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PROCEEDINGS OF THE XVIII WORKSHOP OF ALL INDIA COORDINATED RESEARCH PROJECT ON SPICES

25-27 MAY 2006

Indian Institute of Spices Research

Calicut, Kerala

भाकृअनुप
ICAR

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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NATIONAL GROUP MEETING (XVIII WORKSHOP) OF RESEARCH WORKERS OF ALL INDIA COORDINATED RESEARCH PROJECT ON SPICES

25-27 MAY 2006

PROGRAMME

25 May 2006 (Thursday)

08.30 – 09.30		**REGISTRATION**
09.30-10.30		**INAUGURAL SESSION**
		Welcome **Dr. M. Anandaraj** *Project Coordinator, AICRPS, IISR, Calicut*
		Presidential Address **Dr. V. A. Parthasarathy** Director, IISR, Calicut
		Inauguration and Inaugural Address **Dr. K. V. Ramana** Assistant Director General (P C) ICAR, New Delhi
		Vote of Thanks **Dr. M. N. Venugopal** Head, IISR-CRC, Appangala
Rapporteurs	:	Dr. D. Prasath (IISR) Dr. (Mrs.) S. Backiyarani (KAU, Pampadumpara)
10.30 – 11.00		Tea break
11.00-13.30		**SESSION I: GENETIC RESOURCES**
Chairman	:	Dr. V.A. Parthasarathy (Director, IISR)
Co-Chairman	:	Mr. B. Krishnamoorthy (Head, CI & B, IISR)
Rapporteurs	:	Dr. J. Rema (IISR) Dr. K. Giridhar (ANGRAU, Guntur)

Scientists Identified for Presentation

Crop	Genetic Resources
Black pepper	Dr. R. G. Khandekar (KKV, Dapoli)
Cardamom & Vanilla	Dr. K.J. Madhusoodanan (ICRI, Myladumpara)
Ginger	Dr. B.N. Korla (YSPUHF, Solan)
Turmeric	Dr. S. Tripathi (IGAU, Raigarh)
Tree Spices	Dr. (Mrs.) Swarnapriya, (TNAU, Pechiparai)
Coriander	Dr. A.V. Agalodiya (SDAU, Jagudan)
Cumin	Dr. Dhirendra Singh (RAJAU, Jobner)
Fennel	Dr. P.S. Paratap (CCS HAU, Hisar)
Fenugreek	Dr. K. Giridhar (RARS, APAU, Guntur)
Paprika	Dr. K. Giridhar (RARS, NGRAU, Guntur)

13.30 -14.15 : Lunch

14.15–18.00 **SESSION II: CROP IMPROVEMENT**

Chairman : Dr. B.B. Vashishtha (Director, NRCSS)
Co-Chairman : Dr. P.A. Mathew (SIC, IISR-Farm)

Rapporteurs : Dr. R.R. Nair (IISR)
Dr. D.K. Dash (OUAT, Pottangi)

Scientists Identified for Presentation

Crop	Crop Improvement
Black pepper	Dr. V.P. Neema (KAU, Panniyur)
Cardamom	Dr. M.R. Sudarshan (ICRI, Regional Station, Sakleshpur)
Ginger	Dr. D.K. Dash (OUAT, Pottangi)
Turmeric	Dr. N. Bowmick, (UBKV, Pundibari)
Tree Spices	Dr. (Mrs.) Swarnapiriya, (TNAU, Pechiparai)
Coriander	Dr. J. Dixit (NDUAT, Kumarganj)
Cumin	Dr. G.M. Patel (SDAU, Jagudan)
Fennel	Dr. E.V.D.Sastry (RAJAU, Jobner)
Fenugreek	Dr. R.P. Saxena (NDUAT, Kumarganj)

15.45 – 16.00 : Tea

26 May 2006 (Friday)

09.00 -13.30 **SESSION III: CROP PRODUCTION**

Chairman : Dr. J. Thomas (Director, ICRI)
Co-Chairperson : Dr. B. Chempakam (Head, CP & PHT, IISR)

Rapporteurs : Dr.Anke Gowda (IISR)
Dr.M.Dinesh Kumar (UAS -B, Mudigere)

Scientists Identified for Presentation

Crop	Crop Production
Black pepper	Dr. D. Lakshminarayana (ANGRAU, Chintapalle)
Cardamom	Dr. M.Dinesh Kumar (UAS-Bangalore, Mudigere)
Ginger	Dr. J.C. Jana (UBKV, Pundibari)
Turmeric	Dr. (Mrs.) N. Shobha (TNAU, Coimbatore)
Tree Spices	Dr. (Mrs.) Swarnapiriya (TNAU, Pechiparai)
Coriander	Dr. K.K. Thakkral (CCS HAU, Hisar)
Cumin	Dr. N.L. Jat (RAJAU, Jobner)
Fennel	Dr. C.R. Gupta (IGAU, Raigarh)
Fenugreek	Dr. J. Dixit (NDUAT, Kumarganj)

10.30-10.45 : Tea

13.30 – 14.15 : Lunch

26 May 2006 (Friday)

14.15-18.00 : **SESSION IV : CROP PROTECTION**
Chairman : Dr. Srikant Kulkarni
(Head, Dept. PP, UAS-Dharwad)
Co-Chairman : Dr. M.N. Venugopal (Head, IISR-CRC)
Rapporteurs : Dr. A. Kumar (IISR)
Dr. S. Bandyopadhyay (UBKV, Pundibari)

Scientists Identified for Presentation

Crop	Crop Production
Black pepper	Dr. M.S. Lokesh (UAS-D, Sirsi)
Cardamom	Dr. A. Joseph Rajkumar (KAU, Pampadumpara)
Ginger	Dr. N.P. Dohroo (YSPUHF, Solan)
Turmeric	Dr. S. Bandyopadhyay (UBKV, Pundibari)
Tree Spices	Dr. V.A. Gadre (KKV, Dapoli)
Coriander	Dr. K.D. Patel (SDAU, Jagudan)
Cumin	Dr. K.D. Patel (SDAU, Jagudan)
Fennel	Dr. K.D Patel (SDAU, Jagudan)
Fenugreek	Dr. R.P. Saxena (NDUAT, Kumarganj)

15.45 - 16. 00: Tea

27 May 2006 (Saturday)

09.00-12.30 : **SESSION V: IDENTIFICATION OF VARIETIES FOR RELEASE & RECOMMENDATIONS FOR EXTENSION AGENCIES**

Chairman : Dr.K.U.K. Nampoothiri (Director, MSSRF - Kalpetta)
Co-Chairman : Dr. V.A. Parthasarathy (Director, IISR)

Rapporteurs : Dr. T.E. Sheeja (IISR)
Dr. S.K. Malhotra (NRCSS)

Proposals for identifying Varieties for Release

Sl. No.	Center	Crop	Variety	
			Tested Name	Proposed Name
1.	ICRI, Myladumpara	Cardamom	MHC-26	ICRI-5
2.	ICRI, Myladumpara	Cardamom	MCC-73	ICRI-6
3.	Guntur	Coriander	LCC-128	Sudha
4.	Hisar	Coriander	DH-246	Hisar Surbhi
5.	Jagudan	Cumin	JC-2000-72	GC-4 (Gujarat Cumin-4)
6.	Jagudan	Fenugreek	J.Fenu-244	GM-2 (Gujarat Methi-2)
7.	Jobner	Coriander	UD-480	RCr-480
8.	Jobner	Cumin	UC-341	RZ-341
9.	Jobner	Fennel	UF-178	RF-178
10.	Jobner	Fenugreek	UM-351	RMt-351
11.	NRCSS, Ajmer	Anise	A Ani-01-2	NRCSS-AAni-1
12.	NRCSS, Ajmer	Celery	A Cel-01-1	NRCSS-Acel-1

10.30 - 10.44 : Tea

27 May 2006 (Saturday)

12.30 -13.00 : **SESSION VI : ICAR ADHOC SCHEMES**

Chairman : Dr. K.V. Ramana – ADG (PC) (ICAR)
Rapporteurs : Dr. K. Kandiannan (IISR)
Dr. A. Joseph Rajkumar (KAU, Pampadumpara)

ICAR Ad-hoc Schemes:

1. "Studies on salt tolerance in seed spices (Fennel, coriander & fenugreek)" [PI: **Dr. J.L. Mangal**, Professor, Dept. of Vegetable Crops, CCS Haryana Agril.University, Hisar-125 004 (Haryana)]

2. "Conservation and evaluation of Ajowain *(Trachyspermum ammi)* germplasm for identification of high yielding oil genotypes" [PI: **Dr. R.V. Paliwal**, Associate Professor (PB & G), MPUAT, Agril. Research Sub Station, Pratapgarh Dist. Chittorgarh, Rajasthan]

3. "Studies on nematode problems of seed spice crops in Haryana " [PI: **Dr. I.J. Paruthi**, Sr. Nematologist, Dept. of Nematology, CCS Haryana Agril. University, Hisar-125 004, Haryana]

4. "Investigations on the etiology and integrated management rhizome rot of ginger & turmeric in Northern Karnataka" [PI: **Dr. Srikant Kulkarni**, Professor & Head, Dept. of Plant Pathology, College of Agriculture, UAS, Dharward-580 005]

13.00 –14.00 : Lunch

27 May 2006 (Saturday)

14.00 - 15.30 : SESSION VII : PLENARY SESSION

Chairman : Dr. K. V. Ramana – ADG(PC)(ICAR)
Co-Chairman : Dr. M. Anandaraj (PC-Spices)

Rapporteurs : Dr. V. Srinivasan (IISR)
Dr. A.K. Johny (IISR)

Presentation of
Reports : Technical Session I-V

Remarks of Chairman & Co-Chairman
Vote of Thanks : Dr. K. N. Shiva (IISR)

INAUGURAL SESSION

The inaugural function of the National Biennial Group Meeting of research workers of the All India Coordinated Research Project on Spices (AICRPS) was held at Indian Institute of Spices Research, Calicut. About 100 scientists from 15 State Agricultural Universities, Dept. of Horticulture, Dept. of Agriculture, Directorate of Arecanut and Spices Development, Spices Board, farmer's representatives & Agricultural input agencies apart from scientists of IISR, Calicut and NRC on Seed Spices, Ajmer, Rajasthan and officials from ICAR Headquarters, New Delhi attended the meeting.

Dr M. Anandaraj, Project Coordinator, AICRPS, IISR, Calicut welcomed the dignitaries and delegates. He has briefed about the salient achievements of AICRPS for the last two years since XVII Workshop, especially in enriching the germplasm and their evaluation. He highlighted that 86 lines have been identified from various centres for yield and 36 for quality parameters. He also mentioned about the performance of AICRPS centre as assessed by using the criteria developed by ICAR. About 20% of the centres have scored excellent grading and he urged every centre to strive hard to get such ranking.

The meeting was presided over by Dr. V. A. Parthasarathy, Director, IISR, Calicut. In his presidential address, Dr V. A. Parthasarathy stressed the need for an introspection and reorientation of research projects to develop cost effective organically produced spices to compete in the international market. He also suggested to include North Eastern States in AICRPS.

Dr K.V. Ramana, Assistant Director General (PC), ICAR, New Delhi inaugurated the meeting. He forecast a 26% reduction in black pepper production in Kerala in 2005-06 and pointed out the need to evolve strategies to combat poor yields. Drought management, reducing the cost of production and scientific basin management should be the immediate focus, he said.

Dr. M.N. Venugopal, Head, Cardamom Research Center, Appangala (Karnataka) proposed the vote of thanks.

PROJECT COORDINATOR'S REPORT

The All India Coordinated Research Project on Spices is vested with the mandate to conduct and coordinate research in 12 spice crops with the headquarter at Indian Institute of Spices Research, Calicut. AICRPS has at present 19 centres spread over 14 states based in 15 SAUs. In addition 4 Voluntary Centres including Indian Cardamom Research Institute (Spices Board) are collaborating with this project. The budget of AICRPS is Rs. 700 lakhs during X Plan period with Rs. 150 lakhs (ICAR share) during 2005-2006. About 112 research projects covering the mandate spice crops are being operated at various centres.

The XVIIIth AICRPS Workshop was held at Indian Institute of Spices Research, Calicut during 25-27 May 2006. The deliberations were on the progress of research made during 2003-04 and 2004-05. New need based research programmes were formulated, discussed and finalized in the workshop. The highlight of this workshop was the identification and recommendation of 12 new varieties of spices *viz.*, 2 in cardamom, 3 in coriander, 2 each in cumin and fenugreek, one each in fennel, celery and anise for presentation before central/state variety release committee. Several technologies were also identified in the workshop for transfer to extension agencies for different crops. The new technologies which were identified are integrated nutrient management using biofertilizers in spices crops *viz.*, black pepper, ginger, turmeric, cumin, fennel, fenugreek for different states. The technology under crop protection includes management of cardamom root grub, biocontrol of root rot in Fenugreek, management of leaf blotch and leaf spot in turmeric, biocontrol of rhizome rot in turmeric, management of *Phytophthora* disease in black pepper nursery, control of *Phytophthora* disease of black pepper in the field, were identified and recommended for transfer to extension agencies.

The salient achievements made by AICRPS during 2003-04 and 2004-05 2005-06 in different spice crops are as follows:

CROP IMPROVEMENT

In crop improvement, 54 projects have been carried out in various centres in 11 crops. The centers enhanced genetic resources of spice crops and the germplasm holdings of AICRPS centres are 612 accessions in black pepper, 273 in cardamom, 603 in ginger, 1332 in turmeric, 202 in tree spices and 3961 in seed spices. The promising germplasm are identified through CVTs, IETs are 86 lines for yield and 36 lines for quality attributes.

CROP PRODUCTION

In crop production, 30 programmes were in operation in various centres consisting of 4 each in black pepper, cardamom, ginger, turmeric and fennel, 2 in tree spices, 3 in coriander, 3 in fenugreek and 2 in cumin.

Black pepper and Cardamom

Studies indicated beneficial effect of supplementing biofertilizers *viz.*, *Azospirillum* (50 g) and phosphobacteria (50 g) separately or in combination with recommended inorganic fertilizer in enhancing the yield of black pepper and cardamom. Similarly traditional nutrient sources like burnt earth (10 kg) and wood ash (2 kg) along with farm yard manure (10 kg) was promising in increasing black pepper yield (6.43 kg/vine).

Ginger and Turmeric

Application of inorganic nitrogen 100% + *Azospirillum* (50g) per bed + 5kg FYM schedule proved better in augmenting ginger yield. Similarly application of inorganic nitrogen + *Azospirillum* 50g/bed + 5kg FYM recorded maximum yield in turmeric. In organic farming trial in ginger and turmeric, recommended dose of fertilizers registered maximum yield of 17.87 t/ha in ginger and 26.02 t/ha in turmeric at Raigarh and 18.65 t/ha in ginger and 18.29 t/ha in turmeric at Pottangi and 25.03 t/ha in turmeric at Pundibari centres, while application of FYM 10 kg + pongamia oil cake + neem oil cake + sterameal + rock phosphate + wood ash, each 250 g/bed recorded higher yield of 23.67 t/ha in ginger at Dholi centre. Application of zinc sulphate @ 25.0 kg/ha produced maximum ginger yield (20.27 t/ha) at Dholi centre.

