

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



25TH - 27TH SEPTEMBER 2014



**UTTAR BANGA KRISHI VISWAVIDYALAYA
PUNDIBARI, COOCHBEHAR, WEST BENGAL**



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

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

25th – 27th September 2014

Uttar Banga Krishi Viswavidyalaya
Pundibari, Coochbehar, West Bengal



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

Complied & Edited by

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Scientist (Spices, Plantation, Medicinal and Aromatic Plants)

Dr. C. K. Thankamani

Principal Scientist (Agronomy)

PROGRAMME

25th SEPTEMBER 2014

INAUGURAL SESSION

10.00 AM - 12.00 PM

Rapporteurs: **Dr. C. K. Thankamani, AICRPS, IISR, Kozhikode**
Dr. Parasuram Sial, OUAT, Pottangi

10.00 am -10.05 am	Invocation	ICAR song
10.05 am - 10.15 am	Welcome	Prof. Debasis Mazumdar Director of Research, UBKV
10.15 am-10.45 am	Coordinators report	K. Nirmal Babu Project Coordinator, AICRP on Spices
10.45 am-11.00 am	Presidential address	Prof. B. Bandyopadhyay Hon. Vice Chancellor, UBKVV
11.00 am -11.30 am	Inauguration of the workshop, Inaugural address & Release of Publications	Dr. S. K. Malhotra Assistant Director General (Hort.), ICAR & Horticulture Commissioner, New Delhi
11.30 am -11.35 am	Vote of Thanks	Dr. S. Bandyopadhyay Organizing Secretary, UBKV, Pundibari
11.35 am- 11.40 am	National Anthem	
11.45 am- 12.00 pm	Tea	

Chairpersons : Dr. S. K. Malhotra, ADG (Hort.), ICAR & Horticulture Commissioner,
New Delhi
Dr. J. Suresh, Professor & Head, Spices & Plantation Crops, TNAU, Coimbatore

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

Presentations

- | | | |
|----|------------------|---|
| 1 | Black pepper | Dr. Laxminarayan Hegde, UHS, Sirsi |
| 2 | Large cardamom | Dr. A.K. Vijayan, ICRI, Regional Station, Gangtok, Sikkim |
| 3 | Cardamom | Dr. D. Laxmanan, ZAHRS, Mudigere |
| 4 | Ginger | Dr. Happy Dev, Dr. YSPUHF, Solan |
| 5 | Turmeric | Dr. S. Bandyopadhyay, 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 |
| | 2.00 pm -2.45 pm | Lunch |

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26th SEPTEMBER 2014

SESSION II : CROP IMPROVEMENT	9.00 am - 11.30 am
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Chairpersons : Dr. J. P. Singh, Director of Research, GBPUA&T, Pantnagar
Dr. B. Sasikumar, Head, CI&B, IISR, Kozhikode

Rapporteurs : Dr. C. Ushamalini, TNAU, Coimbatore
Dr. K. Giridhar, Dr.YSRHU, Guntur

Presentations

- | | | |
|---|--------------|-------------------------------------|
| 1 | Black pepper | Dr. P.M. Ajith, KAU, Panniyur |
| 2 | Cardamom | Dr. K. M. Devaraju, ZAHRS, Mudigere |
| 3 | Ginger | Dr. Parsuram Sial, HARS, Pottangi |
| 4 | Turmeric | Dr.R. Chitra,TNAU, Coimbatore |
| 5 | Tree spices | Dr. U. B. Pethe, KKV, Dapoli |
| 6 | Coriander | Dr. Dharendra Singh, RAJAU, 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 |

11.30 am

Tea

Chairpersons : Dr. T.J. Zachariah, Head, Crop Production and PHT, IISR, Kozhikode
Dr. S. J. Ankegowda, Head, CRC, IISR, Appangala

Rapporteurs : Dr. A. U. Amin, CRSS, SDAU, Jagudan
Dr. Gargi D Shirke, KKV, Dapoli

Presentations

- | | | |
|---|--------------|--|
| 1 | Black pepper | Dr. (Mrs) Gargi D Shirke, KKV, Dapoli |
| 2 | Cardamom | Dr. M. Murugan, CRS, (KAU), Pampadumpara |
| 3 | Ginger | Dr. Parasuram Sial, HARS, OUAT, Pottangi |
| 4 | Turmeric | Dr.R.Chitra, TNAU, Coimbaore |
| 5 | Coriander | Dr. T. P. Malik, CCS HAU, Hisar |
| 6 | Cumin | Dr. A.U. Amin, SDAU, Jagudan |
| 7 | Fennel | Dr. T.P. Malik, CCS HAU, Hisar |
| 8 | Fenugreek | Dr. S. Suryakumari, Dr. YSRHU, Guntur |

Chairpersons : Dr. S. K. Malhotra, Horticulture Commissioner, ICAR, New Delhi
Dr. James George, Project Coordinator, AICRP Tuber Crops, Trivandrum

Rapporteurs : Dr. D. Prasath, IISR, Kozhikode
Dr. S.K. Tehlan, CCSHAU, Hisar

CARDAMOM- IISR, Kozhikode
CARDAMOM- KAU, Pampadumpara
CARDAMOM- KAU, Pampadumpara
CORIANDER- Jobner
CORIANDER- Kumarganj
FENUGREEK- Guntur

Chairpersons : Dr. Homey Cheriyan, Director, DASD, Kozhikode
Dr. Gopal Lal, Principal Scientist, NRCSS, Ajmer

Rapporteurs : Dr. A. K. Jha, ICAR RC for NEHR, Barapani
Dr. A.K. Singh, IGKV, Raigarh

1. Control of rhizome rot of ginger by Biofumigation - Dr. Meenu Gupta, Solan
2. Nutrient supplementation through organic manure on ginger - Dr. A. K. Mishra, Dholi
3. Management of stem gall of coriander - Dr. A. K. Singh, Raigarh and Dr. R.S. Mishra, Kumarganj
4. Nutrient management of off season production of leafy coriander - Dr. R. Chitra, Coimbatore
5. Technology for application of PGPR in Fenugreek - Dr. R. S. Mishra, Kumarganj, Dr. T.P. Malik, Hisar and Dr. S. Suryakumari, Guntur
6. Standardization of water management of turmeric through drip irrigation - Dr. R. Chitra, Coimbatore
7. Integrated nutrient management for black pepper under Kerala conditions - Dr. Ajith. P. M, Panniyur.
8. Effect of micronutrients on turmeric - Dr. A. K. Mishra, Dholi

Chairpersons : Dr. M. Anandaraj, Director, IISR, Kozhikode
Prof. Apurba Kr Choudhury, Dean Faculty of Agrl. UBKVV, Pundibari

Rapporteurs : Dr. Meenu Gupta, Dr. YS PUH& F, Solan
Dr. A. K. Mishra, RAU, Pusa Bihar, Dholi

Presentations

- | | | |
|---|----------------|---|
| 1 | Black pepper | Dr. C.R. Rini, PRS, Panniyur |
| 2 | Large cardamom | Dr. A. K. Vijayan, ICRI, Gangtok, Sikkim |
| 3 | Cardamom | Dr. Dhanya. K, KAU, Pampadumpara |
| 4 | Ginger | Dr. (Mrs.) Meenu Gupta, Dr. YSPUHF, Solan |
| 5 | Turmeric | Dr. C. Ushamalini, TNAU, Coimbatore |
| 6 | Coriander | Dr. A.K. Singh, IGAU, Raigarh |
| 7 | Cumin | Dr. N.R. Patel, SDAU, Jagudan |
| 8 | Fennel | Dr. A. K. Mishra, RAU, Dholi |

27th SEPTEMBER 2014

SESSION VII

PLENARY SESSION

8.00 am -11.00 am

Chairperson : Dr. S. K. Malhotra, Horticulture Commissioner & ADG (Hort.), ICAR, New Delhi

Rapporteurs : Dr. P.M. Ajith, PRS, KAU, Panniyur
Dr. Sharon Aravind, IISR, CRC, Appangala

8.00 am	ICAR Song	
8.02 am	Welcome address	Prof. Debasis Mazumdar Director of Research, UBKV, Pundibari
8.05 am	Presidential Address	Prof.B. Bandyopadhyay, Hon.Vice Chancellor, UBKV, Pundibari
8. 10 am	Research highlights and new programmes of AICRPS	K. Nirmal Babu Project Coordinator, AICRP on Spices
8. 15 am	Presentation of session reports and recommendation	Rapporteurs
9. 00 am	Remarks on the group meeting	Dr. M. Anandaraj Director, Indian Institute of Spices Research, Kozhikode
9.10 am	Address by the Chief Guest	Dr. S. K. Malhotra Horticulture Commissioner & Assistant Director General (Hort.),ICAR, New Delhi
9.30 am	Vote of Thanks	Dr. Utpala Parthasarathy Chief Technical Officer, AICRPS, IISR, Kozhikode
9.45 am	National Anthem	
10.00 am	Tea	
11.00 am		
- 4.00 pm	Post workshop field visit	

INAGURAL SESSION

Rapporteurs : Dr. C. K. Thankamani, Principal Scientist, IISR, Kozhikode
Dr. Parshuram Sial, Senior Breeder & OIC, OUAT, Pottangi

The twenty fifth AICRPS workshop was held at Uttar Banga Krishi Viswavidyalaya (UBKV), Pundibari, Cooch Behar Dist, West Bengal from 25th to 27th September 2014. Professor Debasis Mazumdar, Director of Research, UBKV welcomed the dignitaries, delegates and participants. He recounted how UBKV was established in 2001 and AICRP on Spices is working since 1996. Large cardamom, ginger, chilli, turmeric *etc.* are the main spice crops grown in Pundibari. He also mentioned that wide range of genetic variability in Indian arrowroot, turmeric and arecanut is available at Pundibari and nearby areas. He opined that rhizome rot and bacterial wilt in ginger, blight disease in cardamom are the major diseases hampering the cultivation of these spices.

Dr. K. Nirmal Babu, Project Coordinator, AICRPS, presented the action taken report for the year 2013-14 in the workshop. According to him purity, food safety, value addition and sustainability are the road map of AICRP Spices. Project coordinator highlighted the achievements and also mentioned about collection of unique dwarf clove seedlings at Pechiparai, seedless nutmeg at Pampadumpara, availability of pure Megha turmeric at Barapani, Roma turmeric at Chinthapalle, climate resilient turmeric varieties Roma, NDH 98, Prathibha to different agroclimatic zones, seed wasp tolerant black pepper standard (*Erythrina subumbrans*) at Mudigere, protrait technology in ginger and turmeric for reducing the seed material requirement and which provides healthy planting material.

He told the participants to identify the areas for cultivating pure spices varieties, to develop GAP for different spices, to predict the suitable areas of spices cultivation through GIS and to initiate contract cultivation in spices. PC also informed the scientists to send annual report through digitalized form latest by the May each year that will help in compiling, printing and submitting the annual report to the Council in time.

The Hon'ble Vice Chancellor of UBKV, Dr. B. Bandyopadhyay congratulated the AICRPS scientists for developing good technologies. In the context of globalization, he opined to produce clean spices and to work for value addition, to identify compounds meant for medicinal and aromatic aspects of spices and he requested to cultivate remunerative crops, transfer the technology to farmers so that income, growth rate and social status of the farmers would be increased.

The Asst. Director General cum Horticulture Commissioner, Dr. S.K. Malhotra addressed the gathering and opined that AICRPS is an important and unique programme of ICAR where location specific technologies can be generated. Horticulture is a major sunrise

sector for food security, livelihood in health point of view and spices are the major emerging sector in pharmaceutical industry. Though the production in the spices has been increased, a major challenge for us to further increase the production, productivity with quality assurance and to increase input use on account of population rise and for export. He also mentioned that production of healthy medicines, quality planting material, crop protection for new diseases and reduction in the post harvest losses are some of the major issues to be sorted out soon. He also conveyed his heartiest gratitude to IISR, Kozhikode, DASD, Kozhikode and Directorate of seed spices, Ajmer working together for development of spices.

He made mention on the works done by AICRPS viz. about 110 high yielding varieties of spices were developed, site specific varieties are identified through G x E experiment etc. AICRPS centres may contact National Horticulture Board for accrediting their nursery for production of quality planting material in spices including micro-rhizome technique, mini-rhizome technique and single bud rhizome technique in turmeric and ginger.

In MIDH programme, ICAR has initiated to produce organic spices, huge quantity of seed and quality planting materials, and initiated a network project on organic horticulture, and high value compounds. He also advised AICRPS scientists to develop varieties with uniform ripening in black pepper, cardamom varieties with bold capsule, varieties for specific agro climatic zones and eco-friendly integrated production technologies in spices.

