

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

**5-6 July 2010**

**National Research Centre on Seed Spices  
Ajmer, Rajasthan**



**ALL INDIA COORDINATED RESEARCH PROJECT ON SPICES**

**Indian Institute of Spices Research  
(*Indian Council of Agricultural Research*)  
CALICUT-673 012, KERALA**

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**September 2010**

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## PROGRAMME

08.30-09.25 hrs	<b>REGISTRATION</b>
	<b>OPENING SESSION</b>
10.05 -10.10 hrs	Invocation
10.10-10.20 hrs	Welcome address <b>Dr. M.M. Anwer</b>
Director, NRCSS	
10.20-10.25 hrs	Lighting of the Lamp <b>Dr. H. P. Singh, Dy. Director General (Hort.), ICAR</b>
10.25 -11.00 hrs	Presentation of AICRPS Report <b>Dr. M. Anandaraj, Project Coordinator, Spices</b>
11.00-11.20 hrs	Address by <b>Dr. Raturi</b> the Guest of Honour <b>Former Director, NRCSS, Ajmer</b>
11.20-11.25 hrs	Remarks from ICAR <b>Dr. U. Srivastava, Asst. Director General (Hort.II)</b>
11.25-11.50 hrs	Inaugural Address <b>Dr. H. P. Singh, Dy. Director General (Hort.)</b>
11.50-11.52 hrs	Release of publications of NRCSS
11.52-11.55 hrs	Vote of Thanks <b>Dr. Gopal Lal, Principal Scientist</b> NRCSS, Ajmer
11.55-12.30 hrs	Tea break
1230-1345 hrs	<b>Session on Action Taken Report</b>
Chairman	<b>Dr. U. Srivastava, Asst. Director General (Hort.II)</b>
	Presentation of Action Taken Report <b>Dr. M. Anandaraj, Project Coordinator, Spices</b>
Rapporteurs	<b>Dr. J. Rema, Principal Scientist, IISR, Calicut</b> <b>Dr. K. Kandiannan, Sr. Scientist, IISR, Calicut</b>

5<sup>th</sup> July 2010**PROGRAMME**

<b>SESSION I</b>		<b>GENETIC RESOURCES 1500-1730 hrs</b>
Chairperson	:	Dr. Umesh Srivastava, ADG (Hort.II), ICAR, New Delhi
Rapporteurs	:	Dr. (Mrs) N. Shoba, TNAU, Coimbatore Dr. R. Senthil Kumar, IISR, CRC, Appangala
<b>Scientists identified for presentation</b>		
1. Germplasm of seed spices 2. Cardamom (large & small) 3. Black pepper 4. Ginger 5. Turmeric 6. Tree Spices 7. Germplasm collection (NBPGR)		Dr. Kakani, NRCSS, Ajmer Dr. Sree Krishna Bhat, ICRI, Sakleshpur Dr. Nagesh Naik, UHS, Sirsi Dr. Ramesh Kumar Baradwaj YSPUH&F, Solan Dr. Vikas Singh, CAU, Pasighat Dr. J. Prem Joshua, TNAU, HRS, Pechiparai Dr. Narendra Kumar Dwivedi, NBPGR, RS, CAZRI Campus, Jodhpur
<b>SESSION II</b>	:	<b>CROP IMPROVEMENT 1730-1845 hrs</b>
Chairpersons	:	Dr. Homey Cherian, DASD, Calicut Dr. E.V.D. Sastry, RAJAU, Jobner
Rapporteurs	:	Dr. R.S. Meena, NRCSS, Ajmer Dr. K. Giridhar, APHU, Guntur
<b>Scientists identified for presentation</b>		
1. Black pepper 2. Cardamom 3. Large Cardamom 4. Coriander 5. Cumin 6. Fennel		Dr. V.P. Neema, KAU, Panniyur Dr. Sree Krishna Bhat, ICRI, Sakleshpur Dr. Utpal Gupta, ICRI, Gangtok Dr. C. Sarada, APHU, Guntur Dr. Dharendra Singh, RAJAU, Jobner Dr. EVD Sastry, RAJAU, Jobner
<b>6<sup>th</sup> July 2010</b>		
<b>0815 -0845 hrs</b>	:	<b>Breakfast</b>
	:	<b>CROP IMPROVEMENT (contd.) 0845 -0955 hrs</b>
1. Fenugreek 2. Tree Spices 3. Ginger 4. Turmeric		Dr. K. Giridhar, APHU, Guntur Dr. U.B. Pethe, KKV, Dapoli Dr. D.K. Dash, OUAT, Pottangi Dr. D.K. Dash, OUAT, Pottangi
Expert System on Seed Spices	:	Dr. Shanavas Islam, IASRI, New Delhi
<b>SESSION III</b>	:	<b>CROP MANAGEMENT 1000-1230 hrs</b>
Chairperson	:	Dr. R. Dhanapal, Head, Division of Crop Production, CPCRI, Kasaragod
Rapporteurs	:	Dr. K. Kandiannan, IISR, Calicut Dr. C. Sarada, APHU, Guntur

<b>Scientists identified for presentation</b>		
1. Black pepper 2. Cardamom 3. Ginger 4. Turmeric 5. Coriander 6. Cumin 7. Fennel 8. Fenugreek 9. Tree Spices		Dr. D. Jacob, KAU, PRS, Panniyur Dr. K. M. Devaraju, UHS, Mudigere Dr. S. P. Singh, RAU, Dholi Dr. N. Shobha, TNAU, Coimbatore Dr. P. Mallik, CCS HAU, Hisar Dr. E.V. D. Sastry, RAJAU, Jobner Dr. S. K. Tehlan, CCS HAU, Hisar Dr. R. P. Saxena, NDUAT, Kumarganj Dr. R.G. Khandekhar, KKV, Dapoli
<b>SESSION IV</b>	:	<b>CROP PROTECTION 1300-1405 hrs</b>
Chairperson	:	Dr. Tamil Selvan, Director, DASD, Calicut
Co-Chairman		Mr. R.P. Saxena, NDUAT, Kumarganj
Rapporteurs	:	Dr. M.S. Lokesh, UHS, Sirsi Dr. P. Muthulakshmi, TNAU, Coimbatore
<b>Scientists identified for presentation</b>		
1. Black pepper 2. Cardamom 3. Ginger		Dr. M. S. Lokesh, UHS, Sirsi Dr. Jemla Naik D., UHS, Mudigere Dr. S. Bandyopadhyay, UBKV, Pundibari
<b>1405-1445 hrs</b>	:	<b>Lunch</b>
		<b>CROP PROTECTION SESSION (contd.) 1445-1600 hrs</b>
1. Turmeric 2. Coriander 3. Cumin 4. Fennel 5. Fenugreek 6. Tree Spices		Dr. Muthulakshmi, TNAU, Coimbatore Dr. K.S. Shekhawat, RAJAU, Jobner Dr. K.D. Patel, SDAU, Jagudan Dr. A.K. Mishra, RAU, Dholi Dr. A.K. Mishra, RAU, Dholi Dr. V.A. Gadre, KKV, Dapoli
<b>SESSION V</b>	:	<b>RECOMMENDATION OF VARIETIES AND TRANSFER OF TECHNOLOGY 1600-1730 hrs</b>
Chairperson	:	Dr. J.M. Mathur, Chief Training Organizer, KVK, NRCSS Dr. Gopal Lal, NRCSS, Ajmer
Rapporteurs	:	Dr. R.S. Meena, NRCSS, Ajmer Dr. E. Jayasree, IISR, Calicut
<b>Varieties</b>		
		Dr. E.V. D. Sastry, RAJAU, Jobner

<b>Technologies</b>		
1. Coriander 2. Black Pepper 3. Ginger 4. Turmeric 5. Cumin 6. Fenugreek 7. Fennel		Dr. C. Sarada, HRS, Guntur Dr. M.S. Lokesh, UHS, Sirsi Dr. M.S. Lokesh, UHS, Sirsi Dr. A.K. Mishra, RAU, TCA, Dholi Dr. K.D. Patel, SDAU, Jagudan Dr. S.K. Tehlan, CCS HAU, Hisar Dr. S.K. Tehlan, CCS HAU, Hisar
<b>1730-1800 hrs</b>	:	<b>Tea</b>
<b>1800-2015 hrs</b>	:	<b>PLENARY SESSION</b>
<b>Chairpersons</b>	:	Dr. Umesh Srivastava, ADG(Hort.II), ICAR, New Delhi Dr. M. Anandaraj, Project Coordinator, Dr. Tamil Selvan, Director, DASD, Calicut
<b>Rapporteurs</b>	:	Dr. J. Rema, IISR, Calicut Dr. A. K. Johny, IISR, Calicut
<b>Presentation of New Programmes</b>	:	<b>Concerned Scientists</b>
<b>Presentation of proceedings of Session I-V &amp; Discussion</b>		<b>Rapporteurs of various sessions</b> <b>Session I - Genetic Resources</b> Dr. N. Shoba, TNAU, Coimbatore <b>Session II - Crop Improvement</b> Dr. R.S. Meena, NRCSS, Ajmer <b>Session III - Crop Management</b> Dr. K. Kandiannan, IISR, Calicut <b>Session IV - Crop Protection</b> Dr. C. Sarada, HRS, Guntur <b>Session V - Transfer of Technology and Recommendations</b> Dr. M.S. Lokesh, UHS, Sirsi Dr. R.S. Meena, NRCSS, Ajmer
<b>Remarks of Chairpersons</b>		
<b>Vote of thanks</b>	:	<b>Dr. M. Anandaraj, Project Coordinator, Spices</b>

## INAUGURAL SESSION

The twenty-first AICRPS Workshop was held at National Research Centre on Seed Spices, Ajmer between 5-6 July 2010. The meeting was inaugurated by Dr H P Singh, Hon'ble Deputy Director General (Horticulture), ICAR, New Delhi. Dr M M Anwer, Director, NRCSS, Ajmer welcomed the gathering, Dr G B Raturi former Director, NRCSS and Dr Umesh Srivastava, ADG (Horticulture –II), ICAR, New Delhi addressed the gathering. Dr Gopal Lal, Principal Scientist NRCSS proposed the vote of thanks.

Dr M Anandaraj, Project Coordinator, Spices, Indian Institute of Spices Research, Calicut presented the AICRPS report for the year 2009-10 and also action taken report of XX AICRPS Workshop.

- Project Coordinator highlighted that all the suggestions made by DDG (Hort) during previous AICRPS workshop was implemented.
- In order to address the new challenges like climate variability and change, new trial on genotype and environment interactions was initiated in turmeric and ginger at different AICRPS centres.
- Four new AICRPS centres were established in North Eastern region of India during this period.
- All the voluntary centres were brought under AICRPS umbrella and appropriate monetary support were provided that further strengthened the spices research in the country.
- As a new initiative large cardamom crop was brought under AICRPS mandate besides, works on multi-location trials of varieties, projects on mechanization, on farm processing of turmeric and soil water conservation were strengthened.
- Crop-wise achievements were presented in which, inter-varietal hybridization and grafting work in black pepper, irrigation experiments in small cardamom, evaluation of varieties of large cardamom, bio-fumigation studies in ginger, standardization of processing and management of foliar diseases in turmeric, cinnamon post harvest operations, diseases management in nutmeg, rhizobacteria studies in seed spices were highlighted.
- New experiments for the year 2011-12 like fertigation in turmeric, mechanization of turmeric harvesting, micronutrient studies, demonstration of rhizobacteria, etc., were are presented.
- Achievements such as new varieties proposal and technology demonstration by each centre also highlighted by project coordinator.

Dr Umesh Srivastava, ADG (Hort – II), has mentioned the importance of spices in the Indian economy and urged to enhance the productivity.

- He stressed the need to have intensive survey for endangered spices and asked to widen the genetic base of these precious crops with modern tools.
- Introduction of seed spices into various production systems was emphasized.
- Studies on role of micronutrients and biofertilizers in the nutrition of spices and ecofriendly plant protection may be strengthened.
- He has also pointed out to keep international demand and quality requirements of spices in mind while designing experiments.

Dr H P Singh, DDG (Hort.) congratulated the team for the implementation of all suggestions made during last workshop and good progress shown during the year. However, he stressed upon the reorientation of coordinated research to produce maximum output from minimum input as it assumes more significant to address emerging challenges like climate change that may affect agriculture particularly horticulture in temporal and spatial scale in long term.



- Research may be initiated on G x E experiments in other spices as that of one initiated in turmeric and ginger to study the phenomics and predict the key determinants of yield and modify the factors for sustained production or augmenting the yield.
- Rhizosphere of different production systems may be characterized and efficient microbial strain of one location isolated, multiplied and introduced into other soils for better soil and plant health that ultimately reflect on yield and production.
- Basic aspects like quality of water for boiling turmeric, purpose of boiling and keeping quality may be studied in detail.
- He pointed out that new producing countries are emerging in the spice sector and they are our competitors in the international market and we may have to analyze our strengths and weaknesses to plug the yield decline and emerge as spice leader in the world to regain our old glory.
- Shrinking agricultural land, less and poor quality water rise in temperature and carbondioxide, new pests and diseases are the growing challenges and researchers should formulate the projects to address these constraints.
- Strategies have to be planned for 30 years in phased manner to address the seed spices grown in arid and semi arid regions of our country.
- One set of original germplasm of seed spices has to be handed over to NRCSS, Ajmer by seed spices centre. Similarly, ICRI, Saklespur will hand over the one set of small cardamom accessions before August 2010 to IISR Cardamom Research Centre, Appangala for IC/EC registration and further maintenance.
- Uniformity in laying the experiments and data collection has to be followed as per standard procedure. Proforma / guidelines may be formulated and circulated.
- Varietal Committee may visits the centre for making on the spot assessment of the varietal performance.
- One copy of the experimental codes for seed spices may be sent to DGG (Hort. )
- Molecular profile of the variety may also be attached along with variety release proposal wherever possible.
- DUS guidelines has to be strictly followed in future experiments. DUS guidelines may be formulated for seed spices.
- Wild relatives of seed spices may collected and studied and systematic screening and breeding of seed spices by bulking for selecting variability may be initiated.
- Efforts may be made to collected exotic sources of spice crops as per the approved guidelines.
- Elite cardamom lines of IISR may be tested at different centres.
- Pests and diseases survey has to continue and study on basic mechanisms of resistance need to be worked out.
- TNAU Thadiyankudisai Centre will serve as a voluntary centre for black pepper and small cardamom and Horticultural College and Research Institute, Periyakulam will be the voluntary centre for seed spices.
- HRD may be strengthened to augment the analytical ability and creativity of scientists.