Seed Spices

In coriander, micronutrient spray *viz.*, $ZnS0_4$ + $FeSO_4$ + $CuSO_4$ + $MnSO_4$ (each at 0.5%) recorded the higher yield (940 kg/ha). Application of 100% inorganic N + *Azospirillum* @ 1.5 kg/ha + 5 t FYM/ha resulted in maximum seed yield in coriander (3.45 t/ha), cumin (323 kg/ha) and fennel (1.16 t/ha), whereas 100% inorganic N alone gave the highest yield (1.256 t/ha) in fenugreek at Jobner centre. However, maximum yield was obtained in coriander, fennel and fenugreek with the application of 10t/ha of FYM + 1.5 kg/ha of *Azospirillum* as seed treatment at Kumarganj (U.P.) conditions. At Coimbatore conditions, application of FYM 5t/ha + *Azospirillum* 1.5 kg/ha as seed treatment along with inorganic N 50% and 100%, produced the highest yield in coriander (738 kg/ha) and fenugreek (685 kg/ha), respectively. In coriander, spray of bioregulator, Triacontanol @ 0.5%, thrice at 40, 60 and 80 days after sowing significantly increased the yield (1.46 t/ha) at Dholi conditions, while highest yield (1.50 t/ha) was achieved with spraying of Triacontanol @ 1.0%, thrice at 40, 60 and 80 days after sowing at Kumarganj conditions. However, maximum yield of 1.01 t/ha only was obtained with spraying of NAA 10 ppm, twice at 40 and 60 days after sowing at Guntur conditions.

CROP PROTECTION

In crop protection, 28 projects were in progress viz., 6 in black pepper, 4 in cardamom, 5 in ginger, 4 in turmeric, 1 in tree spices, 5 in coriander, 2 in cumin and 1 in fenugreek.

Black pepper and Cardamom

Planting of black pepper cuttings in solarized soil fortified with *Trichoderma harzianum* @ 1g/kg soil and VAM inoculum @ 100 cc/kg soil was found ideal for production of healthy rooted cuttings at Chintapalle, Pampadumpara and Dapoli centers. For the control of *Phytophthora* foot rot disease application of Potassium phosphonate (Akomin 5ml/l) as spray and drench twice during pre-monsoon (first week of June) and post monsoon (Second week of August) periods along with soil application of *T. harzianum* (10^7 cfu e 50g/vine) with one kg of neem cake recommended by Pampadumpara and Ambalavayal (KAU), Sirsi (UAS, Dharwad) and Mudigere (UAS-B) centres. Application of Ridomil Gold MZ (Metalaxyl formulation) (2.5 g l^{-1}) and *T. harzianum* was effective for controlling foot rot disease of black pepper in the field at Panniyur centre. However at Mudigere centre, spraying and drenching with Bordeaux mixture (1%) during May/June and July-August was most effective in controlling foot rot of black pepper.

At high altitude areas, maximum reduction of anthracnose disease in black pepper could be achieved by spraying carbendazim + mancozeb 0.1% as foliar spray or carbendazim 0.1% or Bordeaux mixture 1% thrice at Pampadumpara and at Mudigere, the same results could be achieved by three sprays of 1% Bordeaux mixture during the last week of May, July and August. Spraying of monocrotophos 0.05% was effective for the management of scale insects of black pepper at higher altitudes at Pampadumpara.

In cardamom, root grub *Basileptu fuluicorne* (Jocobz) can be checked effectively by soil drenching with Imidacloprid 0.015% (5l/plant) or chlorpyrifos (0.07%) (5l/plant) or application of carbofuran c 3.0g ai/ clump (10-15 cm around the plant). Removal of cover and forking of soil prior to application of insecticides is also recommended.

Ginger and Turmeric

Rhizome rot of ginger could be controlled by treating the seed rhizomes with hot water at 51°C for 10 minutes and followed by treating with *Trichoderma harzianum* mixed with neem cake for 30 minutes. However, in turmeric, maximum reduction of rhizome rot was obtained by seed and soil application of *T. viride* and *Pseudomonas fluorescens* @ 12.5 kg and 25.0 kg/ha, as basal and top dressing, respectively along with recommended application of NPK and FYM. Seed treatment as well spraying with mancozeb + carbendazim (0.2% each) is the best treatment against leaf blotch and leaf spot of turmeric. The treatment including seed dressing as well as soil application of *T. viride and Pseudomonas fluorescens* @ 12.5kg/ha and 25kg/ ha as basal and top dressing respectively along with application of recommended NPK + FYM is the best treatment against rhizome rot of turmeric.

Tree Spices

In clove, leaf rot, leaf spot and die back were the most common diseases in Konkan region of Maharashtra reported by the survey conducted by the Dapoli centre.

Seed Spices

In coriander, minimum wilt incidence with maximum yield (818 kg/ha) was recorded with the *T. harzianum* applied as seed treatment as well as soil application. Powdery mildew could be effectively managed by applying carbendazim as soil drench and spray (0.01%). In cumin, maximum yield was obtained by checking both blight and wilt diseases with mancozeb @ 0.25% at 40, 50, 60 and 70 days after sowing. Soil application of *T. viride* @ 5kg/ ha at 20 days after sowing and soil application of neem cake @150kg/ ha are recommended for biocontrol of root rot in fenugreek.

Technology Assessment

Under the Assessment of Technology in farmers field, a total of 20 promising technologies in spices are being operated in 14 centers at farmers' field with 100% assistance from ICAR.

Planting material

The centres are also involved in the multiplication and distribution of nucleus planting materials of high yielding varieties of spices.

I am grateful to the Dr. G. Kalloo, Dy. Director General (Hort.) and Dr. K. V. Ramana, Asst. Director General (PC), ICAR and Dr. V. A. Parthasarathy, Director, IISR for all the guidance and support extended to me to discharge my duties. I also place on record the good work carried out and the support and cooperation extended by the scientists working in various centers of AICRPS for the successful running of the project and achieving the target. The untiring efforts of the staff at Project Coordinator's unit for the organization of meetings, bringing out proceedings and publication of reports is thankfully acknowledged.

ACTION TAKEN REPORT ON THE RECOMMENDATIONS OF THE XVII WORKSHOP ON SPICES HELD AT IISR, CALICUT DURING FEBRUARY 2004 AND ON THE EARLIER DECISIONS

Sl. No.	Decision	Action taken
	GENERAL	
1.	It was emphasized to get IC numbers for the collections to avoid duplication and registration of pre-released varieties for their special characters with supporting document with NBPGR for protecting the rights	The promising accession of spices have been evaluated and minimum descriptor has been prepared by NRCSS would be used for collection of passport data and the same submitted to NBPGR, New Delhi.
2.	For all the germplasm accessions of all the crops maintained at each center, the accession number of the center from where it is collected and also IC No. should follow the center's accession number, if obtained in parenthesis to avoid duplication and to identify the original source of the accession.	Suggestion accepted by all centres. Accession numbers are assigned likewise and action initiated for obtaining IC numbers from NBPGR by Pampadumpara. Hisar centre got the IC number for the fenugreek variety HM-350, HM-346, and the proposals for the fenugreek variety HM- 103 in Coriander and DH- 36 submitted to NBPGR.
3.	Due recognition/ credit should be given to be organization/ scientist which / who made the germplasm collection while proposing the entry for release, research publication etc. (Action: All centers).	Suggestion accepted and will be followed by all centres and due recognition given to all in Varietal release/ research publication.
4.	The centers are requested to collect the local germplasm rather than collecting it from the Headquarters and other centers	Suggestion accepted. The Pampadumpara centre collected local cardamom accessions from the farmers field. The other centres are required to do so.
5.	One set of germplasm from AICRPS centre should be sent to IISR, Calicut / NRCSS, Ajmer and NBPGR, New Delhi	The centres viz., Dapoli, Dholi had supplied the germplasm of the respective crops.
6.	IC number of germplasm should be mentioned in the reports, wherever it is available	It will be done.
7.	Characterization and documentation may be done in seed spices before June 2005 with the descriptor developed by NRCSS, Ajmer.	Descriptor developed by NRCSS has been given to all centres. Characterization and documentation of seed spices would be done as per the Proforma, during 2006-07.
8.	List of exotic germplasm to be introduced should be submitted to PC by the end of 2004	NRCSS submitted the proposals to the Council.

Sl. No.	Decision	Action taken
9.	Performance of exotic germplasm introduced so far from the beginning should be prepared and submitted to the PC by August 2004.	The report on exotic germplasm submitted by the Jobner Center has been forwarded to NBPGR.
10.	New varieties identified should emphasize not only on yield but also on chemical constituents, tolerance to biotic and abiotic stresses.	New varieties proposals of/are provided with data on yield and all other parameters.
11.	Passport data of the germplasm accessions should be sent to Project Coordinator immediately for forwarding it to NBPGR, New Delhi for assigning IC numbers	Information regarding passport data is under process. Minimum descriptor of black pepper has been prepared and has been submitted by Sirsi and Mudigere centres.
12.	The superior performing entries must be analyzed for quality attributes	The best performing RH -5 in turmeric at Dholi centre had been submitted for curcumin analysis at Spices Board, Cochin.
13.	Committee may be constituted by Director, ADG & PC to scrutinize the projects & uniform testing of lines.	Suggestion made by committee will be implemented.
14.	Uniformity in plant population, management, date of planting etc have to be followed.	Suggestion accepted and uniformity experimental materials are always ensured, necessary guidelines provided in the workshop proceedings.
15.	In all annual crops, only CVT & IET have to be conducted & close all series I, II, III, IV barring V.	Suggestion accepted.
16.	As there is no Agronomist in position at Jagudan center, nutritional trial on cumin may be kept under suspension.	Suggestion accepted.
17.	Yield attributing parameters to be recorded or to be specified	Done accordingly.
18.	New trial on development of organic package for spices based cropping system may be initiated for Dapoli center	The trial has been initiated with set of treatments suggested in workshop for Dapoli center.
19.	Procedures for grading disease and pest severity of various pests and diseases in seed spices have been discussed and formulated for use.	Noted and will be used as and when necessary.
20.	Reproductive biology of seed spices should be given as post graduate /Ph.D work and thoroughly studied	In the past the work had been carried out at Dholi at horticulture centre Sabour and at present the other department specially plant pathology and entomology have started this work on seed spices.
21.	Entry without having the data on quality parameters may not be promoted to CVT	Followed accordingly.

Sl. No.	Decision	Action taken
22.	All the trials conducted under crop production should also generate data on *quality analysis.*	The quality parameters for ginger, turmeric are done at Solan and Seed Spices at Jobner. The *centres are advised to send the samples for* analysis.
23.	Nutrient status of soil before conducting experiment and after harvest should be carried out in all the trials in crop production.	Nutrient status is recorded in all the experiments before taking up the trials. However, nutrient status is recorded after the trials wherever necessary.
24.	Meteorological data should be recorded in standard weeks	Meteorological data recorded according to standard weeks.
25.	The experiment on efficacy of biofertilizer trial concluded, new trial shall be formulated in seed spices	The programme under crop production have been discussed and new programmes drawn up during the XVIII Workshop.
26.	For agronomic and fertilizer trials in seed spices uniform plot size of 4.0 x 2.7m may be adopted by all seed spices centres	Experiments were laid out in 4.0 x 2.7 m plot size at all locations.
27.	Research on herbal spices may be considered under AICRPS	Under Horticulture mission the Dholi centre had started the work on this aspects. May be considered during XI plan EFC preparation.
28.	In all the organic manuring experiments, same plot may be maintained for treatment imposition over the period at all centres	The centres have taken note of this suggestion.
	BLACK PEPPER	
29.	The experiment PEP/CP/1.4 Control of *Phytophthora* disease in black pepper in farmer's field-observational trial will continue. The details of observations to be recorded.	Observations were recorded as per specification (Both for defoliation and yellowing at regular intervals) by all centers working on black pepper. The experiment is being conducted at Sirsi and observations were recorded accordingly. The seed and soil samples were sent to IISR, Calicut for residue analysis of Metalaxyl Gold MZ 68 WP during Feb and March 2005.
30.	Rapid multiplication trial (PEP/CM/3.1) may be closed at Dapoli center and final report should be submitted to P.C.	Rapid multiplication trial has been closed at Dapoli center and final report has been submitted.
31.	The Dapoli center should focus on major and serious diseases of black pepper during the survey.	The center is focusing on serious diseases of black pepper, nutmeg and clove.
32.	The data on CVT 1987 series III and CVT 1991 series IV of all the centers may be sent to Project Coordinator for analysis and the experiment to be concluded.	Final report received from Sirsi and Panniyur centres. Continued.
33.	CVT 2000 – series V would continue at all the centers	Sirsi, Panniyur centre submitted the final reports.

Sl. No.	Decision	Action taken
34.	Trial on irrigation (PEP/CM/1.1) at Sirsi and Panniyur centers may be closed and the final report should be submitted to Project Coordinator	
35.	Development of organic package for spices based cropping system – observational trial	Initiated a project titled "Development of organic package for spice based cropping system"
36.	Enrich the local germplasm by exploring the potential areas at Chintapalle	Chintapalle centre must take up collection in eastern ghats.
37.	Evaluate the performance of Narayakodi and Thevarmundi as adoptive trail in the farmers field at Chintapalle	Action was taken, rooted cuttings were supplied.
	CARDAMOM	
38.	The title of the project (CAR/CI/2.1 Evaluation of synthetics and OP progenies) may be modified as "Evaluation of OP progenies under intensive management" and the project will continue	Modified as suggested.
39.	A new trial under CAR/CI/2.2 Hybridization may be initiated at Mudigere	Trial has been initiated during 2005.
40.	CVT 1991-1998 Series II may be concluded	Concluded and report submitted.
41.	Both the trials CAR/CI/3.2 CVT 1991/ 1998-Series III with Malabar types and CAR/CI/3.3 CVT 1991/1998 – Series III with Mysore types at all the Centers may be concluded since these trials were conducted for more than 3 years. The final reports of the projects have to be submitted to Project Coordinator	Concluded and report submitted by all the centres.
42.	CVT 2000- Series IV CAR/CI/3.4 CVT 2000- Series IV will be continued at all the centers	The trial is continued at the respective centres.
43.	A new trial (CAR/CI/3.5 CVT 2004) is proposed (Action: Myladampara, Pampadampara, Mudigere and Thadiyankudisai Centres).	Trial was initiated during the 2005.
44.	Both the trials CAR/CI/4.1 Yield evaluation of open pollinated seedling progenies (VET-I) and CAR/CI/4.2 Yield evaluation of promising cardamom selection (VET-II) may be concluded	Concluded and report has been sent by the Mudigere centre.
45.	The title of the project (CAR/CI/4.3 yield evaluation of promising cardamom selections (VET-III) may be modified as	Modified as suggested.

Sl. No.	Decision	Action taken
	"Initial evaluation trial (IET-I)" and the trial will be continued (Action: Mudigere Center)	
46.	Screening of cardamom clones for abiotic stress may be closed as there is no Plant Physiologist at Mudigere center and due to the poor stand of the crop	This experiment closed at Mudigere centre.
47.	The cardamom germplasm materials (drought tolerant lines) may be maintained under germplasm	Maintained in germplasm block at Mudigere.
48.	The titles of CAR/CM/1.4 may be changed as "Effect of bio-fertilizers, *Azospirillum* on yield of cardamom" and CAR/CM/1.5 as "Effect of bio-fertilizers, P-solubilizer on cardamom".	Done accordingly.
49.	Treatments decided in the workshop for all the experiments should be strictly followed.	Followed accordingly.
50.	The trial CAR/CP/2.1 Evaluation of plant based insecticides for the control of thrips and fruit borers in cardamom was conducted for 3 years at Mudigere center and the results indicated that none of the plant based insecticides was effective in controlling either thrips or fruit borers. Hence, it was suggested to conclude the trial and the final report should be submitted to PC	Concluded and report has been submitted by to the Project Coordinator by the Mudigere centre.
51.	Infestation due to shoot fly in cardamom may be initiated as an observational trial at Mudigere and other Centers this year	The experiment will be initiated at Mudigere and other cardamom centres.
52.	The project CAR/CP/2.3 Bio-ecology of natural enemies of major pests of cardamom should be initiated immediately at Mudigere Center	Initiated at Mudigere as per guidelines.
53.	The trial CAR/CP/2.4 Estimation of quantitative losses due to thrips damage has to be initiated and the uniform procedure has to be followed	Initiated at Mudigere and Pampadumpara and cardamom capsules affected with thrips were sent to Calicut for qualitative analysis.
54.	The trial PEP/CP/2.3 Management of scale insects of black pepper with organic products.	Initiated during 2005-06 (Due to non availability of fish oil rosin as one of the treatment, it was not taken up during 2004-05).
55.	A set of drought tolerant types collected by Dapoli center has to deposit at IISR, Calicut	Rooted cuttings of black pepper reported as tolerant has been prepared and supplied to IISR, Calicut-in June 2006 for further study.

