भाकृअनुप
ICAR

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

24-26 OCTOBER 2016

ICAR-NATIONAL RESEARCH CENTRE ON SEED SPICES
AJMER, RAJASTHAN

ICAR-All India Coordinated Research Project on Spices

ICAR-Indian Institute of Spices Research
Kozhikode - 673012, Kerala, India

Proceedings of XXVII Workshop

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ICAR-National Research Centre on Seed Spices, Ajmer, Rajasthan

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

November 2016

Complied & Edited by

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PROGRAMME

24th October 2016

INAUGURAL SESSION		**10.00 am – 11.15 am**

Rapporteurs : 1. Dr. R. S. Mehta, ICAR-NRCSS, Ajmer
2. Dr. M. S. Shivakumar, ICAR-IISR, Kozhikode

	ICAR song	
10.05 am	Welcome	**Dr. K. Nirmal Babu**, Director, ICAR-IISR & Project Coordinator (AICRPS) Kozhikode
10.15 am	Lighting the lamp	
10.20 am	Presidential Address	**Dr. Gopal Lal**, Director, ICAR-NRCSS, Ajmer
10.30 am	Address by Guest of Honour	**Dr. Homey Cheriyan** Director, DASD, Kozhikode **Dr. P. N. Jagadev** Director of Research, OUAT, Bhubaneshwar **Dr. S. R. Maloo** Ex Director Research, MPUAT, Udaipur
10.45 am	Presentation of awards & Inaugural address by Chief Guest 1. Best Centre Award 2. Honoring the scientists 3. Award to media persons 4. Release of Publications	**Dr. T. Janakiram** Assistant Director General (HS II), ICAR, New Delhi
11.10 am	Vote of Thanks	**Dr. Ravindra Singh** Principal Scientist, ICAR-NRCSS, Ajmer
	National Anthem	

11.15 am – 11.30 am Tea

24th October 2016

Special Session **11.30 am – 11.50 am**

Chairpersons : **Dr. T. Janakiram**, Assistant Director General (HS II.), ICAR, New Delhi
Dr. Gopal Lal, Director, ICAR-NRCSS, Ajmer

Coordinators report & Action Taken Report: **Dr. K. Nirmal Babu**, Project Coordinator, AICRPS

24th October 2016

SESSION I : Genetic Resources & Crop Improvement 11.50 am – 2.00 pm

Chairpersons : **Dr. S. R. Maloo**, Ex Director Research, MPUAT, Udaipur
Dr. P. N. Jagadev, Director of Research, OUAT, Bhubaneshwar
Dr. K. Nirmal Babu, Director, IISR & PC – AICRP on Spices

Rapporteurs : Dr. R. K. Solanki, ICAR-NRCSS, Ajmer
Dr. R. Chitra, TNAU, Coimbatore

Presentations

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

Project Mode centres

11	Nutmeg	Dr. M. Murugan, CRS, Pampadumpara
12	Nutmeg	Dr. P. Paramaguru, TNAU, Coimbatore
13	Cumin	Dr. Jansi Rani, HC&RI, TNAU, Periyakulam
14	Coriander, Fenugreek & Fennel	Dr. Maruthi Prasad, COH, Bengaluru
15	**Presentation of New Programmes**	Concerned Scientists

2.00 pm -2.30 pm **Lunch**

24th October 2016

SESSION II : Crop Management	**9.00 am – 12.00 pm**

Chairpersons : Dr. H. P. Maheshwarappa, Project Coordinator, AICRP on Palms, ICAR-CPCRI, Kasaragod
Dr. T. John Zachariah, Head, Crop Production & PHT, ICAR-IISR, Kozhikode
Dr. S. J. Ankegowda, Head, ICAR-IISR Regional Station, Appangala

Rapporteurs : Dr. K. S. Krishnamurthy, ICAR-IISR, Kozhikode
Dr. Sarita Sahu, RARS (IGKV), Raigarh

Presentations

1	Black pepper	Dr. Laxminarayan Hegde, HRS (UHSB), Sirsi
2	Cardamom	Dr. K. M. Devaraju, ZAHRS (UAHS), Mudigere
3	Ginger	Dr. Soumendra Chakraborty, UBKV, Pundibari
4	Turmeric	Dr. R. S. Mishra, NDUAT, Kumarganj
5	Coriander	Dr. T. P. Malik, CCSHAU, Hisar
6	Cumin	Dr. A. C. Shivran, SKNAU, Jobner
7	Fennel	Dr. A. C. Shivran, SKNAU, Jobner
8	**Presentation of New Programmes**	Concerned Scientists

4.00 pm -4.15 pm **Tea**

25th October 2016

SESSION III :	**Crop Protection**	**09.30 am – 11.30 am**

Chairpersons : Dr. Santhosh J. Eapen, Head, Division of Crop Protection, ICAR-IISR, Kozhikode
Dr. S. Devasahayam, Principal Scientist, Division of Crop Protection, ICAR-IISR, Kozhikode

Rapporteurs : Dr. (Mrs.) Meenu Gupta, Dr. YSPUHF, Solan
Dr. M. Manju, HRS (UHSB), Sirsi

Presentations

1	Black pepper	Dr. Rajesh Rangrao Rathod, DrBSKKV, Dapoli
2	Large cardamom	Dr. S. Sreekrishna Bhat, ICRI Regional Station, Gangtok
3	Cardamom	Dr. A. K. Vijayan, ICRI, Myladumpara
4	Ginger	Dr. (Mrs.) Meenu Gupta, Dr. YSPUHF, Solan
5	Turmeric	Dr. C. Ushamalini, TNAU, Coimbatore
6	Coriander	Dr. A.K. Singh, IGKV, Raigarh
7	Cumin	Prof. A. M. Amin, CRSS (SDAU), Jagudan
8	**Presentation of New Programmes**	Concerned Scientists

11.30 am -11.45 am **Tea**

25th October 2016

SESSION IV :	**VARIETY RELEASE**	**12.00 pm – 4.30 pm**

Chairpersons : Dr. T. Janakiram, Assistant Director General (HS II.), ICAR, New Delhi
Dr. A. V. Agalodiya, Former Research Scientist, SDAU, Jagudan

Rapporteurs : Dr. D. Prasath, ICAR-IISR, Kozhikode
Dr. B. Mahender TRS, SKLTSHU, Kammarpalli

1. Black Pepper – PRS, Panniyur
2. Ginger – UBKV, Pundibari
3. Turmeric - UBKV, Pundibari
4. Turmeric – IISR, Kozhikode
5. Turmeric – NDUA&T, Kumarganj
6. Coriander – CRSS, Jagudan
7. Coriander – RAU, Dholi
8. Coriander – RAU, Dholi
9. Fenugreek-CCSHAU, Hisar

2.00 pm-2.30 pm – Lunch

26th October 2016

SESSION V : TRANSFER OF TECHNOLOGY 9.30 am – 11.30 am

Chairpersons **: Dr. Homey Cheriyan**, Director, DASD, Kozhikode
Dr. S. Devasahayam, Principal Scientist, ICAR-IISR, Kozhikode

Rapporteurs : Dr. Ajit Kumar Singh, IGKV, Raigarh
Mr. V. A. Muhammed Nissar, ICAR-IISR, Kozhikode

1. New insecticides in cardamom against thrips, shoot and capsule borers – CRS, Pampadumpara
2. Liming in cardamom - CRS, Pampadumpara
3. Management of blight and powdery mildew by spacing and potash application in cumin – CRSS, Jagudan
4. Management of *Phyllosticta* leaf spot of ginger using fungicides –Dr. YSPUHF, Solan; RAU, Dholi & RARS, Raigarh
5. Management of foliar diseases of Turmeric – RAU, Dholi
6. Management of *Colletotrichum* leaf and *Taphrina* leaf blotch of turmeric - RARS, Raigarh
7. Any other

11.30 am-11.45 am Tea

26th October 2016

SESSION VI	Plenary Session	12.00 pm-2.00 pm

Chairperson : **Dr. T. Janakiram**, Assistant Director General (HS II), ICAR, New Delhi
Co-chairperson : **Dr. Gopal Lal**, Director, ICAR-NRCSS, Ajmer

Rapporteurs : Dr. Ravindra Singh, ICAR-NRCSS, Ajmer
Ms. Akshitha, H. J., ICAR-IISR, Kozhikode

12.00 pm	ICAR Song	
12.02 pm	Welcome address	**Dr. Gopal Lal**, Director, ICAR-NRCSS, Ajmer
12.10 pm	Presentation of session reports and recommendation	**Chairpersons**
12. 30 pm	Research Highlights and New programmes of AICRPS	**K. Nirmal Babu** Director, ICAR-IISR & Project Coordinator (AICRPS) Kozhikode
12.50 pm	Address by the Chairperson	**Dr. T. Janakiram**, Assistant Director General (HS II) ICAR, New Delhi
1.10 pm	Vote of Thanks	**Dr. K. Kandiannan** Principal Scientist, ICAR-IISR, Kozhikode
	National Anthem	

1.10 – 2.00 pm Lunch

2.00 - 4.30 pm Visit to NRCSS, Ajmer

INAUGURAL SESSION

Rapporteurs : Dr. R. S. Mehta, ICAR-NRCSS, Ajmer
Dr. M. S. Shivakumar, ICAR-IISR, Kozhikode

The XXVII workshop of ICAR-All India Coordinated Research Project on Spices (AICRPS) was started with the welcome address by Dr. Nirmal Babu, PC, AICRPS. He also appraised about the status and prospectus of spice research in AICRPS. He pointed out that spices plays very important role in export basket of horticultural products and contributing about 57 % of all the horticultural products exported from our country. The workshop was formally inaugurated by lighting the lamp by the chief guest Dr. T. Janakiram, ADG (HS II), ICAR, New Delhi.

Dr. G. Lal, Director, NRCSS in his presidential address emphasized on varieties, technologies developed and extension activities undertaken at NRCSS for the benefit of stake holders. He pointed out that area and production of Ajwain and Nigella is increasing year after year. Hence these two crops may also be taken under AICRP fold for verification of performance of the varieties and technology developed of these two crops.

Dr. Lal also informed that NRCSS has done wonderful work in value addition of seed spices, six patents have been filed, 10 products developed and technologies have been commercialized. Therefore, there is need to include the value addition and processing of seed spices programme under AICRP activities.

Dr. Homey Cherian, Director, DSAD, Calicut, expressed that AICRP Workshop is the biggest gathering of spices researchers in the country for discussing and deliberating on spices research. He desired that prices and quality of spices should be given proper space in policy framework of spices development in our country and quality parameters of spices should meet international standards.

Dr. Cherian opined that research system of spices should undertake only front line extension activities to benefit the stake holders with direct exposure to the technologies generated in the system. He pointed out that technologies developed should be economical and user friendly.

Dr. P.N. Jagdev, Director Research, OUAT, Orissa highlighted that most of the spices are grown in tropical condition and seed spices are grown under arid and semi arid climatic condition and

diversification of cropping system with introduction of spices is very beneficial. He informed that intensification of cardamom has taken place Orissa.

Dr. S.R. Maloo, Ex- Director Research, MPUAT, Udaipur informed that in our country 63 spices are grown out of which 20 are seed spices. He emphasized that to meet the increasing demand of burgeoning population by 2030, it is necessary to double the production of spices. To meet this target strategies have to be developed involving innovative breeding techniques. Among them are allele mining, genome sequencing, selection of marker and ideotype development. He also gave emphasis for addressing the problem of emerging challenges of spices particularly seed spices.

Dr. T. Janakiram, ADG (HS II), ICAR, New Delhi and Chief Guest of the function expressed his feeling with great happiness that during last three consecutive years production of horticultural crops have surpassed the food grain production in our country. He also pointed out that spices contribute 57 % in export basket of horticultural crops in our country.

Dr. Janakiram informed that over 180 spices or products are exported to more than 150 countries. He also advised to be vigilant as many countries like Vietnam, Indonesia, Australia and China are competing with India in spices export. Climatic diversity of India enables us to grow different kinds of spices and many are of Indian origin. He gladly informed that IISR, Calicut and NRCSS, Ajmer are very important institutions of SMD (Horticultural Science) and pointed out land mark achievements of these two institutions for the benefit of stake holders. He urged the researchers to work on water saving techniques for getting per drop more crop so that we can save these precious natural resources for the future generation.

Dr. Janakiram desired that technologies developed should be included in package of practices so that stake holder may get direct access to the technology and emphasized the need to increase the productivity of the spices and double the farmers income. He suggested the spices scientists to focus research on quality planting material production, resistance to biotic and abiotic stresses, protected cultivation, mechanization, post harvest processing and value addition and development of cropping systems involving spices for climate resilient agriculture.

He advised that ICT's like spice whatsapp and spice face book should be created for easy communication and dissemination of technologies. Mobile Apps may be developed for package of practices and identification of genotypes in spices.

The best AICRPS Centre award was presented to SKNAU, Jobner, Rajasthan and many publications on spices production from different AICRPS centres were released during the occasion.

Special Session

Chairpersons : **Dr. T. Janakiram**, Assistant Director General (HS II.), ICAR, New Delhi
Dr. Gopal Lal, Director, ICAR-NRCSS, Ajmer

Rapporteurs : Mr. Muhammed Nissar V. A., ICAR-IISR, Kozhikode
Dr. Shivakumar M. S., ICAR-IISR, Kozhikode

Coordinators report & Action Taken Report: **Dr. K. Nirmal Babu**, Project Coordinator, AICRPS

PROJECT COORDINATOR'S REPORT

K. Nirmal Babu
Project Coordinator
ICAR-All India Coordinated Research Project on Spices
ICAR-Indian Institute of Spices Research, Kozhikode – 673 012, Kerala

ICAR-All India Coordinated Research Project on Spices is a coordinating unit with 38 centres (19 regular, 10 co-opting and 9 voluntary centres) supplemented by five more in project mode funding, spreading over various agro climatic zones in 23 states of the country. Black Pepper, Large Cardamom, Small Cardamom, Ginger, Turmeric, Cinnamon, Nutmeg, Clove, Coriander, Cumin, Fennel and Fenugreek are the mandate crops. Annual budget for the year 2015/16 was Rs. 504 lakhs as ICAR share.