# Project Coordinator's Report

**M. Anandaraj**

Project Coordinator

All India Coordinated Research Project on Spices

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

The All India Coordinated Research Project on Spices (AICRPS) is vested with the mandate to conduct and coordinate research in 13 spice crops namely, black pepper, cardamom, cassia, cinnamon, clove, coriander, cumin, fennel, fenugreek, ginger, large cardamom, nutmeg and turmeric, with its headquarter at Indian Institute of Spices Research, Calicut. AICRPS has at present 34 centers which include 19 regular, 8 co-opting and 7 voluntary centres located in 21 states of India under 21 State/Central Agricultural Universities (SAUs)/Research Institutes. The XI Plan budget of AICRPS is Rs. 1400 lakhs with Rs 250 lakhs (ICAR share) during 2009 - 10.

In pursuance of the decisions of the brainstorming session on germplasm held at NBPGR, New Delhi and at NRCSS, Ajmer, multilocation testing of germplasm were taken up at various AICRPS centres in a collaborative mode. Based on the decisions of XX AICRPS workshop held at TNAU Coimbatore during 6-8 June 2009, new programmes on fertigation, mechanical harvesting and processing of turmeric with the improved boiling unit were initiated during the year. About 100 research programmes covering the mandate spice crops are being conducted at various centres. These programmes are carried out under the major disciplines of genetic resources, crop improvement, crop production and crop protection. The salient findings in the mandate crops are presented in this report.

## **BLACK PEPPER**

Black pepper germplasm consisting of cultivated, exotic, wild and related species are maintained under different AICRPS centres. Ambalavayal centre has been identified as an alternate centre for germplasm conservation. The characterization of germplasm resulted in identification of high yielding accessions. Among 22 accessions evaluated at Chintapalli, Panniyur-1 recorded highest fresh yield of 7.6 kg/vine followed by Neelamundi (6.84 kg/vine). Among the germplasm accessions evaluated at Panniyur, Angamaly, Chalakudy, ICP-48 and Vattamunda were promising during the year 2009 with a yield more than 3 kg green/vine. In a CVT in black pepper at Panniyur maximum green berry yield/vine was recorded by Cul. 1041 (2.5 kg/vine) followed by Cul. 5489 (2 kg/vine) whereas at Sirsi dry berry yield was maximum in Panniyur-1 (963 g/vine) followed by HP-105 (747 g/vine). At Ambalavayal maximum setting percentage was observed in PRS- 22, followed by Cul. 5489, Coll. 1041, Karimunda OP (98%). Among the intervarietal hybrids in black pepper, P-6 x P-5 was found to be promising with green berry yield of 5 kg/vine. In a fertilizer trial, black pepper vines treated with the integrated methods recorded significantly higher dry berry yield (1.20 kg/vine) compared to those with fully organics (1.01 kg/vine) and fully inorganic (0.94 kg/vine) methods at Sirsi, whereas at Pechiparai, the highest yield of 3.78 kg/vine was recorded in the fully inorganic trial and it was on par with integrated which recorded an yield of 3.54 kg/vine. In black pepper, application of potassium phosphonate + *Trichoderma harzianum* and Bordeaux mixture + COC reduced foot rot incidence by 70.47 and 56.85 per cent respectively, compared to farmers' practice. Grafting of black pepper on tolerant/resistant rootstocks like IISR - Thevam, IISR - Shakthi and *Piper colubrinum* was initiated this year. Besides the performance of orthotropic and runner shoots are also being evaluated in black pepper.

## CARDAMOM

Among the germplasm evaluated during 2009-10 in cardamom at Pampadumpara, highest yield was recorded in CRSP-147 (1055 g dry capsules/plant). PV-2 registered the highest drying percentage (23.4%) among the accessions. The performance of the entry, SKP – 170 was superior to other entries evaluated in a CVT, and is being proposed for release from Sakleshpur centre this year. The open pollinated progeny 23C8 recorded maximum highest yield (221kg/ha) in cardamom at Mudigere. In a CVT in cardamom at Pampadumpara, highest dry yield was recorded in PS 27(1016.58 g/plant) followed by MHC 26 (335.42g/plant). The damage caused by thrips ranged from 26 to 48%. Thrips attack was the lowest for CL-722 and highest for MCC- 246. The damage due to *azhukal* disease was highest for MCC-246 and green gold (GG) and lowest for MCC-309. The percentage loss due to capsule borer was least for MHC- 26 and CL- 722 and highest for MCC- 73 and GG. At Mudigere the cardamom, clone CL-722 was found superior for dry capsule yield (341.00 kg/ha) in the above CVT trial.

## LARGE CARDAMOM

Research programmes on large cardamom was initiated during 2009-10 at ICRI and ICAR RCNEHR located at Gangtok, Sikkim. Surveys were conducted in the Middle Singhik, Sentam and Nung village of North Sikkim and five accessions of large cardamom *viz.* SCC 213 (Golsey), SCC 214 (Golsey), SCC 215 (Golsey), SCC 216 (Ramla) and SCC 217 (Ramla) were added to the germplasm. Characterizations of the collected germplasm were carried out based on the descriptor.

## GINGER

Among the promising accession of ginger evaluated at Dholi, RG-14 and RG-24 gave maximum yield (8.00 kg/7.2m<sup>2</sup>) followed by RG-13 (7.30 kg/ 7.2m<sup>2</sup>). At Pundibari, highest rhizome yield/plant was recorded in GCP-1 (672.33 g). No disease incidence was recorded in the germplasm accessions GCP-29, GCP-50 and GCP-52 evaluated at Pundibari whereas accession SG-785 showed 5.5% disease incidence at Solan. In an IET at Dholi, RG-3 was found to be a promising accession with an yield of 21.34 t/ha as compared to check variety Nadia (17.81 t/ha) and could be promoted to CVT. In a trial to study the influence of environment on genotypes of ginger it was observed that the variety Surabhi recorded highest yield (32.60 t/ha) of fresh rhizome followed by variety Nadia (21.13 t/ha) at Pasighat. In ginger application of fully organic fertilizers gave highest yield (12.90 t/ha) followed by integrated fertilizer (11.62 t/ha) at Dholi centre. Ginger planted in soil treated by biofumigation using cabbage leaves gave highest yield and registered lowest incidence of soft rot at Dholi and Kumarganj.

## TURMERIC

Among the 180 accessions of turmeric evaluated at Pundibari centre, TCP-88, TCP-36 and TCP-25 were found to be promising with respect to yield. At Jagtial, JTS-315 and JTS-14 were found to be promising. In a CVT of turmeric at Chintapalle, PTS-39 recorded maximum yield of 36.37t/ha whereas at Raigarh, Narendra Haldi-1 gave the highest yield of 21.49 t/ha. TCP-129 recorded the highest yield (21.24 t/ha) in an IET on turmeric at Pundibari. The performance of the varieties Rajendra Sonia at Dholi, Roma at Chintapalle, Suprabha at Kanke, Narendra Haldi at Pundibari, Duggirala, IISR Pratibha, Roma and RCT-1 in Mizoram were superior to other varieties and these varieties are suitable for these locations. At Dholi, application of integrated fertilizer resulted in maximum yield of 54.93 t/ha followed by fully organic (50.30 t/ha). The cost: benefit ratio of integrated fertilizer management gave the maximum return of Rs.4.46 per unit cost (1:4.46) followed by fully inorganic *i.e.*, Rs. 3.80 per unit cost (1:3.80). Application of 100% of the recommended dose of fertilizer of turmeric through drip irrigation at fortnightly interval gave highest yield (39.34 kg/plot). Mechanical harvesting of turmeric

indicated that the time taken for harvesting by the tractor mounted harvester is less when compared to power tiller mounted harvester. The percentage of damaged rhizome is also minimum (1.7%) and cost for operating the tractor mounted harvester was low in comparison with power tiller mounted harvester and manual harvesting.

## **TREE SPICES**

Tree spices germplasm is maintained at Dapoli and Pechiparai centre. Among the four selections of cassia evaluated in a CVT, D-3 was found to be promising at Pechiparai.

## **CORIANDER**

Multilocational evaluation of germplasm was initiated during this year in all the seed spices namely, coriander, cumin, fennel and fenugreek. Among the 275 coriander accessions evaluated at Coimbatore, the coriander grain yield ranged from 360 kg/ha to 1080 kg/ha. The highest mean coriander yield was registered by the accession CS- 121 (1080 kg/ha). In a CVT on coriander COR-31 at Dholi and Raigarh and COR - 30 at Guntur were identified as promising. At Guntur, LCC-200 (594 kg/ha) and LCC-143 (547 kg/ha) recorded significantly higher yield than the best check Sadhana (484 kg/ha) and were found suitable for growing under drought conditions. At Jobner, the coriander genotype, UD- 510 was found suitable for growing under irrigated conditions while UD-277 and UD-324 were suitable for drought conditions. In coriander Irrigation at 30 and 60 DAS recorded highest yield (995 kg/ha) followed by irrigation at 30 and 45 DAS (883 kg/ha) at Guntur. The coriander entry COR-34 recorded a high volatile oil yield (7.17 l/ha) followed by COR-31 (6.94 l/ha), COR-27 (6.75 l/ha), and RCr-435 (6.49 l/ha).

## **CUMIN**

Cumin genotypes, UC -239, UC -274 and UC -225 were identified suitable for growing under limited moisture conditions. The cumin entry, CUM-13 recorded maximum seed yield of 667.71 kg/ha at Jobner. The entries GC-4 (4.45%) and CUM-11 (4.2%) recorded very high volatile oil at Jobner.

## **FENNEL**

Among the fifty three collections of fennel evaluated at Dholi, RF-31 produced maximum yield (1.05 kg/5.4m<sup>2</sup>) followed by RF-21 (1.00 kg/5.4m<sup>2</sup>). The fennel entry FNL-40 gave maximum yield of 1216.67 kg/ha in a CVT trial at Raigarh. Two entries FNL-26 and FNL-25 were identified as promising and proposed for release from Jobner centre. The highest mean volatile oil content of 2.89% was recorded in FNL-26 followed by 2.78% in FNL-30 at Jobner.

## **FENUGREEK**

Among the one hundred seventy seven collection of fenugreek germplasm evaluated at Dholi, RM-190 gave a maximum yield of 0.92 kg/4.5 m<sup>2</sup> followed by RM-191 (0.91 kg/4.5 m<sup>2</sup>). None of the entries screened against powdery mildew at Jagudan were found to be free from the incidence of powdery mildew and the incidence ranged between 24.50 to 84.75 %. Among the accessions screened, minimum incidence was noticed in JFG-212 (24.50%) followed by JFG-217 (28%). Among the thirteen fenugreek genotypes evaluated at Coimbatore, the CVT line FGK- 28 recorded the highest grain yield of 348.33 kg/ha followed by FGK-34 & HM-57 of 335.00 kg/ha. At Raigarh and Jabalpur accessions FGK -27 and FGK-28 performed better than other lines. At Jobner the entry UM-126 recorded maximum seed yield of 2163.43 kg/ha in an IET. Large scale demonstration on application of rhizobacteria in seed spices namely coriander, cumin, fennel and fenugreek were under taken this year. In the demonstration in fenugreek, it was observed that, seed treatment and soil application with the

rhizobacteria FK -14 + FL-18 , resulted in a very high yield of 1800 kg/ha followed by seed treatment with FL-18 alone (seed yield 1630 kg/ha).

## **VARIETIES PROPOSED FOR APPROVAL**

### **Cardamom**

1. ICRI-8 (Sakleshpur)

### **Fennel**

1. UF-145 (Jobner)

### **Coriander**

1. LCC-234 (Guntur)
2. LCC-200 (Guntur)

## **TECHNOLOGIES PROPOSED FOR APPROVAL**

### **Black Pepper**

Management of *Phytophthora* foot rot of black pepper (Sirsi)

### **Ginger**

Management of rhizome rot of ginger (Sirsi)

Management of rhizome rot of ginger caused by *Pythium aphanidermatum* - Mudigere

### **Cumin**

Management of wilt and blight disease in cumin (Jagudan)

### **Coriander**

Production of off season coriander (Guntur)

Increase in production through application of biocontrol agents in coriander (Hisar)

### **Fenugreek**

Increase in production through application of biocontrol agents in fenugreek (Hisar)

### **Fennel**

Increase in production through application of biocontrol agents in fennel (Hisar)

## **NEW PROJECTS PROPOSED**

About 15 new project proposals were be discussed and finalized during the workshop. During this year emphasis was given for water conservation experiments and to evolve alternate means for control of diseases in seed spices.