Sl. No.	Decision	Action taken
56.	Proper irrigation should be given to all the cardamom experimental plots at Mudigere to obtain the potential yield	Minor jet sprinkler irrigation facilities is being laid out for regular irrigation at Mudigere.
57.	It was suggested that the minimum yield level has to be specified for considering any cardamom accession as promising. Accordingly the accession giving a minimum cumulative (3 years) yield of 300 g/ clump (dry) can be considered as promising line and can be further evaluated	Noted and considered by all cardamom centres.
58.	Organic carbon, available nitrogen, population of microorganisms may be monitored in the experiments CAR/CM/ 1.4 and 1.5- cardamom	Chemical analysis is being carried-out. Population of microorganism not monitored due to lack of facility at Mudigere.
59.	Characterization of the remaining 99 cardamom germplasm accessions (out of 256 accessions) of the Mudigere centre as per IPGRI Descriptor has to be completed.	As a part of characterization, all the available accessions were screened at Mudigere. Out of mentioned 256, now we are having 132 accessions at Mudigere. During the season, another 20 accessions from different sources were collected and initiated the characterization.
60.	List of germplasm collections of Mudigere centre (other than the accessions obtained from other coordinating enters) may be sent to PC Unit to obtain IC No. from NBPGR.	Mudigere centre is advised to follow the suggestions.
61.	A set of promising/potential cardamom germplasm accessions of Mudigere may be deposited at IISR (CRC, Appangala)	Mudigere centre may deposit the accessions under intimation to Project Coordinator.
62.	Byrapur and Kalasa areas of Western Ghats have to surveyed intensively for cardamom germplasm during 2004-05 by Mudigere	The work has to be completed during the season 2006-07.
	GINGER	
63.	Comparative yield trials CYT I & II	It has been done and reported in 2004-05.
64.	Initial evaluation may be continued at Solan	It has been continued and reported in 2004-05 report.
65.	Quality analysis of ginger may be carried out by all the centres. The facility available at Solan Centre may be utilized for the analysis	The ginger samples of all centers working on ginger are analysed at Solan centre.
66.	GIN/CM/1.1 Efficacy of biofertilizer using *Azospirilum* on ginger" may be concluded and the final report may be submitted to the P C	The experiment is closed and the final report submitted by the ginger centres.

Sl. No.	Decision	Action taken
67.	The quality analysis of ginger of different treatments under the project GIN/CM/1.1 and GIN/CM/1.2 is to be done with the help of Solan centre	The Solan centre has conducted, the analysis and results submitted in 2003-04 report.
68.	Under organic farming (GIN/CM/1.2) the quality analysis to be done and final report to be submitted to P.C.	The analysis has been done and the final report submitted.
69.	The trial GIN/CP/1.1 Integrated management on rhizome of ginger may be modified as Disease Surveillance and etiology of rhizome rot of ginger	It has been conducted accordingly and results presented in 2003-04 and 2004-05 reports.
70.	The trial GIN/CP/1.4 "Integrated management of *Pythium, Fusarium* and *Ralstonia* of ginger was formulated in the XVI workshop and allotted to Solan.	The trial is conducted accordingly and the results are presented in 2003-04 and 2004-05 annual reports.
71.	Standard bed size (3x1 m) has to be followed	Being followed.
72.	Since Raigarh center is identified as a hotspot area for soft rot of ginger germplasm from all coordinating centres should be collected and screened.	The centre is directed to collect the ginger germplasm from ginger centres.
73.	Comparative yield trial I & II will be concluded at Raigarh	Action already taken and final report has been submitted.
74.	Scientist of Raigarh center may contact to Plant Protection Division IISR.	Plant pathologist has already discussed PC during his visit in October 2004.
75.	Quality analysis of Ginger of different treatments, Gin/ CM/ 1.1 at Gin/CM/ 1.2 carried out with the help of Solan centre.	Analyzed from University headquarters. At Kumarganj yield / plot in all treatments were poor to send to quality analysis.
76.	The trial GIN/CP/1.2, Biocontrol studies in rhizome rot of ginger to be continued	Trial already conducted during 2004-05 and 2005-06.
77.	The trial GIN/CP/1.4 should be conducted at Raigarh center	Already conducted at this centre.
78.	Quality analysis of ginger is to be carried out	Samples were sent for the quality Analysis.
79.	The trial GIN/CP/1.2 Biocontrol studies will continue	Experiments conducted and results reported this year.
80.	Pundibari centre has to collect ginger germplasm from North Eastern region and Sikkim	Germplasm collection from NE region and Sikkim has not been completed, to be taken up during 2006-07.

Sl. No.	Decision	Action taken
	TURMERIC	
81.	Programme on turmeric can be deleted from Solan as this is not a traditional area for turmeric and the existing germplasm at this centre has to be transferred to IISR/ Pottangi. However the centre can maintain a set of the germplasm under the University project.	Decision followed.
82.	Data on quality analysis under the trial TUR/CM/1.1 has to be completed and final report should be sent to the P.C.	It is done and the final report submitted.
83.	The experiment TUR/CM/1.1 and TUR/ CM/1.2 are to be continued.	These trials were continued.
84.	Quality parameters are to be analyzed in Turmeric.	Samples were sent for analysis.
85.	The trial TUR/CP/1.1 will be continued at Raigarh center	The survey has already been made in the state.
86.	The trial TUR/CP/1.3 may be closed.	The trial was closed and final report has been submitted.
87.	Data on Turmeric CVT-2000- Series V may be concluded and the data may be sent to Project Coordinator for analysis.	Data was communicated to the Project Coordinator by Chintapalle.
88.	Quality parameters especially curcumin content in turmeric may be analysed.	Action was taken at Chintapalle during 2005-06.
89.	Turmeric accessions which recorded curcumin above 5% at Coimbatore centre may be sent to Spices Board, Cochin for confirmation.	The samples recorded curcumin content above 5% (16) were sent to Spices Board, Cochin for the confirmation of the results. The results showed that none of the above 16 sample recorded more than 5 % curcumin.
90.	The data of the trial "Impact of environment on quality of turmeric" (TUR/CI/4.2) should also contain the details of environmental characters.	The data on environmental parameter has been included by Coimbatore.
91.	The title of the project TUR/CM/1.1 may be changed as a effect of biofertilizers, *Azospirillum* on turmeric.	The title of the project was changed as per the instruction by Coimbatore.
92.	The trial TUR/CP/1.1 survey and identification of disease causing organisms in turmeric and screening germplasm against disease will continue at all the centres.	The experiment is being continued as per the instruction. The trial has been conducted and the result will be presented.
93.	Effect of seed treatment on leaf spot and leaf blotch disease TUR/CP 1.3 may be closed.	The experiment is closed at Kumarganj, Pundibari and Raigarh centres.

Sl. No.	Decision	Action taken
94.	The experiments TUR/CM/1.1 under nutrient management trial to be continued.	The experiment is continued as per the instructions at Coimbatore.
95.	Data on quality analysis under the trial TUR/CM/1.1 has to be completed and final report should be sent to Project Coordinator.	The samples will be sent for analysis after harvest of 2005 –2006 trial is over. The final report will be sent after the harvest of the rhizome by Coimbatore.
96.	The trial TUR/CP/1.4: Investigations on casual organism of rhizome rot of turmeric and screening of biocontrol agents for the management will be conducted.	The experiment is being continued at Coimbatore as per the instruction. The causal organism was Pythium aphanidermatum.
	TREE SPICES	
97.	Rootstocks other than jamun may be tried for softwood grafting in clove.	Trial has been initiated in April 2005 by taking three rootstocks.
98.	Trial for the management of major diseases of tree spices should be initiated.	The trial on management of leaf rot of clove has been initiated.
99.	The trials in Nutmeg (CVT 2001) and Cassia (CVT 2001) will continue at Sirsi.	Plant population is insufficient to continue the experiment.
100.	The Cinnamon project may be closed at Pechiparai.	The trial closed and completion report submitted.
	CORIANDER	
101.	Since Jagudan is a hotspot area for powdery mildew disease, the germplasm can be tested for their reaction to disease at this centre.	Germplasm of coriander screened for powdery mildew.
102.	CVT 2001- Series V will continue at all the centers.	Suggestion accepted.
103.	The quality analysis of entries of Jagudan center may be undertaken at Jobner center and the analysed data may be sent to Jagudan center.	Suggestion accepted.
104.	Coriander seed samples may be sent for quality analysis to Jobner for coriander and Fenugreek to Coimbatore.	Instructions followed and the centre were directed to supply the seed samples.
105.	CVT-1993-Series II, CVT-1996-Series III and CVT-1998-Series-IV be concluded and pooled data sent to PC before August 2004.	Data regarding all the concluded CVTs was submitted along with annual reports.
106.	Nutrient management trial on Coriander may be closed and new project may be taken up after carrying out quality analysis	The Kumarganj centre has been directed to close the trial.
107.	CVT-2001-Series V will continue at all the centers.	CVT-2001 continued and concluded in 2004-05. The final report was submitted along with the annual report of 2004-05.

Sl. No.	Decision	Action taken
108.	COR/CM/1.3 – Effect of Bioregulators on Coriander.	New trial initiated at Chintapalle.
109.	COR/CM/1.4 – Identification of drought tolerance source in Coriander.	New trial initiated at Chintapalle.
110.	COR/CI/2.5 – CVT – Production of leafy type coriander during off-season.	New trial initiated at Chintapalle.
111.	The coriander germplasm should be sent to Jagudan centre for their reaction to powdery mildew disease.	Hisar centre sent to Jagudan.
112.	The quality analysis is to be done and the project COR/CM/1.2 will be concluded.	A total of 10 samples have been sent to AICRP, Rajasthan centre for the estimation of essential oil and oleoresin content by Coimbatore. The experiment concluded at Jobner and final report submitted.
113.	The trial COR/CP/1.2 management of wilt and powdery mildew disease in coriander will be closed and final report submitted.	The project is closed and completion report has been submitted.
114.	In view of the continuance of CVT series V in Coriander and Fenugreek, a new CVT has to be initiated in 2003-04.	New CVT initiated in Coriander and Fenugreek accordingly.
115.	For conducting CVT, 100 g of each seed sample must be supplied to coordinating centers.	Seed dispatched accordingly.
116.	COR/CP/1.3: Management of powdery mildew and stem gall in coriander may be closed	This experiment has been carried out at Coimbatore. The result will be presented. Trial conducted in other centres and report submitted.
	CUMIN	
117.	Hybridization trials at Jagudan center may be continued using marker characters like hairiness, white colour of flower and nonsplitting in cumin. However, the programme need not be continued as a coordinated programme of AICRP on spices.	Action followed.
118.	CVT 1999 – Series IV of cumin may be concluded at the centers. (Action: Respective centers).	Suggestion accepted.
119.	CVT 2001 – Series V trials may continue at all the centers for one more year. (Action: Respective centers).	Suggestion accepted.
120.	Initial evaluation trial at Jagudan center may be concluded. The trial would continue at Jobner center. (Action: Jagudan and Jobner centers).	Suggestion accepted.

Sl. No.	Decision	Action taken
121.	The quality analysis of cumin entries from Jagudan center may be undertaken at Jobner center and the report may be sent to Jagudan center (Action: Jobner and Jagudan centers).	Action followed.
122.	Germplasm of released varieties in Cumin should be supplied to Raigarh centre	The released cumin varieties of Jobner were supplied to Raigarh.
123.	Each centre should send 20 entries of cumin during this year to Jagudan.	The entries were supplied by Jobner and Kumarganj.
124.	Integrated management of pest and diseases of cumin CUM/CP/2.1 will be closed at Jobner and Jagudan centre	The directions followed.
	FENNEL	
125.	Coordinated varietal trial CVT 1997 – Series III may be closed at all the centers. A new CVT may be taken up.	Trial CVT-1957 series III closed and new trial CVT (FNL/CI/3.3) CVT- 2004 started and results included in Annual report 2004-05. A new CVT series-V continued.
126.	CVT 2001 – Series IV and Initial evaluation trials in fennel may be continued at all the centers.	Suggestion accepted.
	FENUGREEK	
127.	CVT 1995 – Series III & CVT 1999 – Series IV may be concluded at all the centers. Series V will continue.	Directions followed.
128.	The promising entries of CVT 1999 – Series IV, HM-346 from Hisar, UM-305 from Jobner, JF-210 and 204 from Jagudan may be proposed for release.	On the bases of three years results, entries JFg-210 and JFg-204 have not found promising for yield and other attributes. Hence not need to be proposed.
129.	The incidence of powdery mildew in CVT 2001 series V may be recorded at Coimbatore center.	As per the instruction the powdery mildew *incidence was recorded by Coimbatore.*
130.	This trial FGK/CP/1.1 Biocontrol of root rot in fenugreek will be closed and final report to be submitted.	The project is closed and completion report has been submitted by Coimbatore.
131.	Quality analysis of Diosgenin in Fenugreek at Coimbatore center and samples 250g samples may be sent to Coimbatore.	Samples were submitted to Coimbatore by Chintapalle and Jobner centres.
132.	FGK/CM/1.3 – Identification of drought tolerance source in Fenugreek	New trial initiated at Coimbatore centre.
133.	The trial FGK/CM/2.2 to be laid out properly at Kumarganj centre.	It has been followed.

Sl. No.	Decision	Action taken
	PAPRIKA	
134.	Germplasm collection, characterization, evaluation and conservation of paprika and paprika like chillies.	Six types in paprika were collected and the trial has been laid out during this year 2005-06. The observations were recorded. Further request has been made to PC for obtaining the seed materials.
	VANILLA	
135.	**VAN/CI/1.1:** Germplasm, collection, characterization, evaluation and conservation of vanilla.	Initiated and titled as –"Germplasm collection, characterization evaluation and conservation of vanilla. This project was just initiated with two collections from Yercaud and Thadiyankudisai. At present the trial cannot be continued at Coimbatore centre due to the non-availability of facilities.
136.	The germplasm collection, conservation and evaluation of vanilla should be initiated at Dapoli center.	It has been followed.

Technical Session I

GENETIC RESOURCES

Chairman	:	Dr. V. A. Parthasarathy
Co-Chairman	:	Shri. B. Krishnamoorthy
Rapporteurs	:	Dr. J. Rema Dr. K. Giridhar

1.	.No. of reports presented	:	11
2.	Name of the centers where work was done	:	Panniyur, Chintapalle, Dapoli, Sirsi, Pundibari, Yercaud, Pechiparai, Mudigere, Pampadumpara, Kumarganj, Pottangi, Raigarh, Solan, Coimbatore, Jagtial, Guntur, Hisar, Jagudan, Jobner, Myladumpara and Ambalavayal
3.	Non-performing centers if any	:	Nil
4.	Brief description of the work done and salient results reported (crop-wise)	:	The centers presented the reports
5.	Recommendations/ decisions (crop wise)	:	

A. Black Pepper

All the Centers should concentrate in collecting germplasm from local and adjoining areas (Chintapalle – Eastern Ghats; Yercaud – Shevroy and Kolli hills; Pundibari – Bhutan border areas; Dapoli – Western Ghats covering the state) in collaboration with NBPGR [**Action**: PC and respective Centers]

B. Ginger & Turmeric

Uniform bed size and population may be followed for evaluating the germplasm of ginger and turmeric at all the centers [**Action**: Respective centers].

C. Seed Spices

Germplasm of seed spices may be characterized based on the minimal descriptor published by NRCSS, Ajmer. The number of germplasm taken for maintenance may be characterized during that season itself so that, when the cycle of planting the germplasm is over the characterization could be completed [**Action**: Respective centers].