New Initiatives

To know the suitability of seed spices cultivation in the South India under Bengaluru conditions a project mode program was undertaken where seed spices such as coriander, fennel and fenugreek were grown. In the same area flowering and seed set in cumin was also observed.

In tune with the ICAR policy of digitization and maintenance of records all the workshop proceedings and Annual Reports of AICRPS are digitized and made available in the AICRPS website. An user friendly web based online reporting system is started for reporting/submitting of monthly, quarterly, annual reports, budget details and Utilization Certificate from the centres.

Varieties recommended for release in 26th AICRPS workshop

Five high yielding varieties of spices were recommended for release in XXVI AICRP on Spices workshop held at ICAR-IISR, Kozhikode**.** One coriander variety- **LCC 219 (Susthira)** from Horticultural Research Station (DrYSRHU), Guntur with high yield, suitable to rainfed and irrigated conditions with high essential oil content was recommended for release in Andhra Pradesh, Telangana and Tamil Nadu. Two fennel varieties **Ajmer Fennel-2 (AF-2)** developed by ICAR-NRCSS, Ajmer with high essential oil content and moderate resistance to *Ramularia*

blight is recommended for release at national level and **RF-157** developed by Sri Karan Narendra Agricultural University, Jobner, Rajasthan with high yield potential and better seed quality is recommended for release in Rajasthan, Gujarat and Haryana. Two fenugreek varieties **RMt-354** with high yield potential and moderate resistance to powdery mildew and downy mildew and **Narendra Methi 2 (NDM 69)** developed by Sri Karan Narendra Agriculture University, Jobner, Rajasthan and Narendra Dev University of Agriculture and Technology, Kumarganj respectively also recommended for release in the workshop.

Black Pepper

During the year, 45 accessions of black pepper were added to black pepper germplasm maintained at various centres of AICRPS. Some unique black pepper accession with extra bold berries –'Pattani pepper' and another genotype with oval shaped berries resembling *'Karivilanchi'* were collected and added to the germplasm.

At Sirsi, the vines treated with 100 percent integrated methods recorded significantly higher dry berry yield (1.25 kg vine^{-1}) compared to those with 100 per cent inorganic (0.97 kg vine^{-1}) and 100 per cent organics (0.88 kg vine^{-1}).
A study at Ambalavayal on black pepper based mixed cropping system showed that crops such as tapioca, arrowroot, elephant foot yam, colocasia and greater yam are suited to intercrops in juvenile black pepper garden which have evidently added to the income generated.

In an experiment to evaluate the effectiveness of new molecules of fungi toxicants against *Phytophthora* foot rot in existing plantation at Sirsi, Sectin @ 0.1 % as spraying (@ 2 l vine^{-1}) and drenching (3 l vine^{-1}) along with bioagent *Trichoderma harzianum* 50 g with one kg of neem cake as soil application two times in a season found superior than other treatments with respect to leaf infection.

Small Cardamom

A total of 309 germplasm accessions are maintained at Mudigere and Pampadumpara centres. In a trial to evaluate promising lines of cardamom at Mudigere, IC-346951 (387 kg ha^{-1}) recorded highest capsule yield followed by CL-726 (340 kg ha^{-1}).

In an experiment at Pampadumpara to study the effect of different liming materials, application of dolomite @ 2 kg plant^{-1} was found to be the best treatment with highest wet (2667.427 g plant^{-1}) and dry capsule (941 g plant^{-1}) yield in PV2 variety. The incidence of pest and disease in this treatment was less compared to other treatments.

In a trial to compare the effect of chemical treatments and bio-control agents against pseudostem rot at Mudigere, the minimum tiller infection of (5.80 %) with higher yield of 645.54 g plant^{-1} was recorded with the application of 0.2 % Bavistin which is followed by the application of *T. harzianum* with Neem cake and spraying of 0.2 % *Pseudomonas fluorescens*.

Large Cardamom

In large cardamom 292 germplasm accessions are maintained at ICAR and ICRI, Gangtok centres. Exploration trips were made to different area of East and West districts of Sikkim and Siang Dist. of Arunachal Pradesh and collected fifteen accessions of large cardamom by ICRI Regional Station, Sikkim.

Mealy bug infestation has been observed for the first time in large cardamom at ICAR Research Complex, Sikkim Centre, Tadong. It is found that spreading of the pest is mostly by irrigation water, re-use of previously infested plots for transplanting and through movement of crawlers from infested plants to other plants.

Ginger

A high yielding ginger accession 'Aanachuvadan' and a unique red ginger were collected from farmer's field at Kerala.

At Pundibari centre highest rhizome yield per plot was recorded in GCP-33 (7.55 kg) whereas the lowest rhizome yield per plot was recorded in GCP-60 (1.38 kg $plot^{-1}$). Maximum disease incidence was recorded in the germplasm GCP- 21 (50.33%) followed GCP-22 (50.00%) whereas lowest disease incidence was recorded in GCP-27 (9.81%).

At Solan centre, 55 best performing genotypes of ginger were analyzed for quality. The dry matter content (%) and crude fibre (%) of ginger ranged between 15.33 (Acc. 578) to 24.31 (SG-247) and 3.90 (Ranchi Local) to 5.62 (Himgiri), respectively. Essential oil (%) and oleoresin contents (%) varied from 0.720 (Varada) to 1.670 (SG-857) and 3.180 (SG-1124) to 4.737 (SG-908), respectively. The high yielding genotype SG-26-04 (Giriganga) was found superior / comparable for dry matter content, essential oil, oleoresin and crude fibre contents to the check Himgiri.

The experiment on source sink relationship in ginger is being carried out in 4 different centres with four varieties viz. IISR Mahima, GCP 5 (Gorubathane), Mizoram Local and Ranchi Local. Results indicated that partitioning efficiency remained almost same in all varieties in all places. In general, rhizome yield per plant was higher in local variety of the place followed by IISR Mahima. Oil and oleoresin contents were higher in GCP 5 compared to other varieties in all the places. Results indicate that IISR Mahima could be a stable variety for yield and GCP 5 for quality.

In a trial for management of bacterial wilt in ginger at Pottangi, the low rot incidence (8.6 %) and high fresh rhizome yield (17.4 t ha^{-1}) was found in the chemical treatment (rhizome treatment with mancozeb @ 3g l^{-1} along with carbendazim @ 1g l^{-1} and streptocycline @ 1g l^{-1} and foliar spray at 45 DAS and 90 DAS).

Turmeric

NDH-98 recorded highest fresh rhizome yield at Kumarganj (30.88 t ha^{-1}), Pasighat (22.64 t ha^{-1}) and Navsari (33.46 t ha^{-1}) in a CVT whereas PTS 12 (455.6 g $plant^{-1}$), NDH 8 (28.04 t ha^{-1}) and PTS-8 (35.08 t ha^{-1}) were the top yielders at Coimbatore, Kammarpally and Pundibari respectively.

At Solan, 133 turmeric collections were evaluated for rhizome yield and other horticultural traits. The yield range varied from 180.07 q ha^{-1} (BDJR-1292) to 411.98 q ha^{-1} (ST-907). Yield of three lines *viz*., ST-907 (411.98 q ha^{-1}), ST-12M (376.76 q ha^{-1}) and PCT-53 (372.07 q ha^{-1}) excelled over the checks Palam Lalima and Palam Pitamber which yielded 331.75 q ha^{-1} and 367.04 q ha^{-1}, respectively. The curcumin content varied from 1.53-6.30 % with the highest value of 6.30 % in PCT-14 whereas, 3.57 % and 2.98 % in the check varieties Palam Lalima and Palam Pitamber, respectively.

The experiment on source sink relationship in turmeric is being carried out in 6 different centres spread over South, North and North Eastern states with the following varieties *viz*., IISR Prathibha, Rajendra Sonia, Duggirala Red, Mydukur and BSR-2. The results showed that at 60 days after planting (DAP), leaf showed maximum partitioning percentage followed by stem while at 120 DAP, rhizomes showed the highest partitioning percentage. Similar trend was noticed in almost all the centres. Among the varieties partitioning to rhizomes was maximum in Rajendra Sonia followed by IISR Prathibha in general at 120 DAP in all the centres. With respect to quality, all the varieties had similar oil and oleoresin levels at Coimbatore while IISR Prathibha & R. Sonia had maximum at Guntur. Oil and oleoresin contents were similar in both Guntur and Coimbatore but less compared to IISR & Dholi. Rajendra Sonia, Prathibha and BSR 2 had the similar oil and oleoresin contents at both IISR and Dholi. IISR Prathibha had the highest oil and oleoresin at Barapani while all the other varieties had similar oil levels but oleoresin content varied among the varieties. In general, IISR Prathibha showed higher oil and oleoresin content among varieties under different agro climatic conditions. Yield wise also, this variety performed well in all the locations.

In a micro nutrient management trial at Pundibari, soil application of boron (as borax) @ 25 kg ha^{-1} gave the highest yield (22.45 t ha^{-1}) which was statistically *on par* with foliar spray of boron (as borax) @ 0.5 % after 60 and 90 days of planting (21.36 t ha^{-1}). Higher yield of turmeric rhizome was also recorded in the treatment of soil application of iron (as Fe_2SO_4) @ 25 kg ha^{-1} (19.90 t ha^{-1}) whereas the lowest yield was recorded in the control plot (14.45 t ha^{-1}).

A trial on ecofriendly management of foliar diseases was undertaken at Kumarganj and the minimum leaf blotch incidence was observed in foliar spray of Argimone oil @ 1.0 % (25.07 %) followed by Mahuwa oil (28.7 %) and Jatropha oil (32.6 %). In case of Argimone oil, it was *at par* with Propiconazole.

Tree Spices

Germplasm of nutmeg (122), cassia (10), cinnamon (27) and clove (30) is maintained at Pechiparai, Dapoli and Yercaud centres.

Survey for unique accessions of nutmeg is continued by project mode centre at KAU, Thrissur and 14 new accessions have been identified from various districts of Kerala during this year. Among the nutmeg germplasm maintained at Dapoli, average number of fruit for four years ranged from 73-226. The higher average number of fruits is recorded in genotypes DBSKKVMF 28 (226), DBSKKVMF 24 (172) and DBSKKVMF 19 (163). The genotype DBSKKVMF 24 recorded maximum dry nut yield (1464.0 g) and dry mace yield (320.25 g). Average dry nut yield (1376.0 g) and dry mace yield (288.0 g) was recorded in genotype DBSKKVMF. The genotype DBSKKVMF 29 is found to be promising considering its fruit weight, nut weight and mace weight. At Pechiparai, the Nutmeg accession MF- 4 recorded maximum number of fruits (1150 fruits /tree) and single fruit weight (108.0 g) and the mace yield (440.50 g $tree^{-1}$).

Among the 24 clove accessions, maintained at Pechiparai, the accession SA-3 recorded the highest leaf length (16.50 cm) leaf breadth (6.20 cm) and dry bud yield (5.50 kg $tree^{-1}$). The local check recorded a dry bud yield of 3.00 kg $tree^{-1}$.

In case of cinnamon, the accession CV-5 recorded maximum plant height (6.69 m), stem girth (29.10 cm), leaf yield (8.90 kg $plant^{-1}$) and dry bark yield (625.00 g $plant^{-1}$) at Pechiparai.

Coriander

In a multi-location evaluation of coriander maximum seed yield was recorded in the genotype LCC 168 (900 kg ha^{-1}) and RCC-12-11 (893.33 kg ha^{-1}) at Coimbatore and NDCor-94 (12.80 q ha^{-1}), NDCor-90 (12.0 q ha^{-1}) and LCC-241 (12.35 q ha^{-1}) at Kumarganj.

In an Coordinated Varietal Trial, maximum seed yield was recorded in the entries RCr-436 (17.36 q ha^{-1}), COR-110 (15.82 q ha^{-1}), COR-96 (15.53 q ha^{-1}) and COR-95 (15.26 q ha^{-1}) at Jobner, COR- 114 (21.49 q ha^{-1}) followed by COR-115 (20.68 q ha^{-1}) at Hisar, COR 106 (6.40 q ha^{-1}) at Coimbatore, COR 118 (25.30 q ha^{-1}) at Jabalpur, COR-119 (17.08 q ha^{-1}) followed by COR-98 (16.66 q ha^{-1}), COR-110 (16.04 q ha^{-1}), COR-111 (15.76 q ha^{-1}) and COR-114 (15.62 q ha^{-1}) at Kumarganj, COR-108 (11.91 q ha^{-1}), COR-107 (13.42 q ha^{-1}), COR-104 (11.42 q ha^{-1}), COR-106 (9.95 q ha^{-1}), COR-120 (9.73 q ha^{-1}) and COR-98 (9.63 q ha^{-1}) at Guntur, COR-95 (14.14 q ha^{-1}), COR-96 (13.89 q ha^{-1}) and COR-98 (13. 87 q ha^{-1}) at Jagudan and COR-99 (15.09 q ha^{-1}), COR-100 (14.50 q ha^{-1}), COR-95 (14.35 q ha^{-1}) and COR-105 (13.95 q ha^{-1}) at Navsari.

In a study to evaluate new generation fungicides against powdery mildew in coriander at Coimbatore, spraying of Propiconazole found to give maximum level of control whereas

Hexaconazole 5% SC @ 0.1and Propiconazole 25% EC @ 0.1% at Jobner and wettbale sulphur 0.2% at Raigarh were found to be best controlling agents.

Cumin

Germplasm of cumin is maintained at Jagudan Jobner and Sanand, at present there are about 340 accessions including the exotic collections.