## ACTION TAKEN REPORT 2010

S.I.No	Decision	Action Taken
<b>GENERAL</b>		
1.	Descriptor may be fine tuned for characterization of major seed spices (coriander, cumin, fennel and fenugreek) in the ensuing workshop at NRCSS, Ajmer.	The descriptor was developed based on the discussions held at NRCSS Ajmer September 2009 and the NRCSS has published the same and distributed to all Centers.
2.	Maintenance and evaluation of seed spices germplasm including layout design may be redefined/fine tuned.	Evaluation of germplasm is being done based on common criteria evolved by the Brain storming session at NRCSS, Ajmer.
3.	Consolidated data of old and new collections should be presented to draw a conclusion or to identify the promising line.	This is being followed and presented in the Workshop.
4.	The data pertaining to each crop should be sent well in advance the persons identified for presentation.	Done accordingly.
5.	IC/EC numbers may be obtained by each centre for the originally collected material and not for those obtained from other centres.	Originally collected materials are under process of getting IC/EC nutmeg. Minimum descriptor has been submitted by Sirsi centre.
6.	While presenting information on germplasm background information and previous years data may be mentioned to get overall pictures.	Directions forward to all centers.
7.	MLT evaluation may be taken in consultation with NBPGR, AICRPS and NRCSS, Ajmer.	MLT evaluation will take accordingly. It is being closed as per the XX workshop decisions.
8.	All the centers should take up the CVT trials simultaneously and the participating centres should ensure that sufficient quantity of seed /planting material and timely despatch of the materials to the concerned centres	The CVT of all the mandate crops are taken up at all centres.
9.	Pooled analysis should be done in all the IET and CVT, CV (%) and CD should also be given in the table. Each centre should identify promising entries to promote for further trials.	Pooled analysis is being done in all IET & CVT trials and CD values are given in table promising entries identified for further evaluation.
10.	In case of CVT a single local and national check should be included and compared with.	Local and National check are included in all trials

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| 11. | Each centre should ensure that the entries allotted to the specific technical programme should not be mixed up.  | It is ensured by PC during the visit that allotted entries are included in trial.   |
| 12. | All the CVT trials should be analyzed across locations to identify the promising line.   | Yield is supported with yield attributing characters are analyzed in all centres.   |
| 13. | In all the trials, yield should be supported with yield attributing characters and quality aspects.  |   |
| 14. | A standing committee may be formulated to assess the variety release.  | A committee constituted in 2009 in to members for IISR.(List the names in Committee)  |
| 15. | All the AICRPS Centres has to submit replication-wise data of the concluded experiments within 3 months for further analysis at PC unit.                       | The centres are directed to submit data of concluded experiments.   |
| 16. | The trial identification/code number allotted by the PC unit for each experiment should invariably be maintained without alteration.                           | All the centres have been advised to follow this. In seed spices, coded samples are given to the centers and decoding is done after the trial is completed.       |
| 17. | All the centers should follow Good Agronomic Practices (GAP) as whole package starting from nursery management to main field management.                       | New programmes will be taken up to evolve GAP.  |
| 18. | Reporting yield data should be in uniform manner; either per plant/plot/ha.  | Yield data is being reported both per plot as well as in ha basis.  |
| 19. | All agronomic experiments should have C: B ratio.  | Before any technology is accepted this is being done  |
| 20. | For all closed projects where disease/pest management trials are involved, economics of various treatments may be worked out before recommendation.            | Economics of various treatments are worked out before recommendation.   |
| 21. | Feasibility of employing contractual staff may be explored to carry out identified technical programmes wherever regular staffs are not available.             | Identified technical programmes are being carried by regular staff at all centres except at Jagtial, Chintapalle centres. Recently the posts have been filled up. |
| 22. | Time period between completion of the experiment and proposal for release has to be fixed.   | To be decided in the workshop.  |
| 23. | Proposals should accompany photographs of crop stage; yield etc., incomplete proposal will not be considered hereafter and last minute rush should be avoided. | All the centres have been instructed to record this.  |
| 24. | In future, DUS guidelines have to be used for description and proposal should contain DUS characters.  | DUS guidelines has been developed for Black pepper, Cardamom, Ginger & Turmeric. For seed spices it would be done in consultation with NRCSS.                     |

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| 25. | Distinctive characters of variety has to be highlighted.  | This will be monitored in the workshop.  |
| 26. | Entries evaluated under AICRPS must get it approved by workshop before submitting the proposal for central/state variety release committee. | Centers have been instructed to follow.  |
| 27. | Large scale evaluation of proposed variety through KVK in farmers field may be taken up depending on the mandate of SAUs.                   | All centres are directed to follow the suggestions made in the workshop.                                   |
| 28. | It has to be ensured that planting material / seed of the proposed variety are in sufficient stock before the proposal is submitted.        | Planting material of the proposed variety are multiplied in sufficient quantities before proposal is made. |

#### **TECHNICAL SESSION-I GENETIC RESOURCES**

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|----|--|--|
| 1. | IC/EC numbers may be obtained from NBPGR based on original collection number and passport data. Renaming/ renumbering should be avoided. | Centres have been instructed and it is monitored closely.  |
| 2. | Crop curators may be identified at national level and specialists from each centre to fix the responsibilities.                          | At crop specific Institutes IISR & NRCSS this has been done.                                     |
| 3. | Joint exploration may be taken up in consultation with NBPGR and PC (AICRPS centres).  | All AICRPS centers were instructed to follow this and some joint exploration have been taken up. |

#### **CARDAMOM**

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|----|--|--|
| 1. | New collections along with promising accessions from old collections may be taken up for germplasm evaluation.                   | This is being done.                                  |
| 2. | Minimal descriptor should be followed for germplasm evaluation by including quality parameters.                                  | The descriptor published by NBPGR would be followed. |
| 3. | Back ground information and combined data of 2-3 years may be presented to draw/identify the promising lines for further trials. | The centres are asked to follow the directions.      |

#### **GINGER**

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|----|--|---|
| 1. | Quality parameters should be given importance, apart from yield. | This is being followed. However it will insist in future in all trials. |
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| <p>2. Some centres (Barapani, Dholi, Kumarganj, Raigarh) where maintenance of germplasm is difficult may be dropped for germplasm trials and new voluntary centres – ICAR Research Complex, Barapani and Mizoram centres, College of Horticulture and Forestry (CAU), Pasighat and GBPA &amp; T, Pantnagar may be included.</p> | <p>The Voluntary centers are included for ginger trials.</p> |
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#### **TURMERIC**

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|--|---|
| <p>1. Consolidated/cumulative yield may be presented along with curcumin content for the promising lines for including in IET.</p>   | <p>The data on curcumin is included in the data.</p>  |
| <p>2. Quality analysis should be taken up by Solan centre. All AICRPS centers are advised to send samples to Solan centre for analysis.</p>  | <p>All the centres are directed to send samples to Solan Centre. For the GXE trial it is done at IISR, Calicut.</p> |
| <p>3. New voluntary centres – ICAR Research Complex, Barapani and Mizoram centres, College of Horticulture and Forestry (CAU), Pasighat, GB PUA and Technology, Pantnagar may be included.</p> | <p>The centres are included as co opting/voluntary centres during XI Plan.</p>                                      |

#### **CORIANDER**

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|--|---|
| <p>1. Uniform parameters may be followed in each centre for reporting.</p>   | <p>It is being followed.</p>  |
| <p>2. Besides yield, pest and disease incidence and quality parameters may be studied.</p>   | <p>Quality parameters will be taken in to consideration in further studies.</p>                             |
| <p>3. Coriander may be classified for various purposes i.e., grain type, leafy type and minimal descriptor may be developed for evaluating leaf type and seed type of coriander separately and also taking into consideration the weather depend of coriander.</p> | <p>It is being done accordingly and the MLT of germplasm is done Zone wise.</p>                             |
| <p>4. Quality aspects should be given importance for each type.</p>  | <p>Will be followed.</p>  |
| <p>5. These issues may be finalized in Ajmer workshop in August 2009.</p>  | <p>The meeting held at NRCSS Ajmer during 15-18, September 2009 and all centres are following uniforms.</p> |

#### **CUMIN**

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|--|---|
| <p>1. Screening of germplasm against drought tolerance may also be presented in genetic resources.</p> | <p>To be done in the next workshop.</p> |
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| 2. | Sufficient quantity of seeds should be supplied to other coordinating centres to take up CVT.  | The centres are advised to send to PC Unit and the coded material distributed to participating centers. |
| 3. | Joint explorations may be carried out by the centres in consultation with NRCSS, Ajmer/ NBPGR. | Exploratory survey has to be finalized for a joint survey.  |

#### **FENUGREEK**

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|----|--|--|
| 1. | Apart from yield data, yield attributing characters are to be submitted to PC for compiling results (Action: Dholi, Kumarganj, Hisar). | The centers were advised to send the data to the person identified to present. |
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#### **TREE SPICES**

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| 1. | Available variability may be explored | Noted for action. |
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### **TECHNICAL SESSION –II CROP IMPROVEMENT**

#### **BLACK PEPPER**

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|----|---|--|
| 1. | PC may examine critically the poor performance of the Chintapalle centre over the years and take up the matter with the University officials. | The poor performance of the Chintapalle centre has been brought to the notice of the Vice Chancellor. He has promised to post staff. |
| 2. | Yield should be expressed per standard (of 4 vines) taking into account height of the canopy.   | It is being followed   |

#### **CARDAMOM**

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|----|--|---|
| 1. | CAR/CI/3.1 CVT 2000 Pooled analysis of the trial should be submitted to PC by end of June 2009. (Action: All the centres). | The trial has been concluded. The centre has been directed to submit the final report.  |
| 2. | CAR/CI/3.3 CVT 2007 The trial should be re laid in the coming season strictly (Action: All the centers).                   | The centres are directed to layout the trial and PC has ensured this doing his visit to centers. However, in some centers there are still gaps. |
| 3. | Target yield of more than 1.0 t/ha by the centre should only be promoted for further trials.                               | These directions will be followed while recommending varieties.   |

#### **GINGER**

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|----|---|--|
| 1. | The seed material of Pottangi centre for CVT trials may be taken to Semiliguda and sent to coordinating centres by speed post to avoid delay. The necessary financial assistance may be provided by PC Unit as per the request from centre. (Action: PC and Pottangi centre). | The Pottangi Centre has reported poor performance of the crop due to failed monsoon. |
|----|---|--|

	<b>TURMERIC</b>	Done accordingly.
1.	The experimental data should be presented with statistical analysis. (Action: Turmeric Centre)	The yield data under CVT was re examined from Dholi critically and it was found to be correct.
	<b>CORIANDER</b>	
1.	The wide variations/difference in yield under CVT should be re-examined critically (Action: Dholi centre).	Noted.
	<b>CUMIN</b>	
1.	The proposal of release of the entry, UC-345 may be submitted with pooled analysis data (Action: Jobner centre).	To be presented in this Workshop
	<b>FENNEL</b>	
1.	The data sheets do not match the trials allocated which must be rechecked critically (Action: Dholi centre).	The trial dropped at Dholi.
2.	The entry, UF- 205 may be proposed for release (Action: Jobner centre).	Proposal awaited from centre.
3.	The entries, NS-63 and NS-46 may be promoted to CVT (Action: Jobner centre).	Noted.
4.	Yield should be mentioned only in Kg/ha uniformly by all the centers.	To be followed.
5.	Entries having the yield data supported with oil content should only be promoted to CVT.	Informed centres for compliance.
6.	The entries identified by the workshop should only be exchanged for conducting CVT through PC unit.	The identified entries are received from centers, coded and again dispatched.
	<b>FENUGREEK</b>	
1	The entry, UM-361 (Jobner) may be proposed for release with pooled analysis data.	The centre is directed to submit the proposal.
2	The importance of diosgenin content may be looked into from health point of view.	It will be considered in future.
3	Chemical constituents responsible for the cure of diabetics may be taken up by NRCSS.	NRCSS is requested to take up such basic works.

## TECHNICAL SESSION- III CROP PRODUCTION

### BLACK PEPPER

1. The experiment on rooting of orthotropic shoots of pepper can be concluded and recommendation of dipping of three node cuttings of pepper in PGPR shall be recommended as a technology to be adopted. The project was concluded and final report submitted.

### CARDAMOM

1. Fertilizer management trials on cardamom are concluded. The final report should be submitted to the PC unit at the earliest. The outcome of the project shall go as technologies for transfer. The trial concluded and final report has to be submitted along with Annual Report 2009-10.
2. A new experiment on water management may be formulated focusing on moisture conservation. A New experiment has already been laid out at Cardamom center – Mudigere.

### GINGER

1. Experiment on the effects of micronutrient trials on ginger shall be concluded. The trial concluded at Pottangi and Kumarganj.
2. Holistic approved of organic management including organic mode of plant protection shall be followed in all organic experiments. New trials shall be taken up during this workshop.

### TURMERIC

1. The project on foliar application of micro nutrient shall be closed the results emerging in the project shall be incorporated for POP. The trial closed at Pottangi.
2. A new experiment on water management may be formulated focusing on moisture conservation. Being taken up this year.

### CUMIN

1. The trial on the effect of Tricentanol shall be concluded. The trial concluded at Jobner Centre.

### CORIANDER

1. The experiment on the effects of rhizobacteria on the yield of coriander shall be concluded and the recommendation of application of rhizobacteria (FL 18) as seed treatment + soil application shall be included for technology transfer. The recommendations demonstrated in the large scale demonstration in farmers plots.

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|----|---|--|
| 2. | For screening drought resistant lines, the precise moisture regime under which the drought resistance lines identified shall be reported. About 4 short listed drought resistant entries may be further evaluated at Guntur and Coimbatore. | Screening was done in two stages. The drought resistant entries identified will be further evaluated in kharif 2010. |
|----|---|--|

**FENNEL**

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|----|---|--|
| 1. | Experiments on the effects of ESP levels x genotype interaction on seed yield of fennel shall be concluded. | The trial concluded.   |
| 2. | The results of concluded experiments on crop production may be incorporated in the transfer of technology.  | The results will be incorporated in Transfer of Technology after concluding the experiments. |

**FENUGREEK**

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|----|---|-------------------------------|
| 1. | Experiments on the effects of <i>Azospirillum</i> on the seed yield of fenugreek shall be closed. | The experiment was concluded. |
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**CLOVE**

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|----|---|---|
| 1. | Experiments on softwood grafting/ wedge grafting of clove may be continued for another six months. Stem cutting may be tried along with different doses of PGPR / hormones. | The centre has been asked to continue. Based on the results the experiment will be reviewed in the next workshop. |
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**CINNAMON**

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|----|--|---|
| 1. | Developing standards for post harvest quality parameters of cinnamon may be continued by including CARI, Port Blair as Voluntary Centre. | Presently the work is done in the tree spice centers viz., Pechiparai & Dapoli. |
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**TECHNICAL SESSION- IV CROP PROTECTION**

**BLACK PEPPER**

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| 1. | Project PEP/CP5.1 may be concluded and final report should be submitted.     | The project concluded at Sirsi and final report submitted.         |
| 2. | While collecting yield data, the diseased and dead vine should be accounted. | Diseased dead vines were accounted while compiling the yield data. |
| 3. | Project PEP/CP5.2 may be conducted for two more years.                       | This is being done.  |
| 4. | Project PEP/CP6.1 may be closed and final report submitted                   | The trial has been concluded.                                      |
| 5. | Identity of various species of <i>Erythrina</i> need to be confirmed.        | Mudigere centre has been entrusted with this work.                 |

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|--------------------|--|---|
| 6.                 | Surveillance for <i>Erythrina</i> gall wasp may be continued.  | This is being done.   |
| <b>CARDAMOM</b>    |  |   |
| 1.                 | Project CAR/CP6.3 Management of shoot fly in cardamom may be concluded and final report submitted.   | The project concluded at Mudigere.  |
| 2.                 | The work identified for the Pampadumpara centre could not be undertaken during second year due to lack of personnel.   | All the sanctioned posts at Pampadumpara has been filled and will the trials laid out.                              |
| 3.                 | Management of root grub through Entomopathogenic nematodes should be continued.  | The trial continued at Pampadumpara centre.   |
| <b>GINGER</b>      |  |   |
| 1.                 | Trials on bio-fumigation may be continued.   | Will be continued for Kharif 2010   |
| 2.                 | In rhizome heat treatment experiments, the temperature of the rhizome may be monitored to avoid over heating of rhizomes.                                      | It will be done accordingly. It was monitored and found that range between 46°C-48°C temperature is ideal.          |
| <b>TURMERIC</b>    |  |   |
| 1.                 | Uniform index may be used for screening germplasm against diseases   | Uniform disease scale as mentioned in the XIX workshop proceedings in being followed in screening.                  |
| 2.                 | Surveillance for disease may be continued with multi locations.  | It will be done accordingly survey for surveillance for disease in turmeric are carried out in different districts. |
| <b>CORIANDER</b>   |  |   |
| 1.                 | COR/CP/6.1 Management of powdery mildew and stem gall in coriander may be closed and final report submitted.   | The trial concluded at Coimbatore & Jobner centers.   |
| 2.                 | Highly resistant accessions against stem gall and powdery mildew may be passed on to breeders for evaluation under IET   | Highly resistant accessions against diseases will be screened further before passing or to breeders for evaluation. |
| <b>CUMIN</b>       |  |   |
| 1.                 | CUM/CP/5.1 In this project best treatment in the management of wilt and blight may be taken up as a new adaptive trial. Involving wilt resistant variety GC-4. | This is followed by the Jobner & Jagudan centres.   |
| 2.                 | Cost benefit ratio of the management of wilt and blight disease may be worked out.   | Done accordingly.   |
| <b>TREE SPICES</b> |  |   |
| 1.                 | TSP/CP/3.1. In this project role of soil physical factors in the wilt of nutmeg may be studied.  | Dapoli centre has been instructed accordingly.  |

## Technical session I

### GENETIC RESOURCES

Chairman : Dr. Umesh Srivasatava, ADG (Hort.II) ICAR, New Delhi  
Rapportetueurs : Dr. N. Shoba, TNAU, Coimbatore  
Dr. R. Senthil Kumar, IISR, CRC, Appangala

In this session total six presentations were made:

#### Recommendations

##### General

1. AICRPS, NRCSS & NBPGR may collectively prepare a crop wise checklist regarding maintenance of germplasm and introduced germplasm materials available at different centres.
2. IC number is a must for original/new collections and may be obtained by all the individual centres.
3. Performa of Data sheet for recording observations will be published in the AICRPS website.
4. All the centres should strictly adhere to the programme.