D. Cumin

The programme on germplasm collection, characterization, evaluation and conservation of cumin (CUM/CI/1.1) may be discontinued at Kumarganj and Raigarh centers since the germination of cumin seeds is very poor [**Action**: Kumarganj and Raigarh centers].

E. Fennel

Reaction to sugary disease may be recorded in fennel germplasm accessions as the incidence of the disease is increasing [**Action**: Respective centers].

F. Vanilla

Since there are no variability available in vanilla, the programme on germplasm collection, characterization, evaluation and conservation of vanilla (VAN/CI/1.1) may be discontinued in all the centers [**Action**: Respective centers].

6. Recommendations ready for transfer to extension agency, if any : Nil

7. New programmes proposed (crop-wise) : Nil

8. General decisions,if any :

1. The research data available at various centers may be compiled and published [**Action:** PC & all the centers].

2. A copy of all the research articles published in the AICRP centers may be submitted to the Project Co-ordinator for keeping in the library [**Action:** PC & all the centers].

3. The promising/unique germplasm should be registered with NBPGR for obtaining IC Nos. [**Action**: Respective centers]

4. For selecting the promising lines from germplasm, standards may be set for each crop [**Action:** PC & all the centers].

5. All the Centers should retain the original name/collection/accession/IC numbers in each crop, while collecting germplasm from other Centers for evaluation and characterization [**Action**: All the Centers]

6. For germplasm evaluation of seed spices, the following spacing may be adapted:

Crop	Spacing
Coriander	45 - 50 x 20 cm (seed type)
	30 x 10 cm (leafy type)
Cumin	30 x 5 cm
Fennel	50-60 x 20 cm (both for direct sowing and transplanting crop)
Fenugreek	30 x 10 cm (rainfed crop)
	45 x 10 cm (irrigated crop)

In each crop, five plants may be selected at random and yield should be expressed (average of 5 plants) in gram per plant.

Technical Session II

CROP IMPROVEMENT

	Chairman	:	Dr. B. B.Vashishtha
	Co-Chairman	:	Sri. P.A. Mathew
	Rapporteur	:	Dr. R. R. Nair
		:	Dr. D. K. Dash
1.	No. of reports presented	:	49
2.	Name of the centers where work was done	:	Panniyur, Chintapalle, Dapoli, Sirsi, Yercaud, Pechiparai, Mudigere, Sakleshpur, Pampadumpara, Kumarganj, Pottangi, Pundibari, Raigarh, Solan, Coimbatore, Jagtial, Guntur, Hisar, Jagudan, Jobner, Myladumpara, Thadiyankudisai and Ambalavayal
3.	Non-performing centers if any	:	Nil
4.	Brief description of the work done and salient results reported (crop-wise)	:	The centers presented the reports
5.	Recommendations/decisions (crop wise)	:	

A. Black Pepper

1. While evaluating varieties of black pepper, bulk density may also be included as one of the parameters [**Action:** All the centers]
2. The trials, PEP/CI/3.1 at Dapoli and PEP/CI/3.2 CVT (1991) at Yercaud center may be closed and final report to be submitted to PC Unit [**Action:** Dapoli and Yercaud Centers]
3. Project Coordinator may visit the Chintapalle center and review the performance of CVT- 2000-V trial and make necessary recommendations [**Action:** PC]
4. Dried samples (150 g each) of the CVT entries of ongoing projects may be sent to Project Coordinator Cell in order to make quality profile in black pepper [**Action:** All the centers & PC Unit]

B. Cardamom

1. CAR/CI/3.4 CVT Series IV may continue for 2 more years at Sakleshpur, Pampadumpara and Mudigere centers [**Action:** Respective Centers]
2. CAR/CI/2.1: Evaluation of OP progenies under intensive management trial will be continued for 2 more years at Mudigere center [**Action:** Mudigere center]
3. CAR/CI/3.2: CVT 1991/1998-Series II with Malabar types and CAR/CI/3.3 CVT 1991/1998 Series III with Mysore types may be concluded and the final report may be sent to the Project Coordinator [**Action:** Sakleshpur center]

4. The trials, CAR/CI/4.3 and 4.4 IET-I&II trials at Mudigere will be continued for two more years [**Action:** Mudigere center]
5. CAR/CI/3.4 CVT 2004 may be continued at Pampadumpara, Mudigere and Myladumpara Centers and discontinued at Thadiyankudisai and Sakleshpur Centers [**Action:** Respective Centers]
6. Dried samples (150 g each) of the CVT entries of ongoing projects may be sent to Project Coordinator Cell in order to make quality profile in cardamom [**Action:** All the Centers & PC Unit]

C. Ginger

1. Biochemical analysis data (replication-wise) from all the centers should be submitted to PC [**Action:** Solan and other Centers]
2. Dried samples (150 g each) of the CVT entries of ongoing projects may be sent to Project Coordinator Cell in order to make quality profile in ginger [**Action:** All the Centers & PC Unit]

D. Turmeric

1. Replication-wise data of CVT should be compiled and submitted to PC [**Action:** All the Centers & PC Unit]
2. Dried samples (150 g each) of the CVT entries of ongoing projects may be sent to Project Coordinator Cell in order to make quality profile in turmeric [**Action:** All the Centers & PC Unit]
3. TUR/CI/3.1 CYT (1999-2000) may be concluded/closed at all the Centers and final report may be submitted to PC Unit [**Action:** Respective Centers]

E. Tree spices

1. Sirsi and Ambalavayal Centers may discontinue CVT in Nutmeg (TSP/CI/2.3) [**Action:** Sirsi and Ambalavayal Centers]
2. Sirsi center may discontinue TSP/CI/2.4 CVT in Cassia [**Action:** Sirsi center]
3. Pechiparai center may study the leaf yield and oil content of cinnamon for two years [**Action:** Pechiparai center]

F. Coriander

1. Seed materials for CVT of all seed spices will be received by Project Coordinator and distributed among other centers, after coding the entries [**Action:** PC and Seed Spices Centers]

G. Cumin

Efforts would be made to include wilt tolerant lines in breeding programmes [**Action:** Jobner, Jagudan and NRCSS, Ajmer]

H. Fennel

Nil

I. Fenugreek

1. Fresh samples (250 g each entry) from coordinating centers may be sent to Coimbatore for quality analysis [**Action:** Coimbatore and respective Centers]
2. Three years data on yield and its attributing characters may be obtained for concluding the project and submitting final report to PC [**Action:** All the Centers]

6. Recommendations ready for transfer to extension agency, if any : Nil
7. New programmes proposed (crop-wise) :

A. BLACK PEPPER

I. Center	:	**Panniyur, Sirsi, Dapoli, Yercaud, Mudigere, Pechiparai, Pundibari, Pampadumpara**
Title of the programme	:	**PEP/CI/3.4 CVT 2006**
Date/Year of start	:	2006-07
Duration of the project	:	6 years
	Details of technical programme	
Design	:	RBD
No. of treatments/ genotypes	:	Promising lines identified by the Centers
Entries	:	
		Panniyur - HB 20052, PRS-64
		Sirsi - Acc. No. 53 (Ademane pepper), Acc. No. 106 (Kudragutta)
		Yercaud – Acc. Nos. 33 and 57
		IISR, Calicut – C-1090 (*Phytophthora* and nematode tolerant),
		HP – 39 (Nematode tolerant)
		Checks – National, state and local
No. of replications	:	3
Plot size/spacing	:	6 plants/plot (3 x 3m)
No. of plants/plot/ treatment	:	2 plts/std
Date of planting season	:	2006-07
Observations to be recorded	:	

- Growth parameters up to third year (height of vine, internodal length, branches etc).
- Yield and attributing characters from third year onwards (no. of spikes, spike weight, spike length, no. of berries/spike, pollu count for fungal and insect pollu).

B. GINGER

I. Center	:	**Kumarganj, Pottangi, Pundibari, Raigarh and Solan**
Title of programme	:	**GIN/CI/ 2.3 CVT 2006**
Date and Year of start	:	2007-08
Duration of project	:	Three years
	Details of Technical Programme	
Design	:	RBD
No of genotypes with details	:	Promising lines indentified by the Centers

Entries	:	
		Pundibari – GCP-05, GCP-31
		Pottangi – PGS-8, V_2E_5 – 2, KG-42
		Raigarh – IG-1, IG-2, IG-3
		Solan - SG-707, SG-827
		Kumarganj – NDG - 1, NDG - 2, NDG - 5
		Checks – National, state and local
No of replications	:	Three
Plot size / spacing	:	3 m x 1 m & 30cm x 20 cm
Date of sowing	:	*Kharif*
Methodology and procedure	:	Standard recommended package of practices
Observations to be recorded	:	Growth, yield and quality parameters & disease incidence
II. Center	**:**	**Raigarh**
Title of programme	**:**	**GIN/CI/3.4 IET**
Date and Year of start	:	2006-07
Duration of project	:	Two years
		Details of Technical Programme
Design	:	RBD
No of genotypes with details	:	Promising lines indentified by the Centers
		IG-5-1, IG-5-2, IG-5-14, IG-5-22, IG-5-24, IG-5-25, IG-5-26, IG-5-27, IG-5-28, IG-5-32 and Local check
No of replications	:	Three
Plot size / spacing	:	3 m x 1 m & 30cm x 20 cm
Date of sowing	:	*Kharif*
Methodology and procedure	:	Standard recommended package of practices
Observations to be recorded	:	Growth, yield and quality parameters & disease incidence

C. **TURMERIC**

I. Center	**:**	**Kumarganj, Pundibari**
Title of programme	**:**	**TUR/CI/3.2 IET**
Date and Year of start	:	2006
Duration of project	:	Three years
		Details of Technical Programme
Design	:	Randomized block design
No of genotypes with details	:	Promising lines indentified by the Centers
Entries	:	
		Kumarganj -NDH-7, NDH- 8, NDH-45, NDH-68, NDH-79, NDH-86, NDH-88,NDH-106, Check-Prabha NDH-18 (Local)
		Pundibari-TCP-11, TCP-57, TCP-84, TCP-70, TCP-104, TCP-107, TCP-119, TCP-128-1, TCP-140, TCP-97, TCP-129, TCP- 160, TCP-139, TCP-64, TCP-72, ABN-1, TCP-2, TCP-54 (Check)

No of replications	:	Three
Plot size / spacing	:	3 x 1 m / 30 x 20 cm
No of plants / plot	:	50
Date of sowing / planting /	:	*Kharif* season
Methodology and procedure	:	Recommended package of practices will be followed
Observations to be recorded	:	

1. Yield
2. Yield attributing characters
3. Quality characters
   a) Oleoresin
   b) Curcumin

D. CORIANDER

I. Center	:	**Jagudan, Jobner, Hisar, Kumarganj, Raigarh, Guntur, Dholi**
Title of the programme	:	COR/CI/2.6 CVT 2005
Date / Year of start	:	2005-06
Duration of the Project	:	Three years

Details of technical programme

Design	:	RBD
No. of treatments / genotypes with details	:	
Entries	:	

Jobner-UD-728, UD-796 and UD-797
Hisar -DH-206 and DH-242
Jagudan-JCori-340 and JCori-375
Kumarganj-ND Cor-33, NDCor-67
Raigarh-ICS-1 and ICS-2
Guntur-LCC-170, LCC-212 and LCC-216
Dholi-RD-154 and RD-366
Checks-National, State and local

No. of replications	:	Three
Plot size / spacing	:	2.40 X 4.00 m, 30 cm Drilling
No. of plants / plot / treatment	:	8 rows per plot
Date of sowing / planting and season	:	First week of November *Rabi*
Methodology & Procedure to be adopted	:	As per recommended package of Practices

Observations to be recorded in detail:

- Growth, yield and quality parameters
- Pest and disease incidence

II. Center	:	**Jagudan, Jobner, Guntur, Kumarganj and Hisar**
Title of the programme	:	**COR/CI/3.3 IET**
Date / Year of start	:	*Rabi* 2005-06
Duration of the Project	:	Three years
	Details of technical programme	
Design	:	RBD
No. of treatments / genotypes with details	:	Promising entries identified by the Centers
Entries	:	

Jagudan -JCr-330, JCr-379, JCr-383, JCr-384, JCr-398, JCr-402, JCr-403, JCr-586, JCr-587, Gco-2 (Ch)
Jobner-UD-475, UD-600, UD-627, UD-630, UD-707, Marigold-6, UD-20-130-728 and three check namely RCr- 435, RCr-436 and Local
Guntur-LCC-134, LCC-214, LCC-220, LCC-228, LCC-229, LCC-234, LCC-236, LCC- 237, LCC-240, LCC-243, Checks- Sadhana, Swathi
Kumarganj-NDcor-14, NDcor -23, NDcor -31, NDcor –33, NDcor -34, NDcor -41, NDcor -66, NDcor –67, Check : Hisar Anand, Pant Haritma
Hisar- DH- 207, DH- 211, DH- 220, DH- 236, DH- 278, DH- 288, DH- 294, DH- 297, DH- 317, Check : Local and Hisar Anand

No. of replications	:	Three
Plot size / spacing	:	1.80 X 4.00 m, 30 cm Drilling
No. of plants / plot / treatment	:	6 rows per plot
Date of sowing / planting and season	:	Last week of October *Rabi*
Methodology & Procedure to be adopted	:	As per recommended package of Practices

Observations to be recorded :

- Growth, yield and quality parameters
- Pest and disease incidence

E. CUMIN

I. Center	:	**Jagudan, Jobner**
Title of the programme	:	**CUM/CI/3.4 CVT 2005**
Date / Year of start	:	*Rabi* 2005-06
Duration of the Project	:	Three years
	Details of technical programme	
Design	:	RBD
No. of treatments / genotypes with details	:	

Entries	:	*Jagudan*-JC-95-12, JC-95-30 *Jobner*-UC-345, UC-346, UC-347, UC-348 *Checks*-National, State and local
No. of replications	:	Three
Plot size / spacing	:	2.40 X 4.00 m, Broadcasting
Date of sowing / planting and season	:	Last week of October *Rabi*
Methodology & Procedure to be adopted	:	As per recommended package of practices

Observations to be recorded :

- Growth, yield and quality parameters
- Pest and disease incidence

II. Center	:	**Jagudan, Jobner**
Title of the programme	:	**CUM/CI/4.2 IET 2005**
Date / Year of start	:	*Rabi* 2005-06
Duration of the Project	:	Three years
		Details of technical programme
Design	:	RBD
No. of treatments / genotypes with details	:	Promising entries identified by the Centers
Entries	:	*Jagudan*-JC-99-4, JC-2002-6, JC-2002-14, JC-2002-21, JC-2002-27, JC-2002-28, JC-2002-32, JC-2002-41, GC-2 (N.Ch), GC-4 (L. Ch) *Jobner*-UC-225, UC-239, UC-273, UC-274, UC-299, UC-331 and UC-334 along with three checks namely RZ-19, RZ-223/UC-198 and Local
No. of replications	:	Three
Plot size / spacing	:	1.80 X 4.00 m, Broadcasting
Date of sowing / planting and season	:	Last week of October *Rabi*
Methodology & Procedure to be adopted	:	As per recommended package of practices

Observations to be recorded :

- Growth, yield and quality parameters
- Disease incidence

F. FENNEL

I. Center	:	**Jagudan, Jobner, Hisar, Kumarganj**
Title of the programme	:	(1) FNL/CI/3.3 CVT 2004-5
Date / Year of start	:	2004-05 (5)
Duration of the Project	:	Three years
		Details of technical programme
Design	:	RBD

No. of treatments / genotypes with details	:	
Entries	:	*Jagudan* -JF-376; JF-421, JF-444-1 *Jobner* -UF-205, UF-206, UF-207 *Hisar*-HF-118, HF-125 *Kumarganj*-NDF-29, NDF-30 *Checks*-National, State and local
No. of replications	:	Three
Plot size / spacing	:	4.0 m x 2.7 m 45 x 20 cm (drilling)
No. of plants / plot / treatment	:	20 plants/row
Date of sowing / planting and season	:	Ist week of November
Season	:	*Rabi*
Methodology & Procedure to be adopted	:	As per recommended package of practices

