

PROCEEDINGS

OF THE GROUP MEETING (XIV WORKSHOP) OF RESEARCH WORKERS OF ALL INDIA COORDINATED RESEARCH PROJECT ON SPICES

08-10 July, 1997

Held at

University of Agricultural Sciences, Hebbal, Bangalore



ALL INDIA COORDINATED RESEARCH PROJECT ON SPICES CALICUT ,KERALA

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INTRODUCTION

The XIV Workshop/National Group Meeting of the All India Coordinated Research Project on Spices was held under the auspices of the University of Agricultural Sciences, Bangalore and the venue was the main auditorium of the University located at its Hebbal Campus. This Workshop was very unique in that the State of Karnataka initiated the first ever Department of Horticulture in this country was the host of XIV Workshop and this marks the "SILVER JUBILEE" (25th Year) of the AICRP on Spices and the Department of Horticulture took active part in the Proceedings. Dr.G.K.Veeresh, Vice Chancellor, UAS, Bangalore was the Chief Guest and delivered an invigourating inaugural address, highlighting problems, progress and potentialities on Spices Research and Development in Karnataka. He highlighted the role of cardamom, black pepper and ginger in the western part of the state and its economy. Dr.S.P.Ghosh, Deputy Director General (Horticulture) presided over the inaugural function and delivered his presidential speech, exhorting the Scientists in this system to concentrate on new areas like Post Harvest Technologies, IPR, Quality awareness etc. Director of Research, UAS, Bangalore- Dr.S.M.Singlachar, ADR deputised/highlighted the importance of Spices Research in the economy of Karnataka and the role of the University in fulfilling this aspiration.

A distinct feature of the Bangalore Workshop has been the inauguration of a comprehensive exhibition on Spices Research and Development brought out by the various coordinating centres for its review by the VIPs. Several Horticultural Input Agencies, especially those dealing in Biotech/Biocontrol products also displayed their materials. Besides the Scientists from the coordinating centres, we had the participation of a large number of Scientists from the Indian Institute of Spices Research, Spices Board, NABARD, DCASD, Directorates of Horticulture of Karnataka and Tamil Nadu etc besides Progressive Farmers from the neighbouring states.

An important function of the Workshop has been a thorough discussion on the transfer of technology, release of varieties etc. The newly started coordinating centres in Maharashtra, Uttar Pradesh, Madhya Pradesh and West Bengal made an effective presence and explained their activities. It is a pleasure to present before you the Proceedings of this National Group Meeting/Workshop of the AICRP on Spices in the following pages.

ACKNOWLEDGEMENTS

The Director General, ICAR & Secretary, Dept of Agricultural Research and Education, Government of India is profusely acknowledged for having given his approval to hold the XIV Spices Workshop at Bangalore. The guidance and support received from Dr.S.P.Ghosh, Deputy Director General and Dr R.N.Pal, Asst. Director General (Plant. Crops) in organising the National Group Meeting is duly acknowledged. The host viz., University of Agricultural Sciences, Bangalore have provided enormous support and physical facilities to organise and conduct the Workshop under its beautiful Hebbal Campus. Dr. G.K.Veeresh, Vice Chancellor deserves special appreciation for having reviewed the progress in the arrangements made for conduct of the Workshop and also inaugurate the same on the 8th July. He was ably assisted by Dr.B.R.Hegde, Director of Research and Dr.S.M.Singlachar, Assoc. Director of Research who have done their best to ensure the smooth conduct of the 3 days' deliberations. We also thank the Governments of Karnataka and Tamil Nadu for having deputed the Directors of Horticulture and Senior Officials who took an active part in our discussions. The Chairmen of the Technical Sessions, Rapporteurs as well as members of the various committees deserve our special thanks for having extended their valuable service.