Twelve booklets including one e-publication were published in the session. Dr. S. Bandyopadhyay, organizing secretary of 25th AICRPS Annual Group Meeting proposed vote of thanks to all.

PROJECT COORDINATOR'S REPORT

K. Nirmal Babu

Project Coordinator

ICAR - All India Coordinated Research Project on Spices

ICAR - Indian Institute of Spices Research, Calicut - 673 012, Kerala

The All India Coordinated Research Project on Spices (AICRPS), a project of Indian Council of Agricultural research (ICAR), is located in Kerala with its head quarters at Indian Institute of Spices Research, Kozhikode. The AICRPS which started with 14 centres in 12 states, has grown to 38 centres spread over 23 states of the country, representing various agro climatic zones suitable for spices cultivation with a budget out lay of Rs.3500.00 lakhs in XII plan. The annual budget for the year 2013-14 was Rs. 396.00 lakhs as ICAR share. AICRPS has sanctioned staff strength of 83 comprising of 51 scientific, 26 technical and 6 auxiliary posts. The mandate crops include black pepper (9 centres), small cardamom (4 centres), large cardamom (2 centres), ginger (16 centres), turmeric (14 centres), coriander (12 centres), cumin (4 centres), fennel (9 centres), fenugreek (12 centres), cinnamon (3 centres), nutmeg (3 centres) and clove (3 centres).

Research achievements during the year

New initiatives

To meet the requirement of seed spices farmers in Rajasthan and Gujarat, two centres of seed spices in Mandor and Sanand has been started and initiated evaluation of cumin germplasm. Realizing the importance of vegetable ginger, a new initiative to collect vegetable ginger from North East and 7 new collections were taken from Nagaland. In addition to this, 10 Nepal collections from IISR were introduced for multiplication and evaluation at 4 centres in North East.

Varieties recommended for release in XXIV AICRPS workshop

Turmeric variety Duggirala Red from Dr. YSRHU, Kamarpally, Keralashree variety of nutmeg from IISR, Kozhikode which was the 1st spices variety developed in participatory breeding mode, LCC-234 off season coriander variety from YSRHU, Guntur and HM-348 of fenugreek from CCSHAU, Hisar were recommended for release during the 24th workshop held at CRSS, Jagudan.

Collaboration

During the year the AICRPS centres were involved in production of disease free planting materials of (5 lakhs black pepper rooted cuttings, 30,000 tree spices grafts/seedlings ,100 tons ginger, 150 tons turmeric, 60 tons seed spices) with the support from DASD under 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.

Monitoring

The programmes of various Centres were monitored by periodical reports and visits by the coordinator to all the AICRPS centres and field visits to the experimental plots.

Black pepper

During the year 20 more accessions were added to the germplasm of black pepper maintained at various centres viz. Panniyur, Ambalavayal, Chintapalle, Dapoli, Pechiparai, Pundibari, Sirsi and Yercaud. Preliminary evaluation of black pepper germplasm at Panniyur indicated that the cultivar PRS 64 ranked first with 3.11 kg green berry yield and 1045 spikes /vine.

At Sirsi grafts of Panniyur 1 runner shoots on black pepper variety IISR shakthi as rootstock recorded maximum height. Under drip fertigation experiment in black pepper at Panniyur, 50 % RDF through drip (81) at weekly interval recorded maximum spike yield (5.43 kg/vine) and saved 25 % water.

The black pepper tolerant varieties, IISR Shakti and IISR Thevam recorded significantly less disease incidence (11.73 and 14.15 respectively) of *Phytophthora* foot rot at Sirsi. Black pepper vines treated with consortium of bacteria (IISR 6 and IISR 859) as spraying (@2l/vine) and drenching (@3l/ vine) 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 2013) and post monsoon (Aug 2013) recorded least disease incidence and recorded more plant height that was on par with Panniyur 1.

Among the new fungi toxicant molecules @0.1 % Fenamidone (10 %) + Mancozeb (50 %) (Sectin) alone and Fenamidone(10 %) + Mancozeb (50 %) (Sectin) as spraying (@ 2 l/vine) and drenching (3 l/vine) along with bioagent *Trichoderma harzianun* (MTCC 5179) 50 g with one kg of neem cake as soil application separately during first week of June and third week August recorded statistically significant reduction in the disease with respect to leaf infection (7.73 and 6.15 %), reduced yellowing (7.88 and 7.59 %), least defoliation (8.05 and 6.06) and death of vines (4.24 and 4.86) respectively at Sirsi.

Cardamom

In a CVT at Sakaleshpur with 15 accessions, maximum per plant yield was recorded by IC 34987 (816.20 g/pl) whereas at Appangala, IC34957 recorded maximum yield (732.5 g/pl). At Mudigere irrigation (9 liters/clump/day) along with 100 % recommended dose (125:125:250 NPK kg ha⁻¹) of fertilizer through drip recorded the maximum capsule yield (220.35 kg ha⁻¹) that was on par with irrigation 9 liters/ clump/day with 75 %

recommended fertilizer dose (215.25 kg ha⁻¹) which saved 44 % water and 25 % recommended dose of fertilizer. In an organic farming trial at Pampadumpara, application of 30 t FYM + recommended dose of NPK (125 :125 : 250 kg ha⁻¹) recorded maximum dry capsule yield (255 kg ha⁻¹). Application of ground lime stone @ 2 kg/plant in cardamom increased the yield by 63 % over control (without liming) at Pampadumpara.

For management of stem rot of cardamom at Pampadumpara spraying and basal application of bavistin 0.2 % resulted in less diseases incidence (19.8 %).

Large Cardamom

Survey was made at different area of Sukhia Pokhri, Darjeeling district of West Bengal and South and North district of North Sikkim for collection of germplasm. Six planting units of three germplasm viz. SCC 249 (Girmaley), SCC 250 (Varlangey) and SCC 251 (Varlangey), were collected and planted under AICRPS trial plot at Kabi farm and characterizations of the collected germplasm were made as per descriptor.

Treating suckers with bio agents *Pseudomonas fluorescens* + *Bacillus subtilis* 3 % each showed less incidence of blight as compared to control. Planting units of large cardamom were introduced into Arunachal Pradesh, Nagaland and West Bengal.

Ginger

Seven accessions of local types were collected from Nagaland and added to the germplasm. In an IET trial in ginger SG - 26 -04 at Solan (2117 kg ha⁻¹), GCP 49 (1326 kg ha⁻¹) at Pundibari, RG -18 (2119 kg ha⁻¹) at Dholi, Baidra Sonth (3366 kg ha⁻¹) at Kumarganj recorded maximum yield.

In a G x E trial in ginger, variety Nadia (2275 kg ha⁻¹) performed best at Chintapalle, Himgiri (1677 kg ha⁻¹) at Mizoram, Surabi (2909 kg ha⁻¹) at Pasighat, and SG-26/04 at Solan (2100 kg ha⁻¹). The variety Suruchi (10.5 %) at Barapani and Surabhi (8.5 %) at Pasighat recorded maximum oleoresin content.

Survey conducted in Vaishali district of Bihar by Dholi centre indicated higher incidence of bacterial wilt caused by *Ralstonia solanacearum* (30 %) compared to soft rot(14 %) caused by *Pythium aphanidermatum*.

At Ambalavayal soft rot incidence and leaf spot incidence were found to be minimum in plots where the soil was bio-fumigated using cabbage (56.0 % and 1.0 % respectively) and rhizome yield was also higher in these plots (20.0 tha⁻¹).

Turmeric

Apart from collection (1225) and cataloguing of turmeric germplasm, evaluation of germplasm was carried out at various centres. Promising genotypes identified from germplasm based on yield were RH 2/80 (44.5 t ha⁻¹) at Dholi, CHFT36 (35.59 t ha⁻¹) at Pasighat, PTS 21 (34 t ha⁻¹) at Pottangi, TCP 168 (54.54 t ha⁻¹) at Pundibari, and IT 40 (22.5 t ha⁻¹) at Raigarh.

In a CVT on turmeric RH 13/90 (44 t ha⁻¹) at Chintapalle, CL 101 (43.57 t ha⁻¹) at Coimbatore, RH 80 (6.70 t ha⁻¹) at Dholi, RH 9/90 (31 t ha⁻¹) at Kammarpally, PTS 55 (14.8 t ha⁻¹) at Pottangi, TCP 70 at Pundibari 26.21 t ha⁻¹ and RH 50 (21.9 t ha⁻¹) at Raigarh recorded maximum yield.

In another CVT on turmeric NDH 98 recorded maximum yield in four centres, 35 t ha⁻¹ at Pasighat, 62 t ha⁻¹ at Chintapalle, 47 t ha⁻¹ at Pundibari, 30 t ha⁻¹ Kumarganj where as ACC 79 recorded maximum yield at Coimbatore. This accession is also field tolerant to leaf diseases of turmeric.

In a continued G x E interaction study turmeric varieties Roma (21 t ha⁻¹) at Pottangi, RH 9/90 (30 t ha⁻¹) at Kammarpally, RCT -1(30 t ha⁻¹) at Mizoram, Megha Turmeric (46 t ha⁻¹) at Kalyani recorded maximum yield.

Integrated nutrient management registered maximum turmeric yield (17.52 t ha⁻¹ and 19.68 t ha⁻¹) at Pundibari and Raigarh respectively whereas organic management recorded maximum yield (27.2 t ha⁻¹) at Pottangi.

At Coimbatore, among the nine different treatments, the treatment single node cutting (5 g) planting in protray (1 month) recorded the highest yield (67.94 kg/plant) compared to control, primary full length rhizome (25-30 g) planted directly in the field which produced (43.77 kg/plot). Among the transplanted seedlings at Chintapalle, two node raised turmeric plants showed good growth and yield (26.57 t ha⁻¹) and on par with sowing of primary rhizomes directly in the field. By this method 350 kg of seed per acre is needed for planting compared to 1400 kg seed per acre in traditional practice of turmeric cultivation.

Tree Spices

The germplasm of the tree spices which include nutmeg, cinnamon, cassia and clove are collected, maintained, characterized and catalogued at Dapoli and at Pechiparai, three new collections were added at Pechiparai. The accession SA-13 of clove was significantly superior than other accessions and recorded highest stem girth (39.78 cm), leaf length (13.70 cm) and leaf breadth (4.40 cm) and dry bud yield (4.50 kg/tree).

Among the nutmeg accessions evaluated at Pechiparai MF4 recorded maximum number of fruits/tree (1040), weight (75.24g), fruit weight maximum dry mace yield (418 kg/tree)

and nutmeg oil (7.7 %). At Dapoli genotype DBSKKVMF 29 recorded maximum yield. Among twelve accessions of cinnamon, CV-5 recorded the highest dry bark yield (567.80 g) per tree whereas local check recorded less dry bark yield (272.80 g) per tree.

In a CVT at Pechiparai, among the six accessions of nutmeg, A9/150 recorded the maximum plant height (2. 12m), stem girth (11.97 cm), number of branches (20.56), and recorded maximum number of fruits (32/tree). At Pechiparai among the cassia accessions D3 recorded maximum dry bark yield (226.12g per plant). In a CVT on cassia, at Dapoli the genotype KKVCTSH2 recorded higher girth (41.38 cm), oil percentage (7.34), followed by KKVCTSH 1 37.00 cm girth and (7.12 %) oil.

A mother garden was planted at Dapoli, Pechiparai (Coimbatore) and IISR with all the relevant varieties of cinnamon and nutmeg for future use as scion bank.

Cumin

Fifty accessions of seed spices were introduced and evaluated in new centres at Mandor and Sanand. At Jagudan in a new CVT the entries CUM- 15 (623 kg ha⁻¹), CUM-16 (546 kg ha⁻¹) and CUM-18 (546 kg ha⁻¹) recorded the higher yield 17,19 and 2.7 per cent higher over the best check GC-4.

At Jobner the results of pooled data indicated that the bio formulation FK 14 + FL 18 recorded significantly higher seed yield (279.61 kg ha⁻¹) over control and FK 14 and was comparable with FL 18. The cumin crop sown by line sowing either 30 cm or 45 cm showed its superiority over broadcasting method with respect to increasing overall yield and reducing per cent disease intensity of blight at Jagudan.

Fennel

The germplasm accessions RF 14 at Dholi, NDF 46, NDF 51 and NDF 84 at Kumarganj were reported as top yielders. In a CVT FNL 54 (2176 kg ha⁻¹) at Hisar, FNL 47 (1288 kg ha⁻¹) at Kumarganj, FNL 55 (1319 kg ha⁻¹) at Jagudan, FNL 52 (670 kg ha⁻¹) at Raigarh were found to be promising based on yield. In an IET at Jobner, entry UF-236 recorded maximum seed yield of 1848.15 kg ha⁻¹ followed by UF-191 (1685.19 kg ha⁻¹). In an initial evaluation trial (IET) in fennel at Hisar maximum seed yield was recorded in HF-151 (2107.4 kg ha⁻¹) followed by HF-212 (1979.8 kg ha⁻¹) showing an increase of 27.0 and 19.3 % over HF-33 (check). At Kumarganj as per yield data NDF- 32 (39.55 g/plant), NDF-39 (38.16 g/plant) and NDF-31 (38.01g/plant) were found to be alkalinity tolerant at 10, 20, 30 and 40 ESP levels.