##### Seed spices

1. Augmented Block Design (ABD) should contain at least 2 checks. Each block (B) should have 15-20 accessions and the check (C) should be present in each block through randomization. The degrees of freedom (d.f.) of the experiment should be at least 12 i.e. (B-1) (C-1) e" 12.
2. All seed spices germplasm including wild species along with passport information should be sent to NAGS (National Active Germplasm Site) within 20 days.
3. All the seed spice materials may be assembled at NRCS and distributed to other centers for evaluation.
4. If more than 5 promising accessions are obtained in the germplasm evaluation, it should go to IET (Initial Evaluation Trial) at station level.

##### Small Cardamom

1. All the AICRPS centres on small cardamom should deposit its germplasm along with passport information to NAG S (CRC-Appangala) by August 2010.
2. The rhizome rot resistant accession of Pampadumpara may be sent to Appangala for further studies.

##### Large Cardamom

1. ICRI Sikkim may explore the germplasm in collaboration with NBPGR RS Shillong.

**Black pepper**

Ongoing experiment at Chintapalli and Sirsi (PEP C1/1) may be concluded and final report may be submitted.

**Ginger**

1. For quality evaluation at Solan, Kumaraganj centre should send samples within 15 days, Pundibari centre should send by Feb.2011 and Dholi centre should send by March 2011.

**Turmeric**

1. Germplasm yield data should be presented per plot.
2. All the centres should send samples to Solan for quality analysis.
3. Getting IC number is must for the promising materials before sending for CVT
4. Pasighat may be included as voluntary center

**Tree Spices**

1. Ambalavayal centre may be included for clove trial.



## Technical session II

### CROP IMPROVEMENT

Chairpersons : Dr. Homey Cherian, Deputy Director, DASD, Calicut, Kerala  
Dr. E.V.D. Sastry, Assoc. Prof., SKN College, RAJAU, Jobner

Rapporteurs : Dr. R.S. Meena, Scientist S.S. (Plant Breeding), NRCSS, Ajmer  
Shri K. Giridhar, Scientist, AICRPS, HRS, APHU, Lam, Guntur

In this session total 10 presentations were made.

#### Recommendations

##### General

1. Cumin may be dropped from Jagtial center due to poor performance of the crop Yield data for all seed spices should be presented in kg/ha.
2. Area of irrigation channels should be reduced when calculating yield of irrigation trials. Yield may be separated on the basis of net plot area.
3. For analyzing the data, the centers may be grouped on the basis of similarity of the growing conditions, so that more regional recommendations may emerge.
4. Fine tuning of all MLT trials has to be taken up.
5. Translation of the “Advanced Production Technology” booklet into Gujarati, Telegu, Tamil and Kannada should to be taken up. The responsibility of the translations is entrusted with Dr. Ravindra Babu, GAU, Jagudan (for Gujarati), Dr. C. Sarada, AICRPS, Guntur (for Telegu), Dr. N. Shoba, TNAU (for Tamil), and Dr. Anke Gowda, CRC, Appangala (for Kannada) respectively.
6. In all the yield trials, per hectare yields should be calculated based on net plot yield only.
7. A good database of photographs and descriptors should be built for all promising entries by the respective centers, so that the proposals have good quality photos.
8. FNL-25 and FNL-26 may be recommended for release at national level.
9. Quality analysis of fenugreek of CVT and IET entries is to be taken up by AICRPS, Coimbatore centre and all the centers working on crop improvement of fenugreek are directed to submit the samples at the earliest.
10. A presentation on expert system on seed spices was made by Dr. S.N. Islam from IASRI, New Delhi. His presentation was appreciated by the delegates. It was suggested that the system should be developed in Hindi language and should cover value addition and economic aspects.
11. The programme on black pepper grafting experiment in *Piper colubrinum* evaluation of grafts, orthotropic and runner shoots may be carried out at Thadiyan kudushi (TNAU) as a testing centre.

**Technical session III**  
**CROP MANAGEMENT**

Chairman : Dr. R. Dhanapal, Head, Crop Production, CPCRI, Kasaragod

Rapporteteurs : Dr. K. Kandiannan, IISR, Calicut  
Dr. C. Sarada, APHU, Guntur

In this session there were nine presentations and the following recommendations emerged.

**Recommendations**

1. A committee with Dr N Kumar, Dean, H C & RI, Coimbatore as a Chairman may formulate cardamom fertigation experiment
2. Presentations/reporting of trials with crop nutritional aspects both organic and inorganic should have nutritional status of the soil and variety tested. It also should have economics aspect so as to make solid recommendations. While working out economics 20% extra cost may be considered for organic products.
3. Turmeric irrigation experiment at Jagtial and Coimbatore should follow same irrigation schedule to draw meaningful information.
4. Mini-tractor may also be tested in operating turmeric harvester and its efficiency recorded.
5. Plant population of treatment or unit area in turmeric harvesting mechanization experiment should be uniform to avoid error in experimentation and reporting. This has to be included in the new workshop presentation.
6. Development of GAP for ginger and turmeric may be explored.
7. CVT on drought resistant coriander lines may be initiated under crop improvement programme. One set of these lines may be deposited with NRCSS, Ajmer, if not done early.
8. NRCSS may take up basic studies on drought resistance work on coriander.
9. Irrigation experiments should have the details on water savings / water productivity aspects for finalizing the recommendations.
10. Dholi centre may bring out the *Azospirillum* application on fennel as a recommendation.
11. In fennel short listed treatments on organic farming at different centre may go for large scale demonstration and adoption.
12. Clove vegetative propagation experiment may be stopped at Dapoli.
13. Dapoli centre may publish the cinnamon post harvest work and bring out the recommendation. Sirsi may take up the same trial and Dr R Senthil Kumar, IISR may provide the results on cinnamon PHT work to PC (Spices) for compilation.

## Technical session IV

### CROP PROTECTION

Chairpersons	:	Dr. M. Tamil Selvan Director, DASD, Calicut
Co-Chairperson	:	Dr. R.P. Saxena NDUAT, Kumarganj
Rapporteurs	:	Dr. M.S. Lokesh, UHS, Sirsi Dr. P. Muthulakshmi, TNAU, Coimbatore

In this session, totally 22 projects were presented on or Black pepper, Cardamom, Ginger, Turmeric, Coriander, Cumin, Fennel, Fenugreek and Tree Spices.

#### General Recommendations

1. All the centers should record the disease incidence along with weather parameters in order to correlate and develop the forecasting system of major diseases of all spice crops.
2. All the resource persons identified should present the results after compiling the information from all the centers in a comparative manner instead of center wise.

#### Black pepper

PEP / CP / 5.1 and 5.2 in black pepper may be closed

Centers which developed the technology for management of *Phytophthora* foot rot disease should send the proposal for transfer of technology (Dapoli, Sirsi, Mudigere, Chintapalle, Panniyur and Pampadumpara).

Pruning and management studies to be conducted for the management of *Erythrina* gall wasp and survey has to be made for identification of natural enemies, alternate hosts and studies on biocontrol should be initiated by Mudigere and Pampadumpara centers.

#### Cardamom

CAR / CP / 6.7: Project may be continued and conduct the experiment in the hot spot areas for pest and diseases since the incidence of pests and diseases was very low at places where experiments were conducted previously.

#### Ginger

Treatments showing higher incidence of (>50%) should not be considered as effective.

#### Turmeric

Disease intensity along with weather parameters should be recorded for the foliar diseases in order to develop the forecasting system wherever facilities are available.

Resistant lines identified against rhizome rot by Jagtial center may be evaluated in the ensuing season. Also, yield data should be recorded and passed on to IET.

Resistant lines identified by other centers for leaf spot and leaf blotch may be evaluated in the ensuing season and may be passed on to IET.

### **Coriander**

Resistant lines/Accessions showing less than 20% disease incidence may be tested for one more year along with yield and passed on to breeders for further evaluation (Jobner and Guntur).

### **Cumin**

In blight management trial, residues of mancozeb should be analysed by sending samples to Spices Board, Survey should be done and samples should be collected and analyzed for residues of Mancozeb at IISR, Calicut (Jobner).

### **Fennel**

Etiology of sugary disease may be studied along with physiological and weather parameters in collaborative manner with plant protection scientists, Physiologists and PC Unit. (NRCSS, Ajmer, Jobner and Jagudan).

## TECHNICAL SESSION: V

### RECOMMENDATION OF VARIETIES AND TRANSFER OF TECHNOLOGY

Chairman	:	Dr. J.M. Mathur, KVK, Chief Training Officer, NRCSS, Ajmer
Co-chairman	:	Dr. Gopal Lal, Principal Scientist NRCSS, Ajmer
Rapporteurs	:	Dr. R.S. Meena, Scientist S.S (Plant Breeding), NRCSS, Ajmer Dr. E. Jayashree, Scientist S.S. (Agriculture Processing) IISR, Calicut

#### VARIETIES

There were four proposals for recommendation

##### Cardamom

SKP-170 from ICRI (Spices Board), Sakleshpur, Karnataka for State release

##### Fennel

RF-145 from Dept. of Plant Breeding & Genetics, SKN College of Agriculture

(Rajasthan Agricultural University), Jobner, Dist. Jaipur, Rajasthan as National release.

##### Coriander

LCC-234 from Regional Agril. Research Station, (Andhra Pradesh Horticultural University), Guntur, Andhra Pradesh for state release

LCC-200 from Regional Agril. Research Station, (Andhra Pradesh Horticultural University), Guntur, Andhra Pradesh for state release

#### Recommendations

- RF-145      The variety RF-145 was accepted and recommended for release. Variety RF-145 for rabi cultivation & direct sowing was recommended for release at National level. The performance may be tested at field level. The variety showed 19 per cent higher seed yield and also higher volatile oil yield per hectare. The variety is recommended for release to Rajasthan, Gujarat, Uttar Pradesh, Haryana & Bihar.
- SKP-170      It is considered as elite germplasm suitable for registration at NBPGR for its quality. For release of this variety, the proposal may be resubmitted after additional two year multilocation data to fulfill the CVT norms.
- LCC-234      It is not qualified as a variety as data on CVT has not been generated. This technology of growing leafy coriander in summer can be recommended as technology. For release of the variety a trial can be formulated with 7-8 genotypes and it should be tested following the CVT norms.
- LCC-200      It is not qualified as variety as data on CVT has not been generated. It can be registered at NBPGR for drought tolerance character. For release as drought tolerant variety, it should be tested in trial following the CVT norms.

**Following general suggestions are also made.**

1. Credit of the release varieties may be shared among the principal Investigator/Chief Breeder/Scientist associated with PI and collaborating Centers including the AICRPS Head quarters.
2. For release of variety, data on multilocational trials for minimum of 2 years along with IC No. is essential
3. Technology of growing leafy coriander under 50% shade net during off season was promising. The elite accessions LCC 244 and LCC 234 were promoted for CVT at Guntur, Coimbatore, Ajmer and Periyakulam centres.

## **TECHNOLOGIES**

**The technologies proposed for consideration in different crops**

### **BLACK PEPPER**

#### **1. Management of *Phytophthora* foot rot of black pepper (Sirsi)**

Under organic farming (for growth, nematode and *Phytophthora* suppression) in black pepper application of bioagents i.e. consortium of bacteria (IISR-6 & IISR- 859) @ 10<sup>8</sup> CFU/gas spraying @2 l<sup>-vine</sup> and drenching @ 3 l<sup>-vine</sup> and *Trichoderma harzanium* (MTCC 5179) 50 g with one kg of neem cake as soil application around the root zone of the vine twice (June and August) is recommended to reduce the disease with respect to leaf infection, yellowing, defoliation and death of vines with high yield.

For organic farming application of potassium phosphonate (0.3%) as spray and drench +*Trichoderma harzanium* (MTCC-5179) 10<sup>8</sup> CFU 50 g/vine with 1 kg of neem cake (two time application during June & August – September) is also recommended for the management of *Phytophthora* foot rot in black pepper.

### **GINGER**

#### **Management of rhizome rot of ginger (Sirsi)**

Rhizome rot could be managed by sowing solarized rhizomes. For solarization, ginger rhizomes are kept under polyethylene sheet (200 micron) at 47° C for 30 min. Before planting the solarized rhizomes are to be treated with both the bioagents in combination i.e. *Trichoderma harzanium* (MTCC-5179) and bacterial consortium IISR-51 & GEB-17 at 10<sup>8</sup> CFU (for growth, nematode and *Pythium* suppression) for 30 minutes. Further, beds have to be treated with respective bioagents as drench at the time of planting of rhizomes and application of bacterial consortium after planting of rhizomes. Alternatively treating the solarized rhizomes with 0.25% of mancozeb for 30 min before planting and application of the fungicides two times after sowing of rhizome is also effective in reducing the rhizome rot disease.

