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

1-3 November, 2001
Kerala Agricultural University,
Vellanikkara, Thrissur

Project Coordinator : Dr P N Ravindran

ALL INDIA COORDINATED RESEARCH PROJECT ON SPICES
INDIAN INSTITUTE OF SPICES RESEARCH
(Indian Council of Agricultural Research)
Calicut – 673 012, Kerala

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Compiled and Edited by :

DR P N RAVINDRAN
Project Coordinator

DR K N SHIVA
Scientist (Horticulture)

DR JOHNY A KALLUPURACKAL
Technical Information Officer

ALL INDIA COORDINATED RESEARCH PROJECT ON SPICES
INDIAN INSTITUTE OF SPICES RESEARCH
CALICUT, KERALA

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INTRODUCTION

The XVI Workshop (National Meet of Research Workers) of All India Coordinated Research Project on Spices (AICRPS) was held at KAU, Vellanikkara, Thrissur from 1-3 November 2001. This Workshop was hosted by Kerala Agricultural University (KAU). The three day-Workshop was inaugurated on 1st November by **Prof. (Dr.) K.V. Peter**, Vice Chancellor, Kerala Agricultural University at the Central Auditorium of KAU at 9.30 am. **Dr. G. Kalloo**, DDG (Horticulture), Indian Council of Agricultural Research, New Delhi presided over the function. **Dr. R.N. Pal**, ADG (PC) introduced to the audience the organization and functioning of the AICRPS. **Dr. P. N. Ravindran**, Project Coordinator (Spices) presented the biennial report (1999-2001) of AICRP on Spices. In his report he focussed on the present germplasm holdings of AICRPS centres consisting of 421 black pepper, 330 cardamom, 443 ginger, 1134 turmeric, 117 tree spices and 3681 seed spices. He also briefed the various improvements made in genetic resources and technologies developed in crop production and crop protection areas for the past two years.

During the inaugural session, **Prof. K.V. Peter**, Vice Chancellor of KAU, stressed the need for active support to the farmers to face the situations arising out of WTO and globalization by Researchers and Scientists in the field. He also remarked that the Indian Spices with their intrinsic qualities are distinctly superior to spices produced in other parts of the world. He also opined the need for the quality spices production to compete in the global market.

Dr. G. Kalloo, Deputy Director General (Horticulture), ICAR, in his presidential address stated that India has been dominating the world trade by contributing about 30 per cent of its volume which was due to the combined effort of Scientists, farmers, traders, merchants and exporters, He also pointed that in a competitive global market, the production cost was intimately linked to productivity, unless and until we achieved high productivity, we would not be able to compete with other countries. He called upon the Scientists to evolve integrated technologies for nutrient and stress management that can eventually reduce the cost of chemical inputs. He also requested the Scientists to focus their researches on the endangered species in spices.

Two publications viz., "AICRPS Annual Report – 2000-2001" and "AICRPS –a profile", brought out by Project Coordinator's cell, IISR, Calicut and two publications from KAU– "Three decades of Spices Research at KAU" and "KAU Manual", were released during the occasion.

The three day-workshop was divided into seven technical sessions including plenary session. Each session was chaired and co-chaired by experts in the respective fields/ areas of research and assisted by rapporteurs. Over 150 delegates representing 15 State Agricultural Universities, Indian Institute of Spices Research, Departments of Agriculture, Officials of ICAR HQ, Agricultural inputs agencies, experts from Spices Board, Directorate of Arecanut and Spices Development, other developmental departments, farming community, traders and exporters participated in the three day deliberations actively. Over 90 projects with more than 175 presentations covering 12 mandate crops from 19 co-ordinating centres and 8 voluntary centres were presented and these projects were discussed in depth, analyzed and debated. New technical programmes were formulated by the experts available in the respective fields/areas in the current topics on priority. Two guest lecturers were also delivered on the occasion, one on "Need of germplasm registration of agricultural crops" and another on "Pre-requisite of quality tests to be carried out on spices for export".

The workshop also recommended seven varieties of different spice crops for State/ Central variety release committees, after analyzing their performances critically. Four recommendations of different spice crops were also made available to extension agencies for general adoption, during the workshop.

In the plenary session, Chairman appreciated the Project Coordinator, Coordinating centres, Chairman, Co-chairman, Rapporteurs and Resource persons of various technical sessions for smooth and successful conduct of the workshop. The workshop came to an end with the vote of thanks of General Convenor of the Workshop, **Dr. E.V. Nybe**, Professor & Head, Department of Plantation Crops & Spices, KAU on 3rd November 2001 at 6.00 pm.

ACKNOWLEDGEMENTS

The Project Coordinator on behalf of the ICAR and KAU place on record his grateful acknowledgements to the following Organizations who supported the XVI Workshop.

1 State Bank of India, Calicut
2 Spices Board, Kochi
3 Micronutrient Technology, Pune
4 Coconut Development Board, Kochi
5 Rubber Board, Kottayam
6 Indian Potash Ltd.
7 Syngenta India Ltd.
8 Indian Pepper and Spices Trade Association, Kochi
9 Synthite Industrial Chemicals Ltd., Kochi
10 Cardamom Marketing Corporation, Idukki
11 Mas Enterprises, Idukki
12 State Bank of Travancore, Thrissur
13 Kerala Chemicals and Proteins Ltd., Kochi
14 Rallis India Ltd.
15 Western India Plywoods, Kannore
16 Raidco, Kannore
17 Western India Cottons, Kannore
18 T- Stanes
19 Indofil Chemicals Co.

The Project Coordinator is also extremely grateful to the Vice Chancellor and all the Staff of KAU, whose untiring efforts made the present Workshop a grand success. The Chairman & Co-Chairman of the various technical sessions, Rapporteurs, Resource persons as well as the Members of the various committees deserve special thanks. He is also thankful to all the panel members and experts who helped in the formulation of the research projects. He is indebted to the staff of the PC's Cell, who have put in long hours of extra work to make this Workshop a great success.

XVI NATIONAL WORKSHOP OF AICRP ON SPICES
1-3 November 2001

Venue: Central Auditorium, Kerala Agricultural University, Vellanikkara

PROGRAMME

1st November 2001 (Thursday)

09.30 - 11.00 **INAUGURAL SESSION**

Welcome address	:	**Dr. K. Kumaran** Director of Research, KAU, Thrissur
Report on AICRPS	:	**Dr. P.N. Ravindran** Project Coordinator
On AICRPS	:	**Dr. R.N. Pal** Asst. Director General (PC), ICAR
Felicitations	:	**Dr.Y.R. Sarma** Director, IISR
		Mr. Koshy John Director (Dev.), Spices Board

Release of Publications:

* AICRPS Annual Report (2000-2001)
* AICRPS Profile
* Three decades of Spices Research at KAU
* KAU-Manual

Presidential Address	:	**Dr.G. Kalloo** Deputy Director General (Hort),ICAR
Inaugural Address	:	**Prof. K.V. Peter** Vice Chancellor, KAU
Vote of Thanks	:	**Dr. E.V. Nybe** General Convenor
11.00 - 11.30	:	Tea

11.30 - 02.05 **SESSION I: GENETIC RESOURCES**

Chairman	:	Dr. G. Sreekantan Nair (KAU)
Co-Chairman	:	Dr. Z. Abraham (NBPGR)
Rapporteurs	:	Dr. V. S. Sujatha (KAU) Mr. K.V. Saji (IISR)
2.05 - 2.45	:	Lunch