Observations to be recorded :

- Growth, yield and quality parameters
- Pest and disease incidence

II. Center	:	**Jagudan, Hisar , Kumarganj**
Title of the programme	:	(2) FNL/CI/3.4 CVT 2006 **(Transplant –early *Rabi*)**
Date / Year of start	:	2006-07
Duration of the Project	:	Three years
Details of technical programme		
Design	:	RBD
No. of treatments / genotypes with details	:	
Entries	:	*Jagudan*-JF-376, JF-444-1, JF-600 & JF-642 *Hisar*-HF-118, HF-125, HF- 107 & HF-116 *Kumarganj*-NDF-12, NDF-5 & NDF- 6 *Checks*-National, State and local
No. of replications	:	Three
Plot size / spacing	:	4.5 m x 3.6 m
No. of plants / plot / treatment	:	60 plants (6 rows of 10 dibbles)
Date of sowing / planting and season	:	Nursery raising : Ist fortnight of June Transplanting : Ist fortnight of August
Season	:	Early *Rabi*

Methodology & Procedure to be adopted	:	As per recommended package of practices
Observations to be recorded	:	(Ten plants in each entry/replication)

- Growth, yield and quality parameters
- Pest and disease incidence

III. Center	:	**Jagudan, Jobner, Kumarganj, Hisar**
Title of the programme	:	FNL/CI/4.2 IET
Date / Year of start	:	2004-05
Duration of the Project	:	Three years
		Details of technical programme
Design	:	RBD
No. of treatments / genotypes with details	:	
Entries		
		Jagudan- JF-456-2, JF-472-2-3, JF-485-1, JF-494, JF-501-2, JF-514-2, JF-529-1, JF- 546, JF572, Checks: GF 11 (Ch)
		Kumarganj- NDF-16,NDF-23, NDF-24, NDF-29, NDF-30, NDF-31, NDF-32, NDF-33, Check : RF 101, GF-2, NDF-5 (Local)
		Jobner- NS-3, NS-10, NS-11, NS-32, NS-37, NS-41, NS-45, NS-46 and NS-63 , Checks- RF-101, RF-125 and Local
		Hisar- HF-108, HF- 122, HF- 123, HF- 126, HF- 131, HF-143, HF- 155, HF-163, HF- 172, HF- 184, GF-1, Checks: HF-33
No. of replications	:	Three
Plot size / spacing	:	4.0 m x 1.8 m 45 x 20 cm (drilling)
No. of plants / plot / treatment	:	20 plants/row
Date of sowing / planting and season	:	Mid-October
Season	:	*Rabi*
Methodology & Procedure to be adopted	:	As per recommended package of practices
Observations to be recorded in detail	:	(Five plants in each entry)

- Growth, yield and quality parameters
- Pest and disease incidence

G. FENUGREEK

I. Center	:	**Jagudan, Jobner, Hisar, Guntur, Kumarganj and Dholi**
Title of the programme	:	**FGK/CI/3.4 CVT 2005**
Date / Year of start	:	*Rabi* 2005-06
Duration of the Project	:	Three years
		Details of technical programme
Design	:	RBD
No. of treatments / genotypes with details	:	

Entries	:	*Jobner*-UM-361, UM-362 and UM-363 *Jagudan* -JFg-239 & JFg – 273 *Hisar*-HM-219, HM-232 and HM-292 *Guntur*-LFC-84 & LFC-87 *Kumarganj*-NDM-20 *Dholi*-RM-18, RM-28 & RM-70 *Checks*-National, State and local
No. of replications	:	Three
Plot size / spacing	:	4.0 m x 2.4 m, 30 cm Drilling
No. of plants / plot / treatment	:	8 rows per plot
Date of sowing / planting and season	:	Last week of October *Rabi*
Methodology & Procedure to be adopted	:	As per recommended package of practices

Observations to be recorded :

- Growth, yield and quality parameters
- Pest and disease incidence

II. Center	:	**Jagudan, Jobner, Guntur, Kumarganj, Hisar**
Title of the programme	:	**FGK/CI/4.3 IET**
Date / Year of start	:	*Rabi* 2005-06
Duration of the Project	:	Three years
		Details of technical programme
Design	:	*RBD*
No. of treatments / genotypes with details *Entries*	:	Promising entries identified by the Centers *Jagudan*-JFg-15, JFg-148, JFg-178, JFg-181, JFg-220, JFg-252, JFg-253, JFg-254, JFg- 255, GM-1 (L.Ch) *Jobner*-UM – 152, UM-202, UM-134, UM-189, UM-163, UM-353, UM-354, Checks – RMt-1, RMt-303 & local *Guntur*-LFC-85, LFC-88, LFC-94, LFC-102, LFC-103, LFC-105, LFC-112, LFC-113, LFC-114, LFC-118, Checks – LS-1 *Kumarganj*-NDM-1, NDM-2, NDM-3, NDM-5, NDM-9, NDM-13, NDM17, NDM-26, Checks- Hisar Sonali, NDM-25 *Hisar*-HM- 202, HM- 214, HM- 221, HM- 247, HM- 300, HM-307, HM- 326, HM- 348, HM- 355, Checks- Hisar Sonali
No. of replications	:	Three
Plot size / spacing	:	1.80 X 4.00 m, 30 cm Drilling

No. of plants / plot / treatment	:	6 rows per plot
Date of sowing / planting and season	:	Last week of October *Rabi*
Methodology & Procedure to be adopted	:	As per recommended package of Practices

Observations to be recorded :

- Growth, yield and quality parameters
- Pest and disease incidence

8. General decisions, if any :

1. Name of the released varieties included in the CVTs have to be clearly indicated instead of accession numbers [**Action:** All the Centers]
2. All the data to be presented in AICRP workshop should be statistically analyzed and presented with standard error (SE), critical difference (CD at 5%) and coefficient of variation (CV%) [**Action:** All the Centers]
3. Proposals for state variety release out of materials involving AICRPS have to be supported by the recommendation of AICRP workshop [**Action:** All the Centers]
4. Materials for Coordinated Varietal Trials (CVT) should be sent to PC Unit for coding, well in advance to avoid problems in germination and establishment at the centers [**Action:** Seed spices Centers]
5. The germplasm material of seed spices available with coordinating centers has to be deposited with NRC Seed spices, Ajmer. The decision was taken in the previous meeting but some centres have not complied with the decision such of the centers who have not deposited (Coimbatore and Hisar) may deposit at the earliest. [**Action:** Seed spices Centers]
6. Evaluation report of seed spices (exotic) imported through NBPGR should be provided to NRC Seed Spices by the Coordinating Centers every year with a copy marked to PC Unit [**Action:** Seedspices Centers and NRCSS, Ajmer]
7. The seeds of released varieties in seed spices should be deposited to seed bank of NBPGR [**Action:** Seed spices Centers]

Technical Session III

CROP PRODUCTION

	Chairman	:	Dr. J. Thomas
	Co-Chairman	:	Dr. B. Chempakam
	Rapporteurs	:	Dr. S.J. Ankegowda Dr. M. Dinesh kumar
1.	No. of reports presented	:	26
2.	Name of the centers where work was done	:	Panniyur, Chintapalle, Dapoli, Sirsi, Pundibari, Yercaud, Mudigere, Pampadumpara, Kumarganj, Pottangi, Raigarh, Solan, Coimbatore, Guntur, Jobner, Ambalavayal, Myladumpara and Ajmer
3.	Non-performing centers if any	:	Nil
4.	Brief description of the work done and salient results reported (crop-wise)	:	The centers presented the reports
5.	Recommendations/decisions (crop wise)	:	

A. Black pepper

1. The following three projects may be concluded and final report to be submitted to PC on or before August 2006:
   i) PEP/CM/2.1 Effect of biofertilizer, *Azospirillum*, on black pepper [**Action:** Panniyur, Sirsi, Ambalavayal Centers]
   ii) PEP/CM/2.2 Effect of biofertilizer, P-solubilizer (Phosphobacteria) on black pepper [**Action:** Panniyur, Sirsi, Ambalavayal Centers]
   iii) PEP/CM/2.3 Organic farming in black pepper [**Action:** Yercaud and Panniyur centers]
2. The project PEP/CM/2.4 Development of organic package for spices based cropping system-Observational trial may be continued in all Centers [**Action:** Dapoli, Sirsi, Chintapalle, Panniyur and Yercaud Centers]
3. All Centers should express the yield in black pepper uniformly, as berry dry weight (kg/vine) along with recovery percentage [**Action:** All the Centers]

B. Cardamom

1. Experiments on effect of biofertilizers, *Azospirillum* and P. solubilizers (Phosphobacteria) (CAR/CM/1.5) at Sakleshpur may be concluded and final report to be submitted to PC [**Action:** Sakleshpur center]
2. For neem cake trial (CAR/CM/1.6), incidence of pests (shoot and capsule borer, thrips, root grubs), diseases (clump rot, Katte) and nematode infestation may be recorded [**Action:** Mudigere and Pampadumpara Centers]

C. Ginger

1. The project, GIN/CM/1.1 Effect of biofertilizer, *Azospirillum*, on ginger may be concluded and final report to be submitted to PC [**Action:** Pottangi, Raigarh, and Pundibari Centers]
2. The project, GIN/CM/1.2 Organic farming in ginger may be concluded and final report to be submitted to PC [**Action:** Raigarh, Dholi and Pottangi Centers]
3. The trial, GIN/CM/1.4 Effect of micronutrients on yield of ginger may be continued in all the centers [**Action:** Dholi, Pottangi, Raigarh, Kumarganj, Pundibari and Solan Centers]
   Under this project, soil and plant nutrient analysis (major and micronutrients) need to be taken during the time of land preparation and at active growth phase of crop (90-120 days after sowing) [**Action:** Dholi, Pottangi, Raigarh, Kumarganj, Pundibari and Solan Centers]
4. The following three trials proposed by Dholi center may be taken as station trial:
   i) Effect of sulphur on ginger
   ii) Effect of organic manure on ginger
   iii) Effect of bio-regulators on yield and quality of ginger [**Action:** Dholi center]

D. Turmeric

1. The following projects may be concluded and final report to be submitted to PC on or before August 2006:
   i) TUR/CM/1.1 Effect of biofertilizer, *Azospirillum* on turmeric
   [**Action:** Kumarganj, Raigarh, Pottangi, Coimbatore, Pundibari Centers]
   ii) TUR/CM/1.2 Organic farming in turmeric
   [**Action:** Raigarh, Pottangi, Pundibari Centers]
   iii) TUR/CM/1.3 Effect of raised and flat beds on yield of turmeric
   [**Action:** Dholi center]
2. New project proposal on fertigation and micro-irrigation in turmeric may be taken up as station trial at Jagtial [**Action:** Jagtial center]

E. Tree spices

1. Pruning trial on clove to reduce height to facilitate easy harvesting may be taken up as station trial at Pechiparai and result may be presented in next workshop [**Action:** Pechiparai center]

F. Coriander

1. The project, COR/CM/1.1 Response of coriander to micronutrients may be concluded at Kumarganj and Guntur centers and Hisar center will continue the experiment [**Action:** Respective Centers]
2. The project, COR/CM/1.2 Effect of biofertilizer, *Azospirillum* on coriander may be concluded at Coimbatore, Jobner and Guntur Centers and Hisar and Kumarganj will continue the experiment [**Action:** Respective Centers]
3. The trial, COR/CM/1.3 Effect of bio-regulators on coriander may continue at all the Centers and Coimbatore center should initiate the programmes (COR/CM/1.3 and COR/CM/1.4) immediately [**Action:** Dholi, Coimbatore, Guntur, Jobner, Hisar, Jagudan and Kumarganj Centers]
4. The trial, COR/CM/1.4 Identification of drought tolerance source in coriander should be taken up by the Centers with modified technical programme [**Action:** Coimbatore, Guntur and Ajmer Centers]

G. Cumin

1. The project, CUM/CM/1.1 Effect of biofertilizer, *Azospirillum* on cumin may be concluded and final report to be submitted to PC [**Action:** Jobner and Jagudan Centers]
2. The project, CUM/CM/1.2 Identification of drought tolerance source in cumin may be taken up by Jobner. However, the basic work done by NRC SS may be presented in the workshop [**Action:** Jobner & Ajmer Centers]

H. Fennel

1. The trial, FNL/CM/1.2 Effect of biofertilizer, *Azospirillum* and P- solubiliser in fennel may be concluded at Jobner, but will continue at Kumarganj center [**Action:** Jobner and Kumarganj Centers]
2. Under the trial, FNL/CM/1.3 Identification of alkalinity tolerance source in fennel alkalinity / salinity stability index may be calculated

I. Fenugreek

1. The trial, FGK/CM/2.2 Effect of biofertilizer, *Azospirillum*/Rhizobium in fenugreek may be concluded and final report to be submitted to PC on or before August 2006:[**Action:** Jobner and Guntur Centers]
2. The project, FGK/CM/2.3 Identification of drought tolerance source in fenugreek may be taken up in all Centers [**Action:** Coimbatore, Guntur and Ajmer Centers]
6. *Recommendations ready for transfer to extension agency, if any* :

Integrated Nutrient Management using bio-fertilizer for different spice crops

- Application of inorganic Nitrogen 100% + *Azospirillum* 50g/plant +10 kg FYM recorded maximum yield followed by normal package of practice treatment at Panniyur, Sirsi and Ambalavayal in Black pepper
- Application of inorganic Phosphorus 100% + P-solubilizer 50g/plant +10 kg FYM recorded maximum yield at Panniyur, Sirsi and Ambalavayal in Black pepper
- Application of inorganic Nitrogen 100% + *Azospirillum* 50g/bed +5 kg FYM recorded maximum rhizome yield at Pottangi, Raigarh, and Pundibari in Ginger
- At Ambalavayal, application of inorganic Nitrogen 75% + *Azospirillum* 50g/bed +5 kg FYM recorded maximum rhizome yield of Ginger.
- Maximum yield of Turmeric was obtained in plots where application of
  - inorganic N 100%+*Azospirillum* 5kg/ha+ FYM 5t/ha at Kumarganj, Raigarh& Pottangi
  - inorganic N 50%+ *Azospirillum* 5kg/ha+ FYM 5t/ha at Coimbatore
  - inorganic N 75%+ *Azospirillum* 5kg/ha+ FYM 5t/ha at Pundibari
- At Pundibari, all organic inputs (FYM 10kg, pongammia cake 250 g, sterameal 250g, rock phosphate 500g, wood ash 250 g/3m^2) recorded maximum yield (20.67 t/ha) in Turmeric.
- Maximum yield was recorded with application of inorganic N 100%+ *Azospirillum* +5t FYM/ha at Jobner for cumin crop.
- Application of inorganic N 100% + *Azospirillum* (1.5kg/ha) + 5 t/ha FYM given higher yield and net returns in fennel at Jobner

Application of inorganic N 100% alone could be recommended for obtaining higher yield and net returns for fenugreek at Jobner and at Guntur, application of inorganic N 100% + *Rhizobium* + FYM 5t/ha gave significantly higher yield.

7. New programmes proposed (crop-wise) :

A. BLACK PEPPER

I. Center	:	**Panniyur, Sirsi, Yercaud, Dapoli, Ambalavayal, Pechiparai**
Title of the programme	:	**PEP/CM/2.5 Organic farming in black pepper (New)**
Date/Year of start	:	2006-07
Duration of the Project	:	3 years
		Details of technical programme
Treatment details	:	
No. of plants/plot/ treatments	:	50 vines/ treatment (The experiment must be conducted in blocks of 50 vines only for the treatment. However, for the purpose of statistical analysis the observations recorded on 50 vines may be analyzed as seven replications of 6 vines each)

Fully Organic

The best organic nutrient combination from previous experiments of the respective Centers with Biofertilizers (*Azospirillum*, P-solubilizer (50g each) per standard and spray of BM (1%) and neem oil (0.5% at 21 days interval from July – October) for disease and pest control. *Trichoderma* and *Pseudomonas* can be applied during June and August-September.