Total eighteen entries of cumin were screened for the resistance against *Alternaria* blight disease and powdery mildew at Jagudan. The minimum blight disease intensity was noticed in GC-3 (5.7 %) followed by GC-4 (10.1 %), while the minimum powdery mildew disease intensity was noticed in JC-2010-1 (3.5 %).

Fennel

The best performed entries in the CVT during the year were RF 205 (16.42 q ha^{-1}) at Jabalpur, RF-143 (29.29 q ha^{-1}) at Jobner, RF-88 (18.51 q ha^{-1}) at Dholi, FNL-86 (15.62 q ha^{-1}) at Kumarganj. FNL-84 (20.91 q ha^{-1}) and FNL-83 (20.33 q ha^{-1}) at Hisar, FNL-77 (15.42 q ha^{-1}) at Jagudan and FNL81 (30.48 q ha^{-1}) at Ajmer.

The seed yield of fennel was found to be influenced significantly with different micronutrient treatments at Jagudan. Application of 3.0 kg Fe + 1.5 kg Zn ha^{-1}enriched with FYM @ 200 kg ha^{-1} along with recommended dose of fertilizer produced significantly higher seed yield over rest of the treatments, but it was *at par* with treatments of recommended dose of fertilizer + 200 kg FYM enriched with 1.5 kg Zn ha^{-1} and recommended dose of fertilizer + 200 kg enriched with 3.0 kg Fe ha^{-1}.

Fenugreek

In a CVT for fenugreek, the highest seed yield was recorded in FGK 86 (4.29 q ha^{-1}) at Coimbatore, RMT 361 (25.30 q ha^{-1}) at Jabalpur and FGK-88 (22.91 q ha^{-1}) at Jobner , FGK 85 (21.33 q ha^{-1}) and FGK-86 (21.17 q ha^{-1}) at Ajmer, FGK-82 (13.5 q ha^{-1}) followed by FGK-79 (12.49 q ha^{-1}), FGK-81 (12.14 q ha^{-1}) and FGK-84 (12.01 q ha^{-1}) at Kumarganj, Hisar Sonali (22.63 q ha^{-1}) followed by FGK-89 (22.55 q ha^{-1}) and FGK-83 (20.49 q ha^{-1}) at Hisar and FGK-87 (13.45 q ha^{-1}), FGK-89 (13.33 q ha^{-1}) at Navsari.

Among eighteen (CVT) entries of fenugreek screened against powdery mildew at Jobner, the entries FGK-79 and FGK-83 were observed as moderately resistant against powdery mildew disease whereas the entries UM-398 and UM-415 were observed as moderately resistant amongst the ten IET entries tested. Thirty two entries among the one hundred and twenty one germplasm accessions were also identified as moderately resistant lines against the disease.

Production and distribution of quality planting material

- 10 lakh black pepper, 15 t of turmeric and 5 t of ginger and 30000 tree spices were distributed. 10 quintals each of cumin, coriander, fennel, fenugreek was distributed along with DASD**.**

Transfer of Technology

The scientists of various centres has taken earnest effort to popularize the latest technologies as the research is meaningful only when it is reached to farmers and they are benefited out of that. Following are some of the technologies demonstrated during the year.

- Demonstration of Ginger portray propagation for tribal farmers and resource persons at Wayanad (AICRP Head Quarter, Kozhikode)
- FLD on high yielding turmeric variety CO 2 (Coimbatore)
- Demonstration of Technique of removing bark of cinnamon, Pro tray propagation technique for ginger and turmeric, Processing of black pepper , Processing of turmeric Soft wood grafting technique in nutmeg and kokum, Bush pepper production technology (Dapoli)
- FLD on management of leaf spot disease through fungicide application (Dholi)
- FLD on high yielding high oil content coriander variety Suguna (LCC-236) (Guntur)
- FLD on disease management technologies and high yielding varieties of cumin, coriander and fennel (Jagudan)
- FLD on HYV and advance technologies in fenugreek, cumin and fennel (Jobner)
- Pro-tray propagation technique for turmeric (Kammarppally)
- Adoption of drip irrigation in cardamom (Mudigere)
- Root grub management in Cardamom (Pampadumpara)
- Yield potential of Panniyur varieties under proper IPDM and High yielding capacity of Panniyur varieties under abiotic stress (Panniyur)
- FLD on organic cultivation of ginger (Pottangi)
- Biofumigation using cabbage for the control of soft rot and bacterial wilt diseases in ginger (Pundibari)
- Bush pepper cultivation (Sirsi)
- FLD on promising Ginger genotype IC-593889 (SG-26-04) along with check cv. Himgiri (Solan)

Apart from the above field level demonstrations, the scientists were made technologies more popular by conducting and attending as resource persons in trainings, seminar and also through various media (newspaper, radio talks and TV programs).

Success stories

Mr. Shridhar Bhat farmer from Sirsi, Karnataka has conserved more than twenty local genotypes of black pepper in an area of five acres. All the genotypes are yielding and are very well adopted in that area. All these genotypes are studied scientifically by the scientists. Varieties collected are varying in their leaf structure, yield, berry quality and resistance to pests and diseases. From his collections, two good yielding varieties (Swaranavalli Surya and Swaranavalli Shalmala) have been selected and studies are been taken up. About 22 genotypes have been identified and are being studied for their growth and yield potentials. These genotypes are collected and added to the black pepper germplasm of Sirsi centre.

He is in contact with scientists of AICRPS centre at Sirsi and getting all the technical information regarding the crop. He has been cultivating pepper from last three decades; there are about 1600 vines among which 1100 are old vines. There are many varieties which Mr. Bhat has collected including Thirapu kare, Kari mallisara, Bilimallisara, Panniyur-1. It is true that the local varieties are low yielding, but Mr. Bhat believes that yields can be increased with improved agro-techniques, and also he says that local varieties are resistant to pest and diseases. He is recommended for the 'Plant Genome Saviour Award'.

Tribal welfare measures

Quality planting materials of spices were distributed to the tribal farmers of Pottangi, Chintapalle and Raigarh area apart from conducting trainings.

New Initiatives in North East

To train the people working in black pepper plantation in the North East about the Nursery and High Production technology in Black Pepper a two days training program *"Pepper Mitra"* was conducted on 22nd and 23rd May 2015 in collaboration with Assam Agriculture University and IISR, Kozhikode at Kahikuchi, Assam (North East region).

Collaboration

In addition to IISR-Kozhikode, NRCSS-Ajmer and State Agricultural Universities we have collaboration with DASD, Spices Board and National Innovation Foundation. We are also helping Girijana Vikasa an NGO from Andhra Pradesh for growing/production of ginger and turmeric in tribal areas.

Monitoring

Monitoring of projects and programs undertaken by the centres is monitored by Project Coordinator and Scientists from PC unit's visit to the centres and the experimental plots. In this

year visits taken up to 14 centres which includes regular, co-opting, voluntary and project mode centres. Monitoring was also done by monthly reports, annual report sent by the centres.

ACTION TAKEN REPORT 2015-16

Sl. No.	Decision/Recommendations	Centres	Action Taken
TECHNICAL SESSION I: GENETIC RESOURCES & Crop Improvement			
1.	Unique genotypes need to be registered in NBPGR, New Delhi	Sirsi, Panniyur	20 acc of black pepper (Panniyur) 63 ginger germplasm – Pundibari 13 accessions of nutmeg from KAU sent for IC number One accession of ginger for registration
	Inter-varietal hybrids of black pepper may be tested for biotic and abiotic stress tolerance with the help of IISR scientists	Panniyur	Promising inter varietal hybrids of black pepper were being screened for biotic and abiotic stress.
	Data to be generated on all aspects of biotic and abiotic stress from the centres before submission of variety release proposal.	All Centres	This is being done. Data generated will be presented in the workshop
	Grafting may be done with Panniyur on P. *nigrum* as an alternative of *P. colubrinum*	Ambalavayal, Panniyur, Sirsi, Yercaud	Grafting done (Panniyur) Root stock is multiplied and ready for grafting (Ambalavayal)
	Unique germplasm of large cardamom may be forwarded to CVT	ICAR Gangtok, ICRI, Gangtok	8 Unique accessions are being multiplied to lay out new CVT during this planting season.
	ICRI-1 and ICRI-2 may be tested in large cardamom growing areas.	ICAR Gangtok, ICRI, Gangtok	ICRI-1 and ICRI-2 are supplied to two planters (*Sukhia pokhri*, West Bengal and another planter at *Pakyong*) for testing.

	CVT 2007/2009-Series VI trial may be continued one more year and concluded for variety release	Mudigere	Due to drought situation sufficient quantity of planting material of genotype identified for release CL-726 could not be multiplied. This will be multiplied and varietal release proposal will be presented in the next.
	Initial Evaluation Trial of bold/vegetable ginger - The varieties Nadia and Bhaise may be added	Pottangi	Nadia is added as check. Bhaise will be added this year.
	Confirm the curcumin content of the genotypes those having more than 7.9%	Raigarh	Rechecked and curcumin content is 4.7%.
	Two high yielding genotypes from each trial may be short listed for new CVT 2016 with national check (Prathibha) and one local check.	Turmeric centres	Trial is started with 12 entries and national check Prathibha and a local check at 9 centres.
	IET on Cumin 2013- Quality evaluation may be done at Gujarat and Rajasthan to find out the facts of market acceptance / industry preference	Jobner, Jagudan	Work is in progress. Available results will be presented in the WS
	Farmer's unique varieties of nutmeg may be registered as per PPVFR act	KAU, Thrissur	The unique collections could not be registered as per PPVFR act as tere were no DUS guidelines in nutmeg. Now they were notified. 13 accessions have been registered with NBPGR.
TECHNICAL SESSION II: CROP MANAGEMENT			
	In all nutrient management trials soil analysis data to be provided with the results for better and accurate interpretation.	All centres	It is followed accordingly.
	The results of all the concluded projects must be made available for technology transfer and demonstrated in farmers' fields.	All centres	This is followed. This year 8 technologies are being presented.
	In all the production trials quality parameters must be recorded along with yield and yield attributes for better interpretation of results.	All centres	Quality parameters are being recorded and added.

	Source sink relationship in ginger - Crude fibre data also to be included in the quality analysis report	IISR	Analysis is done and data will be presented during respective session
	Source sink relationship in turmeric - Timely submission of samples for analysis and analysis of quality parameters is to be taken up.	All centers	This is being done.
	Micro irrigation for fennel & Fenugreek - A recommendation for farmers to be provided as a technical bulletin	Jobner	Preparation of technical bulletin is in progress

	Effect of ferrous and zinc enriched FYM on yield and quality of fennel - Changes in the soil pH should be monitored in the project	Jagudan	According to soil and climatic condition treatments were finalized and experiment will be conducted during 2016-17 at S.K.Nagar
TECHNICAL SESSION III: CROP PROTECTION			
	The compatibility of Fenamidone with *Trichoderma* sp. may be tested at ICAR-IISR, Kozhikode / PRS, Panniyur.	Panniyur	Compatibility studies were undertaken and found compatible
	Studies on management of *Phytophthora* causing foot rot on black pepper .	Panniyur, Sirsi, Dapoli, Mudigere	Treatments are modified by the PC unit in consultation with the IISR scientists and circulated to the respective centres. This will be presented in respective session.
	In the trial on evolving disease and pest tolerant lines in large cardamom - Varlangey (susceptible variety) should be included in the trial as control	ICRI Gangtok, ICAR Gangtok	Varlangey has been included in the trial as control.
	Plants showing no symptoms of viruses may be indexed at IARI RS, Kalimpong to confirm the absence of viruses	ICRI Gangtok, ICAR Gangtok	Approached IARI, RS, Kalimpong for indexing of plants to confirm the absence of viruses in the plants.
	Demonstrations on cultivation of large cardamom may be conducted in Arunachal Pradesh and Nagaland in collaboration with other AICRPS centres in the region	ICRI Gangtok, ICAR Gangtok	Different cultivars of large cardamom are being multiplied in ICRI, research farm. Planting will be done during next planting season for the demonstrations.