02.45 - 04.45		SESSION I: GENETIC RESOURCES - Continues
04.45 - 04.55		Guest lecture - *"Status of spices germplasm in India"* - Dr. Z. Abraham (NBPGR)
04.55 - 05.30		Tea
05.30 - 07.00		**SESSION II: CROP IMPROVEMENT**
Chairman	:	Dr. D.L. Singhania (RAU)
Co-Chairman	:	Dr. M.R. Sudharsan (ICRI)
Rapporteurs	:	Dr. M.R. Shylaja (KAU) Dr. D. Prasath (IISR)

2nd November 2001 (Friday)

08.50 - 09.25		SESSION II: CROP IMPROVEMENT - Continues
09.25 - 09.30		Guest lecture -*"Quality tests for food products"* Dr. C. K. Nair (CEPC Lab, Kollam)
09.30 - 11.00		Tea
11.00 - 01.45		SESSION II: CROP IMPROVEMENT - Continues
01.45 - 02.15		Lunch Break
02.15 - 04.50		**SESSION III: CROP PRODUCTION**
Chairman	:	Dr. S.N. Potty (ICRI)
Co-Chairman	:	Dr.V.S. Korikanthimath(IISR)
Rapporteurs	:	Dr. Jose Mathew (KAU) Dr. V. Srinivasan (IISR)
04.50 - 05.20		Tea
05.20 - 06.50		**SESSION IV: CROP PROTECTION**
Chairman	:	Dr. A. Sukumara Varma (KAU)
Co-Chairman	:	Dr. S. Devasahayam (IISR)
Rapporteurs	:	Dr. M.V.R. Pillai (KAU) Dr. A. Kumar (IISR) Dr. G. Sivakumar (KAU)

3rd November 2001 (Saturday)

08.50 - 11.15 SESSION IV: CROP PROTECTION - Continues

11.15- 11.45 Tea

11.45 - 01.50 SESSION V: RELEASE OF VARIETIES AND RECOMMENDATIONS FOR EXTENSION AGENCIES

Chairman : Dr. S.N. Potty (ICRI)

Rapporteurs : Dr. (Ms.) Mini Raj (KAU)
Dr. K.S. Krishnamoorthy (IISR)

01.50 - 02.30 Lunch

02.30 - 03.40 SESSION VI: ICAR ADHOC SCHEMES

Chairman : Dr. P.N. Ravindran (IISR)

Rapporteurs : Dr. (Ms.) Alice Kurien (KAU)
Dr. K.N. Shiva (IISR)

03.40 - 04.10 Break

04.10 - 06.00 SESSION VII: PLENARY SESSION

Chairman : Dr. K. Kumaran (KAU)

Co-Chairman : Dr. P.N. Ravindran (IISR)

Rapporteurs : Dr. (Ms.) S. Prasannakumari Amma (KAU)
Dr. K.N. Shiva (IISR)

Presentation of Reports of Technical Sessions:I - V

Remarks by Chairman and Co-Chairman

Vote of Thanks : Dr. E.V. Nybe (KAU)

PROJECT COORDINATOR'S REPORT

AICRP on Spices is one among the 78 coordinated research projects under the Indian Council of Agricultural Research. The aim of AICRP on Spices (AICRPS) is to conduct and coordinate spices research in the country. At present, there are 19 centres & 8 voluntary centres to work on 12 spices. The AICRPS at present has a total staff strength of 83, which includes 51 Scientists, 32 technicial /auxiliary staff. The research achievements for the year 1999-2001 are presented in this report.

The AICRPS has about 90 research projects, covering the twelve mandate crops. During the workshop in 1999, new programmes were formulated giving emphasis on integrated pest & disease management, biofertilizer studies and organic farming in spices. The germplasm collections were strengthened and evaluation has been taken up at all centres. The work on tree spices at Yercaud is shifted to Pechiparai. At present germplasm holdings of AICRPS centres consist of 421 black pepper, 330 cardamom, 443 ginger, 1134 turmeric, 117 tree spices and 3681 seed spices and are being maintained at different centres.

Based on the evaluation of germplasm, five accessions of black pepper { Karimunda-II, III, PRS-17, Cul.5489, Cult.5308 (Panniyur) }, nine of cardamom { PS-44, PS-27 & S-1 (Pampadumpara), CL-692, CL-730 (Mudigere), MCC-13, MCC-18, MCC-200 & MCC-347 (ICRI, Myladumpara)]; two of ginger [V_1C_8 and V_1S_1-2 (Pottangi) } and 11 of turmeric [TCP-1 (Punidbari) PTS-55, TU.No-1, PTS-11, PTS-15, PTS-52 & PTS-59 (Pottangi) JTS-6, JTC-313 & TCP-2 (Jagtial) RH-5 (Dholi)] were identified for the new CVTs. Six CVTs were identified in spices in addition to 13 existing CVTs. Besides, promising cardamom genotypes in OP seedling progenies (D-237, CC-730, CL- 692), other superior clones (Acc. 8-4-D11 and 7-24-D11) were identified in cardamom by the Mudigere. Drought tolerant lines were identified in cardamom (CL-668, P-6, D-237 and 2-2-D11). Acc.239 was identified as promising in pepper in Sirsi. Promising entries were identified in the CVT in all mandate spices. V_3S_1-8 in ginger and PTS-59 and PTS-55 in turmeric were identified as promising varieties and are in the pipeline for release at Pottangi. Ginger variety V_1E_8-2 (Pottangi), turmeric varieties PTS-43 (Pottangi) and TCP-1 & TCP-2 (Pundibari) were proposed for release. Exotic line of coriander EC-2 32666 was identified as the best for leaf type for commercial growing.

From quality studies, in turmeric, the Solan centre short-listed three turmeric accessions (PCT-1, GL Puram, PTS-16) and at Coimbatore, accession CL-67 with 6.4% curcumin. Acc.BDJ-105 and Acc-360 have high dry recovery, ST-1M and ST-7M have high essential oil and oleoresin respectively. Solan centre identified SG-685 for high dry recovery. In coriander, JCo-331 is having high oil (0.45%). Turmeric varieties Alleppy followed by BDJR – 1260 were selected for highest in curcumin content and yield. The highest volatile oil content in cumin was in EC-232684 (4.4%) and JC-147 (3.9%) and fennel in UF-144.

With respect to crop production, Sirsi centre standardized the fertilizer and irrigation requirements for black pepper-arecanut mixed cropping system. Studies at Mudigere revealed the influence of micronutrients, boron and molybdenum, on green capsule yield in cardamom. A fertilizer dose of 100:100:175kg NPK/ha has been recommended in the integrated nutrient management using organic and inorganic manures in cardamom. Package of practices for ginger and turmeric were standardized by the Chintapalli centre. A fertilizer package,

including the application of biofertilizer, was standardized for clove and nutmeg by the Yercaud centre. The vegetative propagation standardized in nutmeg through grafting technique gave 50.5% success at Yercaud. Yield and quality of coriander and fennel increased by the application of Zn, Fe, Mn & Cu. In Gujarat, sowing of cumin on 15th October is most appropriate in terms of high yield and less blight incidence. A closer spacing of 15 X 10 cm and sowing in first week of October gave highest yield at Coimbatore and 31st October in Jobner for fenugreek.