Drip irrigation at 0.8 IW/CPE ratio with paired row planting, at par with irrigation at 0.8 IW/ CPE ratio in normal row planting, recorded significantly higher fennel seed yield (30.80 t ha⁻¹) over irrigation at 0.4 and 0.6 IW/CPE ratios.

Beneficial effect of PGPR bioformulation was obtained in fennel by treating the seeds with FK14 (9.5 kg ha⁻¹) at Raigarh, whereas local popular variety HF-33 recorded maximum yield (1806.9 kg ha⁻¹) at Hisar and no significant difference in growth, yield and quality attributes in fennel was observed at Jagudan.

Fenugreek

In a CVT 2012 seed yield of different accessions varied from 408 kg ha⁻¹ to 2754 kg ha⁻¹. The accession FGK 52 recorded maximum seed yield (936 kg ha⁻¹) at Raigarh, FGK 44 at Coimbatore and Udaipur with a yield 408 kg ha⁻¹ and 1493 kg ha⁻¹ respectively, FGK 49 (1848 kg ha⁻¹) at Dholi, FGK 48 (2754 kg ha⁻¹) at Hisar, FGK 40 with a yield of 1458 kg ha⁻¹ at Kumarganj were also promising .

At Jagudan in an IET, the pooled over two year data revealed that entries JFg-268 (1981 kg ha⁻¹) and JFg-224 (1954 kg ha⁻¹) recorded significantly higher yield over check GM-2, which were 10.67 and 9.13 per cent higher over the check GM-2. At Jobner UM-112 was top yielder in both normal and stress conditions. RMt-1, UM-124, UM-140, UM-228, UM-353, UM-304 and UM-302 were found to be the desirable entries for drought conditions.

In a PGPR trial in fenugreek, combination of FK14 (*Pseudomonas putida*) and FL18 (*Macrobacterium paraoxydans*) recorded maximum yield (1233.8 kg ha⁻¹) at Guntur, bioformulation of FGK 14 + FL 18 recorded maximum yield (1587 kg ha⁻¹) and (1668.41 kg ha⁻¹) respectively at Kumarganj and Jobner whereas at Hisar maximum seed yield (2070.5 kg ha⁻¹) was recorded in a treatment bioformulation of FK 14 + FL 18 and no significant difference in between the treatment yield was observed at Jagudan.

Coriander

In a trial multilocation evaluation of germplasm, RD 410 at Coimbatore (7.5g/pl), RD-387(6.13g/pl) at Guntur and VDV/GL-49 at Jobner were promising. In the CVT trial initiated during 2012 the yield of coriander varied from 554.6 to 1912 kg ha⁻¹. Promising entries identified in coordinating centres were COR 46 at Guntur (1300 kg ha⁻¹), COR 43 at Kumarganj (1551 kg ha⁻¹), COR 56 (1481 kg ha⁻¹) at Jagudan, COR 53 (1202 kg ha⁻¹) at Raigarh, COR 44 (1622 kg ha⁻¹) at Jobner. COR 56 at Navsari (1220 kg ha⁻¹), COR 46 (554.6) at Coimbatore, COR 43 (2256 kg ha⁻¹) at Hisar, COR 44 at Udaipur (1198 kg ha⁻¹), COR 48 at Jabalpur (1533 kg ha⁻¹), COR 41 at Hisar and COR 50 (1919 kg ha⁻¹) at Dholi.

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 169 (1284 kg ha⁻¹) recorded maximum yield. New IET in coriander was initiated during 2012 at Jagudan, Guntur, Kumarganj and maximum yield was recorded by JCR 389 (1387 kg ha⁻¹), LCC 268 (1126 kg ha⁻¹), ND cor101 (1569 kg ha⁻¹) respectively at various centres.

In an experiment on identification of drought/alkalinity tolerant source in coriander at Jobner, genotype RCR-684 was top yielder in both normal and stress conditions. Based on the indices UD22, UD562, UD 801 and UD 86 were found to be the desirable entries for drought conditions.

Significant beneficial effect of PGPR bioformulations was obtained in coriander by treating the seeds with FK14 + FL18 (1192 kg ha⁻¹) at Guntur, seed treatment with FK 14 (735 kg ha⁻¹) at Coimbatore, seed treatment with FL18 at Raigarh (920 kg ha⁻¹), maximum yield (1764 kg ha⁻¹) was recorded by local popular variety (Hisar Anand) at Hisar, whereas the effect of bioformulations on growth and genotypes yield of coriander was not significant at Jagudan.

Transfer of Technology

The scientists of AICRPS among others are involved in the area of their operation focused in demonstration of the following technologies in many farmers field.

- FLD on off-season production of coriander LCC-234 (Guntur)
- Demonstrations of high yielding variety fennel GF-12 (Jagudan)
- Demonstrations of high yielding coriander variety GCor-2 (Jagudan)
- Demonstrations of high yielding coriander variety Rcr-480 (Jobner)
- Demonstrations of high yielding cumin variety Rcr-223 (Jobner)
- Demonstrations of high yielding fennel variety RF-143 (Jobner)
- Seed production LCC- 236 (Suguna) (Guntur)
- Popularization of high yielding turmeric variety Prathibha (Guntur)
- Management of rhizome rot of ginger (Raigarh)
- Disease free single node protrait multiplication of turmeric (Coimbatore)
- FLD on high yielding variety of RCr 436 (Pantnagar)
- Rhizome rot management in ginger by biofumigation using cabbage (Raigarh)
- Management of blight in large cardamom by biocontrol agents (ICRI, Sikkim)

ACTION TAKEN REPORT 2013

Sl. No.	Decision	Centers	Action Taken
Recommendations			
TECHNICAL SESSION: I GENETIC RESOURCES			
1	In indigenous local collections should be effectively screened for their major disease resistance	All Centers	It is being followed accordingly. Few disease tolerant genotypes were identified in turmeric.
2	Collect seeds from dwarf clove type	Pechiparai	5 plants were obtained
3	In seed spices, efforts should be made to enrich the germplasm with exotic genotypes	All Centers	About 15 new collections were added to the germplasm
4	For genetic resources trial, characterization of biometrical traits should be done For IET and CVT trials, statistical analysis must be done.	All Centers	This is being followed in all cases of genetic resources characterization For IET and CVT trials, statistical analysis is in practice and analyzed data is supplemented with CD, CV and SEM data
5	In MLT of coriander, apart from yield data, other biometric observations should also be reported	Jobner, Guntur	It is being followed
6	It was proposed to initiate germplasm evaluation programmes in Mandor and Sanand for identifying genotypes suitable for this region in a voluntary mode Mandor & Sanand Centre will be provided 50 accessions of seed spices by Jobner & Jagudan centers respectively	Jobner Jagudan	Sixty eight accessions of cumin were provided Fifty accessions of cumin were provided to Sanand centre, AAU from Jagudan germplasm for evaluation
7	Large cardamom germplasm should be introduced to Nagaland, Arunachal Pradesh and Meghalaya	Sikkim centers	The material is multiplied

8	Large cardamom germplasm collection should be intensified	Gangtok	<p>1. Survey was made at Pulungdung area of Sukhia Pokhri, Darjeeling district of West Bengal, Lingzoo area of South Sikkim and Singhik area of North Sikkim. Four germplasm accessions were collected and planted at conservatory during the year 2013-14. With this four germplasm accessions collection the total germplasm under AICRPS became 29</p> <p>2. Characterization of those collected germplasm was made as per large cardamom descriptor</p>
TECHNICAL SESSION: II CROP IMPROVEMENT			
9	The replicated data of all G x E interaction trials may be compiled and published	All centers involved in the trial	A research paper to this effect was published on turmeric recently Similar effort in ginger is in progress
10	For all trials CD and CV must be calculated and reported	All centers	For all trials, statistical analyzed data is supplemented with CD and CV
11	For IET trial, include one national check decided by PC and one local check which is released /popular variety of that region	All centers	Implemented
12	While reporting the biotic and abiotic stress resistance, stress condition need to be specified	All centers	Implemented
13	Disease tolerant lines of turmeric may be included in the new experiment at Dholi, Pundibari and Coimbatore	Pundibari	A new trial entitled "Evaluation of turmeric for tolerance to foliar diseases" has been initiated at Pundibari centre in 2013-14 with 4 genotypes from Coimbatore centre, 3 genotypes each from Dholi

			and Pundibari centre along with a local check (TCP 2)
14	In fennel Bloomless types may be aptly described as waxy types	Jagudan	Implemented
TECHNICAL SESSION: III CROP MANAGEMENT			
15	In all the Crop Management trials, supportive data from soil analysis may also be collected for better interpretation of results	All centers	In all the Crop Management trials, supportive data from soil analysis is collected and given in the Annual Report
16	New trials may be formulated on the role of micronutrients for Ginger and seed spices	Pottangi, Chintapalle	A new demonstration trial on effect of micronutrients on growth and yield of ginger will be initiated in 2015-16
17	Evaluation of PGPR bio-formulations in seed spices is to be continued for one more year	Jobner Hissar, Guntur	Continued for 2013-14
18	Development of organic package for spices in default organic regions	Centers located in Tribal regions	A new trial is proposed this year
19	Percent saving of water in micro-irrigation over conventional methods may be documented scientifically	Mudigere	Followed and will be presented accordingly
20	In organic farming of black pepper, as there is a variation in the results due to the age of vines, standards and treatments, the present experiment may be closed	Sirsi, Peechiparai	Closed
TECHNICAL SESSION: IV CROP PROTECTION			
21	The effect of insecticide on pollinators may also be studied in the concerned crops	Mudigere, Pampadum para	Observation will be recorded
22	Screening for thrips resistance may be intensified in cardamom		In collaboration with IISR the lines already identified are multiplied for field evaluation
23	In future all new experiments should be presented in the respective sessions	All centers	It is being followed

24	Pesticide residue data may be generated before recommending insecticides, after completion of respective experiments	All centers	At present we have no facilities for this. Explore the possibilities with AICRP on Pesticide residue
25	Evaluation of PGPR bioformulations in coriander and cumin may be reported under crop management		It has been reported in crop management
TECHNICAL SESSION- V: VARIETAL RELEASE			
26	Sufficient quantity of breeder seeds need to be multiplied before submitting the proposals and should be clearly mentioned in the proposal	All centers	Being Implemented
27	Varietal release proposals need to be submitted through concerned Director of Research (SAUs)/Directors		
28	DNA fingerprinting should be undertaken for all the proposed varieties where ever facilities are available or with the help of NBPGR		
29	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		
30	The proposals in future should contain the history of the selection process from selection to the evaluation and the personal involved 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.		
31	The varieties recommended for release have to be submitted to Central Varietal release committee at the earliest		
32	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		
33	Due credit should be given to all the scientists who contributed for the varietal development		
TECHNICAL SESSION : VII PLENARY SESSION			
34	In seed spices, influence of soil and soil microbial factors on quality need to be studied by taking data from different agro-climate regions	Seed spice centers	Implemented
35	Programmes need to be formulated on effect of foliar spray of micro-nutrients on quality enhancement of seed spices		Will be implemented in coming years
36	Priority should be given to pesticide residue aspects in spices		A programme to identify low pesticide areas for cumin is being proposed in a project mode funding by Jagudan
37	Micro - irrigation, micronutrient requirements and organic spices production	Jagudan	Implemented
Genetic resources			
38	New varieties and unique germplasm need to be registered with NBPGR/PPV&FRA, New Delhi.	Jagudan	30 genotypes of each of Cumin, fennel, fenugreek and coriander sent to NBPGR for obtaining IC number
9	Suitable genotypes response to organic farming may be identified	Jagudan	Will be Implemented
Crop improvement			
40	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	Jagudan	This is mainly due to loss of purity Reddening is due to changes in climatic conditions
41	Suitable management practices should be developed for managing gummosis/ lack of pollination in fennel	Jagudan	will be studied
Crop management			
42	Influence of micro-nutrients to quality of spices need to be tested	Jagudan	New research programme "Effect of ferrous and zinc enriched FYM on yield and quality of fennel" will be presented for approval

TECHNICAL SESSION: I

GENETIC RESOURCES

- Chairpersons** : Dr. S. K. Malhotra, ADG (Hort.), ICAR & Horticulture Commissioner, New Delhi
Dr. J. Suresh, Professor & Head, Dept. of Spices & Plantation Crops, TNAU, Coimbatore
- Rapporteurs** : Dr. S. Suryakumari, Dr. YSRHU, Guntur
Dr. R. Chitra, TNAU, Coimbatore

General recommendations

- Passport data for originally collected germplasm should be prepared and submitted for getting IC numbers to avoid duplication.
- Trait specific germplasm should be collected and evaluated.
- Unique genetic resources need to be registered in NBPGR, New Delhi.
- Stability analysis may be done for the germplasm trials conducted for more than five years and core grouping may be done.
- Uniform methodology may be followed for pest and disease scoring.
- Yield data may be presented uniformly in g/kg/q and per plant/plot/acre/ha.
- Status report may be submitted for pollination problem in cumin (Action: Jagudan)
- In indigenous collection of spice crops like Black pepper, Cardamom, Ginger and Turmeric germplasm should be effectively screened for the major disease resistance.
- DNA finger printing of unique germplasm may be done.