Integrated

10 kg FYM + Recommended dose of fertilizer + P - solubilizing bacteria, spraying Bordeaux mixture 1% or Ridomil (0.125%) or Akomin (3ml/l) and drenching with Copper oxy chloride0.1% / Ridomil and spray with quinalphos (0.05%) during June and August-September for disease and pest control. (or)

Applying *Trichoderma* around the base of the vine @ 50g/vine with a foliar spray with Bordeaux mixture 1% (or) Akomin (0.3%) during June and August-September.

Fully Inorganic

Recommended dose of fertilizer and drenching with Copper oxy chloride(0.1%)/ Ridomil and spray with quinalphos (0.05%) during July and Sept for disease and pest control.

Methodology to be adopted : To be imposed in an established pepper garden

Soil nutrient status (macro & micro nutrients) and beneficial microbial status should be recorded before imposing treatments and after the harvest of the crop. Plant nutrient analysis should be taken up at spike initiation stage

Observation to be recorded :

- Growth, yield and quality parameters
- Pest and disease incidence

B. GINGER

II. Center	:	**Pundibari, Pottangi, Solan, Kumarganj, Raigarh, Dholi**
Title of the programme	:	**GIN/CM/1.5 Organic farming in ginger (New)**
Date/Year of start	:	2006-07
Duration of the Project	:	3 years
		Details of technical programme
Plot size/spacing	:	3.0 m x 1.0 m & 30 cm x 20 cm
No. of plants/plot/ treatments	:	25 beds/treatment (The experiment must be conducted in beds of 25 numbers per treatment. For statistical analysis, 7 replications of 3 beds each may be considered)
Date of sowing/ planting and season	:	2006-07

Treatment details :

Fully organic

The best organic nutrient combination from previous experiments of the respective Centers, Biofertilizers (*Azospirillum*, P solubilizers) and *Pseudomonas fluorescens* and *Trichoderma* as seed treatment and soil application (50 g/3m^2) with spray of BM (0.5%) and neem oil (0.5% at 21 days interval from July – October) for disease and pest control.

Integrated

20t FYM+ ½ N, P, K + P- Solubilising Bacteria, *Pseudomonas fluorescens* and *Trichoderma* as seed treatment and soil application (50 g/3m^2) spray/drench with Mancozeb (Dithane M 45) and Malathion (0.1%) at 21days intervals from July – October for disease and pest control.

Inorganic

Recommended N, P, K and drench/spray with Mancozeb (Dithane M 45) for disease and Malathion (0.1%) at 21 days intervals from July – October for pest control

Methodology to be adopted:

- Soil nutrient analysis (macro and micro nutrients) and beneficial microbial status may be taken up before imposing and after harvest of the crop
- Plant nutrient analysis (macro and micro nutrients) may be taken up at active growth phase (90-120 days after sowing)

Observation to be recorded:

- Growth, yield and quality parameters
- Pest and disease incidence

C. TURMERIC

III. Center	:	**Pundibari, Pottangi, Kumarganj, Raigarh, Coimbatore, Dholi, Jagtial**
Title of the programme	:	TUR/CM/1.3 Organic farming in turmeric (New)
Date/Year of start	:	2006-07
Duration of the Project	:	3 years
Details of technical programme		
Plot size/spacing	:	3.0 m x 1.0 m & 30 cm x 20 cm
No. of plants/plot/ treatments	:	25 beds/treatment (The experiment must be conducted in beds of 25 numbers per treatment. For statistical analysis, 7 replications of 3 beds each may be considered)
Date of sowing/ planting and season	:	2006-07

Treatment details:

Fully organic

The best organic nutrient combination from previous experiments of the respective Centers, Biofertilizers (*Azospirillum*, P solubilizers) and *Pseudomonas fluorescens* and *Trichoderma* as seed treatment and soil application (50 g/3m^2) with spray of BM (0.5%) and neem oil (0.5% at 21 days interval from July – October) for disease and pest control.

Integrated

20t FYM+ ½ N, P, K + P- Solubilising Bacteria, *Pseudomonas fluorescens* and *Trichoderma* as seed treatment and soil application (50 g/3m^2) with spray or drenching of Mancozeb (Dithane M 45) and Malathion (0.1%) at 21d intervals from July – October for disease and pest control.

Fully Inorganic

Recommended N, P, K and drench/spray with Mancozeb (Dithane M-45) for disease and Malathion (0.1%) at 21d intervals from July – October for pest control

Methodology to be adopted:

- Soil nutrient status (macro and micronutrients) and beneficial microbial status may be taken up before imposing treatments and after harvest of the crop
- Plant nutrient analysis (macro & micronutrients) may be taken up at active growth phase (90-120 days after sowing)

Observation to be recorded:

- Growth, yield and quality parameters
- Pest and disease incidence

D. CUMIN

IV. Center	:	**Jobner**
Title of the programme	:	**CUM/CM/1.3 Effect of bio-regulators on Cumin**
Date/Year of start	:	*Rabi* 2006-2007
Duration of the Project	:	Three years

Details of Technical Programme

Design	:	Factorial R.B.D.
No. of replications	:	Three
Plot size/spacing	:	4 x 2.7 m Spacing : 30 x 5 cm
No. of plants/plot/ treatment	:	720 plants per plot
Date of sowing/ planting and season	:	*Rabi* 2006-2007 (last week of Nov.)

Treatment details:

Factor		Levels
1.	Triacontanol @ 0.5ml/litre	One spray – 50 DAS
		Two sprays-50 and 80 DAS
		Three sprays-50, 80 and 110 DAS
2.	NAA @ 50 ppm	One spray – 50 DAS
		Two sprays- 50 and 80 DAS
		Three sprays-50, 80 and 110 DAS
3.	GA 50 ppm	One spray – 50 DAS
		Two sprays-50 and 80 DAS
		Three sprays-50, 80 and 110 DAS
4.	Water spray	One spray – 50 DAS
		Two sprays-50 and 80 DAS
		Three sprays-50, 80 and 110 DAS

Absolute control (no water spray)

No. of replications	:	Three
Plot size/spacing	:	4 x 2.7m Spacing: 30 x 5cm
No. of plants	:	720 plants per plot
Date of sowing/ planting and season	:	Rabi 2006-2007 (last week of Nov.)
Methodology & Procedure to be adopted	:	Recommended packages of practices will be followed. Observations on the following characters will be recorded as per the standard procedure.

Observations to be recorded :

- Growth, yield and quality parameters

E. FENUGREEK

V. Center	:	**Jobner, Coimbatore, Kumarganj, Dholi, Hisar**
Title of the programme	:	FGK/CM/2.4 Effect of bioregulators on fenugreek
Date/Year of start	:	*Rabi* 2006-2007
Duration of the Project	:	Three years
	Details of Technical Programme	
Design	:	Factorial – RBD
No. of replications	:	Three
Plot size/spacing	:	4 x 2.7 m Spacing : 30 x 10 cm
No. of plants/plot/ treatment	:	360 plants per plot
Date of sowing/ planting and season	:	*Rabi* 2006-2007 (last week of Oct. to I week of Nov.)

Treatment details:

Facto		Levels
1.	Triacontanol @ 0.5ml/litre	One spray – 25 DAS Two sprays-25 and 45 DAS Three sprays-25, 45 and 70 DAS
2.	NAA @ 50 ppm	One spray – 25 DAS Two sprays-25 and 45 DAS Three sprays-25, 45 and 70 DAS
3.	GA @ 50 ppm	One spray – 25 DAS Two sprays-25 and 45 DAS Three sprays-25, 45 and 70 DAS
4.	Water spray	One spray – 25 DAS Two sprays-25 and 45 DAS Three sprays-25, 45 and 70 DAS.

Absolute control (no water spray)

Methodology & Procedure to be adopted	:	Recommended packages of practices will be followed. Observations on the following characters will be recorded as per the standard procedure
Observations to be recorded in detail	:	Growth, yield and quality parameters

Adaptive trials

I. Center	:	**Panniyur**
Crop	:	Black pepper
Title of programme	:	PEP/CM/2.5 Effect of micronutrients on black pepper (Adaptive trial) Adaptive trial may be taken up by

following the recommendations of IISR, Calicut as given below:

Micronutrients for black pepper

i) In a zinc deficient soil, soil application Zn @ 6.2 kg/ha (30 g zinc sulphate per vine) or foliar application of zinc (0.5% Z_nSO4 during June and September)

ii) In acidic soil (pH < 6.5), lime application @ 0.5t/ha (500 g lime/vine) or in Molybdenium deficient acidic soil, soil application of Mo@ 0.94 kg/ha (2.5 g sodium Molybdate per vine)

II. Center	:	**Dholi**
Crop	:	Turmeric
Title of programme	:	TUR/CM/1.1 A Effect of biofertilizer, *Azospirillum* on turmeric (Adaptive trial) Adaptive trial may be taken up by selecting the best treatments from other Centers.
III. Center	:	**Jagtial**
Crop	:	Turmeric
Title of programme	:	TUR/CM/1.2 A Effect of organic farming in turmeric

Adaptive trial may be taken up by selecting the best treatments from other Centers.

IV. Center	:	**Dholi**
Crop	:	Coriander
Title of programme	:	COR/CM/1.2 A Effect of biofertilizer, *Azospirillum* on coriander

Adaptive trial may be taken up by selecting the best treatments from other Centers.

V. Center	:	**Dholi**
Crop	:	Fennel
Title of programme	:	FNL/CM/1.2 A Effect of biofertilizer, *Azospirillum* on fennel

Adaptive trial may be taken up by selecting the best treatments from other Centers.

VI. Center	:	**Dholi**
Crop	:	Fenugreek
Title of programme	:	FGK//CM/2.2 A Effect of biofertilizer, *Azospirillum* on fenugreek

Adaptive trial may be taken up by selecting the best treatments from other Centers.

8. General decisions, if any:

1. All the Scientists of the centers should go through the proceedings of previous years and compulsorily implement the decisions taken during the workshops [**Action:** All the Centers]
2. All the Scientists of the centers should implement the programmes as decided by the workshop strictly. Any kind of deviation may be brought to the notice of Project Coordinator immediately [**Action:** All the Centers]

3. Soil and plant analyses of each crop in all nutritional experiments should be carried out without fail [**Action:** All the Centers]
4. Quality analyses should form an integral part of observation for all the trial [**Action:** All the Centers]
5. Cost benefit analyses need to be calculated and presented for all agronomy trials [**Action:** All the Centers]
6. All the scientists of the centers are requested to submit the final report of the concluded projects immediately in the form of research paper[**Action:** All the Centers]
7. The treatments, methodology and parameters to be adopted for screening the germplasm of seed spices against drought (COR/CM/1.4, CUM/CM/1.2, FNL/CM/1.3 and FGK/CM/2.3) is given below:

Drought tolerance studies in seed spices:

Treatments details:

Genotypes: Minimum of 50 accessions

1. Control – Irrigated as per crop need
2. Moisture Stress-I : To be imposed during vegetative phase i.e. 30 days to 50 days after sowing for 20 days
3. Moisture Stress –II: Terminal stress i.e. Flowering to Grain filling Stage (varies from crop to crop) – may be 70 to 90 days

Subject the genotypes for the above treatments in three sets and record the following observations:

1. Morphological characters like plant height, no. of leaves, leaf area, yield, yield components (**Action**: All the centers)
2. Biomass observations – Dry weight of root and shoot at initiation and end of moisture stress and calculate per cent reduction over control dry weight and yield (**Action**: All the centers)
3. Physiological parameters – Relative water content, Stomatal resistance, Chlorophyll stability index, Membrane stability index etc. (**Action**: Those centers having facilities to record physiological parameters)

Calculation (Kindly provided by the Director, NRC SS, Ajmer):

1. *Plant Height stress index*: It is calculated by dividing plant height during stress by plant height at irrigated condition
2. *Dry matter stress index*: It is calculated by dividing the dry matter produced under stress by dry matter produced under irrigated condition.
3. *Dry matter distribution*: It can be calculated by partitioning the plant into stem, leaves, root etc and calculating the per cent dry matter allocation to each part.
4. *Leaf rolling index*: It can be calculated by observing the percentage of leaf rolled (on edge of leaf) under irrigated and stressed condition.

Root characteristics: The roots are normally large, have more biomass and has capability to absorb more water in drought tolerant plants.

Technical Session IV

CROP PROTECTION

	Chairman	:	Dr. Srikant Kulkarni
	Co-Chairman	:	Dr. M.N. Venugopal
	Rapporteurs	:	Dr. A. Kumar Dr. S. Bandyopadhyay
1.	No. of reports presented	:	24
2.	Name of the centers where work was done	:	Panniyur, Chintapalle, Dapoli, Sirsi, Pundibari, Pechiparai, Mudigere, Pampadumpara, Kumarganj, Pottangi, Raigarh, Solan, Coimbatore, Jagtial, Jagudan, Jobner & Ambalavayal
3.	Non-performing centers if any	:	Nil
4.	Brief description of the work done and salient results reported (crop-wise)	:	The centers presented the reports
5.	Recommendations/decisions (crop wise)	:	

A. Black pepper

1. Management of scale-insect in black pepper by bio-rationals and insecticides may continue at Pampadumpara and Mudigere Centers [**Action:** Respective Centers]
2. Nematode problems of black pepper must be addressed in coordinating research trials along with *Phytophthora* foot rot (**Action**: All centers)

B. Cardamom

1. Identification of entomo-pathogenic fungi should be done [**Action:** Pampadumpara center]
2. For trials on disease management, the bioagents will be supplied by IISR, Calicut [**Action:** HD CP, IISR, PC would facilitate]
3. Only the chemical name of fungicides/insecticides should be quoted in the report and trade names should be avoided [**Action:** All the Centers]

C. Ginger

1. Healthy seed rhizomes should be used in the trials [**Action:** All the Centers]
2. Trials should not be repeated in field, where ginger was grown earlier [**Action:** All the Centers]
3. Taxonomic identification of soft rot pathogen, *Pythium* using PCR based techniques may be done at IISR, Calicut [**Action:** Concerned centers/PC would facilitate]
4. Information on bio-disinfestation may be generated at Solan against pathogens of ginger [**Action:** Solan center]
5. Ruling local varieties/released varieties should be used in the trials on disease management [**Action:** All the Centers]
6. Biocontrol agents for disease management trials will be supplied by IISR, Calicut [**Action:** PC / HD CP, IISR]

D. Turmeric

1. Since the project TUR/CP/1.4 has been closed, the disease incidence and collection of diseased samples would be taken up under the project TUR/CP/1.1 henceforth, and the samples may be sent to Project Coordinator Unit (IISR, Calicut as collaborating center). Disease free or disease tolerant/resistant germplasm accessions may also be sent to PC Unit. However, the instructions for recording the disease incidence and the collection of samples of turmeric may be followed as given in the proceedings of XVII Workshop of AICRPS (page no. 62-65) [**Action:** PC Unit, IISR, Calicut & respective Centers]

E. Tree Spices

1. Casual organisms of different diseases affecting tree spices must be identified and documented [**Action:** Dapoli center]

F. Coriander

1. Neem product (NSKE 5%) may be taken up as an additional treatment in the ongoing project, COR/CP/1.3: Management of powdery mildew and stem gall in coriander [**Action:** Coimbatore, Dholi, Jagudan, Jobner, Kumarganj & Raigarh Centers]

G. Cumin

1. Neem product (NSKE 5%) may be taken up as an additional treatment against powdery mildew in the ongoing project, CUM/CP/1.3: Management of wilt and blight in cumin [**Action:** Jagudan & Jobner Centers]

H. Fenugreek

1. Benefit cost ratio of the technology may also be worked out before recommendation

6. Recommendations ready for transfer to extension agency, if any:

(i) Management of cardamom root grub *(Pampadumpara)*

Early stages of the cardamom root grub, *Basilepta fulvicorne* (Jacoby) that are usually present in soil during April/May and September/October can be managed by soil drenching of Imidacloprid 0.015% (5 litres/plant) or Chlorpyrifos @ 0.07% (5 litres/plant) or application of Carbofuran @ 3.0 g a.i./clump (10-15 cm around the plant). Removal of mulch/weed cover and forking of soil prior to application of insecticides produced better results.