In the crop protection area, a package of plant protection was recommended for management of *Phytophthora* foot rot in black pepper by Panniyur and Sirsi centres. Survey conducted noticed the occurrence of *anthrocnose* disease and marginal gall thrips in black pepper in Idukki district. A low-cost technology for mass multiplication of *Trichoderma* sp. for field application has been developed by Sirsi. Rhizome rot under storage can be managed and highest recovery of rhizome and the lowest disease incidence was obtained in sand layered pits mixed with Dithane M-45 + Bavistin (5g + 3g/kg of seed). Survey conducted established the severity of stemgall disease in coriander in different areas of Bihar. Coriander varieties RCr-441, RCr-435, RCr-436, UD-446 and UD-684 were resistant to root knot nematodes at Jobner. Sowing cumin on 10th November is best to minimise wilt incidence with maximise green yield (3.63 q/ha). Sowing of cumin on 20th December was recommended by Jobner for higher seed yield and lesser incidence of wilt. Guj. cum.3, Acc-1136, Acc-1145, Acc.1165 were moderately resistant to *Furarium* wilt. Kasuri methi (fenugreek) found to be resistant to powdery mildew.

The AICRP (Spices) centres multiplied and distributed nucleus planting materials (cuttings / suckers / seeds) of different spices. Summary of achievements of the ICAR ad-hoc research projects on spices currently operating is also presented in the Annual Report.

PROCEEDINGS OF XVI WORKSHOP OF AICRPS

Technical Session I: **GENETIC RESOURCES**

Chairman : Dr. G. Sreekandan Nair Co-Chairman : Dr. Z. Abraham

Rapporteurs : Dr. V.S. Sujatha
Mr. K.V. Saji

1. No. of papers presented : 41
2. Name(s) of centres where work was done : Panniyur, Sirsi, Chintapalli, Yercaud, Dapoli, Mudigere, Pampadumpara, Solan, Pottangi, Pundibari, Dholi, Kumarganj, Raigarh, Jagtial, Coimbatore, Pechiparai, Jobner, Jagudan, Guntur, Hisar
3. Non-performing centres, if any : Nil
4. Brief description of the work done and salient results reported (crop wise) : The Coordinating centres presented their reports of different spice crops
5. Recommendations /decisions (crop wise) :

Black pepper

1. Passport data of the accessions collected should be prepared and sent to NBPGR, New Delhi at the earliest with a copy to Project Coordinator, AICRPS, Calicut with voucher specimens – Action :- *All Centres*

2. *Sirsi* :- should complete collection programme before 2003. Extensive survey for germplasm collection should be done in Sagar, Shimoga and Sidhapur areas. Karimalligesara variations should be collected exhaustively within two years.

3. *RARS, Chintapalli* :- collect all released varieties and important cultivars from IISR, Calicut and Pepper Research Station, Panniyur. Suitable types for the locality should be selected and proper characterization and evaluation should be done.

4. *Dapoli* :- should improve collection programme.

Cardamom

1. For any Comparative Yield Trial (CYT), the highest yielding variety should be used as Local Check. Action : *All centres.*

2. Collections from plantations should be carried out to locate super clones and document after characterization and evaluation.

3. *Mudigere and Pampadumpara*: should collect promising clones from Spices Board.

4. *ICRI, Sikkim*: will take up a project on collection and conservation of large cardamom provided, there is funding from AICRP on Spices.

Ginger

1. Yield data should be presented per plot basis rather than single plant basis. Action : *All centres.*

2. *Solan:* – complete collection from Himachal Pradesh.

3. *Raigarh:* – survey and collection from Bastar district should be completed.

4. *Pottangi:* – complete collection from southern districts.

5. Dr. Koshy John, Director (Development), Spices Board suggested that there should be a centre in the North East Region.

6. *The Pundibari:* may take up collection from North Eastern Region and Sikkim

Turmeric

1. For identification of *Curcuma* species, the centres can take the help of Dr. K.C. Velayudhan, Principal Scientist, NBPGR, Vellanikkara, Thrissur. Herbarium specimens are advisable.

2. *Coimbatore:* should deposit highest yielding lines in the National Repository.

3. *Pundibari:* will complete germplasm of Malda district in the next year.

4. *Solan:* – oil quality of the germplasm also should be evaluated along with other parameters

5. *Hisar:* will be included in turmeric germplasm resources collection and conservation

6. *Pundibari:* may start a collection of the Lakadong variety of turmeric and evaluate the same.

Tree Spices

1. Technical programme identified during last workshop was not implemented properly by all the three centres. So, they should implement the programmes immediately without further delay.

2. Tree spices work will be continued only on adhoc basis, by monitoring the progress.

3. *Pechiparai:* should build up collection by surveying Kanyakumari district. They will collect superior types from Thadiyankudissai.

4. *Myristica* swamps in Kulathupuzha should be surveyed for variability in the species taking the help of TBGRI, Palode.

Coriander

1. Importance should be given to small sized, round shaped seeds during collection as it fetches more prices in the international market. Dr. A.A. Farooqui, Professor, Department of Horticulture, GKVK Campus, UAS Bangalore should be approached to provide varieties with high oil content.

2. *Jobner:* can stop collection programme and concentrate on characterization of the germplasm collection.

3. *Solan:* is also identified for work on coriander and fenugreek

4. *Hisar:* should intensify collection and evaluation

5. Seed spices germplasm will have to be deposited at NBPGR. Action : *All centres.*

Cumin

1. *Jagudan, Jobner* and *NRC for Seed Spices:* should jointly bring out a document on "*Genetic Resources of Cumin in India*".

2. *Jobner:* should complete collection programme from different districts as decided in the last Workshop

3. *Jagudan:* can discontinue collection and should concentrate on evaluation and documentation of germplasm

Fennel

1. Evaluation programmes should cover yield both at mature stage and milky stage and evaluate net returns at the two stages for the benefit of farmers

Fenugreek

1. *Jobner:* should complete collection from entire Rajasthan and characterize the germplasm. They should register the valuable germplasm accessions with NBPGR, New Delhi

2. *Kumarganj:* should complete collection of variability within the state in two years.

3. *Coimbatore:* will complete the collection, characterization and evaluation and submit a document before 2002 March.

6. Recommendations ready for transfer to extension agency, if any : Not applicable

7. Programme proposed for the next year (Crop wise and with experimental details) : Please see crop wise suggestions

8. General decisions, if any :

i. NBPGR, IISR and AICRPS (PC - Cell) should join to bring out a document on "*Genetic resources of spices in India*". Dr. Z. Abraham, NBPGR (RS), Thrissur may take initiative in this matter.

ii. One set of germplasm from all Coordinating centres should be sent to IISR, Calicut / NRC Seed Spices, Ajmer & NBPGR, New Delhi.

iii. NRC for Seed Spices will be the lead centre for all seed spices research.

iv. Reproductive biology of Seed Spices should be given as Post Graduate / Ph.D. work and thoroughly studied.

v. All the presentations should be made with good audio-visual aids as instructed by Project Coordinator (Spices). Action : *All centres.*

Technical Session II : CROP IMPROVEMENT & BIOCHEMISTRY

Chairman : Dr. D.L. Singhania Co-Chairman : Dr. M.R. Sudharsan

Rapporteurs : Dr. M.R. Shylaja
Dr. D. Prasath

1. No. of presentations : 102
2. Name(s) of centres where work was done : Panniyur, Sirsi, Chintapalli, Yercaud, Dapoli, Mudigere, Pampadumpara, Solan, Pottangi, Pundibari, Dholi, Kumarganj, Raigarh, Jagtial, Jobner, Guntur, Coimbatore, Hisar, Pechiparai, Jagudan, Sakleshpur, Ambalavayal, Myladumpara.
3. Non-performing centres, if any : Nil
4. Brief description of the work done and salient results reported (crop wise) : Centres presented their reports.
5. Recommendations /decisions (crop wise) :

Black pepper

1. In inter-varietal hybridization programmes, widely related and distinctly different types may be selected as parents. To transfer long spiking character, rather than going for distant crosses involving *Piper attenuatum*, include cultivated types with long spikes like Kuthiravally, Punjaranmunda, etc. in the crossing programme.