Crop specific recommendations

Black pepper

- The material of CUL 5308 may be sent to IISR for verifying the tolerance level to biotic and abiotic stress (Action: Chinthapalle).
- *Piper arboreum* used as rootstock at Sirsi may be confirmed for tolerance to abiotic stresses.

Large cardamom

- Nucleus planting material may be provided to low altitude areas apart from Sikkim. Virus indexing should be done before distribution of the materials (Action: IARI RS, Kalimpong & Spices Board, Gangtok)
- 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.

Small cardamom

- Research papers on variability in flower characters may be published (Action: Pampadumpara).
- Pest and disease scoring may be done and to be presented in next workshop (Action: Pampadampura)

Ginger

- Good photographs may be taken for unique type of germplasm for registration purpose.
- Duplication may be avoided/deleted and new collection should be made from farmers field (Action: Pundibari).
- Wild type collection may be identified with the help of taxonomist (Action: Pottangi).

Turmeric

- High yielding germplasm may be forwarded to IET trial (Action: Pundibari).
- High yielding varieties (compiled for three years) may be forwarded to CVT trial (Action: All centres).

Tree spices

- Mace recovery and oil content of unique genotypes may be analyzed (Action: KAU)
- Unique genotypes may be grafted and supplied to various centres for establishing mother gardens in tree spices centres.
- Unique germplasm collected from farmers field should be registered with NBPGR (Action: KAU).

Coriander

- A set of germplasm lines may be evaluated and others may be deposited in repository at NAGS *i.e.*, NRCSS, Ajmer (Action: Coimbatore).
- Multilocation trial will be continued for one more year

Cumin, Fennel and Fenugreek

- Multilocation trial to be continued for one more year

Project code	Title	Centers	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
CARDAMOM			
CAR/CI/1.1	Germplasm collection, characterization, evaluation and conservation	Mudigere & Pampadumpara	Continued
LARGE CARDAMOM			
LCA/CI/1.1	Germplasm collection & evaluation of large cardamom	Arunachal Pradesh, Gangtok (ICAR), Gangtok (ICRI), Meghalaya & Nagaland	Continued
GINGER			
GIN/CI/1.1	Germplasm collection, characterization, evaluation and conservation	Dholi, Kammarpally, Kumarganj, Pundibari, Pottangi, Raigrah & Solan	Continued
TURMERIC			
TUR/CI/1.1	Germplasm collection, characterization, evaluation and conservation	Coimbatore, Dholi, Kammarpally, Kumarganj, Pantnagar, Pasighat, Pottangi, Pundibari, Raigarh	Continued
TREE SPICES			
TSP/CI/1.1	Germplasm collection, characterization, evaluation and conservation of clove, nutmeg and cinnamon	Dapoli & Pechiparai	Continued
TSP/CI/1.2	Collection of Unique germplasm in tree spices	Dapoli, IISR, KAU & Pechiparai	Continued
CORIANDER			
COR/CI/1.1	Germplasm collection, description, characterization, evaluation, conservation and screening against diseases	Coimbatore, Dholi, Guntur, Hisar, Jagudan, Jobner & Kumarganj	Continued
COR/CI/1.2	Multilocation evaluation of germplasm in coriander	Ajmer, Coimbatore, Guntur & Hisar	Continued
CUMIN			
CUM/CI/1.1	Germplasm collection, characterization, evaluation, conservation and screening against diseases	Jagudan, Jobner & Mandor	Continued
CUM/CI/1.2	Multilocation evaluation of cumin germplasm	Ajmer	Continued
FENNEL			
FNL/CI/1.1	Germplasm collection, characterization, evaluation,	Dholi, Hisar, Jagudan, Jobner & Kumarganj	Continued

	conservation and screening against diseases		
FNL/CI/1.2	Multilocation evaluation of fennel germplasm	Ajmer & Jobner	Continued
FENUGREEK			
FGK/CI/1.1	Germplasm collection, characterization, evaluation, conservation and screening against diseases	Dholi, Guntur, Hisar Jagudan, Jobner & Kumarganj	Continued
FGK/CI/1.2	Multilocation evaluation of fenugreek germplasm	Ajmer, Jobner & Hisar	Continued

TECHNICAL SESSION: II

CROP IMPROVEMENT

Chairpersons : Dr. J. P. Singh, Director of Research, GBPUA&T, Pantnagar
Dr. B. Sasikumar, Head, CI & B, IISR, Kozhikode

Rapporteurs : Dr. C. Ushamalini, TNAU, Coimbatore
Dr. K. Giridhar, Dr. YSRHU, Guntur

General Recommendations:

1. Data should be statistically analyzed and presented along with CD and CV values for proper interpretation of the results.
2. The results of the projects that are concluded may be published as soon as possible in reputed journals.
3. The results of the projects should be given in the format prescribed by the Project Coordinator (uniform pattern).
4. IC No. for all the entries in IET and CVT must be obtained from NBPGRI immediately and mentioned in the trials wherever applicable.
5. Popular article/ Tech. bulletin may be published from the results obtained from the completed trials.

Black pepper

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

- The promising 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.

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

- Sirsi centre must generate sufficient quantity grafts and re-initiate the trial.
- Dapoli center should initiate the trial during 2015-16.

Cardamom

CAR/CI/3.6: CVT 2007/2009 – Series VI

- The closure report of the trial at Appangala and Sakleshpur centers should be submitted to the PC unit and other centers will continue the trial.

Ginger

GIN/CI/3.5: G X E interaction on quality ginger.

- The trial is continued till the replication wise data on quality attributes has to be obtained and submitted to the PC unit.
- The replicated data of the trials has to be submitted to Dr. Parasuram Sial for stability analysis marking a copy to PC unit. Further, Dr. Parasuram Sial is directed to take up the stability analysis and submit the report to the PC unit.

Turmeric

- In all the Crop Improvement trials on turmeric, yield should be reported plot wise and projected yield per hectare. Uniformity should be maintained while reporting the data.
- In all the trials on turmeric, dry recovery, curcumin content and essential oil should be recorded.
- Replication wise samples of turmeric should be sent to Solan centre for analysis in the case of CVT and IETs and to IISR, Kozhikode in G X E trials.

TUR/CI/3.5: G X E interaction on quality

- The trial is continued till the replication wise data on quality attributes is obtained and submitted to the PC unit.
- The replicated data of the trials has to be submitted to Dr. Parasuram Sial for stability analysis marking a copy to PC unit. Further, Dr. Parasuram Sial is directed to take up the stability analysis and submit the report to the PC unit.

Tree spices

TSP/CI/2.2: CVT 2001 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.

TSP/CI/2.3: CVT 2001 in Cassia

Coumarin content in the promising accession D3 should be recorded.

Seed spices

A new IET is to be initiated at the Hisar centre on Coriander, Fennel and Fenugreek.

Coriander

The entries UD-123, UD-61, UD-169 from Jobner and DH-218, DH-318 from Hisar may be promoted to the CVT Series X to be initiated during 2015-16.

Fennel

The entries HF-151 and HF-212 from Hisar may be promoted to the new CVT to be initiated during 2015-16.

Fenugreek

The entries HM-257 and HM-425 from Hisar may be promoted to the new CVT to be initiated during the 2015-16.

Project code	Title	Centers	Comments
Black Pepper			
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, Sirsi & Yercaud	Continued
PEP/CI/3.4	Evaluation of grafts, orthotropic and runner shoots in black pepper	Ambalavayal, Panniyur, Sirsi & Yercaud	Continued
Cardamom			
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	Appangala , Mudigere, Myladumpara, Pampadumpara & Sakleshpura	Trial completed at Sakleshpura and Appangala and in other centers trial will be continued
CAR/CI/3.7	CVT of drought tolerance in Cardamom -Series VII	Appangala, Mudigere & Sakleshpura	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
Ginger			
GIN/CI/2	Coordinated Varietal Trial		
GIN/CI/2.3	CVT 2013 – Series VIII	IISR, Dholi, Pottangi, Pundibari & Solan	Continued
GIN/CI/3	Varietal Evaluation Trial		
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	Trial will be continued till the replication wise data on quality attributes is obtained
GIN/CI/4	Quality Evaluation Trial		
GIN/CI/4.1	Evaluation of germplasm for quality	Solan	Continued
GIN/CI/4.2	Evaluation of germplasm from other centers	Solan	Continued
Turmeric			
TUR/CI/2	Coordinated varietal trial		
TUR/CI/2.5	CVT on Turmeric 2013	Chintapalle, IISR, Kumarganj, Pundibari & Pottangi	Continued
TUR/CI/3	Varietal evaluation trial		
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	Barapani, Kammarpally, Kalyani, Mizoram, Pottangi & Raigrah	Continued
Tree Spices			
TSP/CI/2	Coordinated Varietal Trial		
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	Dapoli & Pechiparai	Continued
Coriander			
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, Jobner, Kumarganj, Navsari, Pantnagar & Kota	Continued
COR/CI/3	Varietal Evaluation Trial		
COR/CI/3.4	Initial Evaluation Trial 2011	Jobner & Hisar	Continued
COR/CI/3.6	Initial Evaluation Trial 2012	Guntur, Jagudan & Kumarganj	Continued
COR/CI/3.7	Initial Evaluation Trial 2013	Dholi	Continued
COR/CI/4	Quality Evaluation Trial		
COR/CI/4.1	Quality evaluation in coriander	Jobner	Continued
Cumin			
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/4	Quality Evaluation Trial		
CUM/CI/4.1	Quality evaluation in cumin	Jobner	Continued
Fennel			
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	Continued
FNL/CI/3	Varietal Evaluation Trial		
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
FNL/CI/4	Quality Evaluation Trial		
FNL/CI/4.1	Quality evaluation in fennel	Jobner	Continued
Fenugreek			
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	Continued

FGK/CI/3	Varietal Evaluation Trial		
FGK/CI/3.4	Initial evaluation trial 2010	Hisar & Pantnagar	Continued
FGK/CI/3.5	Initial evaluation trial 2012	Guntur, Kumarganj, Jagudan & Jobner	Continued
FGK/CI/3.6	Initial evaluation trial on fenugreek	Dholi	Continued

TECHNICAL SESSION: III

CROP MANAGEMENT

Chairpersons : Dr. T. J. Zachariah, Head, Crop Production and PHT, IISR, Kozhikode
Dr. S. J. Ankegowda, Head, CRC, IISR, Appangala

Rapporteurs : Dr. A. U. Amin, CRSS, SDAU, Jagudan
Dr. Gargi D Shirke, KKV, Dapoli

General recommendation:

- Only uniform treatment need to be taken up by all centres

Crop specific recommendations

BLACK PEPPER:

PEP/CM/4.4. Development of organic package for spice based cropping system-
Observational trial.

- Recommended for closure.

PEP/CM/4.5. Organic farming in Black pepper - 2006.

- Recommended for closure and technology should be presented to extension agencies.
- The trial running in Yercaud must be closed & technology developed must be presented in transfer of technology sessions.
- Quality profile should also be included

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

- Dapoli and Sirsi are the extended centers for the trial.

CARDAMOM:

CAR/CM/5.2. Effect of fertigation on yield of cardamom through drips

- Crop management should be given more importance to get better treatment effect.

CAR/CM/5.3. Organic farming in cardamom

- Only uniform treatment need to be taken up by all centres.
- The nutrient composition of Jeevaamrutha may be examined critically.

CAR/CM/5.4. Liming in Cardamom

- Programme may be continued

GINGER:

GIN/CM/5.4. Evaluation of herbicide for the effective control of weed in ginger

- Weed density and weed bio mass must be recorded in different treatments.

GIN/CM/5.5. Source Sink relationship

- Programme may be continued.