The staff of the Mudigere centre of the AICRP on Spices have been always with us to enable detailed arrangements for the exhibition and other related activities; the Scientists from the Sirsi centre were also quite helpful in assisting us. The various Horticultural Input agencies in Karnataka, Kerala and Tamil Nadu had extended their active support to ensure an all round success of the Workshop.

We are especially grateful to the various State Agricultural Universities, Departments of Horticulture, Spices Board, Directorate of Cocoa, Arecanut and Spices Development and the Indian Institute of Spices Research for having nominated their scientists, officials etc. who participated in the Workshop. They were very much instrumental in discussing the progress made so far and refine our new programmes. I also take this opportunity to acknowledge with thanks the Director and Staff of IISR, Calicut who have provided various facilities in connection with the preparation of the reports and conduct of the Spices Workshop at Bangalore.

(Dr. S. Edison)
Project Coordinator

XIV WORKSHOP OF AICRP-ON SPICES

8-10 July, 1997

PROGRAMME

Venue : University of Agricultural Sciences
Main Auditorium, Hebbal, Bangalore

08 July, 1997

08.00 - 09.00 : Registration
09.15 - 09.40 : Exhibition by AICRPS centres
09.45 - 11.30 : **Inaugural Session**

Welcome Address : Dr.S.M. Singlachar, Assoc.Director of
Research, UAS, Bangalore

Presentation of Research Report : Dr.S.Edison, Project Coordinator, IISR, Calicut

Release of Publication(s) : AICRPS Annual Report, AICRPS Research
Highlights,Perspective Plan - IISR - 2020

Inaugural Address : Dr.G.K.Veeresh, Vice Chancellor, UAS (B)
Bangalore

Presidential Address : Dr.S.P.Ghosh, Deputy Director General (H)
ICAR, Krishi Bhavan, New Delhi

Vote of thanks : Dr.S.Edison, Project Coordinator, IISR Calicut.

11.30 - 11.45 : Tea

11.45 -13.35 Session I :: General Session : Action Taken Report

Chairman : Dr.S.P.Ghosh
Rapporteur : Dr.S.Edison

14.15 - 17.30 Session II :: Genetic Resources

Chairman : Dr.Mansoor Kazim
Rapporteurs : Dr.K.C.Velayudhan
Dr.B.N.Korla

09 July, 1997

08.45 - 12.45 Session III :: Crop Improvement, Physiology & Biochemistry

Chairman : Dr.R.K.Sharma
Rapporteurs : Dr.T.Thangaraj
Dr.H.M.Chandrappa

12.45-17.00 Session IV :: Plant Pathology & Entomology

Chairman : Dr.Y.R.Sarma
Co-Chairman : Dr.D.J.Bagyaraj
Rapporteurs : Dr.M.N.Venugopal
Dr.N.P.Dohroo

17.05-19.00 Session V :: Agronomy & Soil Science

Chairman : Dr.S.N.Potty
Rapporteurs : Dr.A.Rajagopalan
Mr.K.Kandiannan

10 July, 1997

09.00 -13.30 Session VI :: Transfer of Technology

Chairman : Dr.G.K.Vasanthkumar
Rapporteurs : Dr.G.R.Chaudhary
Mr.H.G.Hegde

14.15 - 17.30 Session VII :: Variety Release

Chairman : Dr.B.S.Dhankar
Co-Chairman : Dr.R.D.Singh
Rapporteurs : Dr.K.K.Thakral
: Dr.A.Manohar Rao

17.35 - 18.30 Session VIII :: Plenary Session

Chairman : Dr.B.R.Hegde
Co-Chairman : Mr.N.Vasudevan, IAS
Rapporteur : Dr.S.Edison

