acid (100 ppm) at vegetative &amp; flowering stage</li> </ol> </li> </ol> <p>Variety GC- 4, NPK – 30:20:10 kg /ha</p>
No. of replications	3
Plot size/spacing	4 x 3 m , Geometry :30 cm (RxR)
No. of plants/plot/treatment	
Date of sowing/planting and season (Kharif/Rabi/Zhiad)	Rabi
Observation to be recorded in detail	<p>Soil analysis for Sulphur</p> <ol style="list-style-type: none"> <li>1. Plant height (cm)</li> <li>2. No. of primary branches per plant</li> <li>3. No. of secondary branches per plant</li> <li>4. Days to 50% flowering</li> <li>5. No. of Umbels per plant</li> <li>6. No. of Umbellets per umbel</li> <li>7. Seed per umbel</li> <li>8. Days to maturity</li> <li>9. Yield (kg/ha)</li> <li>10. Check yield</li> <li>11. Percentage of yield increase over check</li> <li>12. Disease incidence if any</li> <li>13. oil content</li> </ol>

**New Research Programme : 4**

<b>Crop</b>	<b>Cumin</b>
Title of the programme	CVT on Cumin 2013
Centre	Jagudan, Jobner & Ajmer
Year of start	2013-14
Duration of the project	3 years
Design	RBD
No. of treatments/genotypes with details	JC-2002-9 - Jagudan JC-95-103 - Jagudan UC-339 - Jobner UC-336 - Jobner ACU - 09-04 - NRCSS, Ajmer ACU - 08-44 - NRCSS, Ajmer
No. of replications	6
Plot size/spacing	4 x 2, 30 x 5cm
No. of plants/plot/treatment	—
Date of sowing/planting and season (Kharif/Rabi/Zhiad)	Rabi
Observation to be recorded in detail	1. Plant height (cm) 2. No. of branches per plant 3. No. of Umbels per plant 4. No. of Umbellets per main umbel 5. No. of Seed per umbellets 6. Test weight 7. Volatile oil content 8. Yield

**New Research Programme : 5**

<b>Crop</b>	<b>Turmeric</b>
Title of the programme	Management of foliar diseases in turmeric using tolerant lines
Centre	Kumarganj, Coimbatore, Pundibari, Dholi <sup>1</sup> & Raigarh <sup>2</sup>
Year of start	2013-14
Duration of the project	3 years
Design	RBD
No of treatments/genotypes with details	RH 406 , RH 410, RH7 – Dholi TCP 14, TCP – 129, TCP – 161, - Pundibari CL-32, CL-34, CL-52, CL-54 - Coimbatore Local check
No of replications	3
Plot size/spacing	30 m x 100 m, 30 cm x 20cm
No of plants/plot/treatment	40 plants per plot
Date of sowing/planting and season (Kharif/Rabi/Zhiad)	June 2013
Observation to be recorded in detail	1 Height of the plant 2 No. of tillers per plant 3 No of leaves per tiller 4. No of days to maturity 5. Disease and pest incidence 6 Rhizome yield per plot or per hectare 7 Curcumin, essential oil, oleoresin content and dry recovery %

<sup>1</sup>Experiment will be initiated at Dholi & Raigarh centers during 2014-15

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- 1 Dr. N.K. Krishna Kumar, Dy. Director General (Hort.)
- 2 Dr. S. K. Malhotra, Assistant Director General (Hort. II)

### **Indian Institute of Spices Research, Calicut, Kerala**

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- 4 Dr. S. Devasahayam, Head, Crop Protection
- 5 Dr. T.J. Zachariah, Head, Crop Production
- 6 Sh. B. Krishnamoorthy, Head, Crop Improvement
- 7 Dr. D. Prasath, Sr. Scientist
- 8 Dr. R. Senthil Kumar, Sr. Scientist, CRC, Appangala

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76-100 From Jagudan Organizing Committee