TURMERIC:

TUR/CM/5.5. Standardization of water requirement for turmeric through drip irrigation

- The project is concluded and the technology may be presented in transfer of technology session

TUR/CM/5.8. Studies on the effect of rhizome size and nursery on growth and yield of turmeric

- The project is closed.
- The portray technique may be presented in transfer of technology session

CORIANDER:

COR/CM/5.8. Evaluation of PGPR Bioformualtion on Coriander.

- The project is concluded and the technology may be presented in transfer of technology session

CUMIN:

CUM/CM/5.8. Evaluation of PGPR Bioformulation on Cumin.

- The project is concluded and the technology may be presented in transfer of technology session

FENNEL:

FNL/CM/5.3. Micro irrigation management in fennel

- The project will be continued.

FNL/CM/5.8. Evaluation of PGPR bioformulation on fennel

- The project is concluded and the technology may be presented in transfer of technology session

FENUGREEK:

FGK/CM/5.3. Micro irrigation management in fenugreek

- The project will be continued.

FGK/CM/5.8. Evaluation of PGPR bioformulation on Fenugreek

- The project is concluded and the technology is recommended for extension agencies.

Project code	Title	Centers	Comments
Black Pepper			
PEP/CM/4	Nutrient Management Trial		
PEP/CM/4.4	Development of organic package for spices based cropping system – observational trial	Chintapalle, Dapoli, Panniyur & Sirsi	concluded
PEP/CM/4.5	Organic farming in black pepper – 2006	Dapoli, Panniyur, Pechiparai, Sirsi & Yercaud	concluded
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
Cardamom			
CAR/CM/5	Nutrient Management Trial		
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	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

Turmeric			
TUR/CM/5	Nutrient Management Trial		
TUR/CM/5.5	Standardization of water requirement for turmeric through drip irrigation	Coimbatore, Guntur Kammarpally, Kumarganj & Pundibari	concluded
TUR/CM/5.7	Effect of micronutrients on turmeric	Dholi & Pundibari	Continued
TUR/CM/5.8	Studies on the effect of rhizome size and nursery on growth and yield of turmeric	Chintapalle & Coimbatore	concluded
TUR/CM/5.9	Source sink relationship in turmeric	Coimbatore, IISR & Guntur	Continued
Coriander			
COR/CM/5	Nutrient Management Trial		
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/5.8	Evaluation of PGPR bioformulation on coriander	Coimbatore, Guntur, Hisar, Jagudan, Raigarh & Ajmer	concluded
Cumin			
CUM/CM/5	Nutrient management trial		
CUM/CM/5.1	Identification of drought tolerance	Jobner	Continued
CUM/CM/5.8	Evaluation of PGPR Bioformulation on Cumin	Jagudan, Jobner & Ajmer	Concluded
Fennel			
FNL/CM/5	Nutrient Management Trial		
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	Concluded
Fenugreek			
FGK/CM/5	Nutrient Management Trial		
FGK/CM/4.2	Identification of drought/tolerance source in fenugreek	Jobner	Continued
FGK/CM/5.3	Microirrigation management in fenugreek	Jobner	Continued
FGK/CM/5.8	Evaluation of PGPR bioformulation on fenugreek	Jagudan, Jobner, Guntur, Hisar & Kumarganj	Concluded

TECHNICAL SESSION: IV

VARIETAL RELEASE

Chairpersons : Dr. S. K. Malhotra, Horticulture Commissioner, ICAR, New Delhi
Dr. James George, Project Coordinator, AICRP Tuber Crops, Trivandrum

Rapporteurs : Dr. D. Prasath, IISR, Kozhikode
Dr. S.K. Tehlan, CCSHAU, Hisar

General recommendations

- The proposal of the recommended variety should be submitted to CVRC (Central Varietal Release Committee) for notification, along with IC numbers, DNA finger print profiles and high resolution photographs within one year of identification of varieties in the AICRPS Workshop
- If DUS guidelines are notified in the particular crop, the varieties needs to be registered with PPVFRA, New Delhi as early as possible.
- In case of collection of germplasm from custodian farmers/ planters credit should be given to them.
- A booklet of seed spices released from released from Jobner centre may be published before the next workshop.
- All the scientists involved in the development/evaluation of the particular variety should also be given due credit.
- Sufficient planting material needs to be generated before submission of the proposal.

There were six varietal release proposals presented out of that only 5 varieties were recommended for release and the recommendations are as follows.

1. Crop: Cardamom

Variety: **PV 3 (S 1)**

Centre: Pampadumpara

- Pedigree of the clonal selection need to be specified.
- The data on disease and pest incidence has to be supplemented.
- Identified for release in Kerala state.

2. Crop: Cardamom

Variety: **PV 4 (PS 27)**

Centre: Pampadumpara

- Variety proposed is having high incidence of thrips and yield level is *on par* with other proposed variety.
 - Not recommended
3. Crop: Cardamom
 Variety: **Appangala 2 (IC 547167/NHY 35)**
 Centre: ICAR-IISR, CRC, Appangala
- This variety possess resistance to *katte* disease, the supplementary data with respect to resistance need to be provided.
 - Identified for release in Karnataka
4. Crop: Coriander
 Variety: **Narendra Dhania 2 (K-Selection)**
 Centre: NDUAT, Kumarganj
- The data on stem gall and powdery mildew resistance need to be supplemented.
 - Identified for release in Northern India (Uttar Pradesh, Gujarat and Rajasthan)
5. Crop: Coriander
 Variety: **RCr-475 (UD 475)**
 Centre: SKNAU, Jobner
- The data on stem gall and powdery mildew resistance need to be supplemented.
 - The variety may be tested in Kota region of Rajasthan which is hotspot for stem gall to further prove its resistance.
 - Identified for release in Rajasthan for grain purpose only
6. Crop: Fenugreek
 Variety: **Lam Methi 3 (LFC-103)**
 Centre: APHU, Guntur
- The data on root rot resistance need to be supplemented and data on high diosgenin content may be confirmed.
 - Identified for release in Andhra Pradesh and Telangana under rainfed conditions

TECHNICAL SESSION: V

TRANSFER OF TECHNOLOGY

Chairpersons : Dr. Homey Cheriyan, Director, DASD, Kozhikode
Dr. Gopal Lal, Principal Scientist, NRCSS, Ajmer

Rapporteurs : Dr. A. K. Jha, ICAR RC for NEHR, Barapani
Dr. A. K. Singh, IGKV, Raigarh

1. Control of rhizome rot of ginger by biofumigation: Dr. Meenu Gupta, Solan

Crop residues of mustard and cabbage incorporated in soil (Biofumigation) and rhizome treatment with Metalaxyl + Mancozeb 1.25 g/litre of water for 15-20 minutes is recommended for management of rhizome rot of ginger.

2. Nutrient supplementation through organic manure on ginger: Dr. A.K. Mishra, Dholi

For integrated nutrient management in ginger the recommended fertilizer dosage is FYM @ 30t/ha + NPK 80:50:50 kg/ ha under Bihar conditions. The said dosage gave Cost: Benefit ratio of 1:3.

3. Management of Stem gall of coriander : Dr. A.K. Singh, Raigarh and Dr. R.S. Mishra, Kumarganj

Seed treatment with Hexaconazol 0.2% and Propiconazol 0.2% at 45, 60 and 75 days after sowing was found effective to control stem gall of coriander.

4. Nutrient management in off - season coriander leaf production: Dr. Chitra, Coimbatore

Application of NPK @ 30:40:20 kg per ha along with spraying of GA @ 15 ppm at 20 DAS was recommended to get maximum leaf yield of coriander (4824 kg/ha). Yield increase of 25% over control was reported.

5. Technology for application of PGPR in Fenugreek, Coriander and Fennel: Dr. R.S. Mishra, Kumarganj, Dr. T.P. Malik, Hisar and Dr. Suryakumari, Guntur

In fenugreek, coriander and fennel, seed pelletizing with IISR PGPR strains either FK-14 (*Pseudomonas putida*) or FL-18 (*Macrobacterium paraoxydans*) or combination of both is found as effective as talc formulation @ 1.5 kg/ha seed treatment. The treatment

has increased the yield on average by 10-15% in Andhra Pradesh, Rajasthan, Gujarat, Haryana and Uttar Pradesh conditions.

**6. Standardization of water management of turmeric through drip irrigation:
Dr. R. Chitra, Coimbatore**

Application of water through drip system at 80% pan evaporation (once in a day for 45 minutes) has been recommended to get the maximum fresh rhizome yield (43.52 t/ha), dry rhizome yield (7.79 t/ha), curcumin content (4.26%), essential oil content (3.67%) and oleoresin content (8.69%). Total water to be applied is 538.40 ha mm

**7. Integrated nutrient management for black pepper under Kerala conditions:
Dr. Ajith P.M., Panniyur**

An integrated package involving FYM 10 kg, *Azospirillum* 50g, Phosphobacteria 50g, *Trichoderma* 50g, *Pseudomonas fluorescens* 50g, NPK 50:50:200 g/vine per year from 3rd year onwards and need based application of Bordeaux mixture 1% , Copper-oxychloride 0.2% and Quinalphos 0.05% is recommended under Kerala conditions for vines of 3- 4 meter column height.

8. Effect of micronutrient on turmeric: Dr. A.K. Mishra, Dholi

For Iron deficient soil of Bihar (1.73ppm Fe) foliar application of ferrous sulphate @ 0.5% at 60 and 90 days of planting improved the yield. The Cost: Benefit ratio of the technology was reported to be 1:2.54.

TECHNICAL SESSION: VI

CROP PROTECTION

Chairpersons : Dr. M. Anandaraj, Director, IISR, Kozhikode
Prof. Apurba Kumar Choudhury, Dean, College of Agriculture, UBKV,
Pundibari

Rapporteurs : Dr. Meenu Gupta, Dr YSPUHF, Solan
Dr. A. K. Mishra, RAU, Pusa Bihar, Dholi

Black Pepper

PEP/CP/5.1: Adaptive trial on management of *Phytophthora* foot rot of black pepper in farmers' field

- The experiment may be closed at Ambalavayal with recommendations incorporated in package of practices.

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

- Since the trial was conducted for three years, so it may be concluded and recommendations should be given highlighting the importance of the varieties.
- Mudigere centre should submit the report within fifteen days to the PC Unit.

PEP/CP/5.4: Effectiveness of new molecules of fungi toxicants against foot rot of black pepper in existing plantations

- The experiment may be continued for one more year to know whether yellowing symptoms is due to altered pH, nematodes *etc.*

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

- All pepper growing centers should take up this experiment taking into consideration of soil pH.
- In addition to treatments, soil amelioration should be taken into consideration.
- Sirsi centre should address water stagnation in the fields that predisposes vines to infection.

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

- Mudigere centre has identified *Erythrina subumbrans* as resistant source for gall wasp. So, resistant plants should be multiplied and distributed to all other centres.

Large Cardamom

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

- Resistant collections, SCC 8, SCC11 and SCC 12 should be indexed for viruses and those with high yield potential should be multiplied and supplied to other centres.

Small Cardamom

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

- Pampadumpara should submit the report to PC unit.
- Experiment running at IISR, Kozhikode having organic management with bioagents should be taken up by all centres.

Ginger

All the four experiments of biofumigation with cabbage and mustard for the management of soft rot and bacterial wilt of ginger should be concluded and recommendation may be drawn.

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

- Ginger may be grown under partial shade with red gram or pigeon pea to reduce incidence of *Phyllosticta* leaf spot.

Turmeric

TUR/CP/7.1: 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.

TUR/CP/7.3: Assessment of fungicides and biological control agents against foliar diseases of turmeric.

- Accepted common names of foliar diseases should be followed, such as leaf blotch.

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

- Kumarganj centre should give their entries to Coimbatore again as it was missed.

Coriander

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

- Names of promising entries showing resistant reaction against diseases should be listed and used in other experiments on stem gall of coriander.

Cumin

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

- The causes of yellowing symptoms should be further studied.

Fennel

FNL/CP/6.3 Field evaluation of different insecticides/botanicals against seed midge *Systole albipennis*

The experiment may be continued for one more year with supplementation of data on period between spraying date and sample collection for residue analysis should be taken into consideration.

New experiment

Title: Bioefficacy of new molecules against cumin aphids

It may be taken as observational trial.