2. While presenting data, yield should be presented in fresh weight and driage (dry recovery) (%).

3. In the evaluation of black pepper genotypes, reaction to biotic and abiotic stresses should be recorded.

4. *Sirsi and Chintapalli*: should take up CVT 2000 Series-V. CVT 1991 – Series IV at *Chintapalli* should be discontinued.

5. All management efforts must be made to have "*stunt virus*" free cultivation. Experiment (trials) should be framed to work out management of this disease.

Cardamom

1. In CVT of cardamom, the potential yield of different types included in the trial should be brought out. For that it is suggested that one separate block with experimental design may be maintained for which intensive management practices should be provided.

2. In the evaluation of genotypes, reaction to biotic and abiotic stresses should be recorded.

3. Detailed discussions should be conducted by cardamom Scientists regarding the inclusion of Mysore types in CVTs of Karnataka state and modify the technical programme accordingly.

4. Intensive surveys should be taken up in different cardamom growing tracts.
   - to locate superior clones.
   - to locate better performing types even under average management
   - to locate drought tolerant types

Ginger

1. *Pundibari :* CVT 1996 Series-IV may be concluded.

2. In quality evaluation trials, along with quality attributes, yield data should also be presented together.

3. Short-listed ginger entries for quality attributes from *Solan* centre can be sent to IISR for crude fibre analysis.

4. The existing variability should be exploited fully, (by collecting and evaluating) and then, the efforts should be made to create the variability.

Turmeric

1. CVT 1996 Series-IV at *Kumarganj* is to be concluded this year.

2. Posting of a Plant Breeder at *Jagtial* should be taken up immediately – PC will take up this matter with the University (Director of Research).

3. Quality analysis of the entries in CVT should be done either by sending samples to IISR, Kozhikode or to Spices Board, Quality Control Laboratory at Kochi.

4. For ginger and turmeric varietal trials, it is the responsibility of the centres taking up the trial to depute persons to collect the seed material from different centres to avoid delay in getting materials.
5. In the quality evaluation programme of germplasm, the high content of curcumin reported by the *Coimbatore* centre and the high oleoresin percentage reported by the *Solan* centre should be rechecked at Spices Board Quality Control Laboratory.

6. If possible, the quality attributes of the selected types at different centres should be rechecked at IISR Laboratory also.

7. *Chintapalli:* should prepare a report on biennial turmeric and send the same to the Coordinator for examination.

8. A new initial evaluation trial (IET) for turmeric should be taken up by the *Solan* centre.

Tree Spices

1. CVT 1992 trial in cinnamon at *Yercaud* and *Ambalavayal* may be concluded after quality analysis for eugenol in leaf oil and cinnamaldehyde in bark oil.

2. New CVTs in nutmeg and cassia need to be initiated in the following centres viz., *Dapoli, Sirsi, Pechiparai* and *Ambalavayal.* IISR, Kozhikode has agreed to supply the planting materials.

Seed Spices

Coriander

1. To conclude CVT 1993 Series-II at *Raigarh* by next year and to send the pooled analysis of the data to the Coordinator for inclusion in the next year annual report.

2. CVT 1996 Series-III at *all Centres* are to be concluded. The final report with pooled analysis of data has to be presented to the Coordinator.

3. *All centres* taking up CVT 1998 Series-IV are advised to carry out quality analysis of the good performing lines simultaneously.

4. The pest and disease reaction of the lines selected for CVTs should be recorded.

5. Comparative yield trial at *Coimbatore* centre has to be concluded.

6. In comparative yield trial of leafy type of coriander at *Guntur,* it is decided to multiply the seeds of selected types so as to use the same for on farm trial programme.

7. Hybridization programmes should be initiated on a priority basis by *various centres* (especially *Jobner*) for evolving hybrid varieties.

8. Quality analysis should be carried out in coriander.

Cumin

1. An intensive effort should be made in the inter-varietal hybridization programme. The lack of success in this crossing may be investigated.

Fennel

1. The hybridization programme at *Jobner* centre should be intensified.

2. IET trial at *Jagudan* is concluded and three elite types selected are to be included in new CVT.

3. Efforts should be made on a top priority basis for the inter-varietal crossing programme between var. *dulce* and var. *panmorium* (ie., between sweet fennel and Indian fennel)

Fenugreek

1. The title for the project FGK/CI/2.1 : "*Evolving varieties resistant to powdery mildew thro' mutation breeding and crossing programme of fenugreek*" should be modified as "*Evolving varieties resistant to powdery mildew*".

2. HM-350, a superior performing line from CVT 1995 Series-III at *Jagudan* may be proposed for release.

3. CVT 1995 Series-III trials at *Jobner* and *Guntur* may be continued for one more year and the final report may be submitted with pooled analysis data to the Coordinator.

4. CVT 1995 Series-III at *Kumarganj* may be concluded.

5. Intensive crossing programme should be initiated in fenugreek.

6. Quality evaluation should be carried out in fenugreek.

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

7. Programme proposed for the next year (Crop wise and with experimental details)

8. General decisions, if any

vi. It is decided to have a group meeting of Scientists involved in seed spices research in February or March 2002 at Jobner to chalk out short term and long term strategies for future research in seed spices. The outcome of the meeting will be intimated to the Council through the Project Coordinator.

vii. Research on herbal spices may be considered under AICRP on Spices.

viii. Jobner being the lead centre for quality analysis of seed spices, equipments like GLC and Generator should be provided to the centre through AICRPS.

ix. All out efforts should be made to introduce seed spices germplasm from other countries. The NRC Seed Spices may take up this responsibility.

x. In all seed spices programmes, NRC Seed Spices will be a cooperating centre.

xi. Concerned Scientists must simultaneously get the superior performing entries analysed for quality attributes. As soon as the varieties / entries complete three years of testing in CVT, the identification / release proposals should be prepared, and sufficient seed should be produced.

xii. Work on other spices (Ajowan, Dill and Nigella Savita etc.) if any may be presented to the Scientists get acquainted and so new programmes may be formulated in future.

xiii. The following accessions found superior at different centres are selected for new CVT trials for 2001-2002.