Vote of thanks : **Dr.S.Edison**

INAUGURAL SESSION

The Inaugural Session of the XIV Workshop / National Group Meeting of the AICRP on Spices was held at the main Auditorium of the old Agricultural College buildings located in the Hebbal campus of the UAS at Bangalore. Before the start of the Inaugural Session, the VIPs viz., Dr. S.P. Ghosh, Deputy Director General (Horticulture), Dr.G.K. Veeresh, Vice Chancellor, University of Agricultural Sciences, Bangalore, Dr.M.C. Devaiah, Dean, UAS, Bangalore, Dr. B.R. Hegde, Director of Research, Mr.S.K. Patnaik, IAS, Director of Horticulture, Govt. of Karnataka and other dignitaries visited the comprehensive Exhibition brought out on the occasion by the Coordinating Centres and a few Horticultural Input Agencies. The exhibits included live plants/clumps, panicles/seed materials/seed rhizomes, insect pests and diseases, antagonistic organisms etc. brought by the Mudigere, Sirsi, Panniyur, Jobner, Jagudan, Hisar, Pottangi, Pampadumpara, Coimbatore, Solan, Jagtial, Guntur and other Centres. The research achievements made by the various Centres were displayed through photographs, charts, etc. for review by the dignitaries. The Horticultural Input Agencies like M/s Green-Tech Agro Product Private Limited, Pest Control India Limited, Sun Agro India Limited etc. also displayed their product range together with necessary technical bulletins. This exhibition was inaugurated by Dr.S.P.Ghosh, DDG and was kept open during the Workshop period for the benefit of the participants - Scientists, University Officials, Development Officials and Progressive Farmers. The Exhibition was opened at 0915 AM.

The main inaugural function was presided over by Dr.S.P. Ghosh, DDG and a warm welcome was extended to him by Dr. S.M. Singlachar, Associate Director of Research, UAS; the details of the welcome address are enclosed in the following pages. It was followed by the presentation of the progress report of the AICRP on Spices, presented by Dr.S.Edison.

Dr. G.K. Veeresh, Vice Chancellor while delivering the Inaugural address, thanked the ICAR authorities for having chosen Bangalore as the venue for the XIV Spices Workshop and the credit given to the University by the AICRP System. He mentioned that assembling of Scientists from over 20 Coordinating Centres from 15 State Agricultural Universities at Bangalore is serving the cause of "national integration" and enables a free dialogue between Scientists from different Universities. He congratulated the Scientists who have brought excellent exhibits for display at Bangalore and his University was proud to have the material even as a permanent feature. The Vice Chancellor was critical about the neglect of post harvest technology and the need for promotion of quality awareness in spices which are essentially export oriented. He also mentioned that Karnataka being the home State of excellent plantations of cardamom and pepper is now facing problems due to diseases and pests; in some cases, there has been even a threat to abandon ginger cultivation. Dr. G.K. Veeresh exhorted the Spices Scientists to undertake a serious programme to identify the non-exploited species of spices which are available in abundance in the Western Ghats. He was also weary about the lack of thrust between the production technologies available and those which are acknowledged/adopted. In this connection, the Vice Chancellor mentioned about the need for an effective network for transfer of technology in spices.

The Vice Chancellor released the publication by the IISR entitled "Perspective Plan :: Vision 2020" and Dr.S.P.Ghosh, DDG the document "Research Highlights :: AICRP on Spices, 1996-97" in the Inaugural Session. The lighting of the lamp ceremony was solemnised by Dr.G.K.Veeresh and he inaugurated the Workshop.

The Presidential address was delivered by Dr. S.P. Ghosh who stirred the minds of the participants to take care of the IPR issues, conservation of germplasm, exploiting the potential of non-traditional areas like North-East, identification of lead Centres on Spices research, utilisation of the ICAR agenda on Ad-hoc Schemes/revolving fund schemes to supplement the efforts under the ICAR / SAU System etc. The DDG also mentioned about the priority to be given for the post harvest technology/activities and the need for strengthening the research per se during the IX Plan. He also mentioned about the formation of the National Research Centre for Seed Spices in Rajasthan as well as the massive Project entitled "PHYTONET" which will operate in nine Centres very soon with its headquarters at IISR, Calicut. The DDG expressed his happiness to be with the Spices Group and requested the participants to have a very meaningful exercise in the next three days and come out with practicable recommendations. Dr.S.Edison proposed the vote of thanks.