Title: Management of powdery mildew of coriander

1. Some preliminary data should be generated before finalizing the treatment details.
2. Karathane may be included as positive check.
3. The experiment may be taken up in all the centres having powdery mildew problem

Title: Eco-friendly management of stem gall of coriander

1. It may be initiated as observational trial by taking into account summer tillage of soil.

Project code	Title	Centers	Comments
Black Pepper			
PEP/CP/5	Disease Management Trial		
PEP/CP/5.1	Adaptive trial on management of <i>Phytophthora</i> foot rot of black pepper in farmers field	Ambalavayal	Concluded
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/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/5.6	Biological management of Slow Decline in Black Pepper	Panniyur	Continued
PEP/CP/6	Pest management trial		
PEP/CP/6.2	Management of <i>Erythrina</i> gall wasp in a popular standard of black pepper	Mudigere & Pampadumpara	Closed
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	Pampadumpara & Mudigere	Continued
CAR/CP/6.8	Comparison of effect of chemical treatments as well as bio-control agents against pseudostem rot of cardamom	Pampadumpara	Continued
Large Cardamom			
LCA/CP/1.1	Evolving disease & pest tolerant lines in large cardamom	Gangtok (ICRI)	Continued
LCA/CP/1.2	Integrated pest and disease management in large cardamom	Gangtok (ICRI)	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/6.6	Management of soft rot of ginger (Biofumigation using mustard)	Solan & Kumarganj	Concluded
GIN/CP/6.7	Management of soft rot of ginger (Biofumigation using cabbage)	Ambalavayal , Pundibari Pampadumpara, Solan & Kumarganj	Concluded
GIN/CP/6.10	Efficiency of different fungicide against leaf spot disease of ginger including new molecules	Dholi, Pundibari, Solan & Raigarh	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	Closed and may be started as with new title as Disease surveillance and record weather parameters, GIS, etc.
TUR/CP/7.3	Assessment of Fungicide & Biological control agents against foliar disease of turmeric	Dholi & Raigarh	Continued
TUR/CP/7.4	Management of foliar diseases in turmeric using tolerant lines	Coimbatore, Dholi, Kumarganj, Pundibari & Raigarh	Continued
Coriander			
COR/CP/6	Disease Management Trial		
COR/CP/6.2	Survey to identify the disease incidence, collection and identification of causal organism in coriander	Dholi	Continued
Cumin			
CUM/CP/6	Disease Management Trial		
CUM/CP/6.5	Management of blight and powdery mildew by spacing and potash application	Jagudan	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 fennel	Jagudan	Continued

TECHNICAL SESSION: VII

PLENARY SESSION

Chairpersons : Dr. S. K. Malhotra, Horticulture Commissioner & ADG (Hort.), ICAR, New Delhi

Rapporteurs : Dr. P.M. Ajith, PRS, KAU, Panniyur
Dr. Sharon Aravind, IISR, CRC, Appangala

The Plenary session was held on 27th September 2014. Chief guest of the session was Dr. S. K. Malhotra, Horticulture Commissioner & Assistant Director General (Hort.), ICAR, New Delhi. Welcome address was given by Prof. Debasis Mazumdar, Director of Research, UBKV, Pundibari. He emphasized to develop varieties with good quality for export and resistance to biotic and abiotic stresses.

Chief guest, Dr. S. K. Malhotra complimented this workshop, as many good recommendations have come out and congratulated to cardamom *katte* resistant variety developed by ICAR-IISR.

He emphasized that while implementing the projects we need to keep in mind the following

- Our mission is to produce more spices without increasing the area, and as an intercrop in other cropping systems.
- Importance of sustainability and biosafety
- Research on Ajowain and Dill may be initiated in AICRPS
- Certified planting material production for ginger and turmeric in collaboration with DASD need to be scaled up to meet the emerging demand
- Minimize post harvest losses
- Implementing good nursery practices and get the nurseries of AICRPS accredited as early as possible
- Industry linked programs to meet demands of industries
- Compile the technologies developed by AICRPS for commercialization

New Initiatives

- IARI Kalimpong centre will work as satellite centre for AICRPS, Pundibari (UBKV) for working on large cardamom, especially for virus indexing and producing virus free planting material
- DASD may provide support to establish large cardamom nursery at Kalimpong
- A meeting will be organized by the Horticulture Commissionerate, New Delhi and DASD to develop strategies to intensify large cardamom cultivation in NE states.

- New program of introducing of cumin to Tamil Nadu – TNAU station at Periyakulam will take up under project mode funding.
- Chemoprofiling of all the released varieties of seed spices- Jagudan centre which has sophisticated lab will take up initially in cumin in project mode funding

Research highlights and new programmes of AICRPS was briefed by the Project Coordinator, AICRP on Spices. High priority was given to on productivity enhancement, purity of seed/variety, soil and plant health in AICRPS programs.

Genetic Resources

As we already have large collection of germplasm importance should be given to

- Cataloguing of existing germplasm is to be completed in a phased manner
- New collections will be based on trait specific collections – for eg. high quality lines in black pepper, synchronous flowering types in cardamom, bold vegetable types in ginger and unique fruit types in nutmeg, disease escapes and high quality types in seed spices.

Crop Improvement

- High priority need to be given to breeding/selection for *Phytophthora* resistance in black pepper, thrips in small cardamom, stem gall in coriander and blight in cumin.

Crop Production

- New safer molecules and biologicals including PGPRs to be evaluated

Crop Protection

- Use of root stock for resistance to *Phytophthora* need to be intensified and demonstration of grafted pepper on *Piper colubrinum* will be taken up to popularize in hotspots of *Phytophthora* where water will not be a limiting factor
- A program on micro irrigation in ginger may be initiated

Transfer of technology

- Training on portray technology in turmeric and ginger may be given to officials of various states to popularize the technology.
- Bulletins on varieties released and technologies developed need to be prepared in local languages.
- Two new centres in co-opting mode at SAARD (Nagaland University) and Kahikuchi (AAU) will initiate program this year (2015).

The Rapporteurs of each session presented the reports

Genetic Resources- the session on genetic resources was presented by Dr. R. Chitra

- Passport data of germplasm should be prepared and submitted to get IC numbers
- DNA finger printing of unique germplasm to be done the help of university labs/IISR
- Black pepper- CUL 5308 sent to IISR for verifying drought tolerance

General Recommendations

- Crop specific institute should be identified for DNA finger printing
- All presentations need to be supplemented with good photographs
- Expertise of IISR can be utilized to identify black pepper species in germplasm wherever necessary for varietal description

Crop Improvement- the report was presented by Dr. C. Ushamalini

- All the centres will provide the year wise replication wise data on G×E of ginger and turmeric along with quality analysis data.
- In experiments CD, CV and SE values should be provided.
- Panniyur Centre need to multiply and distribute the grafts of IISR Thevam and IISR Sakthi to other centres for experimentation. Sirsi centre will supplement the graft production

Crop Management- the report was presented by Dr. S. J. Ankegowda

- Develop GAP for spices
- For all organic experiments, soil nutrient status has to be estimated
- GAP for cardamom need to be refine and finalized
- A trial on organic disease management of seed spices has to be initiated

Transfer of technology- the report was presented by Dr. A.K.Jha

- Pamphlet on micro irrigation of turmeric need to be prepared
- While preparing extension bulletins farmer friendly language should be used

Crop Protection- the report was presented by Dr. Meenu Gupta

- Organic management of cardamom thrips trial at IISR may be taken up by other AICRPS centres

Variety Release

- Five varieties PV 3 and Appangala-2 of small cardamom, Narendra Dhania 2 and RCr-475 of coriander and Lam Methi 3 of fenugreek were recommended for release.

Other recommendations

Three projects were recommended by the workshop to be taken in project mode for next 3 years with additional contingency of Rs. 1 lakh/year based on availability of funds. They are:

- Evaluation of large cardamom genotypes lines at Kalimpong centre as satellite centre of UBKV, Pundibari
- Chemo-profiling of released varieties of seed spices cumin, coriander, fennel and fenugreek at SDAU, Jagudan

- Evaluation of cumin genotypes in Ramanad district of Tamil Nadu by TNAU centre at Periyakulam

Prof. B. Bandyopadhyay, Hon. Vice Chancellor, UBKV, Pundibari in his presidential address emphasized importance of testing all varieties for pest and disease resistance before recommending for release.

Dr. M. Anandaraj, Director, IISR emphasized the importance of quality management and residue analysis before technology recommendation.

The plenary session of XXV Group Meeting of All India Coordinated Research Project on Spices at UBKV, Pundibari came to an end with the delivery of vote of thanks by Dr. Utpala Parthasarathy followed by the National Anthem.

Crop Improvement

New Research Programme : 1	
Crop	Ginger
Title of the programme	Initial Evaluation Trial of Bold/vegetable ginger
Centre	Pottangi
Year of start	2015-16
Duration of the project	3 years
Design	RBD
Replication	3
Details of the technical programme	T1:PGS-101 T2: PGS-102 T3: PGS-103 T4: PGS-104 T5:PGS-105 T6: PGS-106 T7:PGS-107 T8: PGS-108 T9: PGS-109 T10: PGS-110 T11: Nadia(C) T12: Varada(NC) T13: Suruchi (LC)
Plot size/spacing	3mx1m/ 30cmx25cm
Observation to be recorded in detail	<ol style="list-style-type: none"> 1. Plant population 2. Number of tillers 3. Plant height(cm) 4. Fresh weight of clump 5. Yield/ha 6. Dry recovery (%) 7. Fibre content 8. Oleoresin (%) 9. Essential oil (%) 10. Reaction to diseases and insect pests

Crop management

New Research Programme : 2	
Crop	Ginger
Title of the programme	Organic production of ginger
Centre	Barapani and Kolasib (Mizoram)
Year of start	2015
Duration of the project	3 years
Design	RBD
Variety	Mahima - Mizoram, Nadiya - Barapani
No. of treatments/genotypes with details	<p>Number of treatments-8</p> <p>T₁ : 100% organic manures equivalent to 100% N requirement of ginger</p> <p>T₂ : 100% organic manures equivalent to 75% N requirement of ginger</p> <p>T₃ : 100% organic manures + (micronutrients)</p> <p>T₄ : 100% organic manures+ (Vermiwash 10%)</p> <p>T₅ : 75% N requirement of ginger + (micronutrients)</p> <p>T₆ : 75% N requirement of ginger + (Vermiwash 10%)</p> <p>T₇ : Recommended Package by SAU (Ginger - NPK 100 : 90:90 kg/ha), Barapani & Mizoram</p> <p>T₈ : Farmers practice.</p>
No. of replications	3
Plot size/spacing	3×1 m/ 30×15 cm
Observation to be recorded in detail	<p>Physico - chemical parameters of soil : pH, nutrient status (major, secondary and micronutrients)</p> <p>Growth parameters</p> <ol style="list-style-type: none"> 1. Plant population 2. Number of tillers 3. Height(cm) 4. Fresh weight of clump(g) 5. Yield/ha 6. Dry recovery 7. Fiber content 8. Oleoresin (%) 9. Essential oil (%) 10. Disease and insect pests

New Research Programme : 3	
Crop	Ginger
Title of the programme	Effect of micronutrients on growth and yield of ginger (Demonstration trial)
Centre	Pottangi and Chinthapalle
Year of start	2015
Design	RBD
Variety	Supraba, Nadia, Surabhi, Varada (Any 3 varieties)
No. of treatments/genotypes with details	Number of treatments-2 T ₁ : Recommended package of practice (Control) T ₂ : Recommended package of practice + IISR micronutrient formulation
No. of replications	3
Plot size/spacing	3×1 m/ 30×15 cm
Observation to be recorded in detail	Physico - chemical parameters of soil : pH, nutrient status (major, secondary and micronutrients) Growth parameters 1. Plant population 2. Number of tillers 3. Height(cm) 4. Fresh weight of clump(g) 5. Yield/ha 6. Dry recovery 7. Fiber content 8. Oleoresin (%) 9. Essential oil (%) 10. Disease and insect pests

New Research Programme : 4	
Crop	Turmeric
Title of the programme	Organic production of turmeric
Centre	Barapani and Kolasib (Mizoram)
Year of start	2015
Duration of the project	3 years
Design	RBD
Variety	Megha turmeric
No. of treatments/genotypes with details	Number of treatments-8 T ₁ : 100% organic manures equivalent to 100% N requirement of turmeric T ₂ : 100% organic manures equivalent to 75% N requirement of turmeric T ₃ : 100% organic manures + (micronutrients) T ₄ : 100% organic manures+ (Vermiwash 10%) T ₅ : 75% N requirement of ginger + (micronutrients) T ₆ : 75% N requirement of ginger + (Vermiwash 10%) T ₇ : Recommended Package by SAU (Turmeric - NPK 120 : 90:90 NPK kg/ha) Barapani & Mizoram T ₈ : Farmers practice.
No. of replications	3
Plot size/spacing	3.0 m×1.0 m, 30 cm×20 cm
No. of plants/plot/treatment	40 plant per plot
Date of sowing/planting and season (Kharif/Rabi/Zhiad)	June 2015
Observation to be recorded in detail	Physico - chemical parameters of soil : pH, nutrient status (major, secondary and micronutrients) Growth parameters <ol style="list-style-type: none"> 1. Plant population 2. Number of tillers 3. Height(cm) 4. Fresh weight of clump(g) 5. Yield/ha 6. Dry recovery 7. Curcumin content 8. Oleoresin (%) 9. Essential oil (%) 10. Disease and insect pests