(ii) Biocontrol of root rot in fenugreek *(Coimbatore)*

Soil application of *Trichoderma viride* @ 5 kg/ha at 20 days before sowing (DBS) and soil application of neem cake @ 150 kg/ha is recommended for biocontrol of root rot in fenugreek.

(iii) Management of leaf blotch and leaf spot in turmeric *(Pundibari)*

Seed treatment as well as spraying with mancozeb + carbendazim (0.2% each) is the best treatment against leaf blotch and leaf spot of turmeric.

(iv) Biocontrol of rhizome rot in turmeric *(Coimbatore)*

The treatment including seed treatment as well as soil application of *Trichoderma viride* & *Pseudomonas fluorescens* @ 12.5 kg/ha and 25 kg/ha as basal & top dressing respectively along with application of recommended NPK + FYM is the best treatment against rhizome rot of turmeric.

(v) Management of *Phytophthora* disease in black pepper nursery *(Pampadumpara, Chintapalle, Dapoli)*

Solarized potting mixture fortified with *Trichoderma harzianum* @1 gm/kg and VAM @ 100cc/ kg potting mixture was found effective for the management of *Phytophthora* infections in black pepper nursery.

(vi) Management of *Phytophthora* disease of black pepper *(Sirsi, Mudigere, Pampadumpara, Panniyur and Ambalavayal)*

Application of Potassium phosphonate (Akomin, 3 to 5 ml per litre) as spray and drench twice, during pre monsoon (first week of June) and post monsoon (second week of August) periods along with the soil application of *Trichoderma harzianum* (10^{7} cfu, @ 50g $vine^{-1}$) with 1 kg of neem cake is recommended.

7. New programmes proposed (crop-wise) :

A. BLACK PEPPER

I. Center	:	**Ambalavayal, Panniyur, Pampadumpara, Sirsi, Chintapalle, Dapoli, Mudigere**
Title of the programme	:	PEP/CP/1.7 Management of *Phytophthora* foot rot disease in black pepper (adaptive trial)
Design	:	RBD
No. of plants	:	50 vines/ treatment (The experiment must be conducted in blocks of 50 vines only for the treatment. However, for the purpose of statistical analysis the observations recorded on 50 vines may be analyzed as seven replications of 6 vines each)
No.of replications	:	7

No. of treatments/genotypes:

1. Potassium phosphonate (0.3%) + *Trichoderma harzianum* (MTCC-5179)
2. Bordeaux mixture spray (1.0%) – COC (0.1%) drench
3. Farmers practice

Time of application : May-June and July-August)

Observations to be recorded :

1.Yellowing 0-3 (0=No yellowing ;
1 = upto 25% of leaves yellowing ;
2=upto 50% yellowing; 3=>75% yellowing)

2. Defoliation 0-3 (0=No defoliation;
1= upto 25% defoliation,
2= upto 25% defoliation; 3=>75% defoliation.

3. Death of vines
4. Canopy size- At 3M (Existing plantations)
5. Gall / lesion index
6. Yield / vine

II. Center	:	**Ambalavayal, Panniyur, Pampadumpara, Sirsi, Chintapalle, Dapoli, Mudigere**
Title of the programme	:	PEP/CP/1.8 Management of *Phytophthora* foot rot disease in black pepper (Existing plantations)
Design	:	RBD
Plot size/spacing	:	6 vines/ treatment (6 x 4=24)
No. of plants/plot/ treatment	:	2 plts/std
No. of replications	:	4
Treatment details	:	

a) Existing plantations

1. Potassium phosphonate (0.3%) + *Trichoderma harzianum* (MTCC-5179)
2. Bordeaux mixture spray (1.0%) –COC (0.1%) drenching
3. Consortium of bacteria (For growth, Nematode and *Phytophthora* suppression – IISR-6 & IISR-859)
4. *T. harzianum* + consortium of bacteria
5. Control

Time of application	:	May-June and July-August
Methodology to be adopted	:	The experiment may be taken up in a block and a minimum of 50 vines may be maintained for each treatment.

- *Trichoderma harzianum* must contain 10^8 (cfu)/g of formulation
- The biocontrol consortium of bacteria may be prepared separately to get 10^8cfu and mixed together

III. Center	:	**Ambalavayal, Panniyur, Pampadumpara, Sirsi, Chintapalle, Dapoli, Mudigere**
Title of the programme	:	PEP/CP/1.9 Management of *Phytophthora* foot rot disease in black pepper (New plantation)

b) New Plantation

Design	:	Split plot
Plot size/spacing	:	6 plants/plot (3 x 3m)
No. of plants/plot/treatment	:	2 plts/std
Replications	:	3
Main Plot	:	3 varieties

1. IISR-Shakthi
2. IISR-Thevam
3. Panniyur-1 (or) Panniyur-5

Sub plots

1. Potassium phosphonate (0.3%) + *Trichoderma harzianum* (MTCC-5179)
2. Bordeaux mixture spray (1.0%) –COC (0.1%) drenching
3. Consortium of bacteria (For growth, Nematode and *Phytophthora* suppression IISR-6 and IISR- 859)
4. *T. harzianum* (MTCC 5179) + consortium of bacteria (IISR-6 + IISR-859)
5. Control

Methodology to be adopted:

Cultural practices such as providing drainage, shade regulation, application of organics, correction of pH and nutrition management as per recommended practice for ideal growth of black pepper.

- *Trichoderma harzianum* must contain 10^8 (cfu)/g of formulation
- The biocontrol consortium of bacteria may be prepared separately and mixed together to get 10^8cfu

Time of application : May-June and July-August

Observations to be recorded :

1. Initial Establishment
2. Yellowing 0-3 (0=No yellowing; 1= upto 25% of leaves; 2=upto 50%; 3=>75% yellowing)
3. Defoliation 0-3 (0=No defoliation; 1= upto 25% defoliation, 2= upto 25% defoliation; 3=>75% defoliation.
4. Death of vines
5. Growth-Height, Girth at collar and production of laterals.
6. Gall / lesion index
7. Yield / vine

B. CARDAMOM

IV. Center : **Pampadumpara, Mudigere**

Title of the programme : CAR/CP/1.1 Management of rhizome and panicle rot in Cardamom (Existing plantations)

Design : RBD

No. of plants : 12 6x12x4 = 288

Replications : 4

Experiment details :

a) Existing plantations

1. *Trichoderma harzianum* (MTCC-5179)
2. Consortium of bacteria (For growth, Nematode and suppression of *Pythium*)
3. *T. harzianum* + consortium of bacteria (IISR-6 & IISR-859)
4. COC (0.1%) drenching
5. Potassium phosphonate (0.3%) spray and drench
6. Control

Time of application : May-June and July-August

Methodology to be adopted:

- *Trichoderma harzianum* must contain 10^8 (cfu)/g of formulation
- The biocontrol consortium of bacteria may be prepared separately to get 10^8cfu and mixed together

Observations to be recorded:

1. Incidence of disease

a) Tiller infection

b) Panicle infection

c) Foliar diseases (leaf blight, leaf blotch)

2. Yield

V. Center : Mudigere, Pampadumpara

Title of the programme : CAR/CP/1.2 Management of rhizome and panicle rot in Cardamom (New plantation)

Design : Split plot

No. of plants : 12 6x12x3x3= 648plants

Replications : 3

Experimental details :

b) New Plantation

Main Plot : 3

Varieties for Mudigere

1. Njallani Green Gold
2. IISR-Avinash
3. Mudigere-1

Varieties for Pampadumpara

1. Njallani Green Gold
2. IISR-Avinash
3. PV-2

Sub plot : 6

1. *Trichoderma harzianum* (MTCC-5178)
2. Consortium of bacteria (For growth, Nematode and suppression of *Pythium*)
3. *T. harzianum* + consortium of bacteria (IISR-6 + IISR-859)
4. COC (0.1%) drenching
5. Potassium phosphonate (0.3%) spray and drench
6. Control

Time of application: May-June and July-August

Methodology to be adopted:

- *Trichoderma harzianum* must contain 10^8 (cfu)/g of formulation
- The biocontrol consortium of bacteria may be prepared separately to get 10^8cfu and mixed together

Observations to be recorded:

1. Initial establishment
2. Incidence of disease
3. Tiller infection
4. Panicle infection
5. Foliar diseases (leaf blight, leaf blotch)
6. Yield

VI. Center	:	**Mudigere and Pampadumpara**
Title of the programme	:	CAR/CP/2.6 Management of shoot fly in cardamom
Date/year of start	:	2006
Duration of the project	:	Three years
		Details of technical programme
Design	:	RCBD
No. of replications	:	3
Plot size/spacing	:	384 clumps
No. of plants/plot/ treatment	:	16 plants/plot
Date of sowing/planting season		2005-06
Treatment details	:	T_1 – Phorate 10 g/clump
		T_2 – 1 kg neem cake/clump (pre and post monsoon application)
		T_3 – Fipronil 1.5 ml/lit of water
		T_4 – Fish oil 4 g/lit of water
		T_5 – NSKE 4%
		T_6 – Thiamethoxam 25% WG (0.0125%)
		T_7 – Imidacloprid 0.01% (0.75 ml/litre)
		T_8 – Control

Methodology & procedure to be adopted:

The observations on incidence of pests indicated that maximum dead heart recorded during dry periods from November to May compared to rainy period (June-September). The treatments application will be taken during emergence of tillers. The trial should be taken up in a new planting.

Observations to be recorded:

Observations will be recorded as pre treatment, one month after first treatment, 60 days after first treatment and 75 days after first treatment.

VII. Center	:	**Pampadumpara and Mudigere**
Title of the programme	:	CAR/CP/2.7 Management of cardamom root grub through Entomopathogenic Nematodes
Duration of the project	:	Two years
		Details of technical programme
Design	:	RBD
No. of treatments	:	7
No. of replication	:	Three
No. of plants/treatment	:	Six
Date of start	:	April-May 2006
Treatment details	:	T1 – *H. indicus* (CRS isolate) 100 IJ/grub
		T2 – *H. indicus* (CRS isolate) 200 IJ/grub
		T3 – *H. bacteriophora* 100 IJ/grub
		T4 – *H. bacteriophora* 200 IJ/grub
		T5 – Imidacloprid 0.01% (0.75 ml/litre)
		T6 – *H. indicus* (CRS isolate) 100 IJ/grub plus
Imidacloprid		0.5 ml/litre
		T7 – Control

Methodology to be adopted:

Determination of LD_{50} for the local isolate

Mass production of required strains of entomopathogenic nematodes using *G. mellonella.*

Observation to be recorded:

The treatments will be applied two times (first season April-May and second season September-October) in a year. Grub population will be assessed in 30 cm^3 of soil prior to and after application of treatments and percentage suppression of the grub population will be worked out. Dry capsule yield will also be recorded. Grubs infected by *Heterorhabditis* sp. turn reddish-brown and those grub alone will be counted as infected during post-treatment count. Survival of EPN will also be determined.

C. GINGER

VIII. Center	:	**Mudigere, Pampadumpara, Chintapalle, Sirsi, Dapoli and IISR, Calicut (collaborating center)**
Title of the programme	:	**GIN/CP/1.6 Management of rhizome rot in ginger**
Design	:	Split plot
Bed size	:	3 x 1 m
Replication	:	5 (average of 3 beds may be considered for one replication)
Treatment details	:	
Main Plot	:	2 (Rhizome solarization-No solarization)
Sub plots	:	5

1. *Trichoderma harzianum* seed treatment + soil application
2. Bacterial consortium- (For growth, Nematode and *Pythium* suppression) Seed treatment and field treatment 3 months at monthly interval after 15 days of 50% germination.
3. *T. harzianum* + Bacterial consortium
4. Mancozeb seed treatment + Soil drench
5. Control

Observations to be recorded:

1. Germination (%) at fortnightly intervals up to 2 months
2. Tiller production-Number
3. Disease incidence- Fortnightly intervals from 45th day after sowing (soft rot, bacterial wilt, foliar diseases)
4. Gall / lesion index
5. Yield – bed-wise

8. General decisions, if any : Nil

Technical Session V

IDENTIFICATION OF VARIETIES & RECOMMENDATIONS FOR EXTENSION AGENCY

Chairman	:	Dr. K.U.K. Nampoothiri
Co-Chairman	:	Dr. V.A. Parthasarathy
Rapporteurs	:	Dr. T.E. Sheeja (IISR)
		Dr. S.K. Malhotra (NRCSS)

There were 12 proposals for identifying varieties for release. The proposals were thoroughly discussed and the decisions taken are given below crop-wise:

1. **SMALL CARDAMOM: Two proposals**

a. MHC 26 (*ICRI-5*): (ICRI, Myladumpara)
The hybrid was identified for state release, with the remarks for ensuring enough planting material. Material may be supplied to Pampadumpara for field evaluation.

b. MCC 73 (*ICRI-6*): (ICRI, Myladumpara)
This variety was identified for state release and the breeders may fill up the prescribed proforma with full details, also should ensure availability of enough planting material.

2. **CORIANDER: Three proposals**

a. **LCC 128 (*Sudha*): (Guntur Center)**
The variety was identified for state release for rainfed areas in Andhra Pradesh.

b. **DH 246 (*Hisar Surabhi*): (Hisar Center)**
This variety, DH 246 identified for state release in earlier AICRP spices Workshop. It was identified for release for Chattisgarh, Bihar and Haryana states.

c. **UD 480 (*RCr.480*): (Jobner Center)**
The variety was identified for state release

3. **CUMIN: Two proposals**

a. **JC-2000-72 (*GC-4*): (Jagudan Center)**
The variety possessing resistance to *Fusarium* wilt was identified for release at National level.

b. **UC-341 (*RZ-341*): (Jobner Center)**
The variety was identified for release at state level.

4. **FENUGREEK: Two proposals**

a. **Fenu-244 (*GM-2*): (Jagudan Center)**
This required to be tested for two more years with National check before consideration for release at National level. However, it was identified for state release.

b. **UM-351 (*RMt-351*): (Jobner Center)**
Identified for state release.

5. **FENNEL: One proposal**

   a. **UF 178 (*RF-178*): (Jobner Center)**
   Identified for state release.

6. **ANISE: One proposal**

   a. **A.Ani-01-2 (*NRCSS-A Ani-1*):(NRCSS, Ajmer)**
   Identified for state release

7. **CELERY: One proposal**

   a. **ACel-01-1 (*NRCSS, ACel-1*): (NRCSS, Ajmer)**
   Identified for state release

General decisions, if any:

1. The breeders should ensure for enough planting material, before submitting the proposals to State Release Agencies.
2. The breeders should mention the quantity of seed stock available for distribution, in the prescribed Varietal Release Proforma for each proposal.
3. Keeping in view the wide yield differences for seed spices in the growing regions, it was felt to improve the existing proforma by inclusion of some yardsticks for comparison of seed spices proposals to be considered for recommendations for release at National level. In this context, a committee consisting of Assistant Director General (PC), Project Co-ordinator, Director (NRCSS) and scientists from AICRP spices centers, shall finalize in group meeting.
4. The seed spices co-ordinating centers shall send the seed samples to Jobner and NRCSS for quality (essential oil) estimation for the selections/entries in pipeline for consideration for release.