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pvs/

Welcome address by Dr.M.A.Singlachar at the Inaugural Session of the 14th Spices Group Meeting held at Hebbal Campus on 8.7.1997

Ladies and Gentlemen,

"It is the Spice of Life" is a common refrain familiar to all of us. What is spicy about spices is a question to which there could be as many answers as there are people in this hall. Suffice it to acknowledge that spices are welcome in our food, in influencing our health and moneywise they are comforting to our pocket.

Spices export from India has touched Rs 1180 crores during 1996-97 with a production of 2,19,400 tonnes. This represents 50% more in value terms and 9% more in quantity over the preceding year. Karnataka is an important spices State in the Country with 25% of the total area and contributing about 15% of the total production. The State is proud of its modest contribution to the spices economy.

The University of Agricultural Sciences, Bangalore, has been involved in spices research since the late 1960s as a result of which two cardamom varieties viz Mudigere-1 and Mudigere-2 were identified and released with a production potential of 250 to 400 Kg per ha and 450 to 500 kg per ha respectively. These varieties have gained wide acceptance among farmers of Karnataka. A recent identification "Selection 7-10" is a highly promising cardamom culture with about 30% more yield potential than Mudigere-1. While cardamom has received considerable attention and was strengthened with the location of AICRP project at Regional Research Station, Mudigere, several other important spice crops have been neglected. In recent years,

crops like ginger and turmeric have assumed importance because of their commercial viability. Similarly, research on pepper requires further strengthening.

Some of the important constraints in spices development in Karnataka are (i) availability of good planting material in cardamom, (ii) quick wilt of pepper, and (iii) rhizome rot in ginger. In cardamom, the University of Agricultural Sciences, Bangalore, would like to focus future research on the extraction and processing of oleo resins which have good market potential and provide value addition.

Chilli (dried) is an important spice crop of Karnataka but has received much less attention than its commercial potential deserves. Clove is being produced on a small scale in Karnataka but its potential in some parts of Karnataka is under-exploited and therefore deserves attention. The University of Agricultural Sciences, Bangalore, is interested in strengthening research in the aforesaid areas and augment the capacity of the Mudigere Centre to take up work on Oleo resin.

This Group Meeting will be reviewing the progress made during the last two years and will be discussing several issues. I request the ICAR and the Project Co-ordinator Dr. Edison, to consider our case on merit and extend support during the 9th Plan period.

About this workshop we believe that by deciding to hold it at our campus, the ICAR has honoured the University of Agricultural Sciences, Bangalore. It is now my pleasure to welcome the distinguished guests on the dais and the invitees.

Dr G K Veeresh, the Vice-Chancellor of this University, who has left a distinct mark as an academician, a teacher and as a research scientist, is familiar to many

An accomplished entomologist in his own right, he has trained many eager students about the science and management of not only pests but also of useful insects. As a Director of Instruction (Agri) and later as Dean he has had occasions to display courage of his convictions about matters academic.

His standing as an academician and as an eco-friendly entomologist has won him membership in important national and state bodies. The cause of environment and ecology and their sustainable use is dear to him and several organisations have benefited from his commitment to these causes. Dr G K Veeresh has consented to inaugurate this workshop and on behalf of all of us I deem it my privilege to extend a very warm welcome to our Vice-Chancellor.

It is comforting to find that a distinguished horticulturist and an equally accomplished research manager is amidst us this morning. Dr S P Ghosh, Deputy Director General (Hor), ICAR, is not a stranger to us. He has had a distinguished career traversing a diverse path. We fondly remember the kind of leadership he provided to NARP as a Project Director for six years from where he moved to the position of Assistant Director General (Fruit Crops).