New Research Programme : 5	
Crop	Turmeric
Title of the programme	Mechanical planting in turmeric (Observational trial)
Centre	Coimbatore
Year of start	2014
Duration of the project	2 years
Design	RBD
Details of the technical programme	T ₁ - Mechanical planter T ₂ - Manual planting
Plot size/spacing	45 x 15 cm
Variety	Co-2
Date of sowing/planting and season (Kharif/Rabi/Zhiad)	Kharif
Observation to be recorded in detail	<ol style="list-style-type: none"> 1. Sprouting percentage 2. Rhizome yield (t/ha) 3. Cost economics

New Research Programme : 6	
Crop	Turmeric
Title of the programme	Effect of organic manures and Bio-fertilizer on partitioning of dry matter of ginger
Centre	Dholi
Year of start	2015-16
Duration of the project	3 years
Design	RBD
No. of treatments/genotypes with details	<p>T₁: N:P:K (80:50:80 kg/ha) T₂: T₁+ <i>Azotobactor</i> T₃: T₁+ <i>Trichoderma</i> T₄: T₁+ PSB T₅: Vermicompost (10t/ha) T₆: T₅ + <i>Azotobactor</i> T₇: T₅ + <i>Trichoderma</i> T₈: T₅ + PSB T₉: FYM (30t/ha) T₁₀: T₉ + <i>Azotobactor</i> T₁₁: T₉ + <i>Trichoderma</i> T₁₂: T₉ + PSB T₁₃: Sewage sludge (25t/ha) T₁₄: T₁₃ + <i>Azotobactor</i> T₁₅: T₁₃ + <i>Trichoderma</i> T₁₆: T₁₃ + PSB T₁₇: Control</p> <p>Method of application: Soil application at the time of land preparation <i>Azotobactor</i>/ <i>Trichoderma</i>/ PSB @15 Kgha⁻¹ mixed with 10q FYM</p>
No. of replications	3
Plot size/spacing	3.0m x 2.0m/30cm x 25cm
Date of sowing/planting and season (Kharif/Rabi/Zhiad)	June 2015
Observation to be recorded in detail	<ol style="list-style-type: none"> 1. Height of the plant 2. No. of tillers per plant 3. Yield per plant 4. Yield per plot or t/ha 5. Dry matter estimation 6. 6. Physic chemical properties of soil-pH, major and secondary micro nutrients

New Research Programme : 7																			
Crop	Turmeric																		
Title of the programme	Screening of post-emergence herbicides for selectivity in turmeric																		
Centre	Guntur																		
Year of start	2015																		
Duration of the project	One year																		
Design	FRBD																		
Variety	Mydukar																		
Number of treatments/genotypes with details	<table border="1" style="width: 100%;"> <thead> <tr> <th style="width: 70%;">Herbicide</th> <th style="width: 30%;">Dosage (a.i. g/ha)</th> </tr> </thead> <tbody> <tr> <td>Pyriithiobac sodium 10% (Hitweed)</td> <td>63</td> </tr> <tr> <td>Bispyribac 10% (Nominee Gold)</td> <td>25</td> </tr> <tr> <td>Imazethapyr 10% (Pursuit)</td> <td>50</td> </tr> <tr> <td>Ethoxy sulfuran 15% (Sunrice)</td> <td>20</td> </tr> <tr> <td>Pyrazosulfuran 10% (Saathi)</td> <td>20</td> </tr> <tr> <td>Atrazine 50 % (Atrataf)</td> <td>1000</td> </tr> <tr> <td>Metribuzine 70% (Cencor)</td> <td>200</td> </tr> <tr> <td>Clorimuron ethyl 25% (Classic)</td> <td>12</td> </tr> </tbody> </table>	Herbicide	Dosage (a.i. g/ha)	Pyriithiobac sodium 10% (Hitweed)	63	Bispyribac 10% (Nominee Gold)	25	Imazethapyr 10% (Pursuit)	50	Ethoxy sulfuran 15% (Sunrice)	20	Pyrazosulfuran 10% (Saathi)	20	Atrazine 50 % (Atrataf)	1000	Metribuzine 70% (Cencor)	200	Clorimuron ethyl 25% (Classic)	12
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	Metribuzine 70% (Cencor)	200																	
	Clorimuron ethyl 25% (Classic)	12																	
Stage of application: 30 and 60 DAS																			
No. of replications	2																		
Plot size/spacing	3 x 1 m; 45 cm x 15 cm																		
Observation to be recorded in detail	<ol style="list-style-type: none"> 1. Plant population 2. Number of tillers 3. Height (cm) 4. Weed population/m² 5. Fresh weight of clump 6. Yield t/ha 7. Dry recovery 8. Curcumin content 9. Disease and insect pest incidence 																		

New Research Programme : 8	
Crop	Coriander
Title of the programme	Response of coriander varieties to various levels of fertility under multicut management practices
Centre	Jagudan
Year of start	2014-15
Duration of the project	3 years
Design	Split Plot
No. of treatments/genotypes with details	<p>Main plot :</p> <p>Variety (V): 2</p> <ul style="list-style-type: none"> ➤ V1 : GDLC 1 and ➤ V2 : G Co 2 <p>Cutting management (M):3</p> <ul style="list-style-type: none"> ➤ M1 : No cutting (Top dressing at 30 DAS) ➤ M2 : One cutting at 40 - 45 DAS (Top dressing after first cut) ➤ M3 : Two cutting at 40 - 45 DAS and 60-65 DAS (Top dressing after each cut) <p>Sub Plot :</p> <p>Fertilizer (Kg NP / ha): 3</p> <ul style="list-style-type: none"> ➤ F1 : 20:10:00 kg NPK / ha ➤ F2 : 40:20:00 kg NPK / ha ➤ F3 : 60:30:00 kg NPK / ha <p>Note : Full dose of phosphorus and half of nitrogen may be applied as Basal and remaining half dose of nitrogen may be applied at top dressing.</p>
No. of replications	3
Plot size/spacing	<p>Gross:5.0 X 3.0 m²</p> <p>Net :4.0 X 2.40 m²</p> <p>Spacing: 30 cm (Drilling)</p>
Date of sowing/planting and season (Kharif/Rabi/Zhiad)	Rabi (Sowing time November)
Observation to be recorded in detail	<ol style="list-style-type: none"> 1. Growth & yield attributes 2. Green leaf yield (kg/ha) 3. Seed yield (kg/ha) 4. Volatile oil content (Seed and Leaf) 5. Economics

New Research Programme : 9	
Crop	Coriander
Title of the programme	Effect of using varying levels of NPK and Bio-fertilizers on growth and yield of coriander
Centre	Dholi
Year of start	2014-15
Duration of the project	3 years
Design	RBD
No. of treatments/genotypes with details	<p>T₁- 50% N and full does of PK+ <i>Azospirillum</i> T₂- 75% N and full does of PK+ <i>Azospirillum</i> T₃- Recommended dose of NPK+ <i>Azospirillum</i> T₄- 50% P and full dose of NK+ <i>Azotobacter</i> T₅- 75% P and full dose of NK+ <i>Azotobacter</i> T₆- Recommended dose of NPK + <i>Azotobacter</i> T₇- 50% K and full dose of NP + PSB T₈- 75% K and full dose of NP + PSB T₉- Recommended dose of NPK + PSB T₁₀- Control (Recommended dose:- N:P:K:60:40:30 kg/ha)</p> <p>Method of application: Seed treatment with <i>Azospirillum</i>/<i>Azotobacter</i>/ PSB @ 4g/ kg seed & Soil application @15 Kg ha⁻¹ mixed with 10q FYM at 40 days after germination. NPK application at the time of land preparation.</p>
No. of replications	3
Plot size/spacing	3.0m x 2.0m/30cm x 20cm
Date of sowing/planting and season (Kharif/Rabi/Zhiad)	Rabi (Sowing time November)
Observation to be recorded in detail	<ol style="list-style-type: none"> 1. Height of the plant 2. No. of primary branches per plant 3. No. of secondary branches per plant 4. No. of umbel per plant 5. No. of umbellets per umbel 6. No. of grains per umbel & umbellets 7. Yield kg per plot or kg/ha.

New Research Programme : 10	
Crop	Cumin
Title of the programme	Organic nutrient and disease management in cumin
Centre	Jobner
Year of start	2014-15
Duration of the project	3 years
Design	RBD
No. of treatments/genotypes with details	<p>Treatments -13</p> <ol style="list-style-type: none"> 1. FYM@ 6t/ha + Seed treatment with <i>Trichoderma</i> @ 6g/kg + Spray of NSKE @5% 2. FYM@ 6t/ha + Seed treatment with Marigold extract @ 5% + Spray of NSKE @5% 3. FYM@ 6t/ha + Seed treatment with Aminobutyric acid @ 100ppm + Spray of NSKE @ 5% 4. Vermicompost @ 2t/ha + Seed treatment with <i>Trichoderma</i> @ 6g/kg + Spray of NSKE @5% 5. Vermicompost @ 2t/ha + Seed treatment with Marigold extract @ 5% + Spray of NSKE @5% 6. Vermicompost @ 2t/ha + Seed treatment with Aminobutyric acid @ 100ppm+Spray of NSKE @5% 7. Poultry Manure@ 1t/ha + Seed treatment with <i>Trichoderma</i> @ 6g/kg + Spray of NSKE @5% 8. Poultry Manure@ 1t/ha + Seed treatment with Marigold extract @ 5%+Spray of NSKE @5% 9. Poultry Manure@ 1t/ha +Seed treatment with Aminobutyric acid@ 100ppm+Spray of NSKE @5% 10. Neem cake@ 0.5 t/ha + Seed treatment with <i>Trichoderma</i> @ 6g/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@ 100ppm + Spray of NSKE @5% 13. Control
No. of replications	3
Plot size/spacing	3x2.4 m spacing : 30x5 cm
No. of plants/plot/treatment	480 plants per plot
Date of sowing/planting and season (Kharif/Rabi/Zhiad)	Rabi
Observation 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)

New Research Programme : 11	
Crop	Fennel
Title of the programme	Effect of ferrous and zinc enriched FYM on yield and quality of fennel
Centre	Jagudan
Year of start	Rabi 2013-14
Duration of the project	3 years
Design	RBD
Variety	Gujarat Fennel 12
No. of treatments/genotypes with details	Treatments: 8 T ₁ : RDF (90 kg N + 30 kg P ₂ O ₅ /ha) T ₂ : T ₁ + 3.0 t FYM/ha T ₃ : T ₁ + 10.0 kg Fe/ha T ₄ : T ₁ + 5 kg Zn/ha T ₅ : T ₁ + 6.0 kg Fe/ha + 3.0 kg Zn/ha T ₆ : T ₁ + 200 kg FYM enriched with 3.0 kg Fe/ha T ₇ : T ₁ + 200 kg FYM enriched with 1.5 kg Zn/ha T ₈ : T ₁ + 200 kg FYM enriched with 3.0 kg Fe/ha + 1.5 kg Zn / ha
No. of replications	3
Plot size/spacing	Gross: 5.00 X 3.60 m ² Net:4.00 X 2.70 m ² Spacing: 45 cm (Drilling)
Date of sowing/planting and season (Kharif/Rabi/Zhiad)	Rabi
Observation to be recorded in detail	<ul style="list-style-type: none"> ➤ Growth & yield attributes ➤ Seed yield (kg/ha) ➤ Volatile oil content (Seed) ➤ Chemical study ➤ Economics

Crop Protection

New Research Programme : 12	
Crop	Black pepper
Title of the programme	Studies on management of <i>Phytophthora</i> causing foot rot on black pepper
Centre	Dapoli
Year of start	2015
Duration of the project	3 years
Design	RBD
No. of treatments/genotypes with details	6 treatments <ol style="list-style-type: none"> 1. Cartrap hydrochloride @15 g / vine 2. Soil application of <i>Trichoderma harzianum</i> (IISR) + <i>Pochonia chlamydosporia</i> at the time of planting twice before and after rain 3. Copper oxychloride drenching +Bordeux mixture spray 4. Application of fungicide (Fosytal Al) amended fertilizer brickets at the onset of rain and post monsoon 5. Krysoxym methyl (Ergon) 0.7 % soil drenching 6. Control
No. of replications	3
Plot size/spacing	1 x 1 m
Date of sowing/planting and season (Kharif/Rabi/Zhiad)	<i>Kharif</i>
Observation to be recorded in detail	<ol style="list-style-type: none"> 1. Weekly disease incidence and Percent Disease Incidence (PDI) 2. Height and no of leaves for first and second year 3. No of spikes / vine after three years 4. Yield/vine