	Efficiency of different fungicides including new molecules against leaf spot disease of ginger - The pathogen may be sent for confirmation of identity to ICAR-IISR, Kozhikode by the Dholi centre	Dholi	The pathogen is being isolated and will be sent for confirmation.
	The causal organism of stem gall disease of coriander may be confirmed by NRCSS, Ajmer.	Dholi	The pathogen is being isolated and will be sent for confirmation.
PLENARY SESSION			
	AICRPS name should be included in all the publications which are brought out from AICRPS centres	All centres	It is being implemented
	A copy of all the publications released are to be submitted to the Council/SMD library	AICRPS	Publications are submitted whenever published
	Nutmeg – KAU, Thrissur project mode centre requested for increasing funds from Rs. 1 lakh to 2 lakh due to increase in cost of grafts/budded plants	AICRPS	Increased funds
	Project mode centre - Studies on the performance of the Nutmeg (*Myristica fragrans* Houtt) ecotypes in coconut based cropping system in Tamil Nadu – TNAU, Tamil Nadu	AICRPS	Approved with fund of Rs. 1.00 lakh per year
	Project mode centre - Evaluation of seed spices genotypes in Bengaluru conditions – COH, Bengaluru	AICRPS	Approved with fund of Rs. 1.00 lakh per year

Recommendations of the session:

- Unique germplasm has to be registered with NBPGR/PPVFRA
- A committee has to be formed for identification and registration of germplasm if required
- Varietal notification status of Large cardamom varieties ICRI 1 and ICRI 2 need to be confirmed
- Recently released varieties should be included in CVT as check varieties

- Combined programmed with PPVFRA needs to be organized for registration of farmers varieties
- Newly proposed technologies should be a evaluated with a committee of 2-3 experts

  (Guidelines for horticultural crops has to be formulated from ICAR)
- A meeting has to be conducted for making action plan for virus screening in large cardamom
- IISR Kozhikode has been identified for virus indexing in large cardamom instead of

  IARI, Kalimpong (Director IARI has to be intimated)
- Technologies under AICRPS need to be commercialized. The centers has to share the credit with AICRPS
- Funds for conservation of genetic resources need to be increased. A proposal for this may be submitted.
- Funding from bio varsity international may be explored for conservation of genetic resources
- Varieties recommended by AICRPS should be submitted immediately to Central Varietal Release committee. A time frame of six months should be fixed for this
- Technologies recommended from AICRPS should be incorporated in Package of Practices of respective states

TECHNICAL SESSION: I

GENETIC RESOURCES AND CROP IMPROVEMENT

Chair persons : Dr. S. R. Maloo, Ex Director of Research, MPUAT, Udaipur
Dr. P. N. Jagadev, Director of Research, OUAT, Orissa
Dr. K. Nirmal Babu, Director, IISR & PC – AICRP on Spices

Rapporteurs : Dr. R. K. Solanki, ICAR-NRCSS, Ajmer
Dr. R. Chitra, TNAU, Coimbatore

General Comments:

- Disease and pest screening trials, the observation recorded for field conditions are not dependable. Data should be obtained from sick plot or at hot spots.
- SOP (Standard operation protocol) for all AICRPS may be developed for uniformity in the trial layout, data recording, compilation and presentation

Black pepper

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

- Tolerant lines against biotic and abiotic stress may be tested with the help of IISR scientists (Action: Panniyur)

PEP/CI/2.2 - Hybridization to evolve varieties tolerant to biotic and abiotic stresses

- Biotic and abiotic stress tolerance line *viz*., Ceylon (PRS 8) to be confirmed with the help of IISR scientists (Action: Panniyur)

PEP/CI/3.3 – Coordinated Varietal Trial 2006 Series VI on Black pepper

- Data to be collected, compile and submit to PC unit (Action: Panniyur)

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

- Dapoli, Chintapalle and Assam centres may be taken this trial during 2016-17. Sirsi centre to be supply the grafts to above centres (Action: Dapoli, Chintapalle, Assam and Sirsi)

Large cardamom

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

- Promising golsai and varlange may be multiplied and trial may be laid out in Arunachal Pradesh and Nagaland (Action: ICRI, Sikkim)

Small cardamom

CAR/CI/1.1 – Germplasm collection, characterization, evaluation and conservation

- Unique germplasm may be registered during 2016-17
- Thrips tolerant line (HY 14) may be tested in other field condition (Action: Pampadumpara)

CAR/CI/3.6 - Coordinated Varietal Trial 2007/2009-Series VI on Small Cardamom

- The trial may be concluded for variety release during 2017-18. Final report may be submitted.

CAR/CI/3.8 - CVT of drought tolerance in Cardamom – Series VII

- Sakaleshapura will be join the trial during 2016-17
- Mudigere centre may collect the planting material from Appangala centre.
- Pampadumpara centre may collect the planting material from Myladumpara centre.

Ginger

GIN/CI/2.3 Coordinated Varietal Trial 2013-Series VIII on Ginger

- The trial may be concluded. Pooled data of Solan and Dholi centres need not be included during the preparation of variety release proposal.

Turmeric

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

- Confirm the curcumin content of the genotypes those having more than 6.0% (Action: Barapani)

TUR/CI/2.5 – CVT on Turmeric 2013

- The trial may be concluded. Final report may be submitted.

TUR/CI/3.6 - Initial Evaluation Trial 2013

- The trial may be concluded. Final report may be submitted.

Tree spices

TSP/CI/2.3 – CVT 2001 – Cassia

- The growth and yield data may be collected from Appangala centre (Action: Dapoli and Pechiparai)
- Dapoli and Pechiparai centres may prepare variety release for forthcoming workshop
- Barks of the Cinnamon and Cassia genotypes may be sent to IISR, Calicut for quality analysis

Coriander

COR/CI/1.2 – Multilocation evaluation of germplasm in coriander

- After completion of MLT, germplasm catalogue should be compiled based on descriptors with respect to tested locations.

COR/CI/2.6 - CVT Coriander 2015 series X

- In the ongoing CVT, after completion of 2 years trial, mean performance may be assessed and best entries may be screened under stem gall sick plot developed at Dholi

COR/CI/3.6 - Initial Evaluation Trial 2012

- New CVT trial may be initiated for leafy type coriander and will shortlist 2 genotypes each for the trial. Jobner, Jagudan, Ajmer, Pottangi, Barapani, Kalyani, Nagaland will take up this trial.

Cumin

CUM/CI/1.3 - Identification of drought tolerance

- Trial may be continued for one more year.

CUM/CI/2.4 - CVT-2013 on Cumin

- Trial may be continued for one more year

Fenugreek

FGK/CI/1.3: Identification of drought tolerance source in fenugreek:

- The term 'drought' may be replaced with 'limited moisture conditions' in the present trial.

Project Mode Centres

1. Nutmeg – KAU, Vellanikkara

- The project may be closed and submit final report.
- The new project mode poroposal on "Evaluation of nutmeg genotypes" is approved for project mode funding for next three years.
- Unique genotype *viz*., Acc 28 may be multiplied and supplied to Dapoli, Pechiparai and IISR centres.

2. Studies on the performance of the Nutmeg (*Myristica fragrans* Houtt) ecotypes in coconut based cropping system in Tamil Nadu – TNAU, Coimbatore

- The project may be continued.

3. Performance evaluation of cumin genotypes for Tamil Nadu conditions – TNAU, Periyakulam

- The project may be concluded and submit the completion report

4. Evaluation of coriander, fenugreek and fennel for growth, yield and quality parameters under Bengaluru conditions – COH, Bengaluru

- Seeds of short duration varieties from Guntur and DWD-3 from Dharwad may be collected and included in the trial.

Project code	Title	Centres	Comments
Black Pepper			
PEP/CI/1	**Genetic Resources**		
PEP/CI/1.1	Germplasm collection, characterization, evaluation and conservation	Ambalavayal, Chintapalle, Dapoli, Panniyur, Pundibari, Sirsi, Yercaud	Continued
PEP/CI/2	**Hybridization trial**		
PEP/CI/2.1	Inter-varietal hybridization to evolve high yielding varieties	Panniyur	Continued
PEP/CI/2.2	Hybridization to evolve varieties tolerant to biotic and abiotic stresses	Panniyur	Continued
PEP/CI/3	**Coordinated Varietal Trial (CVT)**		
PEP/CI/3.3	CVT 2006 Series VI	Chintapalle, Dapoli, Panniyur, Pampadumpara, Sirsi, Yercaud, Pechiparai	Continued
PEP/CI/3.4	Evaluation of grafts, orthotropic and runner shoots in black pepper	Ambalavayal, Panniyur, Sirsi, Yercaud	Continued
PEP/CI/3.5	CVT 2015 on Farmers varieties of black pepper – Series VII	Chintapalle, Sirsi, Panniyur, Dapoli, Yercaud	Continued
PEP/CI/3.6	CVT on black pepper 2015-Series VIII	Chintapalle, Sirsi, Panniyur, Dapoli, Yercaud, Kahikuchi	Continued
Small Cardamom			
CAR/CI/1	**Genetic Resources**		Continued
CAR/CI/1.1	Germplasm collection, characterization, evaluation and conservation	Mudigere, Pampadumpara	Continued
CAR/CI/2	**Hybridization**		
CAR/CI/2.1	Hybridization and selection in cardamom	Mudigere	Continued
CAR/CI/2.2	Evaluation of promising small cardamom (*Elettaria cardamom* L. Maton) cultivars/varieties for organic cultivation in the high ranges of Idukki district	Pampadumpara	Continued
CAR/CI/3	**Coordinated Varietal Trial**		
CAR/CI/3.6	CVT 2007/2009-Series VI	Mudigere, Pampadumpara	Continued at Mudegere and Pampadumpara
CAR/CI/3.7	CVT of drought tolerance in Cardamom – Series VII	Appangala, Mudigere, Sakaleshapura, Myladumpara	Continued
CAR/CI/3.8	CVT 2015 on Farmers varieties of	Appangala, Mudigere,	Continued

	cardamom-Series VIII	Pampadumpara, Myladumpara, Sakleshpur	
CAR/CI/4	**Varietal Evaluation Trial (VET)**		
CAR/CI/4.1	Initial Evaluation Trial – I	Mudigere	Continued
CAR/CI/4.2	Initial Evaluation Trial – II	Mudigere	Continued
CAR/ CI/4.3	Initial Evaluation Trial – 2012	Pampadumpara	Continued
Large Cardamom			
LCA/CI/1.1	Germplasm collection and evaluation of large cardamom	ICAR Regional Station, Gangtok, ICRI Regional Research Station, Gangtok	Continued
Ginger			
GIN/CI/1	**Genetic Resources**		
GIN/CI/1.1	Germplasm collection, characterization, evaluation and conservation	Barapani, Dholi, Kammarpally, Kumarganj, Pundibari, Pottangi, Raigarh, Solan	Continued
GIN/CI/2	**Coordinated Varietal Trial (CVT)**		
GIN/CI/2.3	CVT 2013-Series VIII	IISR, Dholi, Pottangi, Pundibari, Solan	Concluded
GIN/CI/2.4	CVT 2015-Series IX	IISR, Dholi, Pottangi, Pundibari, Kalyani, Solan, Nagaland	Continued
GIN/CI/3	**Varietal Evaluation Trial**		
GIN/CI/3.3	Initial Evaluation Trial – 2013	Pottangi, Dholi	Continued
GIN/CI/3.4	Initial Evaluation Trial of bold/vegetable ginger	Pottangi	Continued
GIN/CI/3.5	Initial Evaluation Trial – 2015	Kumarganj	Continued
GIN/CI/3.6	Initial Evaluation Trial – 2016	Pundibari, Pottangi, Solan	Continued
GIN/CI/4	**Quality Evaluation Trial**		
GIN/CI/4.1	Evaluation of germplasm for quality	Solan	Continued
GIN/CI/4.2	Evaluation of germplasm from other centres	Solan	Continued
Turmeric			
TUR/CI/1	**Genetic Resources**		Continued
TUR/CI/1.1	Germplasm collection, characterization, evaluation and conservation	Barapani, Coimbatore, Dholi, Guntur, Kammarpally, Kumarganj, Pasighat, Pottangi, Pundibari, Raigarh, Solan	Continued
TUR/CI/2	**Coordinated Varietal Trial**		

TUR/CI/2.5	CVT on Turmeric 2013	Chintapalle, Coimbatore, IISR, Kammarpally, Kumarganj, Pundibari, Pottangi, Raigarh, Navsari, Pasighat	To be concluded & final report has to be submitted
TUR/CI/2.6	CVT on Turmeric – 2016	Chintapalle, Coimbatore, Dholi, Guntur, Kammarpally, Kumarganj, Pundibari, Pottangi , Raigarh	Continued
TUR/CI/3	**Varietal Evaluation Trial**		
TUR/CI/3.6	Initial Evaluation Trial 2013	Pottangi	Concluded
TUR/CI/3.7	Initial Evaluation Trial 2015	Kumarganj	Continued
TUR/CI/3.8	Initial Evaluation Trial 2016	Pundibari, Pottangi, Solan	Continued
TUR/CI/4	**Quality Evaluation Trial**		
TUR/CI/4.1	Evaluation of germplasm for quality	Solan	
TUR/CI/4.2	Evaluation of germplasm from other centres	Solan	
Tree Spices			
TSP/CI/1	**Genetic Resources**		
TSP/CI/1.1	Germplasm collection, characterization, evaluation and conservation of clove, nutmeg and cinnamon	Dapoli, Pechiparai	Continued
TSP/CI/1.2	Collection of unique germplasm in tree spices	Dapoli, IISR, KAU, Pechiparai	Continued
TSP/CI/2	**Coordinated Varietal Trial**		
TSP/CI/2.2	CVT 2001-Nutmeg	Dapoli, Pechiparai	Continued
TSP/CI/2.3	CVT-2001-Cassia	Dapoli, Pechiparai	Continued
TSP/CI/2.4	Coordinated Varietal Trial on farmer's varieties of Nutmeg	Dapoli, Pechiparai, Thrissur	Continued
Project Mode	Studies on the performance of the Nutmeg (*Myristica fragrans* Houtt) ecotypes in coconut based cropping system in Tamil Nadu	HC&RI, Coimbatore	Continued
Coriander			
COR/CI/1	**Genetic Resources**		
COR/CI/1.1	Germplasm collection, description, characterization, evaluation, conservation and screening against	Coimbatore, Dholi, Guntur, Hisar, Jagudan, Jobner, Kumarganj, Raigarh	Continued
COR/CI/1.3	Identification of drought/alkalinity tolerant source in	Jobner	Continued