Crop	Accessions	Centre
Turmeric	NDH-14	Kumarganj
Coriander	Kumarganj selection	Kumarganj
	ND Cor-2	Kumarganj
	DH 205, DH 234	Hisar
	DH 202, DH 228 (leafy type)	Hisar
	LCC-174, LCC-225	Guntur
	UD-480 & UD-118	Jobner
Fennel	NDF-5	Kumarganj
	NDF-6	Kumarganj
	HF-107, HF-116	Hisar
	JF-303, JF-234, JF-332	Jagudan

Fenugreek	NDM-19, NDM-25	Kumarganj
	HM-65, HM-372, HM-444, HM-376	Hisar
	J-Fenu 1954	Kumarganj
	JF-270, 224	Jagudan

Technical Session III — **CROP PRODUCTION**

Chairman : Dr. S.N. Potty — Co-Chairman : Dr. V.S. Korikanthimath

Rapporteurs : Dr. Jose Mathew
Dr. V. Srinivasan

1. No. of presentations	:	52
2. Name(s) of centres where work was done	:	Panniyur, Sirsi, Chintapalli, Dapoli, Mudigere, Solan, Pampadumpara, Pottangi, Pundibari, Kumarganj, Dholi, Raigarh, Jagtial, Coimbatore, Thadiyankudissai, Dapoli, Jobner, Guntur, Hisar
3. Non-performing centres, if any	:	Nil
4. Brief description of the work done and salient results reported (crop wise)	:	The centres presented the reports
5. Recommendations /decisions (crop wise)	:	

Black pepper

1. In all the biofertilizer treatments, efficient native strains should be isolated and used. Strains from other centres with comparable soil and climatic conditions can be initially used, until the native strains are isolated. *Ambalavayal* centre can use the strains available at KAU strains for immediate use.

2. The treatments similar to that of *Sirsi* centre may be adopted in the experiment No. PEP/CM/2.3: "*Organic farming in black pepper*" at the *Yercaud* centre.

3. Disease incidence may be recorded in all the crop management trials

Cardamom

1. CAR/CM/1.2: "*Influence of micronutrients on the yield of cardamom*". The Principal Investigator of *Mudigere* centre may contact ICRI, Myladumpara for getting the treatment details on Zinc nutrition.

2. CAR/CM/1.3: "*Integrated nutrient management of organic and inorganic manures*". The present fertilizer trial with the test variety PV-1 at *Pampadumpara* centre may be concluded. New trials with locally popular varieties as well as released varieties or

varieties ready for release may be laid out, both under irrigated and rainfed situations at *Pampadumpara.*

3. CAR/CM/1.4 and 1.5: "*Efficacy of biofertilizer using P-Solubilizers on cardamom*". Application of biofertilizers may be done in two splits and biometric observations may be recorded 60 days after treatment application in *all centres* uniformly. Soil and leaf nutrient status may be analyzed once in a year.

Ginger

1. GIN/CM/1.1 & 1.2 In all the organic manuring and biofertilizer experiments, quality parameters should be analysed by *Solan* centre.

2. Crop rotation with legumes may be adopted as a practice during fallow season in experiments with ginger crop.

3. Effect of biofertilizers on quality of ginger may be taken up by *Solan* centre.

Turmeric

1. TUR/CM/1.1 : "*Efficacy of biofertilizer using Azospirillum on turmeric*". The *Ambalavayal* centre may initiate the trial by next season by getting the available strain from KAU.

2. TUR/CM/1.2 : "*Effect of different organic inputs on turmeric*". *Pundibari* may be included as one of the centre.

3. Effect of biofertilizers on quality of turmeric may be analyzed.

Tree Spices

1. All the existing projects under tree spices may be closed.

Seed Spices

1. In addition to the existing seven treatments in the biofertilizer trial, three more treatments *viz.*, absolute control, 100% inorganic N and *Azospirillum* alone, may be included from the next year onwards in the case of all seed spices.

Fennel

1. FNL/CM/1.1: "*Response of fennel to the application of Zn, Fe, Mn and Cu*" is concluded. The PI may pass on the recommendation to the Project Coordinator.

2. FNL/CM/3.1: "*Studies on organic and inorganic source of fertilizers for sustainable production of fennel*". This project may be merged with FNL/CM/1.2: "*Effect of biofertilizers using Azospirillum & P-Solubilizers*". *Jagudan* centre may discontinue this experiment

Fenugreek

FGK/CM/2.3: "*Response of fertility levels and spacing on growth and yield of fenugreek*". Title may be changed as "*Efficacy of biofertilizer using Rhizobium*"

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

7. Programme proposed for the next year (Crop wise and with experimental details) :

A new trial on the "*Effect of neem cake on productivity and pest and disease incidence of cardamom*" may be initiated in three centres *viz. Mudigere, Pampadumpara, Myladumpara* and *Sakleshpur.*

CAR/CM/1.6: Application of neem cake on productivity, pest and disease incidences in cardamom

Centres identified : *Mudigere, Pampadumpara, Sakleshpur* and *Myladumpara*

Treatments:

Application of neem cake per clump

1) 0.5 Kg - Once as pre-monsoon (May)
2) 0.5Kg – Twice – May and September
3) 1Kg – Once as pre-monsoon (May)
4) 1Kg – Twice – May and September
5) Control –Recommended fertilizer application without neem cake.

Replications: 4 (10 clumps / Replication)

Observations :

1) Nutrient status of soil
   - at the beginning of the experiment
   - after final harvest

2) Pest
   - Incidence of shoot borer on pseudostem and capsules
   - Incidence of thrips in harvested capsules

3) Disease :
   - Incidence of capsule and rhizome / clump rot.

4) Nematode
   - Incidence of nematodes before application (May)
   - Incidence of nematodes during September (before 2nd round)

5) Fruit set (%)

6) Yield

7) Quality parameters, if possible

8. General decisions, if any

1. Emphasis may be given to isolate native strains of all biofertilizers and use it in the concerned experiments.

2. In all the organic manuring experiments, same plots may be maintained for treatment imposition over the periods.

3. In all the organic farming experiments, content of volatile oils should be analysed.

4. Screening of germplasm against salt affected areas to be discussed in seed spices meeting.

Technical Session IV : **CROP PROTECTION**

Chairman : Prof. A. Sukumara Varma Co-Chairman : Dr. S. Devasahayam

Rapporteurs : Dr. M. V. R. Pillai
Dr. A. Kumar
Dr. G. Sivakumar

1.	No. of presentations	:	35
2.	Name(s) of centres where work was done	:	Panniyur, Sirsi, Chintapalli, Yercaud, Dapoli, Mudigere, Pampadumpara, Solan, Pottangi, Pundibari, Kumarganj, Dholi, Raigarh, Jagtial, Coimbatore, Pechiparai, Thadiyankudissai, Jobner, Jagudan, Guntur, Hisar
3.	Non-performing centres, if any	:	Nil
4.	Brief description of the work done and salient results reported (crop wise)	:	Centres presented the reports.
5.	Recommendations /decisions (crop wise)	:	

Black pepper

1. Residues of metalaxyl should be analysed in the trials against Phytophthora foot rot disease.- *All centres.*

2. The title of Project No. PEP/CP/1.6 : "*Survey for the occurrence of diseases in black pepper*" may be modified as "*Incidence, epidemiology and management of anthracnose of black pepper.*

PEP/CP/1.6 : Incidence, epidemiology and management of anthracnose disease of black pepper.

1. Survey and recording the disease severity.
2. Isolation of pathogen from leaves & spikes and testing the pathogenicity on spikes and leaves.
3. Recording of weather factors daily with automatic weather station.
4. Recording incidence of disease daily and rating the severity. .
5. Chemical control trails using following treatments:

1. 1% Bordeaux mixture – Twice (May-June, August – September)
2. 1% Bordeaux mixture – Thrice (May, July & August)
3. Mancozeb (Dithane Z.78) (0.2%) Twice (May-June, August-September)
4. Propiconozone (0.1%) – Twice (May-June, August-September)
5. Control

Plot size : Minimum of 10 vines
Replication : 4
Total : 5 x 10 x 4 = 200 vines

Duration : 3 years
Observations : As mentioned above

3. The role of nematodes and root grubs in the poor establishment of pepper in *Sirsi* centre may be studied. Director, IISR, may depute Nematologist and Entomologist to study this problem.