#### **Management of rhizome rot of ginger caused by *Pythium aphanidermatum* (Mudigere)**

Solarization and seed rhizome treatment with Mancozeb @ 0.3% + soil drenching with Dithane M-45 (0.3%) is recommended for the management of rhizome rot in ginger.

For organic ginger cultivation solarization of rhizomes + seed treatment with bacterial consortium IISR-51 and GEB-17 at 10<sup>8</sup> CFU and *Trichoderma harzanium* (MTCC-5179) as bed treatment is recommended. Further beds are to be treated with respective bioagents as drench at the time of planting and after sowing of rhizomes.

## **CUMIN**

### **Management of wilt and blight disease in cumin (Jagudan)**

#### **Wilt:**

Application of *Pseudomonas fluorescens* (IISR-6)  $10^8$  CFU as seed treatment & spray of *Pseudomonas fluorescens* at 60 DAS was effective in management of cumin wilt.

#### **Blight**

Spraying mancozeb @0.25% at 40, 50, 60 & 90 DAS or soil application of *Trichoderma harzianum* + soil solarization + spray of mancozeb @0.25 % at 60 DAS is recommended for control of blight in cumin.

## **CORIANDER**

### **Off season production technology of coriander (Guntur)**

Growing coriander under 50% shade net was recommended for production of season coriander.

The accession LCC-244 was found promising to be grown in off season for leaf purpose.

## **FENUGREEK**

### **Increase in production through application of biocontrol agents (Hisar)**

Application of rhizobacteria IISR-FL-18 (seed treatment +soil application) or rhizobacteria IISR-FK-14 + IISR-FL-18 (seed treatment +soil application) was recommended for increasing production in fenugreek.

## **FENNEL**

### **Increase in production through application of biocontrol agent (Hisar)**

Application of *Trichoderma* (MTCC-5179) or rhizobacteria IISR-FK-14 (seed treatment) or rhizobacteria IISR-FL-18 (seed treatment + soil application) were found to increase yield in fennel.

## **Proceedings of the recommendations made by the committee after screening the variety release proposals to be considered in the XXI AICRPS Workshop**

The committee of the following members constituted by DDG (Hort.) and compiled by PC met on July 5, 2010 at NRCSS and examined the four varietal proposals namely ICRI-8 for cardamom submitted by ICRI, Sakeshpur, UF-145 for fennel submitted by SKNCOA, Jobner, LCC-234 and LCC-200 for Guntur submitted by HRS, Guntur.

Dr. Umesh Srivastava, ADG, ICAR, New Delhi	Chairman
Dr. M.M. Anwer, Director, NRCSS, Ajmer	Member
Dr. V.P. Neema, Professor & Head (P.B.), Pepper Research Station, Panniyur	Member
Dr. R. K. Kakani, Sr. Scientist & Head, crop Improvement, NRCSS, Ajmer	Member
Dr. M. Anandaraj, Coordinator, AICRP on Spices, IISR, Calicut	Member

The committee recommends that there should be a credit sharing system in all varietal release proposals. It should be as follows.

Chief Breeder	:	Breeder, who develops the variety.
Associates	:	Associated scientists from the centre where variety was developed
Collaborators	:	Scientists associated with the coordinated trial at different centres including project Coordinator's unit and who had conducted the trial very well and submitted the data well in time. 80 per cent of centres should be included to acknowledge their efficiency.

The four varietal release proposal received from three centers were presented for screening by the Committee. Each proposals were thoroughly discussed and following recommendation emerged out.

SKP-170	It is considered as elite germplasm suitable for registration at NBPGR for its quality. For release of this variety, the proposal may be resubmitted after additional two year multilocation data to fulfill the CVT norms.
RF-145	This variety is recommended for release to Rajasthan, Gujarat, Uttar Pradesh, Haryana and Bihar. The variety showed 19 per cent higher seed yield and also higher volatile oil yield per hectare.
LCC-234	It is not qualified as a variety as data on CVT has not been generated. This information of growing leafy coriander in summer can be recommended as a technology. For release of the variety a trial can be formulated with 7-8 genotypes and it should be tested following the CVT norms.
LCC-200	It is not qualified as variety as data on CVT has not been generated. It can be registered at NBPGR for drought tolerance character. For release as drought tolerant variety, it should be tested in trial following the CVT norms.



## PLENARY SESSION

Chairpersons	:	Dr. Umesh Srivastava, ADG (Hort. II)
		Dr. M. Anandaraj Project Coordinator, AICRP on Spices
		Dr. M. Tamil Selvan Director, DASD
Rapporteur	:	Dr. J. Rema Principal Scientist (Hort.), IISR, Calicut

Dr. Umesh Srivastava, Asst. Director General (Hort.II) directed detailed action taken report has to be sent regularly. All the reports to be sent in time.

The rapporteurs of different technical sessions presented the report.

Fourteen new projects were presented and approved during the session. Of this three were in crop improvement, seven in crop management and four in crop protection.

### **New Projects**

Following are the New Research Programmes approved.

1. Initial Evaluation Trial on Turmeric
2. Initial Evaluation Trial on Coriander (Seed purpose)
3. Initial Evaluation Trial on Coriander (Leafy type)
4. New Initial Evaluation trial on coriander
5. Coordinated varietal trial on coriander (Leafy type) during off season
6. Evolving disease and pest tolerant lines in large cardamom
7. Initial evaluation trial on ginger
8. Standardization of water requirement for turmeric through drip irrigation
9. Effect of fertigation on yield of cardamom through drips
10. Organic farming in cardamom
11. Nutrient management in off season production of leafy type coriander.
12. Comparison of effect of chemical treatments as well as biocontrol agents against pseudostem rot of cardamom
13. Survey for identification of yellowing causing organisms in cumin
14. Management of stem gall disease of coriander

Dr. M. Anandaraj, Project Coordinator, Spices proposed vote of thanks.

## All India Coordinated Research Project on Spices

### New Research Programme to be initiated during 2010-11

New Research Programme : 1	
Crop	Cardamom
Title of the programme	Effect of fertigation on yield of cardamom through drip
Centres	Mudigere & Pampadumpara
Year of start	2010-11
Duration of the project	Three years
No. of treatments	Treatments : Fifteen Main plot treatments - Three (Irrigation levels) Sub plot treatments - Five (Fertilizer levels)
Design/spacing*	Split plot/ 1.8 m X 1.8 m
No. of replications/Variety	Three replications ; Variety –prevailing variety at each centre
No. of plants/plot/treatment	16
Methodology & procedure to be adopted.	<p><b>MAIN PLOT TREATMENTS - 3 (Irrigation levels)</b>  <math>I_1</math> = Irrigation to be adopted at 33% PE (3 litre /day/clump)  <math>I_2</math> – Irrigation at 66% PE (6 litre /day/clump)  <math>I_3</math> - Irrigation at 100% PE (9 litre /day/clump)                      PE = Pan Evaporation</p> <p><b>Sub plot treatments – 5 (Fertilizer level)</b>                      Recommended Fertilizer NPK 125:125:250 kg/ha</p> <ol style="list-style-type: none"> <li>1. 25% Rec. dose of fertilizer</li> <li>2. 50% Rec. dose of fertilizer</li> <li>3. 75% Rec. dose of fertilizer</li> <li>4. 100% Rec. dose of fertilizer</li> <li>5. Conventional methods</li> </ol>
Observation to be recorded in detail	<ol style="list-style-type: none"> <li>1. Plant height</li> <li>2. No. of bearing suckers / clump</li> <li>3. No. of panicles/clump</li> <li>4. No. of capsules /panicle</li> <li>5. Dry capsule yield (kg/ha)</li> <li>6. Soil analysis for available nutrients</li> <li>7. Incidence of pests and diseases and severity</li> <li>8. Quantum of water</li> </ol>

If it is to be undertaken in existing plantations, the spacing followed may be indicated at the time of reporting

- Note:
1. Recommended dose of NPK should be applied in eight monthly equal instalments through drip starting from October to May.
  2. The drip irrigation should be started when the soil moisture comes to 50% field capacity.

<b>New Research Programme : 2</b>	
Crop	<b>Cardamom</b>
Title of the programme	Organic farming in cardamom
Centres	Mudigere & Pampadumpara
Year of start	2010-11
Duration of the project	Three years
Design/spacing	RBD
No. of treatments/genotypes with details	<p>Treatments: Eight</p> <p><b>T1</b> : Rec. dose of FYM (30 t/ha)</p> <p><b>T2*</b> : Rec. dose of CPC (15 t/ha) [CPC=Coffee Pulp Compost]*</p> <p><b>T3</b> : Rec. dose of vermicompost (15 t/ha)</p> <p><b>T4</b> : Jeevamruta</p> <p><b>T5</b> : Rec. dose of FYM (30 t/ha) + <i>Azospirillum</i> (10g. /clump) + 10g.PSB/clump + <i>Trichoderma</i> 10g/clump (PSB = Phosphate Solubilising Bacteria)</p> <p><b>T6</b> : Rec. dose of CPC (15 t/ha) + <i>Azospirillum</i> (10g./clump) + 10g.PSB/clump + <i>Trichoderma</i> 10g /clump</p> <p><b>T7</b> : Rec. dose of CPC (15 t/ha) <i>Azospirillum</i> 10g/clump + 10g.PSB/clump</p> <p><b>T8</b> : Jeevamruta + <i>Azospirillum</i> (10g/clump) + 10g.PSB/clump. + <i>Trichoderma</i> 10g / clump</p>
No. of replications/Variety	Three replications;
No. of plants/plot/treatment	Eight
Methodology & procedure to be adopted	<p><b>Preparation and application of Jeevamruta</b></p> <ol style="list-style-type: none"> <li>10 kg fresh cow dung + 5 litre of cow urine + 2 kg. Jaggery + 2 kg Bengal gram flour + ½ kg soil of the experimental plot dissolved in 200 litre of water and stirred daily and kept for 15 days ] [Soil application 20 litre /clump @ one month interval.</li> <li>Pest and disease should be controlled by organic pesticide and fungicide recommended in organic farming only</li> </ol>
Observation to be recorded in detail	<ol style="list-style-type: none"> <li>Plant height</li> <li>No. of bearing suckers / clump</li> <li>No. of panicles/clump</li> <li>No. of capsules /panicle</li> <li>Dry capsule yield (kg/ha)</li> <li>Soil analysis for available nutrients and microflora before and after conducting the experiments</li> <li>Quality parameters of cardamom</li> <li>Pest and disease incidence and severity</li> </ol>

\* T2 be coffee pulp compost or coir pith compost as per availability.

<b>New Research Programme :3</b>	
Crop	<b>Cardamom</b>
Title of the programme	Comparison of effect of chemical treatment as well as bio control agents against pseudostem rot of cardamom
Centre	Pampadumpara & Mudigere
Year of start	2010-11
Duration of the project	Three years
Design	RBD
No. of treatments/genotypes with details	Five
No. of replications	Four replications
Plot size/spacing	2 m X 2 m /1.8 m X 1.8 m
No. of plants/plot/treatment	10 plants / replication
Date of sowing/planting and season (Kharif/Rabi/Zhiad)	November - March
Lay-out plan	
Methodology & Procedure to be adopted	Basal application and foliar spraying. Treatments <ol style="list-style-type: none"> <li>1. Bavistin (2g/l)</li> <li>2. <i>Pseudomonas fluorescens</i> *</li> <li>3. Consortium of bacteria *</li> <li>4. <i>Trichoderma harzianum</i> (50g* with 1kg neem cake) + consortium of bacteria</li> <li>5. <i>Trichoderma harzianum</i> (50g* with 1kg neemcake) + <i>Pseudomonas fluorescens</i></li> </ol>
Observation to be recorded in detail	<ol style="list-style-type: none"> <li>1. Percent disease incidence</li> <li>2. Tiller infection</li> <li>3. Panicle infection</li> <li>4. Yield / plant (kg)</li> <li>5. Observations to be recorded as per treatment, one month after first treatment, 60 days after first treatment and 75 days after first treatment.</li> </ol>

\* The cfu in the formulation must be 10<sup>8</sup>/g

<b>New Research Programme: 4</b>	
<b>Crop</b>	<b>Large cardamom</b>
<b>Title of the programme</b>	Evolving disease and pest tolerant lines in large cardamom
<b>Centre</b>	ICRI Regional Station, Tadong
<b>Year of start</b>	2010-11
<b>Duration of the Project</b>	Five years
<b>No. of replications</b>	-
<b>Plot size/spacing</b>	1.5 m X 1.5 m
<b>No. of plants /plot / treatment</b>	6 units
<b>Methodology</b>	<i>Colletotrichum</i> blight and leaf caterpillar damage ( <i>Artona chorista</i> ) are the target disease/pest for the collection of escapes. The plants would be collected in June-August 2010-11 and would be planted in ICRI Research Farm at Kabi, North Sikkim for preliminary evaluation. The growth data, disease and pest occurrence (percentage and severity) would be recorded. The plants would also be established in pots/protected area for challenge inoculation. After one year, suckers from established collections would be raised in poly bags/protected area for inoculation with pathogen/pest. Thus the collections could be short listed/ascertained for disease/pest tolerance by 2-3 years.
<b>Observation to be recorded</b>	<p>Growth parameters (per plant)</p> <ol style="list-style-type: none"> <li>1. Total number of tillers</li> <li>2. Height of tallest tiller</li> <li>3. Third leaf length &amp; breadth</li> <li>4. No. of productive tillers</li> <li>5. No. of spikes</li> <li>6. No. of capsules/spike</li> <li>7. No. of seeds/capsule</li> <li>8. Yield</li> </ol> <p>Disease/pest incidence</p> <ol style="list-style-type: none"> <li>1. No. of <i>collectotrichum</i> blight affected tillers</li> <li>2. No. of leaf caterpillar infested tillers</li> </ol>