COR/CI/1.4	Multilocation evaluation of coriander germplasm – 2015	Ajmer, Guntur, Coimbatore, Dholi, Hisar, Jobner, Jagudan, Kota, Kumarganj, Raigarh	Continued
COR/CI/2	**Coordinated Varietal Trial**		
COR/CI/2.6	Coordinated Varietal Trial on coriander 2015-Series X	Ajmer, Coimbatore, Dholi, Guntur, Hisar, Jabalpur, Jagudan, Jobner, Kumarganj, Navsari, Pantnagar, Kota, Raigarh	Continued
COR/CI/3	**Varietal Evaluation Trial**		
COR/CI/3.6	Initial Evaluation Trial 2012 (Leaf)	Guntur	Continued
COR/CI/3.7	Initial Evaluation in coriander 2014	Hisar, Jobner	Continued
COR/CI/3.8	Initial Evaluation Trial 2015	Guntur, Jagudan, Kumarganj, Dholi, Raigarh	Continued
COR/CI/4	Quality Evaluation Trial		
COR/CI/4.1	Quality Evaluation in coriander	Jobner	Continued
Cumin			
CUM/CI/1	**Genetic Resources**		
CUM/CI/1.1	Germplasm collection, characterization, evaluation, conservation and screening against diseases	Jagudan, Jobner, Mandor, Sanand	Continued
CUM/CI/1.3	Identification of drought tolerance	Jobner	Continued
CUM/CI/2	**Coordinated Varietal Trial**		
CUM/CI/2.4	Coordinated Varietal Trial – 2013	Ajmer, Jagudan, Jobner	Continued
CUM/CI/3	**Varietal Evaluation Trial**		
CUM/CI/3.4	IET on Cumin 2012	Jobner	Continued
CUM/CI/3.5	IET on Cumin 2013	Jagudan	Continued
CUM/CI/4	**Quality Evaluation Trial**		
CUM/CI/4.1	Quality Evaluation in Cumin	Jobner	
Project Mode	Performance evaluation of Cumin genotypes for Tamil Nadu conditions	Periyakulam	Concluded
Fennel			
FNL/CI/1	**Genetic Resources**		
FNL/CI/1.1	Germplasm collection, characterization, evaluation, conservation and screening against	Dholi, Hisar, Jagudan, Jobner, Kumarganj	Continued
FNL/CI/2	**Coordinated Varietal Trial**		
FNL/CI/2.6	Coordinated Varietal Trial on Fennel 2015 – Series IX	Ajmer, Dholi, Hisar, Jabalpur, Jagudan, Jobner, Kumarganj, Pantnagar	Continued
FNL/CI/3	**Varietal Evaluation Trial**		

FNL/CI/3.4	Initial Evaluation Trial 2014	Jobner, Pantnagar, Hisar	Continued
FNL/CI/3.5	Initial Evaluation Trial 2015	Jagudan, Kumarganj, Dholi	Continued
FNL/CI/4	**Quality Evaluation Trial**		
FNL/CI/4.1	Quality Evaluation in Fennel	Jobner	Continued
Fenugreek			
FGK/CI/1	**Genetic Resources**		
FGK/CI/1.1	Germplasm collection, characterization, evaluation, conservation and screening against diseases	Dholi, Guntur, Hisar, Jagudan, Jobner, Kumarganj, Raigarh	Continued
FGK/CI/1.3	Identification of drought tolerance source in fenugreek	Jobner	Continued
FGK/CI/2	**Coordinated Varietal Trial**		
FGK/CI/2.4	Coordinated Varietal Trial of fenugreek 2015 – Series IX	Ajmer, Coimbatore, Dholi, Guntur, Hisar, Jagudan, Jabalpur,	Continued
		Jobner, Kumarganj, Pantnagar, Navsari, Raigarh, Kota	
FGK/CI/3	**Varietal Evaluation Trial**		
FGK/CI/3.6	Initial Evaluation Trial 2014	Dholi, Hisar	Continued
FGK/CI/3.7	Chemo-profiling for identification of industrial types among the released varieties of fenugreek	Ajmer, Coimbatore, Guntur, Dholi, Hisar, Jobner, Kumarganj	Continued
FGK/CI/3.8	Initial Evaluation Trial 2015	Kumarganj, Jagudan, Jobner	Continued
Project Mode	Evaluation of Coriander, fenugreek and fennel for growth, yield and quality parameters under Bengaluru conditions.	COH, Bengaluru	Continued

TECHNICAL SESSION II
CROP PRODUCTION

Chair persons: Dr. H. P. Maheshwarappa, Project Coordinator, AICRP on Palms, ICAR-CPCRI, Kasaragod;
Dr. T. John Zachariah, Head, Crop Production & PHT, ICAR-IISR, Kozhikode
Dr. S. J. Ankegowda, Head, ICAR-IISR Regional Station, Appangala.

Rapporteurs : Dr. K. S. Krishnamurthy, ICAR-IISR, Kozhikode
Dr. Sarita Sahu, RARS (IGKV),

General recommendations

- Final report of all the closed projected must be sent to PC cell and the technologies originated must be presented in the ensuing workshop. The technologies developed must be taken for demonstration
- Name of the session may be changed to crop production
- Research on cropping systems may be explored
- Quantity and quality of publications may be enhanced
- Projects may be listed under the headings irrigation management, fertigation management, nutrient management, source-sink relationship experiment and organic farming and the project numbering may be done appropriately.

Black pepper

PEP/CM/4.6-Standardization of drip fertigation in black pepper (Panniyur)

- A team of scientists from IISR may visit and advise on scoring for diseases
- Communication regarding staff deployment and providing requisite facilities for the conduct of research may be sent to the Director of Research, Kerala Agricultural University.

Cardamom

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

- Experiment may be concluded after recording present year's data

CAR/CM/5.3 - Organic farming in cardamom (Mudigere, Pampadumpara)

- Experiment may be closed at Mudigere and continued for one more year at Pampadumpara
- Recommended organic plant protection measures may be followed

CAR/CM/5.4-Liming in cardamom

- The data may be checked for confirmation

Ginger

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

- The project may be concluded

GIN/CM/5.5-Source sink relationship in ginger

- Local variety of each centre must be included in all the centres

Turmeric

TUR/CM/5.11-Screening of post-emergent herbicides for selectivity in turmeric

- Experiment is concluded and the final report will be sent to the PC cell

TUR/CM/5.12 -Mechanical planting in turmeric (Observational trial**)**

- Experiment is concluded and the final report will be sent to the PC cell

TUR/CM/5.13-Comparative performance of turmeric entries under polyhouse and field conditions

- Dry weight and curcumin analysis data may be included

Coriander

COR/CM/5.5-Response of coriander varieties to various levels of fertility under multicut management practice

- Data on herbage yield may be included

COR/CM/5.7-Standardization of drip irrigation and fertigation in coriander

- Treatments may be imposed in all the centres as per the technical programme

COR/CM/5.9-Comparative performance of coriander entries under polyhouse, field and selfing net

- Data on herbage yield may be recorded

Cumin

CUM/CM/5.3-Response of sulphur and bio regulators on yield and quality of cumin

- Experiment is closed and final report will be submitted to the PC cell. Quality analysis data may also be included in the report.

CUM/CM/5.4-Standardization of drip irrigation and fertigation in cumin

- Treatments may be finalized in consultation with Dr Ravinder Singh, ICAR-NRCSS, Ajmer
- Ajmer centre may also be included

Fennel

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

- Soil analysis and quality analysis data may be included

Four new programmes, namely evaluation of PGPR biocapsule in ginger, evaluation of IISR micronutrients in ginger and turmeric, evaluation of organic package in ginger & turmeric and evaluation of agrolyser & agrosmile in black pepper & cardamom were also discussed and approved.

Project code	Title	Centres	Comments
Black Pepper			
PEP/CM/4	**Nutrient Management Trial**		
PEP/CM/4.6	Standardization of drip fertigation in black pepper	Panniyur	Continued
PEP/CM/4.7	Black pepper based mixed cropping system for sustainable productivity and food security	Ambalavayal, Sirsi, Panniyur, Dapoli	Continued
Small Cardamom			
CAR/CM/5	**Nutrient Management Trial**		
CAR/CM/5.2	Effect of fertigation on yield of cardamom through drips	Mudigere, Pampadumpara	Concluded
CAR/CM/5.3	Organic farming in cardamom	Mudigere, Pampadumpara	Experiment may be closed at Mudigere and continued for one more year at Pampadumpara
CAR/CM/5.4	Liming in cardamom	Pampadumpara	Continued
Ginger			
GIN/CM/5	**Nutrient Management Trial**		
GIN/CM/5.4	Evaluation of herbicide for the effective control of weeds in ginger	Chintapalle	Concluded
GIN/CM/5.5	Source sink relationship	IISR, Kanke, Mizoram, Pundibari, Solan, Barapani	Continued
GIN/CM/5.6	Organic production of ginger	Barapani, Mizoram	Continued
GIN/CM/5.7	Effect of micronutrients on growth and yield of ginger (Demonstration trial)	Pottangi, Chintapalle	Continued
GIN/CM/5.8	Effect of organic manures and bio-fertilizers on partitioning of dry matter in ginger	Dholi	Continued
Turmeric			
TUR/CM/5	**Nutrient Management Trial**		
TUR/CM/5.9	Source sink relationship in turmeric	Coimbatore, IISR,	Continued

		Guntur, Kammarpally, Dholi, Barapani	
TUR/CM/5.10	Organic production of turmeric	Barapani, Mizoram	Continued
TUR/CM/5.11	Screening of post-emergent herbicides for selectivity in turmeric	Guntur	Concluded
TUR/CM/5.12	Mechanical planting in turmeric (Observational trial)	Coimbatore	Concluded
TUR/CM/5.13	Comparative performance of turmeric entries under polyhouse and field conditions	Raigarh	Continued
Coriander			
COR/CM/5	**Nutrient management trial**		
COR/CM/5.5	Response of coriander varieties to various levels of fertility under multi cut management practice	Jagudan	Continued
COR/CM/5.6	Effect of using varying levels of NPK and bio-fertilizers on growth and yield of coriander	Dholi	Continued
COR/CM/5.7	Standardization of drip irrigation and fertigation in coriander	Ajmer, Jobner, Guntur, Kumarganj	Continued
COR/CM/5.9	Comparative performance of coriander entries under polyhouse, field and selfing net	Raigarh	Continued
Cumin			
CUM/CM/5	**Nutrient Management Trial**		
CUM/CM/5.2	Organic nutrient and disease management in cumin	Jobner	Continued
CUM/CM/5.3	Response of sulphur and bio regulators on yield and quality of cumin	Mandor	Concluded
CUM/CM/5.4	Standardization of drip irrigation and fertigation in cumin	Jobner, Jagudan, Mandor	Continued
Fennel			
FNL/CM/5	**Nutrient Management Trial**		
FNL/CM/5.4	Effect of ferrous and zinc enriched FYM on yield and quality of fennel	Jagudan	Continued
FNL/CM/5.5	Standardization of drip fertigation in fennel	Jobner	Continued

TECHNICAL SESSION III

CROP PROTECTION

Chairpersons : Dr. Santhosh J. Eapen, Head, Division of Crop Protection, ICAR-IISR, Kozhikode
Dr. S. Devasahayam, Principal Scientist, Division of Crop Protection, ICAR-IISR, Kozhikode

Rapporteurs : Dr. Meenu Gupta, Dr. YSPUHF, Solan
Dr. M. Manju, HRS (UHSB), Sirsi

General recommendations

- Expertise available at ICAR-IISR may be availed for confirming the identity of pathogens isolated by coordinating centres.
- In experiments on field screening of accessions to various pathogens and pests, the results may be supplemented by laboratory/greenhouse studies with identified strains.
- A group meeting cum training of pathologists will be organized at ICAR-IISR for identification of pathogens and methodologies for screening.

Black Pepper

PEP/CP/5 Disease Management Trial

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

- At Pechiparai, incidence of *Phytophthora* foot rot was not recorded for the last two years, therefore, the experiment need not be continued.
- The experiment is to be continued at other centres.

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

- The experiment may be concluded at all the centres and the technology developed presented.

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

- The trial may be continued.
- The presence of nematodes in the treatments may be checked at all centres.

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

- The trial may be continued.

PEP/CP/5.7Management of *Phytophthora* foot rot by mulching

- The programme may be included under Crop Management.

Small Cardamom

CAR/CP/6 Pest and Disease Management Trial
CAR/CP/6.7 Evaluation of new insecticides / biopesticides in cardamom against thrips and capsule borer

- The trial may be concluded and the technology developed may be presented.

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

- The correct identity of the pathogen may be confirmed with ICAR-IISR, Kozhikode.
- The trial may be concluded at Pampadumpara but continued at Mudigere.

New Programme: Management of nematodes of cardamom
(Pampadumpara)

- The trial may be initiated as a new experiment with the approved technical programme.

New Programme: To evolve disease tolerant lines in small cardamom
(Myladumpara)

- The trial may be taken up as observational trial at Myladumpara.

New Programme: Evaluation of new insecticides for cardamom thrips control

- Myladumpara, Pampadumpara, Mudigere, Sakleshurcentres will take up the trial.
- Residue analysis may be taken up in collaboration with All India Network Project on Pesticide Residues.
- The feasibility of obtaining funds from AINP on Pesticides Residues for conducting the trials may be explored.

Large Cardamom

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

- The trial may be continued.

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

- Virus indexing in nucleus planting materials should be done at Spices Board with the support from ICAR- IISR, Kozhikode to prevent the spread of the disease to new areas.

Ginger

GIN/CP/6 Disease Management Trial
GIN/CP/6.1 Disease surveillance and etiology of rhizome rot in ginger

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

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

- The trial may be concluded at all centres and the technology developed presented.
- The pathogen may be sent for confirmation of identity to ICAR-IISR, Kozhikode by the Dholi centre.

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

- The trial may be continued.

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

- The trial may be continued.
- Glasshouse screening should be done for confirming the disease reaction.

TURMERIC

TUR/CP/7 Disease Management Trial
TUR/CP/7.1 Survey and identification of disease causing organisms in turmeric and screening of turmeric germplasm against diseases (Disease Surveillance**)**

- A consolidated report on the surveys conducted may be submitted to the PC unit by Coimbatore centre.

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

- The trial may be continued at Coimbatore and concluded at Raigarh.

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

- Glasshouse screening of shortlisted promising lines with artificial inoculation should be done at Coimbatore and Pundibari.

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

- The trial may be continued.

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

- The trial may be continued.

Coriander

COR/CP/6 Disease Management Trial
COR/CP/6.2 Survey to identify the disease incidence, collection and identification of causal organism in coriander

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

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

- The trial may be continued.

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

- The trial may be continued.

COR/CP/6.6 Integrated management of stem gall disease of coriander

- The trial may be continued.

New Programme: Bio-efficacy of new insecticides against coriander aphid (Jobner)

Comments:

- Present recommendation should be included as one of the treatments.
- Title should be modified to reflect the treatments.
- *Beauveria bassiana* and *Verticillium lecanii* alone may also be included as treatments.
- The trial may be undertaken as a station trial initially and the promising treatments alone need to be evaluated next year.