4. *Pampadumpara*: The insects recorded on black pepper in Idukki District may be identified.

Cardamom

1. The frequency of sprays may be increased in the evaluation of plant based insecticides for the control of thrips and fruit borers and Econeem may be included in this trial.

2. Preliminary evaluation of microbial pathogens against root grubs and whiteflies may be carried out at *Pampadumpara*

Ginger

1. New trials would be initiated at *Solan, Dholi* and *Pundibari* for the *integrated management of Pythium, Fusarium* and *Ralstonia* that would be formulated by IISR and KAU.

2. Incidence of scale insects should be recorded in the post harvest management trial at *Pundibari.*

Turmeric

1. The etiology of turmeric rhizome rot should be confirmed with IISR.

2. The *Coimbatore* centre would also be included in the project TUR/CP/1.1 – "*Survey and identification of disease causing organisms in turmeric and screening of turmeric germplasm against diseases*".

3. The *Coimbatore* centre would also be included in project no. TUR/CP/1.4 – "*Investigations on casual organisms of rhizome rot of turmeric and screening of biocontrol agents for their management*".

Tree Spices

1. The survey of diseases of tree spices may be conducted by *Pechiparai* and *Ambalavayal* centres, in addition to *Dapoli.*

Coriander

1. The *Coimbatore* centre would be included in the project COR/CP/1.2 – "*Management of wilt and powdery mildew disease in coriander*".

Fenugreek

1. The *Coimbatore* centre would be included in the project FGK/CP/1.1 – "*Biocontrol of root rot in fenugreek*".

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

Management of mussel scale of black pepper at high altitudes.

7. Programme proposed for the next year : (Crop wise and with experimental details)

GIN/CP/1.4 : Integrated management of *Pythium, Fusarium* and *Ralstonia* of Ginger

Centres identified : *Solan, Dholi* and *Pundibari*

Seed treatment with following treatments :

a) Mancozeb (0.3%)

b) *T. harzianum* :– 250g formulation in 10 liters of water for 10kg seed rhizomes.

c) *Solarization* :- Solarization of rhizomes in polythene bags of size 30x45 cms for 1kg seed rhizomes for 2h (9-11 AM) before sowing.

d) *Hot water treatment* :- at 51°C for 30 min.

e) *Aerated steam* :- for 30 min.

f) Control

Treatments : 6
Replication : 4

Planting pit : Apply *T. harzianum* – 50g + Neem cake 250g/bed (3x1m)
: As soon as symptoms appear, remove the affected plants and destroy and adopt appropriate control measures against the diseases.

If, a) *Pythium* - Mancozeb (0.3%) as drench
b) *Fusarium* - Carbendazim (0.1%) as drench
c) *Ralstonia* - Bleaching powder as such when soil moisture is there.

Observations:

1) Sprouting (%)
2) Disease incidence
3) Yield

Duration: 3 seasons

8. General decisions, if any : Nil

Technical Session V : **RELEASE OF VARIETIES AND RECOMMENDATIONS FOR EXTENSION AGENCIES**

Chairman : Dr. S.N. Potty

Rapporteurs : Dr. (Ms.) Mini Raj
Dr.K.S. Krishnamoorthy

The following proposals were submitted for variety release and transfer of technology

A. Variety Release

Cardamom

1. **PV-2** — Cardamom Research Centre (KAU)
Pampadumpara

High yielder and bold berries.

Recommended for release in Idukki District of Kerala. Data on number of capsules per kg and no. of seeds/capsule should be presented based on composit sampling from all harvests. Volatile oil profile and content must be estimated in the variety. The centre should establish a demonstration plot of PV-2 with intensive management.

Cinnamon

2. **PPI-1 (cv.203)** — Horticultural Research Station (TNAU)
Pechiparai
(Kanyakumari)

Not recommended as data on quality profiles of bark and leaf oil is missing.

Turmeric

3. **TCP-1 (UBCT-1)** — Regional Research Station
Uttar Banga Krishi Viswavidyala (UBKV)
Pundibari, W.B.

Not recommended.

4. **TCP-2 (UBCT-2)** — Pundibari (UBKV)
Cooch Behar, W.B.

High yielder and quality attributes. Recommended for release in Bengal.

Coriander

5. **Hisar Sugandh**	Dept. of Vegetable Crops, (CCS Haryana Agricultural University)
(DH-36)	Hisar

Recommended for National release (High yielder)

6. **UD-446**	Jobner centre (RAJAU)
(For National release)	Rajasthan

Recommended for Central release (High yielder)

Fenugreek

Dept. of Vegetable Crops, (CCS Haryana Agricultural University), Hisar

7. **Hisar Suvarna (HM 103)** Resistant to *Cercospora* leaf spot, moderately resistant to powdery mildew, high yield. Recommended for Central release.

8. **Hisar Madhavi (HM 350)** High yield, resistant to powdery mildew. Recommended for Central release.

9. **Hisar Mukta (HM 346)** High yield, resistant to downy mildew. Recommended for Central release.

General decisions:

1. In future, no centre will be allowed to present variety release proposals unless they submit the proposal well in advance one month to circulate among the Scientists.
2. All the varieties recommended for release must be registered with the NBPGR at the earliest.
3. Molecular characterization of the varieties recommended for release must be done at the earliest.

B. Transfer of Technology

Based on three years experimentations, the following recommendations can be made for general adoption:

Fenugreek (*Jobner* centre, RAJAU)

1. Sowing of Fenugreek variety RMt-1 by the last week of October and UM-305 upto 15th November at 25-30cm row spacing can be recommended to get higher seed yield for general adoption under semi-arid conditions.

Coriander (*Jobner* centre, RAJAU)

2. Foliar application of $MnSO_4$, $ZnSO_4$ and $CuSO_4$ each @ 0.50% and soil application of $FeSO_4$ @ 5 kg/ha or foliar application @ 0.125% can be recommended to get higher seed yield of coriander under micronutrient deficient sandy loam soils. Foliar application should be done at pre-flowering stage.

Fennel (*Jobner* centre, RAJAU)

3. Application of $ZnSO_4$ as foliar application @ 0.50% or soil + foliar application @ 10 kg/ha + 0.25%, $FeSO_4$ as foliar application @ 0.25% or soil + foliar application @ 5 kg/ha +0.125%, $MnSO_4$ as foliar application @ 0.50% or soil + foliar application @ 12.5 kg/ha + 0.25% and $CuSO_4$ as foliar application @ 0.50% can be recommended to get higher seed yield of fennel under the micronutrient deficient sandy loam soils. Foliar application should be done at pre-flowering stage.

Black Pepper (*Pampadumpara* centre, KAU)

4. Two sprayings of either Monocrotophos (0.05%) or Dimethoate (0.05%) at fortnightly intervals after the harvest of berries are very effective in the reduction of black pepper mussel scale (*Lepidosaphes piperis*) at high ranges of Idukki district.

Technical Session VI — ICAR ADHOC SCHEMES

Chairman : Dr. P.N. Ravindran

Rapporteurs : Dr. K.N. Shiva
Dr. (Ms) Alice Kurien

ICAR is funding 15 Adhoc research schemes in spices, out of which seven projects are operated at IISR, Calicut.