<b>New Research Programme: 5</b>	
Crop	<b>Large cardamom</b>
Title of the programme	Integrated pest and disease management in large cardamom
Centre	ICRI Regional Station, Tadong
Year of start	2010-11
Duration of the project	3 years
Design	Exploded Block Design (EBD)
No. of treatments/ genotypes with details	T <sub>1</sub> - Control, T <sub>2</sub> - Phytosanitation and application of bio- agents
No. of replications	-
Plot size/ spacing	Existing plantation (1.5 m x 1.5 m)
No. of plants/ plot/ treatment	200 plants per treatment
Date of sowing/ planting and season (Kharif/ Rabi/ Zhiad)	Age of plantation: Above 3 years, in farmers field
Lay-out plan	<p>T<sub>1</sub> - 200 plants</p> <p>T<sub>2</sub> - 200 plants</p> <p>Sample size for observation: 20 plants in each treatment</p> <p>Targeted pests and diseases</p> <ol style="list-style-type: none"> <li>1. Leaf caterpillar (<i>Artona chorista</i>)</li> <li>2. Shoot fly (<i>Merchlorops dimorphus</i>)</li> <li>3. <i>Colletotrichum</i> blight</li> <li>4. Chirkey and foorkey (viral diseases)</li> </ol>
Methodology and procedure to be adopted	<p>Infested leaves by leaf caterpillar would be collected manually at monthly interval. The collected leaves with the caterpillars would be killed by dipping in kerosene mixed water. Shoot fly infested and <i>Colletotrichum</i> blight tillers would be removed from the clump during Sept–Nov (time of harvesting) and destroyed by burning/ composting. Similarly, chirkey and foorkey affected clumps would be removed at monthly intervals and buried and replanted with healthy plants.</p> <p>Bio-agent (<i>Pseudomonas fluorescens</i> and <i>Bacillus subtilis</i>, 5% each with cfu value of 10<sup>8</sup>, 1 litre/ clump) would be sprayed in the month of March-April, June-July and September-October. Agronomic practices would be followed in all the treatments.</p>
Observations to be recorded in detail	<ul style="list-style-type: none"> <li>➤ Total number of tillers at monthly interval</li> <li>➤ No. of infested/ infected tillers at monthly interval</li> <li>➤ Yield</li> </ul>

<b>New Research Programme: 6</b>	
<b>Crop</b>	<b>Ginger</b>
<b>Title of the programme</b>	Initial evaluation trial - 2010
<b>Centre</b>	Dholi
<b>Year of start</b>	2011 – 12
<b>Duration of the project</b>	Three years
<b>Design</b>	RBD
<b>No. of treatments</b>	8 genotypes + 1 Nadia (check)
	V <sub>1</sub> – RG-14                      V <sub>6</sub> – RG-13
	V <sub>2</sub> – RG-32                      V <sub>7</sub> – RG-7
	V <sub>3</sub> – RG-30                      V <sub>8</sub> – RG-38
	V <sub>4</sub> – RG-9                      V <sub>9</sub> – Nadia (Local check)
	V <sub>5</sub> – RG-24
<b>No. of replications</b>	Three replications
<b>Plot size and spacing</b>	3.0 m X 1.0 m & 25 cm (row spacing) X 30 cm (intra-row spacing)
<b>No. of plants/plot/treatment</b>	40 plants
<b>Date of sowing /planting season</b>	Planting time – May/June
<b>Observations to be recorded</b>	<ol style="list-style-type: none"> <li>1. Height of the plant</li> <li>2. No. of tillers per plant</li> <li>3. No. of leaves per tiller</li> <li>4. No. of days to maturity</li> <li>5. Yield per plot or per hectare</li> <li>6. Disease &amp; pest incidence</li> <li>7. Quality parameters</li> </ol>

<b>New Research Programme: 7</b>	
<b>Crop</b>	<b>Turmeric</b>
<b>Title of the programme</b>	Initial evaluation trial - 2010
<b>Centre</b>	Pantnagar
<b>Year of start</b>	2010-11
<b>Duration of the Project</b>	Three years
<b>Design</b>	R.B.D
<b>No. of treatments/genotypes with details</b>	PT-1,PT-2, PT-3,PT-4,PT-5,PT-6, PT-7, PT-8, PT-9, PT-10,Plant Peetabh (Check-1), Sugandham (Check-2)
<b>No. of replications</b>	Three replications
<b>Plot size and spacing</b>	1.0 m X 1.0 m bed ; 25 cm x 30 cm 25 cm (row spacing) x 30 cm (intra –row spacing)
<b>No. of plants /plot / treatment</b>	40 plants /plot
<b>Methodology and procedure</b>	Recommended package of practices will be followed
<b>Date of sowing/planting</b>	Kharif season
<b>Observation to be recorded in detail</b>	<ol style="list-style-type: none"> <li>1. Plant height (cm)</li> <li>2. No. of tillers/plant</li> <li>3. No of days to maturity</li> <li>4. Yield (kg/plot) or (t/ha)</li> <li>5. Curcumin, essential oil, oleoresin content and dry recovery (%)*</li> <li>6. Disease &amp; pest incidence</li> </ol>

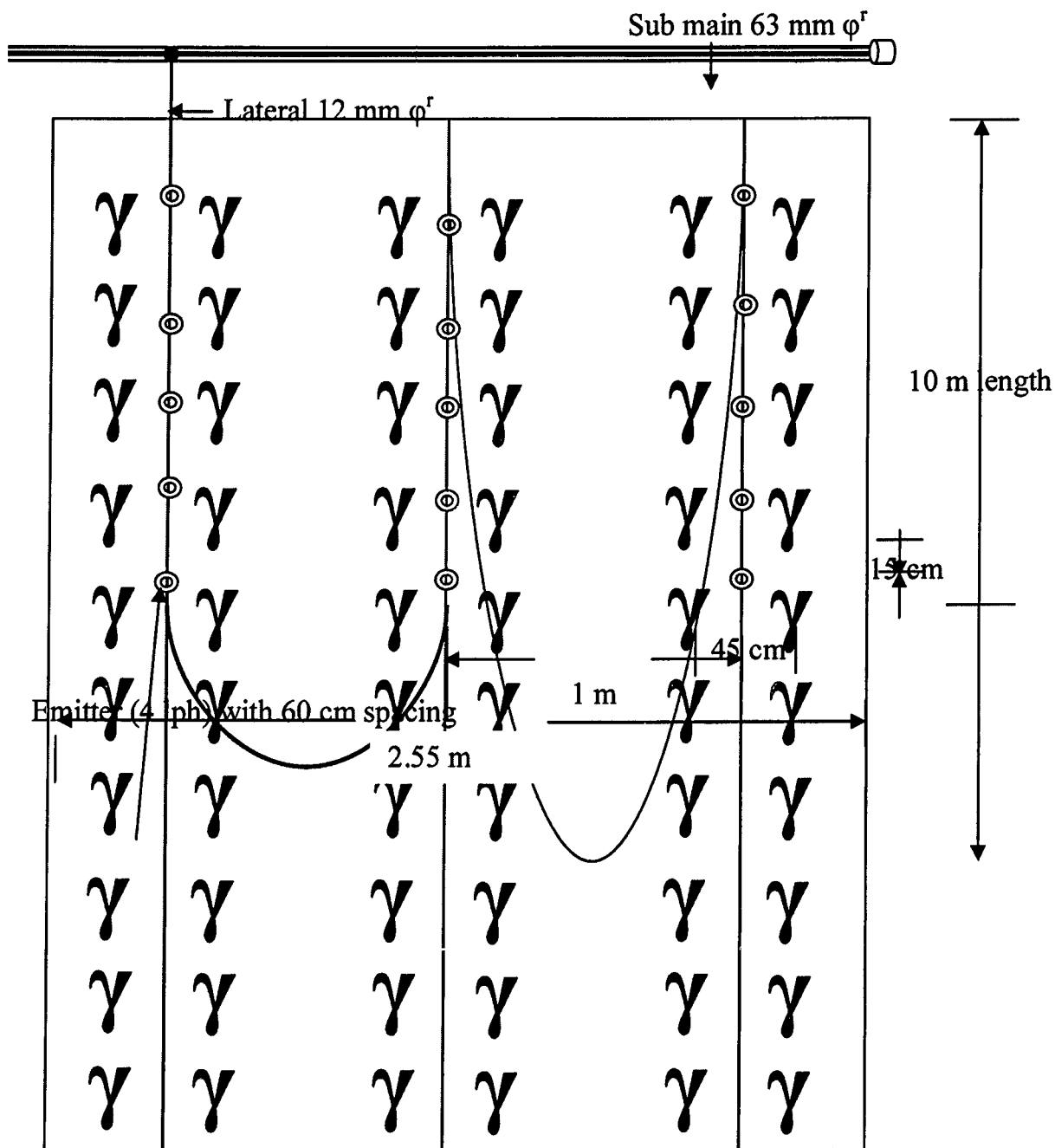
\* The portion of primary fingers (60%), secondary fingers (20%) and mother rhizomes (20%) for quality analysis should be collected (in the ratio 3:1:1) and dried to get moisture level below 10%.



<b>New Research Programme: 8</b>		
1.	Crop	<b>Turmeric</b>
2.	Title of the programme	Standardization of water requirement for turmeric through drip irrigation
3.	Centres	Coimbatore, Dholi, Jagtial, Kumarganj, Raigarh, Guntur & Pottangi
4.	Year of start	2010-11
5.	No. of replications/variety	Local Variety
6.	Duration of the project	Three years
7.	No. of treatments	Seven
8.	Details of the technical programme	<p>T<sub>1</sub>- Surface irrigation, 5cm, 0.90 IW/CPE ratio</p> <p>T<sub>2</sub>- Drip once in a day at 80% PE</p> <p>T<sub>3</sub>- Drip once in 2 days at 80 %PE</p> <p>T<sub>4</sub>- Drip once in a day at 60% PE</p> <p>T<sub>5</sub>- Drip once in 2 days at 60% PE</p> <p>T<sub>6</sub> – Drip once in a day at 40% PE</p> <p>T<sub>7</sub>- Drip once in 2 days at 40% PE</p> <p>For surface irrigation treatment, irrigation will be given through ridges and furrows and for drip irrigation treatments, irrigations will be given through constant discharge drippers, 4lph capacity with one lateral for two rows of crop. The drippers are spaced 60 cm apart along the laterals. The spacing between the laterals is 100 cm. Irrigation has to be withheld one month before harvest.</p>
9.	Design	RBD
10.	No. of replication	Three replications
11.	Plot size /spacing	Raised beds of 10.0 m length and 1 m width Spacing -45 cm X 15 cm
12.	Season	Kharif
13.	Layout plan	Refer figure
14.	Observations to be recorded	<p><b>Morphological parameters</b> – plant height, number of tillers.</p> <p><b>Yield parameters</b> – Fresh yield/bed; Driage (%) and quality parameters*</p> <p><b>Water use efficiency &amp; Cost economics</b></p>

\* The portion of primary fingers (60%), secondary fingers (20%) and mother rhizomes (20%) for quality analysis should be collected (in the ratio 3:1:1) and dried to get moisture level below 10%.

### Lay out of individual plot



Spacing between beds : 50cm  
 Spacing between rows in the bed: 45cm

Spacing between laterals : 1mt  
 Spacing between plants in the row: 15cm

<b>New Research Programme: 9</b>		
<b>Crop</b>	<b>Coriander</b>	
<b>Title of the programme</b>	Initial evaluation trial - 2010	
<b>Centre</b>	Dholi	
<b>Year of start</b>	2010 – 11	
<b>Duration of the project</b>	Three years	
<b>Design</b>	RBD	
<b>No. of treatments</b>	8 genotypes + 2 checks (R. Swati & Pant Haritima)	
	V <sub>1</sub> – RD-379	V <sub>6</sub> – RD-385
	V <sub>2</sub> – RD-377	V <sub>7</sub> – RD-392
	V <sub>3</sub> – RD-380	V <sub>8</sub> – RD393
	V <sub>4</sub> – RD-382	V <sub>9</sub> – Rajendra Swati (Local check)
	V <sub>5</sub> – RD-384	V <sub>10</sub> – Pant Haritima (Local check)
<b>No. of replications</b>	Three replications	
<b>Plot size &amp; spacing</b>	3.0 m X 1.6 m & 30 cm X 20 cm	
<b>No. of plants/plot/treatment</b>	80 plants/ plot	
<b>Date of season</b>	Rabi, Sowing time - October	
<b>Observations to be recorded</b>	<ol style="list-style-type: none"> <li>1. Plant height</li> <li>2. No. of branches per plant</li> <li>3. No. of secondary branches per plant</li> <li>4. Days to 50% flowering</li> <li>5. Disease &amp; pest incidence</li> <li>6. Quality parameters</li> <li>7. No. of umbel per plant</li> <li>8. No. umbellets per umbel</li> <li>9. No. of grains per umbel/ umbellet</li> <li>10. Yield per plot or per hectare (kg/ha)</li> </ol>	

<b>New Research Programme: 10</b>	
<b>Crop</b>	<b>Coriander</b>
<b>Title of the programme</b>	Initial evaluation trial (Seed type) - 2010
<b>Centre</b>	Pantnagar
<b>Year of start</b>	2010 – 11
<b>Duration of the project</b>	Three years
<b>Design</b>	RBD
<b>No. of treatments</b>	10 genotypes + 2 check (DH-5) PD(S)-5, PD(S)-21, PD(S)-2, PD(S)-3, PD(S)-4, PD(S)-6, PD(S)-7, PD(S)-8, PD(S)-9, PD(S)-10, Pant Haritma (Check-1), DH-5 (Check-2)
<b>No. of replications</b>	Three replications
<b>Plot size &amp; spacing</b>	3.0 m X 1.6 m & 30 cm X 20 cm
<b>No. of plants/plot/treatment</b>	80 plants/ plot
<b>Date of sowing season</b>	Rabi, Sowing time - October
<b>Observations to be recorded</b>	<ol style="list-style-type: none"> <li>1. Plant height</li> <li>2. No. of branches per plant</li> <li>3. No. of secondary branches per plant</li> <li>4. Days to 50% flowering</li> <li>5. No. of umbel per plant</li> <li>6. No. umbellets per umbel</li> <li>7. No. of grains per umbel/umbellet</li> <li>8. Yield per plot or per hectare</li> <li>9. Test weight 1000 seeds(g)</li> <li>10. Seed yield (kg/ha)</li> <li>11. Disease &amp; pest incidence</li> <li>12. Quality parameters</li> </ol>