Cumin

CUM/CP/6 Disease Management Trial

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

- The trial may be concluded and the technology developed presented.

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

- The trial may be continued

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

- The trial may be continued.

Project code	Title	Centres	Comments
Black Pepper			
PEP/CP/5	**Disease Management Trial**		
PEP/CP/5.3	Trial on management of *Phytophthora* foot rot of black pepper in new plantation	Chintapalle, Mudigere, Dapoli, Pechiparai	Closed at Pechipparai and continued at other centres
PEP/CP/5.4	Effectiveness of new molecules of fungi toxicants against *Phytophthora* foot rot of black pepper in existing plantation	Chintapalle, Mudigere, Sirsi	concluded
PEP/CP/5.6	Biological Management of Slow Decline in Black Pepper	Panniyur, Sirsi, Dapoli	Continued
PEP/CP/5.7	Studies on management of *Phytophthora* causing foot rot in black pepper	Panniyur, Sirsi, Dapoli, Mudigere	Continued
PEP/CP/5.8	Management of *Phytophthora* foot rot by mulching	Sirsi	The programme may be included under Crop Management.
Small Cardamom			
CAR/CP/6	**Pest and Disease Management Trial**		
CAR/CP/6.7	Evaluation of new insecticides / biopesticides in cardamom against thrips and capsule borer	Mudigere, Pampadumpara	Concluded
CAR/CP/6.8	Comparison of effect of chemical treatments as well as bio-control agents against pseudostem rot of cardamom	Mudigere	The trial may be concluded at Pampadumpara and continued at Mudigere.
Large Cardamom			
LCA/CP/1.1	Evolving disease and pest tolerant lines in large cardamom	ICRI Regional Station, Gangtok, ICAR Regional station, Gangtok	Continued
LCA/CP/1.2	Integrated pest and disease management in large cardamom	ICRI Regional Station, Gangtok, ICAR Regional station, Gangtok	Continued
Ginger			
GIN/CP/6	**Disease Management Trial**		
GIN/CP/6.1	Disease surveillance and etiology of rhizome rot in ginger	Dholi	The work done under the experiment may

			be consolidated and submitted to the PC Unit.
GIN/CP/6.10	Efficiency of different fungicides including new molecules against leaf spot disease of ginger	Solan, Raigarh	Concluded
GIN/CP/6.11	Eco-friendly management of rhizome rot of ginger	Kumarganj	Continued
GIN/CP/6.12	Field screening of different varieties of ginger against leaf spot and rhizome rot	Dapoli	Continued
Turmeric			
TUR/CP/7	**Disease Management Trial**		
TUR/CP/7.1	Survey and identification of disease causing organisms in turmeric and screening of turmeric germplasm against diseases (Disease Surveillance)	Coimbatore, Pundibari, Dholi, Raigarh	A consolidated report on the surveys conducted may be submitted to the PC unit by Coimbatore centre.
TUR/CP/7.3	Assessment of fungicide and biological control agents against foliar disease of turmeric	Raigarh, Coimbatore	The trial may be continued at Coimbatore and concluded at Raigarh.
TUR/CP/7.4	Management of foliar diseases in turmeric using tolerant lines	Dholi, Kumarganj, Pundibari, Raigarh, Kammaraplly, Solan, Guntur	Continued
TUR/CP/7.5	Eco-friendly management of foliar diseases of turmeric	Kumarganj	Continued
TUR/CP/7.6	Field screening of different varieties of turmeric against leaf spot and rhizome rot	Dapoli	Continued
Coriander			
COR/CP/6	**Disease Management Trial**		
COR/CP/6.2	Survey to identify the disease incidence, collection and identification of causal organism in coriander	Dholi	Continued
COR/CP/6.4	Studies on the management of coriander powdery mildew using new generation fungicides	Coimbatore, Raigarh, Jobner, Jagudan, Kumarganj	Continued
COR/CP/6.5	Eco-friendly management of stem gall of coriander (Observational	Kumarganj	Continued

	trial)		
COR/CP/6.6	Integrated management of stem gall disease of coriander	Dholi	Continued
Cumin			
CUM/CP/6	**Disease Management Trial**		
CUM/CP/6.5	Management of blight and powdery mildew by spacing and potash application	Jagudan	Concluded
CUM/CP/6.6	Bio-efficacy of newer molecules of insecticides against cumin aphid	Jagudan, Jobner, Ajmer	Continued
CUM/CP/6.7	Management of powdery mildew in cumin through new chemicals	Jobner	Continued

TECHNICAL SESSION: IV

VARIETAL RELEASE

Chairpersons : Dr. T. Janakiram, Assistant Director General (HS II.), ICAR, New Delhi
Dr. Homey Cheriyan, Director, DASD, Kozhikode

Rapporteurs : Dr. D. Prasath, ICAR-IISR, Kozhikode
Dr. B. Mahender TRS, SKLTSHU, Kammarpalli

Eleven varietal release proposals were presented in the session for identification of varieties.

Sl. No.	Crop	Name of the variety	Organization
1.	Black Pepper	Cul. 5308	PRS, Panniyur
2.	Ginger	GCP-49 (UBKV AADA 1)	UBKV, Pundibari
3.	Ginger	V_1S_1-2	OUAT, Pottangi
4.	Turmeric	NDH-98	NDUA&T, Kumarganj
5.	Turmeric	Acc. 48	IISR, Kozhikode
6.	Turmeric	PTS-55	OUAT, Pottangi
7.	Turmeric	TCP-64 (UBKV HALUD-2)	UBKV, Pundibari
8.	Coriander	RD-385	RAU, Dholi
9.	Coriander	RD-377	RAU, Dholi
10.	Coriander	Gujarat Coriander-3 (Jcr-404)	CRSS (SDAU), Jagudan
11.	Fenugreek	HM-444	CCSHAU, Hisar

General recommendations:

- The varieties identified by AICRPS workshop need to be submitted to Central Varietal release Committee (CVRC) within six months.
- Due credit should be given to all those involved in the development of the variety.
- Passport data of germplasm including place and year of collection is to be clearly mentioned in the proposal.
- In case of biotic and abiotic tolerance, sufficient data has to be included in the proposal.
- Photographs of unique characters, DUS characterization data and DNA finger printing are to be included in the proposal.
- Package of practices for the proposed variety need to be included.

The recommendations of the committee is as follows

1. **Crop: Black pepper**
   Variety: **Cul. 5308 (Panniyur 9)**
   Centre: KAU, Panniyur Research Station, (KAU), Panniyur, Kerala
   - The proposal was presented by Dr PM Ajit, PRS, Panniyur, Kerala.
   - The variety is recommended for black pepper growing areas of Kerala, Karnataka and Andhra Pradesh for its high yield.
   - Rooted cuttings of the variety need to be submitted to ICAR-IISR, Kozhikode to confirm *Phytophthora* tolerance.

2. **Crop: Ginger**
   Variety: **UBKV Aada 1 (GCP 49)**
   Centre: UBKV, Pundibari, West Bengal
   - The proposal was presented by Dr Soumendra Chakraborthy, UBKV, Pundibari.
   - It is recommended to submit revised proposal to Project Coordinator, Spices, Kozhikode, Kerala within a month for considering for recommendation.
   - The revised performa should be in prescribed format, containing good quality photographs and statistically analyzed data. Revised performa has been submitted and the variety is recommended for the ginger growing states of the country.

3. **Crop: Ginger**
   Variety: **V_1S_1-2**
   Centre: OUAT, Pottangi
   - The proposal was presented by Dr Parshuram Sial, OUAT, Pottangi.
   - The ginger variety is recommended for release in Odisha state for high yield potential.
4. **Crop: Turmeric**
   Variety: **NDH-98**
   Centre: NDUA&T, Kumarganj
   - The proposal was presented by Dr R.S Mishra, NDUA&T, Kumarganj.
   - The turmeric variety NDH 98 is recommended for national release for its high yield potential.
   - Variety should be registered with NBPGR, New Delhi.

5. **Crop: Turmeric**
   Variety: **Acc. 48 (IISR Pragati)**
   Centre: ICAR-IISR, Kozhikode
   - The proposal was presented by Dr D Prasath, ICAR-IISR.
   - The turmeric variety Acc. 48 is recommended for release in Kerala, Karnataka, Tamil Nadu, Andhra Pradesh, Telangana and Chhattisgarh for its high yield potential, short duration nature, moderately tolerant to root-knot nematodes and curcumin content of 5%.

6. **Crop: Turmeric**
   Variety: **PTS 55**
   Centre: OUAT, Pottangi
   - The proposal was presented by Dr Parshuram Sial, OUAT, Pottangi.
   - It is recommended to re-submit the proposal with additional data on yield performance in the next workshop.

7. **Crop: Turmeric**
   Variety: **TCP 64**
   Centre: UBKV, Pundibari
   - The proposal was presented by Dr Soumendra Chakraborthy, UBKV, Pundibari.
   - The committee not recommended the proposal because of no yield advantage over NDH 98, Acc. 48, other recommended varieties of same CVT.

8. **Crop: Coriander**
   Variety: **RD 385**
   Centre: Dr. RPCAU, Dholi
   - The proposal was presented by Dr SP Singh, RAU, Dholi.
   - The variety is recommended for release at national level for its high yield potential.

9. **Crop: Coriander**
   Variety: **RD 377**
   Centre: Dr.RPCAU, Dholi
   - The proposal was presented by Dr SP Singh, RAU, Dholi.
   - The committee not recommended the proposal as there is no yield advantage over RD 377, the other recommended varieties of same CVT.

10. **Crop: Coriander**
    Variety: **Gujarat coriander 3 (JCr 404)**
    Centre: SDAU, Jagudan
    - The proposal was presented by Dr H Patel, SDAU, Jagudan.
    - It is recommended to re-submit the proposal in the next workshop.
    - The revised proforma should be in the prescribed format, containing good quality photographs and statistically analyzed data.

11. **Crop: Fenugreek**
    Variety: **HM 444**
    Centre: CCSHAU, Hisar
    - The proposal was presented by Dr SK Tehlan, CCSHAU, Hisar
    - The variety HM 444 is recommended for release in Haryana state for its high yield potential and unique green seed colour.
    - Variety should be registered with NBPGR, New Delhi.

TECHNICAL SESSION: V

TRANSFER OF TECHNOLOGY

Chairpersons: Dr. S. Devasahayam, Principal Scientist, Division of Crop Protection, ICAR-IISR, Kozhikode
Dr. V. P. Neema, Professor & Head, Pepper Research Station, KAU, Panniyur

Rapporteurs : Dr. Ajit Kumar Singh, IGKV, Raigarh
Mr. Muhammed Nissar V. A., ICAR-IISR, Kozhikode

General recommendations:

- The promising technologies may be demonstrated in farmer's field and it has to be included in the Package of Practices of respective states.

Six technologies presented during the session

1. **New insecticides in cardamom against thrips, shoot and capsule borer- CRS Pampadumpara**

- Application of imidacloprid for thrips (200 SL (0.5 ml/lit. of water)-Pesticide residue analysis should be done
- Application of *Ponneem* (2 ml/lit. of water) for shoot and capsule borer-(Recommended)

2. **Management of foliar disease of turmeric –Dholi**

- Pre-planting treatment of rhizome and foliar spray of standing crop at 90, 105, 120 days after planting with Propiconazole (0.1%)-(Recommended)

3. **Management of *Colletotrichum* and *Taphrina* leaf blotch of turmeric - Raigarh**

- Rhizome treatment with Carbendazim + Mancozeb (1:1) (0.1%) + Foliar spray – Carbendazim + Mancozeb (0.1%) on 45 and 90 days (Recommended)
- Rhizome treatment with Azystrobin (0.1%)+ Spray on 45 , 75 and 105 DAP (Recommended)

4. **Management of blight and powdery mildew in cumin by spacing and potash application- CRSS Jagudan**

- The experiment may be continued for one more year incorporating fungicide treatment as control
- Jobner Centre may be included in the trial

5. **Application of Sulphur and bio regulators for yield and quality enhancement in cumin- AUJ Mandor**

- Application of sulphur @ 45 kg/ha and foliar application of TGA, Ascorbic acid and Salicylic acid @ 100 ppm at vegetative and flowering stage. (Recommended)

6. **Management of *Phyllosticta* leaf spot in ginger using new molecules**

- Spray with Hexaconazole two times at 20 DI (0.1%) - **Solan** (Recommended)
- Carbendazim (0.1%) + Mancozeb (0.1%) first at disease appearance and subsequently 2 sprays at 20 DI after 1st spray-**Dholi** (Recommended)

or

- Foliar spray with Propiconazole (0.1%) first at disease appearance and then 2 times at 20 DI.

or

- Foliar spray with Tricyclazole (0.1%) first at disease appearance and then 2 times at 20 DI.

- Foliar spray with Carbendazim: Mancozeb (1:1) (0.1%) first at a disease appearance with two times at 20 days of interval- **Raigarh**(Recommended)
- Spray with Hexaconazole (0.1%) or with Propiconazole (0.1%) first at disease appearance and then 2 times at 20 days interval- **Pundibari** (Recommended)

TECHNICAL SESSION: VI

Plenary session

Chairperson : Dr. T. Janakiram, Assistant Director General (HS II), ICAR, New Delhi
Co-Chairperson : Dr. Gopal Lal, Director, ICAR-NRCSS, Ajmer
Rapporteurs : Dr. Ravindra Singh, ICAR-NRCSS, Ajmer
Ms. H. J. Akshitha, Scientist, ICAR – IISR, Kozhikode

Dr. Gopal Lal, Director, NRCSS welcomed the gathering.
This was followed by presentations of recommendations from various sessions by the rapporteurs

Genetic Resources & Crop Improvement session: Rapporteur of this session presented the project wise recommendations and also general recommendations of the session. Some more points suggested during presentation were

1. Two new crops Nigella and Ajowain were included in the AICRPS trials and NRCSS, Ajmer will prepare the new CVT trials in these crops. Seed material for these trials should be sent directly to the respective centre from the contributing centre.
2. This year few leafy type coriander genotypes from coriander centres can be given to Barapani and Nagaland centres for evaluation.
3. Coriander centres may take up a station trial of leafy type corianders this year and in the next year new CVT may be taken up in all the centres.
4. Promising varieties of coriander before submitting for varietal release has to be checked for stem gall resistance. This has to be tested in the sick plots at Dholi centre.
5. All the seed spices varieties quality analysis has to be done. For this NRCSS will give the quality score card and centres which have facility can do the quality analysis or else they can submit the major varieties seed samples to NRCSS, Ajmer for quality analysis.
6. Prepare the catalogue and document all the germplasm in consultation with NAGS centre.
7. IC numbers should be obtained for the germplam accessions.