The Principal Investigators of the projects presented the following progress reports:

1. **Prof. C. Chatterjee**, Botany Department, Lucknow University.
   "Enhancement of yield and quality of spices by secondary and micronutrients".

2. **Dr. Luchon Saikia**, Assam Agricultural University, Jorhat.
   "Collection, Maintenance, Evaluation and Standardization of Agro-Technique of a few seed spices of N.E. India".

3. **Dr. (Ms) P.A. Valsala**, Dept. of Plantation Crops & Spices, College of Horticulture, KAU.
   "Hybridization in ginger through *in vitro* pollination" (Progress report not submitted).

4. **Dr. N. Kumar**, Horticultural Research Station, Thadiyankudisai, Perumbarai – 624 212.
   "Scheme for intensification of research on Vanilla" (*Vanilla planifolia* Andrews).

5. **Dr. R. Sridar**, Centre of Advanced Studies in Agricultural Microbiology, Dept. of Agricultural Microbiology, TNAU, Coimbatore – 641 003.
   "Studies on the compatibility of *Azospirillum* and Biocontrol agents in turmeric".

6. **Dr (Mrs.) Sabita J.N. Baruah**, Dept. of Horticulture, Assam Agricultural University, Jorhat.
   "Improvement of productivity and quality of Bird's Eye Chillies of N. E. India".

Progress report of the following ad-hoc research schemes was submitted but the Principal Investigators were not available to present the reports during the workshop.

1. "Development of resistant variety/lines of cumin to wilt caused by *Fusarium oxysporum* using *in vitro* techniques" - S. Gangopadhyay, S.N. Saxena, Plant Biotechnology Centre, Agricultural Research Station, Rajasthan Agricultural University, Bikaner –334 006 (Rajasthan).

2. Identification and evaluation of bioactive peptides: A biotechnological approach towards controlling the fungal pathogen of the quick wilt disease of black pepper - George Thomas, Plant Molecular Biology Group, Rajiv Gandhi Centre for Biotechnology, Thiruvananthapuram – 695 014.

The ad-hoc projects operating at IISR will be reviewed by ADG (PC) during the SRC meeting of IISR.

The presentation elicited lot of discussions from the participants.

PLENARY SESSION

Chairman : Dr. K. Kumaran Co-Chairman : Dr. P.N. Ravindran

Rapporteurs : Dr. K.N. Shiva
Dr. (Ms.) S. Prasannakumari Amma

The Plenary Session was held at 4.00 PM on 3rd November 2001 under the chairmanship of Dr. K. Kumaran, Director (Research), Kerala Agricultural University, Vellanikkara, Thrissur. Dr. P.N. Ravindran, Project Coordinator, Co-Chaired the session. At the beginning, the Chairman appreciated the Project Coordinator, Project scientists of coordinating centres, chairman, co-chairman, rapporteurs, resource persons and organizers for the detailed deliberations and smooth conduct of Workshop for the last three days at KAU campus.

The chairmans of various technical sessions presented their reports in brief and the house approved the same. The Workshop also recommended seven varieties of spice crops for state/central release committees. Four recommendations on transfer of technology, out of which three in crop production and one in crop protection aspects were made available to extension agency for general adoption.

The detailed discussions were also held on the ongoing technical programmes and formulations /modifications of CVTs and technical programmes in crop improvement, production and protection of spice crops.

Prof. (Dr.) K.V. Peter, Vice Chancellor, KAU and former Director, IISR offered felicitations to Dr. P.N. Ravindran, Project Coordinator (Spices) and Committee members for their team work and effective way of conducting workshop for the past three days.

The Proceedings of the XVI Workshop of AICRPS came to an end at 6.00 PM with the vote of thanks of Dr. E.V. Nybe, Prof. & Head, Dept. of Plantation Crops and Spices, KAU and the general convenor of the Workshop.

Annexure – I

LIST OF PARTICIPANTS

A. Indian Council of Agricultural Research, New Delhi

1. Dr. G. Kalloo
   Deputy Director General (Horticulture
2. Dr. R.N. Pal
   Asst. Director General (Plantation Crops)
3. Dr. P.N. Ravindran
   Project Coordinator (Spices)

B. Spices Board, Cochin

4. The Chairman
   Spices Board
5. Dr. Koshy John
   Director (Development)
   Spices Board
6. The Director (Marketing)
   Spices Board

C. ICRI, Myladumpara (Spices Board)

7. Dr. S.N. Potty
   Director
8. Dr. K.J. Madhusoodhanan
   Deputy Director
9. Dr. V. Krishnakumar
   Sr. Scientist (Agronomy)
10. Dr. M.R. Sudharshan
    Scientist
11. Dr. K.M. Kuruvila
    Sr. Scientist (Botany)
12. Dr. V.V. Radhakrishnan
    Scientist
13. Mr. S. Sreekrishna Bhat
    Scientist
14. Dr. V.A. Vadiraj
    Scientist

D. Kerala Agricultural University

15. Prof. (Dr.) K.V. Peter
    Vice Chancellor
16. Dr. Kumaran, K.
    Director of Research
17. Dr. A. Sukumara Varma
    Associate Dean, CoH
18. Dr. G. Sreekantan Nair
    Professor & Head (Hort), CoA
19. Dr. C. Sundaresan Nair
    ADR (M&E), KAU, Hqr.
20. Dr. S. Rajan,.
    Officer on Special Duty, KAU, Hqr.
21. Dr. E.V. Nybe
    Prof. & Head,
    Dept. of plantation crops & Spices, CoH
22. Dr. S. Prasannakumari Amma
    Assoc. Professor, CoH.