<b>New Research Programme: 11</b>	
Crop	<b>Coriander</b>
Title of the program	Initial evaluation trial (leaf type) - 2010
Centre	Pantnagar
Date/Year of start	2010-11
Duration of the project	Three years
Design	RBD
No. of treatments/genotypes with details	PD(L)51, PD(L)11, PD(L)12, PD(L)13, PD(L)14, PD(L)15, PD(L)16, PD(L)17, PD(L)18, PD(L)19, Pant Haritma(Check-1), DH-5 (Check-2)
No. of replications	Three replications
Plot size/spacing	Gross :- 1.80 X 4.00 m <sup>2</sup> Net :- 1.35 X 3.00 m <sup>2</sup> Spacing :- 22.5 cm drilling
No. of plants/plot/treatment	8 rows per plot (10 cm apart from plant to plant approximate with in row)
Date of sowing/planting and season (Kharif/Rabi/Zhiad)	1 <sup>st</sup> week of November
Methodology & Procedure to be adopted	The recommended crop practices are adopted for experiment. Only basal fertilizers will be applied. The plants should be up rooted at 45 days after sowing.
Observation to be recorded in detail	<ol style="list-style-type: none"> <li>1. Days to germination</li> <li>2. Plant height (cm) at harvest (Harvest at 45 DAS)</li> <li>3. No. of leaves per plant (10 plants observation)</li> <li>4. 1<sup>st</sup> leaf length (cm) (- - » - -)</li> <li>5. 2<sup>nd</sup> leaf length (cm) (- - » - -)</li> <li>6. 3<sup>rd</sup> leaf length (cm) (- - » - -)</li> <li>7. Fresh plant yield (gm) (- - » - -)</li> <li>8. Fresh plant yield of net plot (kg) ie. leaf yield</li> <li>9. Disease &amp; pest incidence</li> <li>10. Market price (Rs. per kg)</li> </ol>

<b>New Research Programme: 12</b>	
<b>Crop</b>	<b>Coriander</b>
<b>Title of the programme</b>	Coordinated varietal trial (Leaf type) during off season – CVT - 2010
<b>Centers</b>	Guntur, Ajmer, Coimbatore & Periyakulam*
<b>Year of start</b>	2010-11
<b>Duration of the Project</b>	Three years
<b>Design</b>	RBD with three factors & 3 replications
<b>No. of treatments/genotypes with details</b>	<p>Nine</p> <ol style="list-style-type: none"> <li>1. ACr- 1 (NRCSS –Ajmer)</li> <li>2. CS-1 (TNAU - Coimbatore)</li> <li>3. CS-11 (TNAU - Coimbatore)</li> <li>4. CS-38 (TNAU - Coimbatore)</li> <li>5. LCC – 234 (APHU-HRS, Lam ,Guntur)</li> <li>6. LCC – 242 (APHU-HRS, Lam , Guntur)</li> <li>7. LCC – 244(APHU-HRS, Lam, Guntur)</li> <li>8. Local (Check)</li> <li>9. Sadhana (check) Supplied to the other centers from APHU-HRS, Lam, Guntur</li> </ol>
<b>No. of replications</b>	Three replications
<b>Plot size/spacing</b>	4.0 m X 1.2 m
<b>No. of plants/plot/treatment</b>	300-400
<b>Date of sowing/planting and Season(kharif/Rabi/Zhiad)</b>	Summer season
<b>Methodology &amp; Procedure to be adopted Observations to be recorded in detail</b>	<ol style="list-style-type: none"> <li>1. Days to germination</li> <li>2. Plant height (cm) at harvest (Harvest at 45 DAS)</li> <li>3. No. of leaves per plant (10 plants observation)</li> <li>4. 1<sup>st</sup> leaf length (cm) (- - ” - -)</li> <li>5. 2<sup>nd</sup> leaf length (cm) (- - ” - -)</li> <li>6. 3<sup>rd</sup> leaf length (cm) (- - ” - -)</li> <li>7. Fresh plant yield (gm) (- - ” - -)</li> <li>8. Fresh plant yield of net plot (kg) ie. leaf yield</li> <li>9. Disease &amp; pest incidence</li> <li>10. Market price (Rs. per kg)</li> </ol>

\* The programme will be carried out at Periyakulam (TNAU) as a testing centre.

<b>New Research Programme: 13</b>	
Crop	<b>Coriander</b>
Title of the programme	Nutrient management in off-season production of coriander leaf
Centre	Guntur, NRCSS, Ajmer, Coimbatore & Periyakulam
Year of start	2010-11
Duration of the Project	Three years
Design	RBD
No. of treatments/genotypes with details	-
	<ol style="list-style-type: none"> <li>1. Control : No fertilizer.</li> <li>2. 30:40:20 NPK</li> <li>4. 45:40 :20 NPK ( P as basal and N &amp; K in two split applications - i.e basal +top dressing)</li> <li>5. 30:40:20 NPK + spraying with GA 5 ppm at 20DAS</li> <li>6. 30:40:20 NPK + spraying with GA 10 ppm at 20DAS</li> <li>7. 30:40:20 NPK + spraying with GA 15 ppm at 20DAS</li> <li>8. 45:40 :20 NPK + spraying with GA 5 ppm at 20DAS</li> <li>9. 45:40 :20 NPK + spraying with GA 10 ppm at 20DAS</li> <li>10. 45:40 :20 NPK + spraying with GA 15 ppm at 20DAS</li> </ol>
No. of replications	Three replications
Plot size/spacing	4.0 m X 2.4 m
No. of plants/plot/treatment	300-400 plants
Date of sowing/planting and Season(kharif/Rabi/Zhiad)	Summer season (February-May)
Lay-out Plan	FRBD with 3 factors and 3 replications
Methodology & Procedure to be adopted Observations to be recorded in detail	<ol style="list-style-type: none"> <li>1. Days taken for germination</li> <li>2. Plant height</li> <li>3. Days to 50% flowering</li> <li>4. Primary branches per plant</li> <li>5. Secondary branches /plant</li> <li>6. Yield/ plot</li> <li>7. Market value / kg.</li> </ol>

New Research Programme: 14	
Crop	Coriander
Title of the programme	Management of stem gall disease of coriander.
Centre	Dholi, Pantnagar, Jabalpur, Kumarganj, Raigarh & Udaipur (Kota)
Year of start	2010-11
Duration of the project	Three years
Design	RBD
No. of treatments	6 T <sub>1</sub> Seed treatment with IISR <i>Trichoderma</i> liquid formulation (@0.40%) + spray at 45, 60 & 75 DAP (@0.40%).* T <sub>2</sub> Seed treatment with IISR <i>Pseudomonas</i> talc formulation (@0.40%) + spray at 45, 60 & 75 DAP (@0.40%).* T <sub>3</sub> Seed treatment with Carbendazim (@0.20%) + spray at 45, 60 & 75 DAP (@0.20%). T <sub>4</sub> Seed treatment with Blitox (@0.20%) + spray at 45, 60 & 75 DAP (@0.20%). T <sub>5</sub> Seed treatment with Hexaconazole (@0.20%) + spray at 45, 60 & 75 DAP (@0.20%). T <sub>6</sub> Seed treatment with Propiconazole (@0.20%) + spray at 45, 60 & 75 DAP (@0.20%). T <sub>7</sub> Control
No. of replications	Three replications
Plot size & spacing	3.0 m X 1.6 m & 30 cm X 20 cm
No. of plants/plot/treatment	300 -400 plants
Date of season	Rabi
Observations to be recorded	1. Observation on disease incidence and severity under different treatments will be recorded. 2. Yield data under different treatments will be recorded.

\* Liquid formulation of *Trichoderma* (10<sup>10</sup> spores/ml) and talc formulation of *Pseudomonas* (10<sup>9</sup> cells/ml) for seed treatment and spraying will be supplied by PC unit, IISR, Calicut.



<b>New Research Programme: 15</b>	
<b>Crop</b>	<b>Cumin</b>
<b>Title of the programme</b>	Survey and identification of casual organism of yellowing in cumin
<b>Centre</b>	Jobner, Jagudan & NRCSS, Ajmer
<b>year of start</b>	Rabi 2010-11
<b>Duration of the project</b>	Three years (will be concluded in Rabi 2012-13)
<b>Design</b>	-
<b>No. of treatments/genotypes with details</b>	Observations to be recorded in endemic areas
<b>No. of replications</b>	Three replications
<b>Plot size/spacing</b>	3 .0 m X 2 .4 m spacing : 30 cm X 5 cm
<b>No. of plants/plot/treatment</b>	480 plants per plot
<b>Date of sowing/planting and season (Kharif/Rabi/Zhiad)</b>	Rabi 2010-11
<b>Lay-out Plan</b>	To be recorded from farmers plot
<b>Methodology &amp; Procedure to be adopted</b>	Survey will be carried out in cumin growing areas and infected plants and soil samples will be collected for isolation of organism causing the disease. The associated organism isolated from the samples will be sent for identification at IISR Calicut/IARI, New Delhi. The soil factors such as pH, conductivity, nutrient status to be analysed.
<b>Observations to be recorded in detail</b>	<ol style="list-style-type: none"> <li>1. Per cent disease incidence in the field</li> <li>2. Soil and plant samples from infected field for isolation of organism</li> <li>3. Frequency of isolation of disease causing organisms</li> <li>4. Recording of pH, NPK &amp; micronutrients of soil</li> <li>5. Weather parameters, previous cultivation history of the field and present crop management practices adopted by the farmers in the infected fields e.g. Date of sowing, fertilizer application and irrigation schedule and crop protection measures applied previous crop , Yield/ha etc.</li> </ol>

<b>New Research Programme: 16</b>		
<b>Crop</b>	<b>Fenugreek</b>	
<b>Title of the programme</b>	Initial evaluation trial on fenugreek -JET-2010	
<b>Centre</b>	Dholi	
<b>Year of start</b>	2010 – 11	
<b>Duration of the project</b>	3 years	
<b>Design</b>	RBD	
<b>No. of treatments</b>	8 genotypes + 2 check	
	V <sub>1</sub> – RM-190	V <sub>6</sub> – RM-197
	V <sub>2</sub> – RM-191	V <sub>7</sub> – RM-185
	V <sub>3</sub> – RM-188	V <sub>8</sub> – RM-198
	V <sub>4</sub> – RM-192	V <sub>9</sub> – Rajendra Kanti (Local check)
	V <sub>5</sub> – RM-194	V <sub>10</sub> – Hisar Sonali (Local check)
<b>No. of replications</b>	Three replications	
<b>Plot size &amp; spacing</b>	3.0 m X 1.5 m & 30 cm X 10 cm	
<b>No. of plants/plot/treatment</b>	150 plants/ plot	
<b>Date of season</b>	Rabi, Sowing time October	
<b>Observations to be recorded</b>	<ol style="list-style-type: none"> <li>1. Height of the plant</li> <li>2. No. of branches per plant</li> <li>3. No. of secondary branches/plot</li> <li>4. Days to 50% flowering umlets/plot</li> <li>5. No. of umbel per plant</li> <li>6. No. umbellets per umbel</li> <li>7. Secondary /unumbellets</li> <li>8. Test weight</li> <li>9. Seed yield kg/ha</li> <li>10. Disease &amp; pest incidence</li> <li>11. Quality parameters</li> <li>12. No. of pods per plants</li> <li>13. Length of pod</li> <li>14. No. of grains per pod</li> <li>15. No. of days to maturity</li> <li>16. Yield per plot or per hectare</li> </ol>	

## Technical Programme (2010-11)

Project Code	Title	Centres
<b>BLACK PEPPER</b>		
<b>PEP/CI/1</b>	<b>Genetic Resources</b>	
PEP/CI/1.1	Germplasm collection, characterization, evaluation and conservation	Chintapalle, Dapoli, Panniyur, Pundibari, Sirsi, Ambalavayal and Yercaud
<b>PEP/CI/2</b>	<b>Hybridization Trial</b>	
PEP/CI/2.1	Intervarietal hybridization to evolve high yielding varieties	Panniyur
<b>PEP/CI/3</b>	<b>Coordinated Varietal Trial (CVT)</b>	
PEP/CI/3.2	CVT 2000 – Series V	Chintapalle, Pampadumpara, Panniyur, Sirsi and Ambalavayal
PEP/CI/3.3	CVT 2006 – Series VI	Chintapalle, Dapoli, Panniyur, Pampadumpara, Pundibari, Sirsi, Ambalavayal, Yercaud / Pechiparai
PEP/CI/3.4	Evaluation of grafts, orthotropic and runner shoots in black pepper	Ambalavayal, Panniyur, Sirsi Yercaud & Thadiyankudassi*
<b>PEP/CM/4</b>	<b>Nutrient Management Trial</b>	
PEP/CM/4.4	Development of organic package for spices based cropping system – Observational trial	Chintapalle, Sirsi, Panniyur, and Dapoli
PEP/CM/4.5	Organic farming in black pepper - 2006	Panniyur, Dapoli, Pechiparai, Sirsi and Yercaud
<b>PEP/CP/5</b>	<b>Disease Management Trial</b>	
PEP/CP/5.1	Adaptive trial on management of <i>Phytophthora</i> foot rot of black pepper in farmers field	Ambalavayal
PEP/CP/5.2	Trial on management of <i>Phytophthora</i> foot rot of black pepper in existing plantation	Chintapalle, Dapoli, Panniyur, Pampadumpara, Mudigere and Sirsi
PEP/CP/5.3	Trial on management of <i>Phytophthora</i> foot rot of black pepper in new plantation	Chintapalle, Dapoli, Panniyur, Pampadumpara, Pechiparai, Mudigere and Sirsi
<b>PEP/CP/6</b>	<b>Pest Management Trial</b>	
PEP/CP/6.2	Management of <i>Erythrina</i> gall was, a popular standard of black pepper	Mudigere

\* Testing centre

<b>CARDAMOM</b>		
<b>CAR/CI/1</b>	<b>Genetic Resources</b>	
CAR/CI/1.1	Germplasm collection, characterization, evaluation and conservation	Mudigere and Pampadumpara
<b>CAR/CI/2</b>	<b>Hybridization</b>	
CAR/CI/2.1	Evaluation of OP progenies under intensive management	Mudigere
CAR/CI/2.2	Hybridization & selection in cardamom	Mudigere
<b>CAR/CI/3</b>	<b>Coordinated Varietal Trial</b>	
CAR/CI/3.5	CVT 2005-series V	Pampadumpara, Mudigere and Myladumpara
CAR/CI/3.6	CVT 2007/2009 -series VI	Mudigere, Pampadumpara, Sakleshpur, Ambalavayal and Myladumpara
<b>CAR/CI/4</b>	<b>Varietal Evaluation Trial (VET)</b>	
CAR/CI/4.1	Initial evaluation trial - I	Mudigere
CAR/CI/4.2	Initial evaluation trial - II	Mudigere
<b>CAR/CM/5</b>	<b>Nutrient Management Trial</b>	
CAR/CM/5.1	Effect of different irrigation schedule and fertilizers on yield of cardamom	Mudigere
CAR/CM/5.2	Effect of fertigation on yield of cardamom through drips	Mudigere & Pampadumpara
CAR/CM/5.3	Organic farming in cardamom	Mudigere & Pampadumpara
<b>CAR/CP/6</b>	<b>Pest and disease management trial</b>	
CAR/CP/6.7	Evaluation of new insecticides/ biopesticide in cardamom against thrips and shoot and capsule borer	Mudigere & Pampadumpara
CAR/CP/6.8	Comparison of effect of chemical treatments as well as biocontrol agents against pseudostems rot of cardamom	Pampadumpara & Mudigere
<b>LARGE CARDAMOM</b>		
LCA/CI	Germplasm of large cardamom	Gangtok
LCA/CI	Initial Evaluation Trial	Gangtok
LCA/CP	Evolving disease & pest tolerant lines in large cardamom	Gangtok
LCA/CP	Integrated pest and disease management in large cardamom	Gangtok