Crop Management Session: Rapporteur presented the session report. Some of the new programmes started in crop management are micro nutrient, organic package trials in ginger and turmeric.

Crop Protection: Project wise recommendations were presented by the rapporteur. Some of the new programmes started were bio capsule trial in ginger and turmeric, bio efficacy/pesticide residue trial in small cardamom.

Transfer of Technology: Rapporteur presented the session report and during this session technologies were recommended. In the technology on new insecticides in cardamom against

thrips, shoot and capsule borer presented by Pampadumpara centre if the centre provides the data on pesticide residue then this technology will be recommended. For the technology on management of blight and powdery mildew in cumin by spacing and potash application, this trial has to be taken up for one more year in Jagudan as well as Jobner before recommending this technology. Some other recommendations for this session were

1. Technology recommended can also be demonstrated in KVKs also.
2. Centres should take necessary steps and pursue to include these technologies in the respective state/SAUs package of practices.
3. Letter from coordinator should go to DDG (Extn.) to demonstrate these technologies in KVKs.

Variety Release Session: rapporteur presented the report of the session. During this session 7 varieties were recommended for release. It was suggested that 2 varieties NDH 98 (turmeric) and HM 444 (fenugreek) recommended for release need to be registered with NBPGR, New Delhi for their unique characteristics.

There was also a presentation by the scientist from Mangalam Seeds Limited Ahmedabad on fennel hybrid 'Volina' developed by the company to include this hybrid in AICRPS trial. It was suggested that based on project coordinators decision it will be taken up by fixing the charges for testing the variety in AICRPS.

This was followed by presentation of report **Dr. K. Nirmal Babu**, Project Coordinator, AICRPS. He gave report on the 3 days deliberations and number of varieties & technologies recommended. He also highlighted the achievements of all the AICRPS centres.

Dr. Gopal Lal, Director, NRCSS in his remarks suggested including IISR and NRCSS in the AICRPS list. He thanked all the delegates and media persons.

Dr. T. Janakiram, ADG (HS-II) in his remarks congratulated the Best AICRPS centre and the scientists whose varieties & technologies were approved in the workshop. He also suggested that there should be 10 action points for each workshop and action has to taken for those points by the next workshop. 10 action points are as follows

1. Unique germplasm has to be registered with NBPGR, New Delhi.
2. Proposals of varieties recommended for release during the workshop have to be submitted to the Central Varietal Release Committee within next 6 months.
3. AICRPS in consultation with all will prepare SOP and this will be made available in the AICRPS website.
4. Status report on AICRPS centres in different states and spices cultivation in respective state may be prepared. One publication on this may be brought out.
5. Fact sheets on spices may be prepared for publishing in the Indian Horticulture Journal.

6. Human Resource Development is very important and in this regard Project Coordinator may facilitate for special trainings to the staff working in AICRPS.
7. For the recommendation on transfer of technology follow up action to be taken up.
8. Seed standards may be prepared for seed spices.
9. Publications – Popular articles can be prepared and published in Indian Horticulture Journal, Phal Phool, ICAR newsletter etc. Success stories may also be prepared and sent for publishing.
10. Technologies which have created impact may be compiled and report may be submitted to the Director General, ICAR.

Dr. K. Kandiannan, Principal Scientist, IISR proposed the vote of thanks and the session was concluded with National Anthem.

New Research Programmes

Genetic Resources

Crop	Cardamom
Title of the program	Multilocation evaluation of thrips tolerant cardamom lines
Centre	Mudigere, Pampadumpara, Myladumpara and Sakaleshapura
Year of start	2016-17
Duration of the project	Three years
Design	RBD
No. of genotypes	Genotypes: 6 1. IC 349362 2. IC 349364 3. IC 349370 4. IC 349606 5. *Njallani* green gold 6. Local check from respective centre
No. of replications	4
Plot size	3×3 m, 12 plants/plot
Observations to be recorded	1. Plant height (m) 2. Number of tillers 3. Number of bearing tillers 4. Number of panicles 5. Panicle length (cm) 6. Number of capsules 7. Yield (kg/ha) 8. Incidence of pest and diseases 9. Per cent capsule damage by thrips

Crop Improvement

Crop	Ginger
Title of the Programme	Initial Evaluation Trial 2016 (IET 2016)
Centre	Pundibari
Year of start	2016-17
No. of treatments/genotypes	7 Genotypes + Gorubathan (local check) = 8 GCP 14, GCP 30, GCP 36, GCP 39, GCP 46, GCP 51, GCP 56, Gorubathan (Local check)
Duration of the project	Three years
Design	Randomized Block Design
No. of replications	Three replications
Plot size/spacing	3 m × 1 m & 30 cm × 20 cm
Number of plants/plot/treatment	40
Methodology & Procedure	Recommended package of practices will be followed
Date of planting	April-May
Observations to be taken	1. Plant height, Number of leaves/plant, Leaf length, Leaf Breadth, Pseudostem girth, Number of tillers/plant, Rhizome yield per plot (Kg), Projected yield (t/ha), Disease incidence for rhizome rot and bacterial wilt disease, Percent Disease Index (PDI) for leaf spot disease of ginger and Percent disease reduction over control for all the diseases. 2. Quality analysis of the harvested rhizome

Crop	Ginger
Title of the Programme	Initial Evaluation Trial 2016 (IET 2016)
Centre	Solan
Year of start	2016-17
No. of treatments/genotypes	9 Genotypes + local check= 10 SG 15-01, SG 15-02, SG 15-03, SG 15-04, SG 15-05, SG 15-06, SG 15-07, SG 15-08, SG 15-09 and Local Check-Himgiri
Duration of the project	Three years
Design	Randomized Block Design
No. of replications	Three replications
Plot size/spacing	3 m × 1 m & 30 cm × 25 cm
Number of plants/plot/treatment	40
Methodology & Procedure	Recommended package of practices will be followed
Date of planting	April-May
Observations to be taken	1. Plant height, Number of leaves/plant, Leaf length, Leaf Breadth, Pseudo stem girth, Number of tillers/plant, Rhizome yield per plant (g), Projected yield (t/ha), Rhizome rot incidence (%) 2. Quality analysis of the harvested rhizome

Crop	Turmeric
Title of the Programme	Initial Evaluation Trial 2016 (IET 2016)
Centre	Solan
Year of start	2016-17
No. of treatments/genotypes	8 Genotypes + 2 local checks= 10 ST 15-01, ST 15-02, ST 15-03, ST 15-04, ST 15-05, ST 15-06, ST 15-07, ST 15-08 and 2 Local Checks Palam Pitamber and Palam Lalima
Duration of the project	Three years
Design	Randomized Block Design
No. of replications	Three replications
Plot size/spacing	3 m × 1 m & 30 cm × 25 cm
Number of plants/plot/treatment	40
Methodology & Procedure	Recommended package of practices will be followed
Date of planting	April-May
Observations to be taken	1. Plant height, Number of leaves/plant, Leaf length, Leaf Breadth, Pseudo stem girth, Number of tillers/plant, Rhizome yield per plant(g), Projected yield (t/ha), Disease incidence (%) 2. Quality analysis of the harvested rhizome

Crop	Turmeric
Title of the Programme	Initial Evaluation Trial 2016 (IET 2016)
Centre	Pundibari
Year of start	2016-17
No. of treatments/genotypes	9 Genotypes + local check= 10 TCP- 58, TCP- 32, TCP- 90, Tcp-94, TCP- 120, TCP-246, TCP- 190,TCP-235, TCP- 232, TCP- 2 (Local Check)
Duration of the project	Three years
Design	Randomized Block Design
No. of replications	Three replications
Plot size/spacing	3 m × 1 m & 30 cm × 20 cm
Number of plants/plot/treatment	40
Methodology & Procedure	Recommended package of practices will be followed
Date of planting	April May
Observations to be taken	1. Plant height, Number of leaves/plant, Leaf length, Leaf Breadth, Pseudostem girth, Number of tillers/plant, Rhizome yield per plot (Kg), Projected yield (t/ha), Percent Disease Index (PDI) and Percent disease reduction over control for leaf blotch and leaf spot disease of Turmeric- 2. Quality analysis of the harvested rhizome.

Crop	Coriander
Name of the programme	Initial Evaluation Trial – 2016
Centres	Dholi
Date/ Year of Start	Rabi 2016-17
Design	RBD
Entries	9 (7+2 local check) 1. RD-383 2. RD-405 3. RD-423 4. RD-435 5. RD-436 6. RD-437 7. RD-440 8. Hisar Anand (LC) 9. R. Swati (LC)
No. of replications	3
Plot size	3.0m x 1.6m
Observation to be recorded	1. Height of the plant (cm) 2. Number of primary branches per plant 3. Number of secondary branches per plant 4. Number of umbels per plant 5. Number of umbellets per umbel 6. Number of grains per umbel 7. Number of grains per umbellet 8. Number of days to maturity 9. Yield per plot (kg) 10. Yield per hectare (kg)

Crop	Fenugreek.
Name of the programme	Initial evaluation trial
Centres	Dholi
Date/ Year of Start	Rabi – 2016
Design	RBD
Entries	9 (7+2 local check) 1. RM-189 2. RM-195 3. RM-196 4. RM-199 5. RM-200 6. RM-201 7. RM-209 8. Hisar Sonali (LC) 9. R. Kanti (LC)
No. of replications	3
Plot size	3.0m x 1.5m
Spacing	30cm x 10cm
Observation to be recorded	1. Height of the plant (cm) 2. Number of primary branches per plant 3. Number of secondary branches per plant 4. Number of pods per plant 5. Length of pods per pod (cm) 6. Number of grains per pod 7. Days to maturity 8. Yield per plot (kg) 9. Yield per hectare (kg)

Crop	Ajowain
Name of the programme	Coordinated Varietal Trial – 2016
Centres	Ajmer, Jobner, Jagudan, Raigarh, Hisar, Kumarganj, Guntur
Entries	11
Date/ Year of Start	Rabi 2016-17
Duration of the project	Three years
Testing centres/ No of Treatments/ genotypes with details	Ajmer: 02 entries Jobner: Nil Raigarh: 01 entry Hisar: 02 entries Jagudan: 02 entries Kumarganj (Faizabad): 02 entries Guntur: 02 entries Check varieties: Ajmer Ajwain-1 and Ajmer Ajwain-2
Design	R.B.D
No of replication	03
Plot Size/ Spacing	4.00 x 2.5 m^2 / Spacing- 50 x 20 cm
No of rows per plot	5 rows
Date of sowing/planting season	First week of Nov (rabi)
Methodology and procedure to be adopted	As per recommended package of practices Fertilizer: 40 + 20 + 20 NPK kg/ha
Observation to be recorded	1. Plant height (cm) 2. Primary branches per plant 3. Secondary branches per plant 4. Days to 50 % flowering (on plot basis) 5. Umbells per plant 6. Umbellets per umbel 7. Seeds per umbel 8. Test weight (g) 9. Seed yield (kg/ha) 10. Disease and pest incidence, if any 11. Quality (essential oil %)

Crop	Nigella
Name of the programme	Coordinated Varietal Trial – 2016
Centres	Ajmer, Raigarh, Hisar, Kumarganj, Kota, Kalyani, Pantnagar
Entries	08
Date/ Year of Start	Rabi 2016-17
Duration of the project	Three years
Testing Centres/No of Treatments/ genotypes with details	Ajmer: 02 entries Raigarh: 01 entry Hisar: 01 entries Kumarganj (Faizabad): 02 entries Kota: Nil Pantnagar: 02 Check varieties: Ajmer Nigella-1 and Pant Krishna
Design	R.B.D
No of replication	03
Plot Size/ Spacing	4.00 x 2.4 m^2 / Spacing- 30 x 15 cm
No of rows per plot	8 rows
Date of sowing/planting season	First week of Nov (rabi)
Methodology and procedure to be adopted	As per recommended package of practices Fertilizer: 40 + 20 + 20 NPK kg/ha
Observation to be recorded	1. Plant height (cm) 2. Primary branches per plant 3. Secondary branches per plant 4. Days to 50 % flowering (on plot basis) 5. Capsules per plant 6. Seeds per capsule 7. Test weight (g) 8. Seed yield (kg/ha) 9. Disease and pest incidence, if any 10. Quality (Total oil %)

Crop Production

Crop	Ginger
Title of the programme	Organic production of ginger
Centre	Ambalavayal, Pottangi, Chinthapalle, Dholi, Barapani, Kammarpally, Kumarganj, Pundibari, Raigarh, Solan, Kalyani, Mizoram
Year of start	2017
Duration of the project	3 years
Design	RBD
Variety	Any 3 varieties
No. of treatments/genotypes with details	Number of treatments-2 T_1 : Organic package developed by IISR T_2 : Recommended Package by SAU
No. of replications	4
Plot size/no. of plants per bed	3×1 m/ 40 plants
Observation to be recorded in detail	**Physico - chemical parameters of soil** : pH, nutrient status (major, secondary and micronutrients) **Growth parameters** 1. Plant population 2. Number of tillers 3. Height(cm) 4. Fresh weight of clump(g) 5. Yield/ha 6. Dry recovery 7. Fiber content 8. Oleoresin (%) 9. Essential oil (%) 10. Disease and insect pests