23. Sri. K.P. Mammotty
ADR, RARS, Pilicode

24. Dr. Jim Thomas
Associate Professor, CoH

25. Dr. Jacob John
Associate Professor, CoH

26. Dr. B.K. Jayachandran
Assoc. Prof, CoA.

27. Dr. K. Vasanthakumar,
Assoc. Prof., Commn. Centre, Mannuthy

28. Sri. M. Murugan
Asst. Prof. IF, Vellanikkara

29. Sri. C.M. George
Assoc. Prof. & Head, KVK, Ambalavayal

30. Dr. T.P. Manomohandas
Assoc. Prof., KVK, Ambalavayal

31. Dr. Koshy Abraham
Assoc. Professor, CoH

32. Dr. Jose Mathew
Assoc. Professor, CoH

33. Dr. T.J. Rahumath Niza
Assoc. Prof., CoH

34. Dr. T.E. George
Assoc. Professor, CoH

35. Dr.P.C. Rajendran
Associate Professor, CoH

36. Dr. Alice Kurian
Associate Professor, CoH

37. Dr.; M. R. Shylaja
Assoc. Professor, CoH

38. Dr. Sarah, T. George
Asst. Professor, CoH

39. Dr. Indira, V
Asst. Professor, CoH

40. Dr. Nirmala Devi
Asst. Professor, CoH

41. Dr. V.S. Sujatha
Asst. Professor, CoH

42. Dr. N. Mini Raj
Asst. Professor, CoH

43. Dr. M. Asha Sankar
Asst. Professor, CoH

44. Dr. B. Suma
Asst. Professor, CoH

45. Dr. P.A. Nazeem
Assoc. Professor, CoH

46.Dr. A. Augustin
Assoc. Professor, CoH

47. Dr. K.I. Enasi
Assoc. Professor, RARS, Kumarakom

48. Dr. Joseph Philip
Assoc. Prof., RARS, Kumarakom

49. Dr. K.N. Satheesan
Asst.Prof., CoA, Padannakkad

50. Dr. A.E. Jose
KAU

51. Dr. Ms. Abeda. P.S
Asst. Professor (Plant physiology)
Padannakkad

52. Dr. C.G. Rajendran
Assoc. Professor and Head
Vellayani

53. Dr. Sajan Kurian
College of Horticulture

54. Dr. P.S. Johny
Associate Professor of Agronomy.

55. Dr. Mercy George
Associate Professor of Agronomy.

56. Dr. Latha.A
Asst. Professor of Agronomy.

57. Dr. Vandana Venugopal
Asst. Prof. Agronomy.

58. Dr. E.K. Thomas
Asst. Professor, CoH

59. Dr. M.V. Rajendran Pillai
Asst. Prof., CoH

60. Dr. V.S. Devadas
Asst. Prof. & Head
PRS. Vazhakleu

E. Tamil Nadu Agricultural University, Coimbatore

61. Dr. Chezhiyan
Professor & Head
Dept. of plantation and spice crops

F. College of Horticulture, University of Agricultural Sciences, Bangalore

62. Smt. Sunitha J. Rai
Assistant Horticulture Officer (Plantation Crops)

G. Govt. of India, DASD, Min. of Agriculture

63. Dr. K. Sivaraman
Director

64. Mr. K.G. Thomas
Deputy Director

65. Mr. Tamil Selvan
Deputy Director

H. CPCRI, Kasaragod

66. Dr. H.H. Khan
Project Coordinator (Palms)

67. Dr. Thamban
Scientist

68. Dr. P.K. Koshy
Head, CPCRI
Kayangulam

69. Dr. P. Rajan
Scientist in Charge
CPCRI-RC, Kannur

I. Director of Research, SAUs

70. Dr. K. Dilip Kumar De
UBKV, Pundibari (W.B)

71. Dr. P.V. Malahotra
ADR, RARS, Pottangi

J. Department of Agriculture/ Horticulture

72. Mr. K. Periyaswami
Asst. Director,Theni, Tamil Nadu

73. Mr. R. Prabhakaran
Asst. Director, Gudalloor

74. Mr. K. K. Gangadharan
Addl. Director of Agriculture, Trivandrum

75. Mr. Jose P. Abraham
Deputy Director of Agriculture
Thodupuzha, Iddukki

76. Mr. A.M. John
Deputy Director of Agriculture, Waynad

77. Mr. M. Saseendran
Dy. Director of Agriculture, Kozhikode

78. Smt. Sunitha J. Rai
AHO (PC), Lalbagh, Bangalore

79. Mr. K.V. Vasu
DDA(YP) Thrissur

80. Joint Director of Agriculture
Thrissur

K. Indian Institute of Spices Research, Calicut

81. Dr. Y.R. Sarma
Director

82. Dr. K.V. Ramana
Principal Scientist

83. Dr. M. Anandaraj
Pr. Scientist

84. Dr. V.S. Korikanthimath
Pr. Scientist

85. Dr. S. Devasahayam
Pr. Scientist

86. Dr. M.N. Venugopal
Pr. Scientist, Appangala

87. Dr. M. S. Madan
Sr.Scientist

88. Dr. T.J. Zachariah
Sr. Scientist

89. Dr. K.S. Krishnamoorthy
Scientist (SS)

90. Dr. C.K. Thankamani
Scientist

91. Mr. K.V. Saji
Scientist

92. Dr. A. Kumar
Scientist

93. Dr. K.N. Shiva
Scientist

94. Mr. D. Prasath
Scientist

95. Dr. Johny A.K
Technical Information Officer

96. Mr. K.M. Prakash
Technical Officer, KVK

97. Ms. Sali, P.V
PA to PC (Spices)

98.Mr. Nagendra, J
Research Associate

99. Mr. Remichandran
Research Associate

100. Mr. D. Ramnath
Research Associate

101. Mr. K.V. Thushar
JRF

L. Coordinating Centres

Kerala Agricultural University

Pampadumpara centre

102. Dr. A. Joseph Rajkumar
Asst. Professor

103. Smt. Sainamol P. Kurian
Asst. Professor

104. Dr. Backiya Rani
Asst. Professor

Panniyur Centre

105. Mr. P.K. Unnikrishnan Nair
Professor & Head

106. Dr. G. Sivakumar
Asst. Professor

107. Dr. T. Vanaja
Asst. Professor

108. Dr. V.P. Neema
Associate Professor

Tamil Nadu Agricultural University

Coimbatore centre

109. Dr. M. Selvarajan
Breeder (Horticulturist)

110. Dr. P. Muthulakshmi
Research Associate (Plant Pathology)

Yercaud centre

111. Dr. R. Murugesan
Professor & Head

112. Dr. V. Lakshmanan
Agronomist (Horti.)

Haryana Agricultural University

Hisar centre

113. Dr. J.L. Mangal
Professor & Head

114. Dr. K.K. Thakral
Horticulturist

115. Dr. S.K. Tehlan
Asst. Scientist (VC)

116. Dr. P.S. Pratap
Professor

117. Dr. Rakesh Mehra
Asst. Professor

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118. Dr. I.P. Patel
Scientist & Head

119. Dr. K.D. Patel
Sr. Plant Pathologist

120. Dr. G. M. Patel
Jr. Breeder (Horti.)

Rajasthan Agricultural University

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Sr. Breeder (Professor)

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132. Mr. Nagesh Naik
Asst. Professor

Mudigere centre

133. M. Narayana Swamy
Breeder, AICRPS Project

134. Mr. M. Dinesh Kumar
Agronomist (Horti)

135 Mr. Arasu Mallaiah
Pathologist

136 Mr. N.E. Thyagaraj
Jr. Entomologist

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137. Dr. J.C. Jana
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Jr. Pathologist

Narendra Dev University of Agricultural Technology

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Horticulturist

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National Bureau of Plant Genetic Resources

156. K.C. Velayudhan, Principal Scientist,
Research Station, Vellanikkara

157. Dr. Z. Abraham, Scientist i/c
Vellanikkara

Principal Investigators, ICAR Adhoc Schemes

158. Dr. K.V. Ramana
IISR, Calicut

159. Mr. B. Krishnamoorthy
IISR, Calicut

160. Dr. B. Sasikumar
IISR, Calicut

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HC & RI, TNAU, Coimbatore

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KAU, Vellanikkara

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University of Lucknow, Lucknow

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IISR, Calicut

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Director

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170. Dr. J. Thomas
A.M.P.R.S, Odakkali

171. Dr. M.V. Pushpadas
Kochi-36

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Sirao daily

173. Mr. V. Viswabharai
Public Relation Officer

174. Mr. Dinesh Varma
Deshabhimani, Thrissur

175. Mr. P.V. Sujith
Deshabhimani, Thrissur

176. Dr. B.K. Dube
Botany Dept., LKO University

177. Mr. M.L. Antony
HDFC Bank

178. Mr. Ramesh
HDFC Bank

179. Mr. M. Balakrishnan
Programme Officer (Current Affairs)

R. Progressive farmers

180. Mr. Gouri Sankar
Advocate & Notary
Laksmi Nivas, HPO.
College Road
Palakkad –678 001

181. Mr. Juby. T.R
Thelekkadan (W)

182. Mr. K. Selvan
Anbakam (H)

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