<b>GINGER</b>		
<b>GIN/CI/1</b>	<b>Genetic Resources</b>	
GIN/CI/1.1	Germplasm collection, characterization, evaluation and conservation	Dholi, Kumarganj, Pottangi, Pundibari, Raigarh & Solan
<b>GIN/CI/2</b>	<b>Coordinated Varietal Trial</b>	
GIN/CI/2.1	CVT 2006 – Series VII	Pottangi
<b>GIN/CI/3</b>	<b>Varietal Evaluation Trial</b>	
GIN/CI/3.1	Initial evaluation trial-2010	Dholi
GIN/CI/3.2	Comparative yield trial	Pottangi
GIN/CI/3.3	Genotype X Environment interaction on quality of ginger	Appangala, Ambalavayal, Barapani, Calicut, Chintapalli, Dapoli, Dholi, Kanke, Kalyani, Mizoram, Navsari, Pantnagar, Pasighat, Pottangi, Pundibari, Raigarh & Solan
<b>GIN/CI/4</b>	<b>Quality Evaluation Trial</b>	
GIN/CI/4.1	Evaluation of germplasm for quality	Solan
GIN/CI/4.2	Evaluation of germplasm from other centers	Solan
<b>GIN/CM/5</b>	<b>Nutrient Management Trial</b>	
GIN/CM/5.2	Organic farming in ginger - 2006	Solan, Pundibari, Pottangi, Dholi & Kumarganj
GIN/CM/5.3	Nutrient supplementation through organic manures for growth and yield of ginger	Dholi & Kumarganj
<b>GIN/CP/6</b>	<b>Disease Management Trial</b>	
GIN/CP/6.1	Disease surveillance and etiology of rhizome rot in ginger	Solan & Dholi
GIN/CP/6.2	Biocontrol studies on rhizome rot of ginger	Pottangi
GIN/CP/6.5	Management of rhizome rot in ginger	Chintapalle, Sirsi, Mudigere & Dapoli
GIN/CP/6.6	Management of soft rot of ginger (Biofumigation using Mustard)	Dholi, Solan, Chintapalle, Pundibari, Kumarganj & Raigarh
GIN/CP/6.7	Management of soft rot of ginger (Biofumigation using cabbage)	Dholi, Solan, Chintapalle, Pottangi, Kumarganj, Ambalavayal & Raigarh

GIN/CP/6.8	Management of bacterial wilt of ginger (Biofumigation using mustard)	Dholi, Solan & Pundibari
GIN/CP/6.9	Management of bacterial wilt of ginger (Biofumigation using cabbage)	Dholi, Solan, Ambalavayal & Pottangi
<b>TURMERIC</b>		
<b>TUR/CI/1</b>	<b>Genetic Resources</b>	
TUR/CI/1.1	Germplasm collection, characterization, evaluation and conservation	Coimbatore, Dholi, Jagtial, Kumarganj, Pottangi, & Raigarh
<b>TUR/CI/2</b>	<b>Coordinated varietal trial</b>	
TUR/CI/2.1	Coordinated Varietal Trial - 2009	Ambalavayal, Chintapalle, Jagtial, Dholi, Coimbatore, Kumarganj, Pottangi, Pundibari, Pasighat, Pantnagar, Raigarh & Navsari
<b>TUR/CI/3</b>	<b>Varietal evaluation trial</b>	
TUR/CI/3.1	Initial Evaluation Trial 2006	Kumarganj, Pottangi & Pundibari
TUR/CI/3.2	Initial Evaluation Trial 2010	Pantnagar
TUR/CI/3.3	Initial Evaluation Trial 2009	Dholi
TUR/CI/3.5	Genotype x Environmental interaction on quality	Dholi, Chintapalle, Jagtial, Pottangi, Kumarganj, Pundibari, Coimbatore & Mizoram
<b>TUR/CI/4</b>	<b>Quality Evaluation</b>	
TUR/CI/4.1	Quality evaluation of germplasm	Coimbatore
<b>TUR/CM/5</b>	<b>Nutrient Management Trial</b>	
TUR/CM/5.2	Effect of organic farming in turmeric	Dholi
TUR/CM/5.4	Efficacy of biocontrol agents for control of rhizome rot of turmeric	Pottangi
TUR/CM/5.5	Standardization of water requirement for Turmeric through drip irrigation	Coimbatore, Dholi, Jagtial, Kumarganj, Raigarh, Guntur & Pottangi
TUR/CM/5.6	Standardization of fertigation in turmeric	Coimbatore & Jagtial
TUR/CM/5.7	Effect of micronutrients on turmeric	Dholi, Kumarganj, Pundibari
<b>TUR/CM/6</b>	<b>Processing and post harvest technology</b>	
TUR/CM/6.1	Standardization of processing in turmeric	Calicut & Coimbatore
TUR/CM/6.2	Mechanical harvesting in turmeric (Observational trial)	Coimbatore

<b>TUR/CP/7</b>	<b>Disease Management Trial</b>	
TUR/CP/7.1	Survey and identification of disease causing organisms in turmeric and screening of turmeric germplasm against diseases	Coimbatore, Pundibari, Raigarh & Dholi
TUR/CP/7.2	Management of foliar disease of turmeric	Dholi, Chintapalle, Pottangi, Kumarganj, Pundibari, Jagtial, Raigarh & Coimbatore
<b>TREE SPICES</b>		
<b>TSP/CI/1</b>	<b>Genetic Resources</b>	
TSP/CI/1.1	Germplasm collection, characterization, evaluation and conservation of clove, nutmeg and cinnamon	Dapoli and Yercaud/ Pechiparai
<b>TSP/CI/2</b>	<b>Coordinated Varietal Trial</b>	
TSP/CI/2.1	CVT 1992 - clove	Yercaud & Pechiparai
TSP/CI/2.2	CVT 2001- nutmeg	Dapoli & Pechiparai
TSP/CI/2.3	CVT 2001 - cassia	Pechiparai & Dapoli
<b>TSP/CM/2</b>	<b>Propagation/Multiplication Trial</b>	
TSP/CM/2.1	Softwood grafting in clove	Dapoli
TSP/CM/2.2	Post harvest technology studies in cinnamon	Dapoli & Pechiparai
<b>TSP/CI/3</b>	<b>Disease Management Trial</b>	
TSP/CP/3.1	Management of die back and wilt disease of nutmeg	Dapoli
<b>SEED SPICES</b>		
<b>CORIANDER</b>		
<b>COR/CI/1</b>	<b>Genetic Resources</b>	
COR/CI/1.1	Germplasm collection, description, characterization, evaluation, conservation and screening against diseases	Coimbatore, Dholi, Guntur, Hisar, Jagudan, Jobner & Kumarganj
<b>COR/CI/2</b>	<b>Coordinated Varietal Trial</b>	
COR/CI/2.4	Coordinated Varietal Trial 2009 series VIII	Ajmer, Dholi, Guntur, Hisar, Jabalpur, Jagudan, Jobner, Kumarganj, Navasari, Pantnagar, Raigarh & Udaipur
COR/CI/2.6	Coordinated varietal trial on coriander (Leafy type during off season) CVT 2010	Guntur, Ajmer, Coimbatore & Periyakulam*

<b>COR/CI/3</b>	<b>Varietal Evaluation Trial</b>	
COR/CI/3.1	Initial evaluation trial 2010	Dholi
COR/CI/3.2	Initial evaluation trial 2010 (Leaf purpose)	Pantnagar
COR/CI/3.3	Initial Evaluation Trial 2010 (Seed purpose)	Pantnagar
<b>COR/CI/4</b>	<b>Quality Evaluation Trial</b>	
COR/CI/4.1	Quality evaluation in coriander	Jobner
<b>COR/CM/5</b>	<b>Nutrient Management Trial</b>	
COR/CM/5.3	Identification of drought/ alkalinity tolerant source in coriander	Guntur , Coimbatore, Kumarganj & Jobner
COR/CM/5.4	Production of leafy type of coriander in off season	Kumarganj
COR/CM/5.5	Role of rhizobacteria in growth promotion of coriander	Hisar and Jagudan
COR/CM/5.6	Nutrient supplementation though organic manures for growth and yield of coriander	Coimbatore, Dholi, Hisar, Jagudan, Jobner, Kumarganj & Raigarh
COR/CM/5.7	Effect of micronutrients on yield of coriander	Coimbatore & Dholi
COR/CM/5.8	Irrigation management for sustainable coriander production	Guntur
COR/CM/5.9	Nutrient management in off season coriander leaf production	Periyakulam*, Guntur, Ajmer & Coimbatore
<b>COR/CP/6</b>	<b>Disease Management Trial</b>	
COR/CP/6.2	Survey to identify the disease incidence collection and identification of casual organism	Dholi
COR/CM/6.3	Management of stem gall disease of coriander	Dholi, Pantnagar, Jabalpur, Udaipur, Kumarganj & Raigarh
COR/CM/6.4	Large Scale Demonstration of the role of <i>Rhizobacteria</i> in growth promotion of Coriander	Coimbatore, Guntur, Hisar, Jagudan & Raigarh
<b>CUMIN</b>		
<b>CUM/CI/1</b>	<b>Genetic Resources</b>	
CUM/CI/1.1	Germplasm collection, characterization, evaluation conservation and screening against diseases	Jagudan and Jobner

\* Testing centre



<b>CUM/CI/2</b>	<b>Coordinated Varietal Trial</b>	
CUM/C1/2.3	Coordinated Varietal Trial - 2009	Jobner, Jagudan, Ajmer & Jabalpur
<b>CUM/CI/3</b>	<b>Varietal Evaluation Trial</b>	
CUM/CI/3.2	Initial evaluation trial -2008	Jabalpur
CUM/CI/3.3	Initial evaluation trial-2009	Jobner
<b>CUM/CI/4</b>	<b>Quality Evaluation Trial</b>	
CUM/CI/4.1	Quality evaluation in cumin	Jobner
<b>CUM/CM/5</b>	<b>Nutrient management trial</b>	
CUM/CM/5.1	Identification of drought tolerance	Jobner
CUM/CM/5.2	Role of rhizo.bacteria on growth and yield of cumin	Jagudan & Jobner
<b>CUM/CP/6</b>	<b>Disease Management Trial</b>	
CUM/CP/6.1	Management of wilt and blight diseases in cumin	Jobner
CUM/CP/6.2	Survey for identification of yellowing causing organisms in cumin	Jobner, Jagudan & NRCSS Ajmer
CUM/CM/6.3	Large scale demonstration of the role of Rhizobacteria in growth promotion of cumin	Jagudan & Jobner
<b>FENNEL</b>		
<b>FEL/CI/1</b>	<b>Genetic Resources</b>	
FNL/CI/1.1	Germplasm collection, characterization, evaluation, conservation and screening against diseases	Dholi, Hisar, Jagudan, Jobner & Kumarganj
<b>FNL/CI/2</b>	<b>Coordinated Varietal Trial</b>	
FNL/C1/2.4	Co-ordinated Varietal Trial - 2009 Series VII	Ajmer, Dholi, Hisar, Jabalpur, Jagudan, Jobner, Kumarganj, Pantnagar, Udaipur & Raigarh
<b>FNL/CI/3</b>	<b>Varietal Evaluation Trial</b>	
FNL/CI/3.1	Initial evaluation trial	Hisar, Jobner , Kumarganj & Jagudan
FNL/CI/3.2	Initial evaluation trial-2009	Jabalpur
<b>FNL/CI/4</b>	<b>Quality evaluation trial</b>	
FNL/CI/4.1	Quality evaluation in fennel	Jobner

<b>FNL/CM/5</b>	<b>Nutrient Management Trial</b>	
FNL/CM/5.2	Identification of drought/alkalinity tolerance source in fennel	Kumarganj
FNL/CM/5.3	Role of rhizobacteria on growth and yield of fennel	Jagudan, Raigarh & Hisar
<b>FNL/CP/6</b>	<b>Disease Management Trial</b>	
FNL/CP/6.1	Survey, identification of disease causing organisms and survey of germplasm against disease	Dholi
FNL/CM/6.2	Large scale demonstration of the role of Rhizobacteria in growth promotion of Fennel	Hisar, Jagudan, & Raigarh
<b>FENUGREEK</b>		
<b>FGK/CI/1</b>	<b>Genetic Resources</b>	
FGK/CI/1.1	Germplasm collection, characterization, evaluation conservation and screening against diseases	Dholi, Hisar, Jagudan, Jobner, Kumarganj, Guntur
<b>FGK/CI/2</b>	<b>Coordinated Varietal Trial</b>	
FGK/CI/2.1	Coordinated Variety Trial 2009 Series VII	Ajmer, Coimbatore, Dholi, Guntur, Hisar, Jabalpur, Jagudan, Jobner, Kumarganj, Pantnagar, Raigarh & Udaipur
<b>FGK/CI/3</b>	<b>Varietal Evaluation Trial</b>	
FGK/CI/3.2	Initial evaluation trial 2009	Jabalpur
FGK/CI/3.3	Initial evaluation trial 2009	Jobner
FGK/CI/3.4	Initial evaluatial trial 2010	Dholi
<b>FGK/CM/4</b>	<b>Nutrient Management Trial</b>	
FGK/CM/4.2	Identification of drought/tolerance source in fenugreek	Jobner & Guntur
FGK/CM/4.4	Role of rhizobacteria on growth and yield of fennel	Hisar & Jagudan
FGK/CM/4.5	Large scale demonstration of the role of Rhizobacteria in growth promotion of fenugreek	Jagudan, Jobner, Guntur, Hisar & Kumarganj
<b>FGK/CP/5</b>	<b>Disease Management Trial</b>	
FGK/CP/5.1	Survey and identification of disease causing organisms and screening germplasm against disease	Dholi

**List of participants – XXI Workshop of All India Coordinated Research  
Project on Spices**

**5-6 July 2010, NRCSS, Ajmer, Rajasthan**

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