Technical Session VI

ICAR ADHOC SCHEMES

Chairman : Dr. K.V. Ramana

Rapporteurs : Dr. K Kandiannan

Dr. A Joseph Rajkumar

In this session, the following four projects were presented and reviewed :

1. "Studies on salt tolerance in seed spices (Fennel, coriander & fenugreek)" [PI: **Dr. J.L. Mangal**, Professor, Dept. of Vegetable Crops, CCS Haryana Agril. University, Hisar-125 004 (Haryana)]
2. "Conservation and evaluation of Ajowain (*Trachyspermum ammi*) germplasm for identification of high yielding oil genotypes" [PI: **Dr. R.V. Paliwal,**] Associate Professor (PB & G), MPUAT, Agril. Research Sub Station, (Pratapgarh Dist. Chittorgarh (Rajasthan)]
3. "Studies on nematode problems of seed spice crops in Haryana " [PI: **Dr. I.J. Paruthi**, Sr. Nematologist, Deptt. of Nematology, CCS Haryana Agril. University, Hisar-125 004, Haryana)]
4. "Investigations on the etiology and integrated management rhizome rot of ginger & turmeric in Northern Karnataka" [PI: **Dr. Srikant Kulkarni**, Professor & Head, Dept. of Plant Pathology, College of Agriculture, UAS, Dharward-580 005)]

Recommendations / Suggestions:

Project (1) : The data collected may be statistically analysed and presented in the reports

Project (2) : (a) All accessions along with passport data need be deposited with NBPGR, New Delhi for assigning EC numbers

(b) It was suggested to consider Ajowain as a mandate crop of AICRPS

(c) The data on oil content of ajowan genotypes may be analysed and presented

Project (3) : Various nematode species encountered in the survey may be identified up to species level. Frequency of occurrence and levels of infestation may be tabulated and presented.

Project (4) : Since the causal organisms for rhizome rot are many, screening should be done specifically for each pathogen.

PLENARY SESSION

Chairman	:	Dr. K V Ramana – ADG (PC) (ICAR)
Co- Chairman	:	Dr. M. Anandaraj, Project Coordinator (Spices)
Rapporteurs	:	Dr. V. Srinivasan (IISR)
		Dr. A.K. Johny (IISR)

Plenary session was chaired by Dr. K. V. Ramana, ADG (PC) and co-chaired by Dr. M. Anandaraj, PC (Spices). Reports of various technical sessions were presented by the respective members and discussions were made on the recommendations. The major points that emerged in the sessions are:

- Under Genetic Resources, Pundibari center may discontinue the work on evaluation of pepper germplasm and they can concentrate more on collecting black pepper lines from local growing areas
- Under Crop Improvement, all the Centers providing germplasm materials for CYT should provide the IC Nos. & passport data. The accessions without those registration data will not be allowed for inclusion in trials
- The seed materials for all CVT trials may be sent to PC and in turn will be distributed to all the other Centers for trials
- The availability of planting materials of promising lines of black pepper for CVT may be ensured and can be supplied to the Centers during next planting season
- Centers are asked to select the promising lines with only distinct characters like disease resistance, drought tolerance, high yield etc for promoting to CVTs at different locations.
- For drought tolerant studies of seed spices, many AICRPS Centers expressed their inability on measurement of parameters like SR, RWC, as they don't have the equipments. Hence it was decided that measurable parameters & their protocols can be standardized & circulated to Centers from NRCSS, Ajmer through PC (Spices)

Jagudan center also expressed their inability to take up bioregulator studies on seed spices as there is no Agronomist/Horticulturist. Regarding organic farming trials on black pepper, the existing trials at Panniyur will be continued in addition to the newly formulated ones.

Crop Protection Session recommendations were discussed and the importance of nematode pest in crop loss was highlighted for indepth studies. As the Centers have no nematologists posts, ADG suggested for including nematologist posts during the next plan period by PC (Spices). Till then the services of nematologist in their respective universities may be sought.

It is also suggested to train the scientists from coordinating Centers working on black pepper, on viral diseases of black pepper at IISR, Calicut.

ADG also emphasized for development of efficient biocontrol consortia at IISR, Calicut by doing basic research for rhizome rot of turmeric and ginger and further evaluation at different Centers in later stages.

Some of the common decisions to be implemented by the Centers are,

- All the data to be presented in AICRPS workshop should be statistically analyzed with standard error (SE), critical difference (CD at 5%), coefficient of variation (CV), etc.
- Consolidated data from all the Centers have to be presented in a comprehensive table for each crop for easy identification and understanding.
- All the AICRPS Centers should send a copy of their publications on spices including M.Sc. and Ph.D theses on spices to the PC (Spices), to have a centralized reference unit at IISR, Library.
- PC Unit can compile replication-wise raw data collected from different Centers of closed projects on spice crops and bring out a publication.
- All the Centers are instructed to submit their AUC in time for ensuring their fund release.

The meeting came to an end with vote of thanks by Dr. K. N. Shiva, Scientist, PC Unit, IISR, Calicut.

Annexure-I

Group Meetings under AICRPS

The following four Group Meetings were organized and conducted at IISR, Calicut to review the progress and recasting of ongoing research projects and formulation of new research programmes on spices under AICRPS :

Sl. No.	Date	Technical session/ Discipline	Resource persons
1.	23.8.2005	Crop Protection (Black pepper & Cardamom)	Dr. V. A. Parthasarathy, Director, IISR, Calicut Dr. M. N. Venugopal, Head, IISR CRC, Appangala Dr. M. Anandaraj, Head, Crop Protection, IISR, Calicut Dr. K. N. Shiva, Scientist SS, PC Unit, IISR, Calicut Dr. A. K. Johny, Technical Information Officer, PC Unit, IISR, Calicut Dr. K. P. Mammootty, Assoc. Prof., Panniyur Dr. S. D. Rangaswamy, Pl. Pathology, Mudigere Dr. V. A. Gadre, Pl. Pathology, DapoliDr. A. Joseph Rajkumar, Agrl. Entomology, Pampadumpara Dr. Prasannakumari, Pl. Pathology, Chintapalle Dr. G. Sivakumar, Pl. Pathology, Panniyur Dr. Susamma P. George, Breeder, Ambalavayal Dr. M. S. Lokesh, Pl. Pathology, Sirsi and Scientists of Crop Protection Division, IISR, Calicut
2.	9.5.2006	Crop Protection	Dr. M. Anandaraj, PC (Spices), IISR, Calicut Dr. S. Devasahayam, Head, Crop Protection, IISR, Calicut Dr. K. N. Shiva, Scientist SS, PC Unit, IISR, Calicut
3.	11.5.2006	Crop Production	Dr. M. Anandaraj, PC (Spices), IISR, Calicut Dr. K. Kandiannan, Sr. Scientist, IISR, Calicut Dr. V. Srinivasan, Scientist SS, IISR, Calicut Dr. K. N. Shiva, Scientist SS, PC Unit, IISR, Calicut
4.	12.5.2006	Genetic Resources & Crop Improvement	Dr. M. Anandaraj, PC (Spices), IISR, Calicut Dr. K. N. Shiva, Scientist SS, PC Unit, IISR, Calicut

Annexure-II

LIST OF PARTICIPANTS

A. Indian Council of Agricultural Research, New Delhi

1. Dr. K.V. Ramana, Asst. Director General (PC)

B. Project Coordinator Unit, IISR, Calicut

2. Dr. M. Anandaraj, Project Coordinator, AICRP on Spices
3. Dr. K. N. Shiva, Scientist Sr. Scale (Hort.)
4. Dr .A. K. Johny, Technical Information Officer

C. NRC on Seed Spices, Ajmer, Rajasthan

5. Dr. B. B. Vashishta, Director
6. Dr. S.K. Malhotra, Sr. Scientist (Hort.)

D. Coordinating Centers,
Cardamom Research Station, KAU, Pampadumpara

7. Dr. A. Joseph Rajkumar, Asst. Prof. (Agri. Entomology)
8 Dr. S. Backiyarani, Asst. Prof. (Pl. Breeding)
9. Dr. G. Shivakumar, Asst. Prof. (Pl. Pathology)

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10. Dr. S.D. Rangaswamy, Pathologist
11. Dr. S. Gangaprasad, Breeder
12. Mr. M. Dinesh Kumar, Agronomist (Hort.)
13. Mr. D. Jemla Naik, Jr. Entomologist

Horticultural Research Station, TNAU, Yercaud/Pechiparai

14. Dr. V. Lakshmanan , Professor & Head
15. Dr. Swarnapriya, Jr. Breeder, Pechiparai

Pepper Research Station, KAU, Panniyur

16. Dr. K.P. Mammootty, Assoc. Professor
17. Dr. Neema V.P., Breeder (Hort.)

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18. Mr. D. Lakshminarayana, Horticulturist

Agricultural Research Station, UAS (Dharward), Sirsi

19. Mr. M. S. Lokesh, Head of the Station
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26. Dr. E.V.D. Sastry, Sr. Breeder
27. Dr. Dhirendra Singh, Breeder
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31. Dr. A.V. Agalodiya, Head of the Scheme
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33. Mr. G. M. Patel, Jr. Breeder

Department of Spices & Plantation Crops, TNAU, Coimbatore

34. Dr. K. Rajamani, Prof. & Head
35. Dr. (Mrs.) N. Shoba, Breeder (Horticulturist)
36. Dr. Sendhilvel, Jr. Pathologist

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37. Mr. Raja Naik, Jr. Horticulturist

Department of Vegetable Crops, CCS HAU, Hisar

38. Dr. K. K. Thakral, Olericulturist/Horticulturist
39. Dr. P.S. Partap, Prof. & Head

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40. Dr. R.G. Khandekar, Jr. Breeder
41. Dr. U.A. Gadre, Plant Pathologist

Narendra Dev University of Agriculture and Technology, Kumarganj

42. Dr. J. Dixit, Breeder
43. Dr. R. P. Saxena, Jr. Pathologist

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44. Dr. C.R. Gupta, Horticulturist
45. Dr. S. Tripathi, Jr. Breeder
46. Dr. A. K. Singh, Jr. Pathologist

Uttar Banga Krishi Viswa Vidhyalaya, Pundibari

47. Dr. J. C. Jana, Horticulturist
48. Dr. Niladri Bhowmik, Jr. Breeder
49. Dr. S. Bandopadhyay, Jr. Pathologist

Voluntary Centre

50. Dr. K.C. Aipe, Regional Agricultural Research Station (KAU), Ambalavayal
51. Smt. Susamma P. George, Asst. Professor RARS, (KAU) Ambalavayal
52. Mr. Paul Lazarus, Asst. Professor, RARS, (KAU) Ambalavayal

E. Principal Investigators of Ad-hoc Schemes

53. Dr. Srikant Kulkarni, UAS, Dharward
54. Dr. R.V. Paliwal, MPUAT, Agril. Research Sub Station, Pratapgarh Dist. Chittorgarh (Raj.)
55. Dr. I.J. Paruthi, HAU, Hisar

F. Spices Board (ICRI)

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57. Dr. K.J. Madhusoodanan
58. Dr. B. Gopakumar
59 Dr. K.M. Kuruvilla
60. Dr.V.V. Radhakrishnan
61. Dr. B.A. Vadiraj (Sakleshpur)
62. Sh. Hrideek T.K.

G. Farmers Representatives

63. Mr. K. Mukundan (IMC & RAC Member, IISR, Wynad)
64. Sh.V. K Rajamani, Kozhikode
65. Sh. C.P. Koya, Kozhikode

H. Directorate of Arecanut & Spices Development, Calicut

66. Dr. P. Premaja, Research Officer
67. Dr. V.R.V. Krishna

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68. Dr. P.V. Balachandran, Associate Director of ResearchKerala Agricultural University, RARS, Mele Pattambi Post, Palakkad-679 306
69. Dr. K.U.K. Nampoothiri, Director, MS Swaminathan Research Foundation, Kalpetta

J. Indian Institute of Spices Research, Calicut

70. Dr. V.A. Parthasarathy, Director
71. Dr. B. Chempakam, Head, Division of Crop Production & Post Harvest Technology
72. Dr. S. Devasahayam, Principal Scientist
73. Dr. K. N. Kurup, Principal Scientist
74. Dr. M. N.Venugopal, Head, CRC, Appangala
75. Sri B. Krishnamoorthy, Head Crop Improvement & Bio Technology
76. Sri P.A. Mathew, Principal Scientist & Scientist-in-Charge, IISR Experimental Farm, Peruvannamuzhi
77. Dr. T.K. Jacob, CTO-in-Charge, KVK, IISR Exptl. Farm, Peruvannamuzhi
78. Dr. K. Nirmal Babu, Sr. Scientist
79. Dr. John Zachariah, Sr. Scientist
80 Dr. B. Sasikumar, Sr. Scientist
81. Dr. J. Rema, Sr. Scientist
82. Dr. Johnson K. George, Sr. Scientist
83. Dr. C. K. Thankamani, Sr. Scientist
84. Dr. R. Dinesh, Sr. Scientist
85. Dr. Susheela Bhai, Sr. Scientist
86. Dr. A. Ishwara Bhat, Sr. Scientist
87. Dr. R. R. Nair, Sr. Scientist
88. Dr. P. Rajeev, Sr. Scientist
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90. Dr. K.S. Krishnamoorthy, Sr. Scientist
91. Dr. K. Kandiannan, Scientist, Sr. Scientist
92. Dr. S.J. Eapen, Scientist, Sr. Scientist
93. Dr. N. K. Leela, Sr. Scientist
94. Sri K. M. A. Koya, Scientist SG
95. Mr. K.V. Saji, Scientist, SG
96. Dr. A. Kumar, Scientist Sr. Scale
97. Dr. V. Srinivasan, Scientist Sr. Scale
98. Dr. (Mrs.) Sheeja, Scientist Sr. Scale
99. Dr. (Mrs.) Jayashree, Scientist Sr. Scale, IISR, Peruvennamuzhi
100. Dr. D. Prasath, Scientist, IISR – CRC Appangala

K. Other participants

101. Mr. Prabakharan, Manager, State Bank of India, Calicut
102. Dr. Z. Abraham, NBPGR Regional Station, Trichur

Annexure-III

List of Committees

I. Organizing Committee

Chairman	:	Dr. V.A. Parthasarathy
Convener	:	Dr. M. Anandaraj

II. Programme Committee

Chairman	:	Dr. S. Devasahayam
Convener	:	Dr. A Ishwara Bhat
Members	:	Dr. Santhosh J. Eapen
		Dr. N.K. Leela
		Dr. K.N. Shiva

III. Reception & Registration Committee

Chairperson	:	Dr. B. Chempakam
Convener	:	Dr. K. S. Krishnamoorthy
Members	:	Dr. R. Suseela Bhai
		Dr. C.K. Thankamani
		Dr. A. K. Johny
		Dr. Utpala Parthasarathy

IV. Administrative and Finance Committee

Chairman	:	Dr. K.N. Kurup
Members	:	Mr. M.K. Sachidanandan
	:	Dr.J. Rema
		Dr. R. Ramakrishnan Nair

V. Publicity Committee

Chairman	:	Dr. R. Dinesh
Member	:	Dr. P. Rajeev

VI Hospitality Committee

Chairman	:	Dr. T. John Zachariah
Convener	:	Dr. Johnson K. George
Member	:	Mr. K.V. Saji

VII. Transport and Accommodation Committee

Chairman	:	Mr. S.M. Chettiar
Convener	:	Dr. S. Hamza
Member	:	Mr. M. M. Augusthy

VIII. Hall Arrangement Committee

Chairman	:	Dr. K. Nirmal Babu
Convener	:	Dr. T.E. Sheeja
Members	:	Dr. A. Kumar
		Mr. K.K. Sasidharan
		Mr. K. Jayarajan
		Mr. A. Sudhakaran
		Ms. Minoo Divakaran

IX. Exhibition Committee

Chairman	:	Dr. T.K. Jacob
Convener	:	Mr. V. Sivaraman
Members	:	Mr. P.A. Mathew
		Dr. K. Kandiannan
		Dr. V. Srinivasan
		Mr. K.M. Prakash