Dr Ghosh earlier served at CTCRI, Trivandrum, and in the north-east hill region. Knowledgeable people recognise his contribution to the problem of citrus decline.

A widely travelled person with assignments under FAO and SAARC, Dr S P Ghosh wears his accomplishments rather lightly. Above all Dr Ghosh is warm, amiable and endearing. This workshop is privileged to have him preside over the inaugural programme. On behalf of University of Agricultural Sciences and on your and on my personal behalf, I extend Dr Ghosh a hearty welcome.

An All India Project must necessarily have a Project Co-ordinator. In Dr.Edison we not merely have a Project Co-ordinator but a person whose biodata makes me envious. A sound academic accomplishment with Ist ranks a couple of times followed by national awards is no mean achievement. In the short time that I have known him I have experienced with pleasure his mercurial personality.

Dr.Edison has been leading the spices group for more than a decade and has shared his expertise under FAO/UNDP sponsorship. He has many publications to his credit and has the distinction of having served on many committees, academic bodies and professional organisations. It is indeed my pleasure to extend a warm welcome to Dr. Edison.

We have a distinguished gathering in this hall comprising scientists working on spices, eminent invitees and participants representing a wide spectrum of organisations and development departments engaged in promoting production, processing, marketing and export of spices. Besides, we have the honourable Members of the Board of Regents, UAS (B), Officers and faculty. Equally, we are happy to have a few farmers.

The Press, Doordarshan and Akashavani is an essential presence that provides a valuable interface between us and the farmer.

To all of you, on behalf of University of Agricultural Sciences and ICAR, I extend a very hearty welcome.

Thank you,

PROJECT COORDINATOR'S REPORT*

The All India Coordinated Research Project on Spices was formulated during the IV Five Year Plan (1971) as a combined Project on Spices & Cashewnut with its headquarters at the Central Plantation Crops Research Institute, Kasaragod. In view of the increasing attention paid to Spices as well as to facilitate adequate care, the combined Project was bifurcated and the independent Spices Project is in operation since 1986 with the headquarters at the Indian Institute of Spices Research, Calicut. Certain developmental changes happened in the organisation of Spices research in our country which led to the CPCRI Regional Station (estd. 1975) being upgraded as the National Research Centre for Spices in 1986 and again to the level of an Institute in 1996. Even though the first research activity on spices was commenced in 1949 by the then Government of Madras at Panniyur/Taliparamba, it was not until 1971 -- when the coordinated network was commissioned -- as the first major organised step towards spices research. Hence, we look back with pride and a sense of satisfaction, the genesis of the Project, its incremental changes over the consecutive Plan periods - IV to VIII - and it has just completed 25 years of its function. In this august forum, let me place on record the yeomen services rendered by Dr.M.C.Nambiar, the first Project Coordinator who held the position for nearly 12 years as well as the vision and direction of Dr.K.V.Ahamed Bavappa, Dr. N.M. Nayar and Dr. M.K. Nair, the Directors of the CPCRI over the years.

The Spices Project had four Centres during the IV Plan viz., for Black Pepper, Cardamom, Ginger & Turmeric and "Seed Spices" were added during the V Plan by initiating five additional Coordinating Centres. The VI Plan added four more Centres and the VII Plan, two.

*Presented by Dr. S. Edison, Project Coordinator.

The large cardamom was given its importance during the VII Plan by opening a Centre in Gangtok in Sikkim. Two more new Centres were added during VIII Plan in Haryana and Bihar which was further followed by four more new Centres by mid-VIII Plan and this was as a result of a recommendation by a Parliamentary Committee. Tree Spices were added as a new group of crops during the VIII Plan period. Hence, we have today the mandate of the Project spread out in 15 States and 15 State Agricultural Universities besides one ICAR Research Institute and the crops handled are black pepper, cardamom, large cardamom, ginger, turmeric, cumin, coriander, fennel, fenugreek and the tree spices like clove, nutmeg and cinnamon. The Project Centres are spread over eight major agroclimatic zones in the country.