New Research Programme : 13	
Crop	Ginger
Title of the programme	Eco-friendly management of rhizome rot of ginger
Centre	Kumarganj
Year of start	2015-16
Duration of the project	3 years
Design	RBD
No. of treatments/genotypes with details	<p>8 treatments</p> <p>T₁: Pre sowing Soil solarization by polythene covering (60days)</p> <p>T₂: Post sowing Plastic mulching (From sowing to harvest)</p> <p>T₃: Rhizome treatment with 2.0% neem cake</p> <p>T₄: Pre sowing Soil solarization by polythene covering (60days) + Post sowing Plastic mulching (From sowing to harvest)</p> <p>T₅: Pre sowing Soil solarization by polythene covering (60days) + Rhizome treatment with 2.0% neem cake</p> <p>T₆: Post sowing Plastic mulching (From sowing to harvest + Rhizome treatment with 2.0% neem cake</p> <p>T₇: Pre sowing Soil solarization by polythene covering (60days) + Post sowing Plastic mulching (From sowing to harvest + Rhizome treatment with 2.0% neem cake</p> <p>T₈: Control</p>
No. of replications	3
Plot size/spacing	3.0x1.0 m ² / 30x20cm
Date of sowing/planting and season (Kharif/Rabi/Zhiad)	June 2015
Observation to be recorded in detail	<ol style="list-style-type: none"> 1. Height of plant 2. Number of tillers per plant 3. Number of leaves per tiller 4. Number of days to maturity 5. Disease incidence 6. Rhizome yield per plot or per hectare

New Research Programme : 14	
Crop	Turmeric
Title of the programme	Eco-friendly management of foliar diseases of turmeric
Centre	Kumarganj
Year of start	2014
Duration of the project	3 years
Design	RBD
No. of treatments/genotypes with details	<p>9 treatments</p> <p>T₁: Foliar spray of Neem oil (1.0%) at 45, 60 75 and 90 days T₂: Foliar spray of Marigold oil (1.0%) at 45, 60 75 and 90 days T₃: Foliar spray of eucalyptus oil (1.0%) at 45, 60 75 and 90 days T₄: Foliar spray of Jatropha oil (1.0%) at 45, 60 75 and 90 days T₅: Foliar spray of Mahuwa oil (1.0%) at 45, 60 75 and 90 days T₆: Foliar spray of Argemone oil (1.0%) at 45, 60 75 and 90 days T₇: Foliar spray of <i>Trichoderma viride</i> (1.0%) at 45, 60 75 and 90 days T₈: Foliar spray of Propiconazole (0.2%) at 45, 60 75 and 90 days T₉: Control</p>
No. of replications	3
Plot size/spacing	3.0x1.0 m ² / 30x20cm
Date of sowing/planting and season (Kharif/Rabi/Zhiad)	June
Observation to be recorded in detail	<ol style="list-style-type: none"> 1. Height of plant 2. Number of tillers per plant 3. Number of leaves per tiller 4. Number of days to maturity 5. Initial disease incidence. 6. Percent disease incidence 7. Percent disease index 8. Rhizome yield per plot or per hectare 9. Curcumin, essential oil, oleoresin content and dry recovery %

New Research Programme : 15	
Crop	Ginger
Title of the programme	Field screening of different varieties of ginger against leaf spot and rhizome rot
Centre	Dapoli
Year of start	2015
Duration of the project	3 years
Design	RBD
No. of treatments/genotypes with details	1. Varada, 2. Rajatha, 3. Mahima, 4. Athira, 5. Suruchi, 6. Suravi, 7. Suprabha, 8. Himgiri, 9. V ₃ E ₈ , 10. V ₃ S ₁₈ ,
No. of replications	3
Plot size/spacing	30 x 30 cm
No. of plants/plot/treatment	40
Date of sowing/planting and season (Kharif/Rabi/Zhiad)	June - July
Observation to be recorded in detail	<ol style="list-style-type: none"> 1. Height of plant 2. Number of tillers per plant 3. Number of leaves per tiller 4. Number of days to maturity 5. Initial disease incidence. 6. Percent disease incidence 7. Percent disease index 8. Rhizome yield per plot or per hectare

New Research Programme : 16	
Crop	Turmeric
Title of the programme	Field screening of different varieties of turmeric against leaf spot and rhizome rot
Centre	Dapoli
Year of start	2015
Duration of the project	3 years
Design	RBD
No. of treatments/genotypes with details	1. Krishna, 2. Rajpuri, 3. Selam local, 4. Ranga, 5 .Pratibha, 6. Roma, 7. Pant Peethabar, 8. Narendra Haldi, 9. Sona, 10. BSR-1, 11. BSR-2, 12. Kedaram, 13. Panjab Haldi-1, 14. Panjab Haldi-2, 15. Sobha, 16. Prabha, 17. Suvarna, 18. Suguna, 19. Sudharshna, 20. Kanti, 21. Sikandarabad, 22. Alleppey Supreme, 23. SB - 10843, 24. RH-5, 25. Arunachal local, 26. Cochbet, 27. Tekurpeta, 28. Jalpalguri local, 29. Allampuram, 30. Suranjana
No. of replications	2
Plot size/spacing	30 x 30 cm
No. of plants/plot/treatment	10
Date of sowing/planting and season (Kharif/Rabi/Zhiad)	June - July
Observation to be recorded in detail	1) Initial disease incidence. 2) Percent disease incidence 3) Percent disease index 4) Yield (t/ha)

New Research Programme : 17	
Crop	Coriander
Title of the programme	Studies on the management of coriander powdery mildew using bio-inoculants (Observational trial)
Centre	HC &RI, TNAU, Coimbatore
Year of start	2015
Duration of the project	3 years
Design	RBD
No. of treatments/genotypes with details	<p>7 treatments</p> <ol style="list-style-type: none"> 1. FS with <i>Pseudomonas fluorescens</i> (Pf1) 2. FS with <i>Bacillus subtilis</i> 3. FS with <i>B.cereus</i> 4. FS with <i>B.mojavensis</i> 5. FS with <i>B.amyloliquefacens</i> 6. FS with Wetable sulphur 7. Control <p>FS @ 0.2% conc. First spray immediately after the incidence of disease and second spray at 15 days after the first spray</p>
No. of replications	3
Plot size/spacing	15 x15 cm
No. of plants/plot/treatment	--
Date of sowing/planting and season (Kharif/Rabi/Zhiad)	Rabi
Observation to be recorded in detail	<ol style="list-style-type: none"> a. Plant height b. No. of primary branches c. No. of secondary branches d. No. of leaves e. No. of umbels f. No. of umbellets/ umbel g. No. of seeds/ umbellate h. Incidence of powdery mildew- PDI i. Seed yield

New Research Programme : 18	
Crop	Coriander
Title of the programme	Studies on the management of coriander powdery mildew using new generation fungicides (Observational trial)
Centre	HC &RI, TNAU, Coimbatore
Year of start	2015
Duration of the project	3 years
Design	RBD
No. of treatments/genotypes with details	6 treatments 1. FS with Tebuconazole 0.15% 2. FS with Probineb 0.25% 3. FS with Azoxystrobin 0.15% 4. FS with Difenfenazole 0.05% 5. FS with Wettable sulphur 0.5% 6. Control First spray immediately after the incidence of disease Second spray at 15 days after the first spray
No. of replications	3
Plot size/spacing	15 x15 cm
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 primary branches 3. No. of secondary branches 4. No. of leaves 5. No. of umbels 6. No. of umbellate/ umbel 7. No. of seeds/ umbellate 8. Incidence of powdery mildew- PDI 9. Seed yield

FS- Foliar spray

New Research Programme : 19	
Crop	Coriander
Title of the programme	Eco-friendly management of stem gall of coriander (Observational trial)
Centre	Kumarganj
Year of start	2015
Duration of the project	3 years
Design	RBD
No. of treatments/genotypes with details	Treatments: 1. Pre sowing Soil solarization by polythene covering (60days) 2. Post sowing Plastic mulching (From sowing to harvest) 3. Seed treatment with 1.0% neem oil+ three sprays at 45, 60 and 90 days 4. Pre sowing Soil solarization by polythene covering (60days) + Post sowing Plastic mulching (From sowing to harvest) 5. Pre sowing Soil solarization by polythene covering (60days) +Seed treatment with 1.0% neem oil + three spray at 45,60 and 90 days 6. Post sowing Plastic mulching (From sowing to harvest + Seed treatment with 1.0% neem oil + three spray at 45,60 and 90 days 7. Pre sowing Soil solarization by polythene covering (60days) + Post sowing Plastic mulching (From sowing to harvest + Seed treatment with 1.0% neem oil 8. Control
No. of replications	3
Plot size/spacing	2.0x2.40 m ² , Spacing- 30x20 cm
No. of plants/plot/treatment	--
Date of sowing/planting and season (Kharif/Rabi/Zhiad)	Rabi
Observation to be recorded in detail	1. Plant height 2. Number of branches per plant 3. Initial disease incidence. 4. Percent disease incidence 5. Percent disease index 6. Number of umbels per plant 7. Number of umbellate per main branch 8. Number of seeds per umbellate

New Research Programme : 20	
Crop	Cumin
Title of the programme	Bio-efficacy of newer molecules of insecticides against cumin aphid (Observational trial)
Centre	Jagudan, Jobner and Ajmer
Year of start	2014-15
Duration of the project	
Design	RBD
No. of treatments/genotypes with details	<p>Treatments:</p> <ol style="list-style-type: none"> 1. Thiamethoxam 25WG @ 25g a.i/ha followed by Thiachloprid 21.7SC @ 25g a.i/ha 2. Thiamethoxam 25WG@ 25g a.i/ha followed by Clothianidin 50WDG@ 20g a.i/ha 3. Thiamethoxam 25WG @ 25g a.i/ha followed by V. lecanii 1.15 WP @ 40g/10lit. 4. Acetamiprid 20SP @ 20g a.i/ha followed by Thiachloprid 21.7SC @ 25 g a.i/ha 5. Acetamiprid 20SP @ 20g a.i/ha followed by Clothianidin 50WDG @ 20 g a.i/ha 6. Acetamiprid 20SP @ 20g a.i/ha followed by V. lecanii 1.15 WP @ 40g/10lit. 7. Carbosulfan 25EC @ 250g a.i/ha followed by Thiachloprid 21.7SC @ 25 g a.i/ha 8. Carbosulfan 25EC @ 250g a.i/ha followed by Clothianidin 50WDG @ 20g a.i/ha 9. Carbosulfan 25EC @ 250 g a.i/ha followed by V. lecanii 1.15 WP @ 40g/10lit. 10. Untreated control -No spray <p>Note : Each insecticide will be applied by means of manually operated knapsack sprayer. First foliar spray will be made at 10 per cent umbels infested by cumin aphid and the subsequent spray will be advocated after 10days of the first spray.</p>
No. of replications	3
Plot size/spacing	Gross: 4×3 m, Net: 3×2.4 m Spacing: 30 cm drilling
Date of sowing/planting and season (Kharif/Rabi/Zhiad)	Rabi
Observation to be recorded in detail	<ol style="list-style-type: none"> 1. Number of umbels infested by cumin aphid out of total number of umbels and % umbels infested by cumin aphid 2. % umbels infested by cumin aphid prior to spray & 3 and 7 days after each spray. 3. Population of predatory coccinellids on twenty plants and mean population of coccinellids/plant 4. Seed yield of cumin in kg /hectare at harvest 5. Economics of different treatments 6. Volatile oil (%). 7. Residual analysis

New Research Programme : 21	
Crop	Cumin
Title of the programme	Management of powdery mildew in cumin through new chemicals
Centre	Jobner
Year of start	2014-15
Duration of the project	Three years
Design	RBD
No. of treatments/genotypes with details	Treatments: 7 <ol style="list-style-type: none"> 1. Foliar spray of Propiconazole @0.1% 2. Foliar spray of Penconazole @0.1% 3. Foliar spray of Baleytan @0.1% 4. Foliar spray of Hexaconazole @0.1% 5. Foliar spray of Dinocap @0.1% 6. Foliar Spray of Wetttable Sulphur @0.2% 7. Control
No. of replications	3
Plot size/spacing	3x2.4 m spacing : 30x5 cm
No. of plants/plot/treatment	480 plant per plot
Date of sowing/planting and season (Kharif/Rabi/Zhiad)	<i>Rabi</i>
Observation to be recorded in detail	<ol style="list-style-type: none"> 1. Test weight (g) 2. Seed yield(kg/ha) 3. Powdery mildew incidence (0-4)

List of Participants – XXV AICRP on Spices Workshop

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