Organic package developed by IISR

Pre sowing rhizome treatment	PGPR strain GRB-35 1 capsule/100 l of water	Seed rhizome dipping in PGPR solution
Basal application of organic manures	FYM 25-30 t/ha Neem cake 2 t/ha	To be applied before last ploughing
Top dressing of organic manures	Vermicompost 2 t/ha Ash 0.5 t/ha Soil low in K – Sulphate of potash supplementation 50 kg	45^{th} & 90^{th} DAP
Micronutrient	IISR ginger booster @ 5 g/l water 3-5 kg/ha	Foliar spray at 60^{th} and 90^{th} DAP
Pest and disease management 1. Shoot borer	Neem oil/neem gold	5 ml/l foliar spray
2. Soft rot and bacterial wilt	BM 1%	Spray and drenching

Crop	Turmeric
Title of the programme	Organic production of turmeric
Centre	Barapani, Chinthapalle Coimbatore, Dholi, Guntur, Kammarpally, Kumarganj, Mizoram, Pantnagar, Pasighat, Pottangi, Pundibari, Raigarh, Solan
Year of start	2017
Duration of the project	3 years
Design	RBD
Variety	Any three varieties
No. of treatments/genotypes with details	Number of treatments-2 T_1 : Organic package developed by IISR T_2 : Recommended Package by SAU
No. of replications	4
Plot size/No. of plants per bed	3×1 m/ 40 plants
Observation to be recorded in detail	**Physico - chemical parameters of soil** : pH, nutrient status (major, secondary and micronutrients) **Growth parameters** 1. Plant population 2. Number of tillers 3. Height(cm) 4. Fresh weight of clump(g) 5. Yield/ha 6. Dry recovery 7. Curcumin content 8. Oleoresin (%) 9. Essential oil (%) 10. Disease and insect pests

Organic package developed by IISR

Pre sowing rhizome treatment	PGPR strain GRB-35 1 capsule/100 l of water	Seed rhizome dipping in PGPR solution
Basal application of organic manures	FYM 20 t/ha Neem cake 2 t/ha	To be applied before last ploughing
Top dressing of organic manures	Vermicompost 2 t/ha Ash 0.5 t/ha Soil low in K – Sulphate of potash supplementation 50-100 kg	45^{th} & 90^{th} DAP
Micronutrient	IISR turmeric booster @ 5 g/l water 3-5 kg/ha	Foliar spray at 60^{th} and 90^{th} DAP
Pest and disease management 1. Shoot borer	Neem oil/neem gold	5 ml/l foliar spray
2. Rhizome rot	BM 1%	Spray and drenching

Crop	Ginger
Title of the programme	*Effect of micronutrients on growth and yield of ginger
Centre	Pottangi, Chinthapalle, Dholi, Barapani, Kammarpally, Kumarganj, Pundibari, Raigarh, Solan, Kalyani, Ambalavayal
Year of start	2017
Design	RBD
Variety	Any 3 varieties
No. of treatments/genotypes with details	Number of treatments-2 T_1: Recommended package of practice (Control) T_2 : Recommended package of practice + IISR ginger micronutrient two sprays at 60 and 90 Days after planting @ 5g/litre
No. of replications	3
Plot size/spacing	3×1 m/ 40 plants
Observation to be recorded in detail	**Physico - chemical parameters of soil** : pH, nutrient status (major, secondary and micronutrients) **Growth parameters** 1. Plant population 2. Number of tillers 3. Height(cm) 4. Fresh weight of clump(g) 5. Yield/ha 6. Dry recovery 7. Fiber content 8. Oleoresin (%) 9. Essential oil (%) 10. Disease and insect pests

Method of application of bioagent:

Dosage of micronutrient is 5 g/l. Mix 5 g of micronutrient in one ltr of water and take up foliar spray. Approximately 2 ltr is required per bed. Take up foliar spray at 60 and 90 days after sowing.

Do the soil sampling before application of micronutrients

*The trial was ongoing as demonstration trial at Chintappalli and Pottangi. Now it has included as an experimental trial.

Crop	Turmeric
Title of the programme	Effect of micronutrients on growth and yield of turmeric
Centre	Chinthapalle , Coimbatore, Dholi, Kammarpally, Kumarganj, Pantnagar, Pasighat, Pottangi, Pundibari, Raigarh, Solan
Year of start	2017
Design	RBD
Variety	Any 3 varieties
No. of treatments/genotypes with details	Number of treatments-2 T_1: Recommended package of practice (Control) T_2: Recommended package of practice + IISR turmeric micronutrient two sprays at 60 and 90 Days after planting @ 5g/litre
No. of replications	4
Plot size/spacing	3×1 m/ 40 plants
Observation to be recorded in detail	**Physico - chemical parameters of soil** : pH, nutrient status (major, secondary and micronutrients) **Growth parameters** 1. Plant population 2. Number of tillers 3. Height(cm) 4. Fresh weight of clump(g) 5. Yield/ha 6. Dry recovery 7. Fiber content 8. Oleoresin (%) 9. Essential oil (%) 10. Disease and insect pests

Method of application of bioagent:

Dosage of micronutrient is 5 g/l. Mix 5 g of micronutrient in one ltr of water and take up foliar spray. Approximately 2 ltr is required per bed. Take up foliar spray at 60 and 90 days after sowing.

Do the soil sampling before application of micronutrients

Crop Protection

Crop	Cardamom
Title of the program	Evaluation of new insecticides for thrips control
Centre	Mudigere, Pampadumpara, Myladumpara and Sakaleshapura
Year of start	2016-17
Duration of the project	Three years
Design	RBD
No. of treatments with details	Treatments: 5 1. Spinosad 45% SC @ 0.0135% 2. Imidacloprid 17.8SL @ 0.0089% 3. Fipronil 5% SC @ 0.005% 4. Quinalphos 25EC @ 0.05% 5. Water spray (control)
No. of replications	4
Plot size	3×3 m, 12 plants/plot
Observations to be recorded	10. Per cent capsule damage 11. Residue level in capsules after 0, 7, 15 and 30 days after the last spray

Spray schedule:

Kerala: 7 sprays in Feb, Mar, Apr, May, Aug, Sep & Oct

Karnataka: 3 sprays in Mar, May & Aug

Crop	Ginger
Title of the programme	Effect of PGPR biocapsule on growth and yield of ginger
Centre	Pottangi, Chinthapalle, Dholi, Barapani, Kammarpally, Kumarganj, Pundibari, Raigarh, Solan, Kalyani, Ambalavayal
Year of start	2017
Design	RBD
Variety	Any 3 varieties
No. of treatments/genotypes with details	Number of treatments-5 T_1: POP + *Trichoderma* (Talc formulation) + GRB 35 (Talc formulation) T_2: POP + *Trichoderma* capsule + GRB 35 capsule T_3: POP + *Trichoderma* capsule T_4: POP + GRB 35 capsule T_5: POP
No. of replications	4
Plot size/spacing	3×1 m/ 40 plants
Observation to be recorded in detail	Plant population, Number of tillers, Height(cm), Fresh weight of clump (g), Yield/ha, Dry recovery, Fiber content, Oleoresin (%), Essential oil (%), Disease and insect pests

PGPR capsule- GRB35 (for 1.0 acre ~800 beds) for ginger

- Suspend two capsules in 2000 mL sterile water (boiled and cooled) for activation, keep overnight
- Dilute this suspension to 2000 litres with ordinary water
- Soak the ginger rhizomes required for 1.0 acre in this suspension for 30 minutes before sowing
- Drench the remaining suspension on the beds

<u>At 90 DAP</u>

- Suspend four capsules in 4000 mL sterile water (heated and cooled) for activation
- Dilute this suspension to 4000 litres with ordinary water
- Apply 5 liters of this suspension per bed

(2 capsules per acre at the time of planting; 4 capsules per acre at 90DAP)

Crop	Turmeric
Title of the programme	Effect of PGPR biocapsule on growth and yield of turmeric
Centre	Chinthapalle , Coimbatore, Dholi, Kammarpally, Kumarganj, Pantnagar, Pasighat, Pottangi, Pundibari, Raigarh, Solan
Year of start	2017
Design	RBD
Variety	Any 3 varieties
No. of treatments/genotypes with details	Number of treatments-5 T_1: POP + *Trichoderma* (Talc formulation) + GRB 35 (Talc formulation) T_2: POP + *Trichoderma* capsule + GRB 35 capsule T_3: POP + *Trichoderma* capsule T_4: POP + GRB 35 capsule T_5: POP
No. of replications	4
Plot size/spacing	3×1 m/ 40 plants
Observation to be recorded in detail	Plant population, Number of tillers, Height(cm), Fresh weight of clump (g), Yield/ha, Dry recovery, Fiber content, Oleoresin (%), Essential oil (%), Disease and insect pests

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- Dilute this suspension to 4000 litres with ordinary water
- Apply 5 liters of this suspension per bed

(2 capsules per acre at the time of planting; 4 capsules per acre at 90 DAP

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52	Dr. Girish Kumar Mittal, Jr. Biochemist
53	Dr. R. N. Sharma, STA, Plant Pathology
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54	Prof. A. M. Amin, Plant Pathologist, OIC, AICRPS
55	Dr. H. B. Patel, Assistant Professor
56	Dr. B. G. Prajapthi, Entomologist
57	Dr. A. U. Amin, Research Scientist (Spices) & Head

58	Dr. N. R Patel, Asst. Res. Scientist (Pl. Pathology)
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59	Dr. T.P. Malik, Principal Scientist
60	Dr. S. K. Tehlan, Principal Scientist
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61	Dr. S. P. Singh, Horticulturist &PI, OIC, AICRPS
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64	Dr. R.S. Mishra, Assoc. Professsor & Breeder
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65	Dr. Suchand Dutta, Associate Professor & OIC, AICRPS
66	Dr. (Mrs.) Anamika Debnath, Assistant Professor (Plant Pathology)
67	Dr. Soumendra Chakraborty, Asst. Professor (Genetics & Plant Breeding)
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68	Dr. R. G. Khandekar, Horticulturist, OIC, AICRPS
69	Dr. Rajesh Rangrao Rathod, Jr. Plant Pathologist
70	Dr. Pethe, U.B., Jr. Breeder
Regional Agril. Research Station, (Indira Gandhi Agricultural University), Boirdadar Farm, RAIGARH – 496 001, Dist. Raigarh, Chhattisgarh	
71	Dr. Ajit Kumar Singh, Jr. Pathologist, OIC, AICRPS
72	Dr. Shrikant Laxmikant Swargaonkar, Jr. Breeder
73	Dr. Sarita Sahu, Horticulturist
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Indian Cardamom Research Institute, MYLADUMPARA, Kailasanadu – 685 553, Idukki Dist., Kerala	
74	Dr. A.K. Vijayan, Head, Division of Plant Pathology
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75	Dr. Sreekrishna Bhat. S., Sr. Scientist
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76	Dr. K. Pradip Kumar, Scientist-C
Horticultural Research Station (TNAU), PECHIPARAI – 629 161, Kanyakumari Dist., Tamil Nadu	
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78	Dr. Anjani Kumar Jha, Principal Scientist (Hort.)
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81	Dr. Kusum Kr. Deka, Sr. Scientist (Hort.),
Voluntary Centres	
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82	Dr. Dhirendra Singh, Professor
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83	Dr. Sachindra Nath, Jr. Scientist-cum-Asst. Professor, Department of Horticulture In-charge of AICRP on Spices
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84	Dr. Anupam Pariari, Professor & PI of AICRP on Spices
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85	Dr. Ritesh K. Patel, Asst. Professor Dept. of Botany & (PI) of the Scheme
Jawaharlal Nehru Krishi Vishwavidyalaya, Jabalpur-482004, Madhya Pradesh	
86	Dr. S.K. Sengupta, Sr. Scientist (Veg.)
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87	Dr. Preeti Verma, Asst. Professor
Cator-Seed Spices Research Station, Anand Agricultural University, Sanand, Dist. Ahmedabad, Sanand-382 110	
88	Dr. B.H. Patel, Asst. Research Scientist
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89	Dr. Motilal Mehriya, Asst. Professor (Agro.)
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90	Dr. P.S. Mariam Anal, Asst. Professor
Project Mode Centres	
College of Horticulture (UHS), GKVK (P), Bengaluru – 560065, Karnataka	
91	Dr. B. Maruthi Prasad, Assistant Professor
PROGRESSIVE FARMER & INDUSTRALIST	
92	Mr. Patel Pradip, N., Kashvin Seeds, Pvt. Ltd., Gujarat
93	Mr. Prakash N. Patel, Mangalam seeds Ltd., Gujarat
COMMITTEE MEMBERS AND OTHER SCIENTISTS FROM NRCSS, AJMER	
	From NRCSS, Ajmer Organizing Committee (10-15 members)

Ginger: V1 S1-2 (Sourabh)

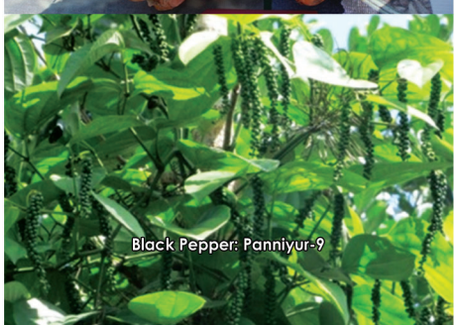
Coriander: RD 385 (Dr.RPCAU Dhania-1)

Ginger: GCP-49 (Mohini)

Fenugreek- HM444 (Hisar Manohar)

Turmeric: IISR Pragati (Acc.48)

Turmeric: NDH-98



Black Pepper: Panniyur-9

हर कदम, हर डगर
किसानों का हमसफर
भारतीय कृषि अनुसंधान परिषद

भाकृअनुप
ICAR

Agrisearch with a human touch

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