RESEARCH ACTIVITIES :

The AICRP on Spices is vested with the mandate to develop location specific agro-techniques to sustain spices production; this includes multilocation testing, development and release of Spices varieties, standardisation of seed rate, seed size, spacing, irrigation-cum-fertilizer doses, management/control measures for major pests and diseases etc. An important activity has also been to effectively exchange germplasm between the various Coordinating Centres in the country as well as with the NBPGR, IISR, ICRI, etc. With the popularity of the Project and its need-based mechanism of operation, we have added eight Voluntary/Participating Centres to represent the knowledge-gaps. As on today, we have 80 Research Projects in our hand and these are distributed as Crop Improvement - 39, Crop Production - 17, Crop Protection - 19 and Quality Evaluation - 5. The crop wise distribution will be in the order of 10 each in cardamom, ginger, coriander and fenugreek, 9 in black pepper, 8 each in turmeric and cumin, 6 each in fennel and tree spices and 3 in large cardamom.

MONITORING :

The research programmes are discussed and finalised in the consecutive Workshops/National Group Meetings conducted from time to time and we have so far held 13 such Workshops so far and the venues have been located in almost all the major Spices growing States viz., Kerala, Tamil Nadu, Andhra Pradesh, Himachal Pradesh, Rajasthan, Goa and now we have assembled at Karnataka to conduct our deliberations of the XIV Workshop in the series. It is also pertinent to mention here that this Bangalore Workshop is the seventh independent Spices Workshop and hence you may kindly realise the importance given by the higher authorities to the review of the Spices Project. The Project Coordinator located at Calicut has the responsibility to monitor, review, guide and of late arrange for funding of the Coordinating Centres as well. During the past two years, I was able to make about 45 visits covering almost all the Coordinating Centres, besides periodical discussions with the higher Officials at the ICAR headquarters. The IX Plan document has also been prepared in the light of our past experience, incorporating corrections and propositions for the future.

It is my privilege and pleasure to present the biennial report of work done, research results accomplished by the various Centres under the AICRP on Spices during 1995-96 and 1996-97.

GENETIC RESOURCES :

The total assemblage of germplasm under the various Coordinating Centres (including the Voluntary Centres) stand at 4478 which may also perhaps include duplicate entries as a result of exchange between the Centres. To highlight a few of the activities, it may be mentioned that wild and related species of black pepper were collected by Sirsi, Chintapalli, Panniyur and Vercaud centres; one new accession was added at Panniyur besides 22 from NBPGR. Chintapalli added four new wild accessions whereas Sirsi collected 19 wild accessions during the two years under report. Pampadumpara centre collected 17 promising clones of cardamom from farmers besides adding

14 wild relatives to its collection. Pottangi collected three indigenous / wild species in each of ginger and turmeric from Orissa whereas Solan collected 10 accessions of ginger. Jobner and Jagudan Centres added 14 and .45 new accessions respectively in cumin. The new Coordinating Centres viz., Raigarh and Pundibari made a good beginning by collecting five local ginger, one wild turmeric, eight local coriander and two fenugreek accessions in Raigarh whereas Pundibari collected ten accessions of turmeric. Kumarganj Centre collected 15 accessions of turmeric during the last year. The tree spices germplasm has been exchanged between IISR, Calicut and the Dapoli, Pechiparai and Vercaud Centres; the Vercaud Centre also collected 13 elite clove accessions to enrich their collection.

The role of NBPGR has been phenomenal and they helped our Guntur and Panniyur Centres to improve their collections; the seed spices germplasm received by the Project Coordinator periodically from the NBPGR has also been transferred to Jobner, Jagudan and Coimbatore centres from time to time. In general, there has been a very good activity in enlarging the genetic resources under the different Centres. Similarly Centres like Pottangi have spared germplasm of ginger and turmeric to NBPGR for international exchange.

EVALUATION OF GERMPLASM :

For any meaningful result from the programmes on crop improvement, appropriate evaluation and cataloguing of the available genetic resources is very important. Some of the leads shown by our Centres in the past two years are highlighted below:

- * Black pepper accession from the Nilgiris evaluated at Panniyur Centre gave an yield of 6 kg green berries/vine. Coriander accession LCC-177 gave an yield of 1333 kg/ha at Guntur and RD-23, an yield of 1276 kg/ha at Kumarganj
- * Cumin accession JC-29 outyielded the existing ruling varieties by over 12% in Gujarat
- * Turmeric accession PTS-45 and a promising accession in Mango ginger have been found to perform quite good in Pottangi Centre.

As a result of the evaluations, the following promising lines have been identified during the past two years.

- i) Panniyur .. Black pepper .. Karimunda III .. 52.9 Q/ha
- ii) Jagtial .. Turmeric .. JTS-1 .. 65 Q cured rhizomes/ha
JTS-2 .. 78 Q cured rhizomes/ha
- iii) Pottangi .. Turmeric .. PTS-4 .. 35 tonnes/ha
PTS-59 .. 29 tonnes/ha
PTS-51 .. 28 tonnes/ha
- iv) Jagudan .. Cumin .. JF-29 .. 2930 kg/ha
EC 279081 .. 907 kg/ha
- v) Coimbatore .. Coriander .. ATP-77 .. 683 kg/ha
JCo.64 .. 530 kg/ha
- vi) Pampadumpara .. Cardamom .. Sel. 800, Cl.679 and SKP-14.

Tolerance to diseases have been noticed in :

- * Solan Centre identified PGS 23 and Tura as less susceptible to rhizome rot of ginger. At Pottangi, V_1E_8-2 (EMS mutant) has been found tolerant to rhizome rot.
- * PCT accessions and Cl.1 were free of Colletotrichum leaf spot in Jagtial.
- * At Jagudan, wilt resistance in cumin has been recorded in EC-232684, EC-243373, EC-243375 and EC-109635. At Jobner, UC-227 showed tolerance to wilt.
- * Fenugreek EC-257566 showed tolerance to powdery mildew at Jagudan
- * At Hisar, stem gall resistance was noticed in coriander acc.DH 56.

Besides the above information on genetic resources, evaluation and the identification of promising lines, some of the important achievements under crop improvement are presented below:

CROP IMPROVEMENT

About 16 multilocation trials are being conducted and the split up will be four in black pepper, two each in cardamom, fenugreek, ginger and turmeric and one each in clove, cinnamon, coriander and cumin; besides, IETs and CVTs are also under progress in different Centres. Based on the research results from the past two years, some of the salient achievements are mentioned below:

- * During the Jaipur Workshop (August 1995), 16 proposals for release of varieties were considered and 9 recommended. These include Mudigere-2 in Cardamom, Himgiri in Ginger (Solan) and UD-20 Coriander from Jobner.
- * Black pepper cultures 4879, 5089 and 5621 have been found promising with yields of 9.52, 8.42 and 7.38 kg/vine respectively at Panniyur.
- * MLT with "Mysore" as well as "Malabar" types of cardamom are progressing satisfactorily at Pampadumpara and Vercaud besides the Voluntary Centres at Thadiyankudissai; similarly the MLT on tree spices is also proceeding smoothly at Pechiparai, Ambalavayal, Thadiyankudissai, Vercaud and Dapoli.
- * New sets of MLT (Series IV) have been started recently (1995-96) on ginger and turmeric and this has been laid out even in the new Centres which started functioning since 1996.
- * A natural mutant of cumin RZ-19 viz., UC-223 showed low wilt incidence and an yield of 292 kg/ha at Jobner.

- * Fennel accession JF-29 recorded 12% higher yield than the ruling varieties in Gujarat, based on four years' data.
- * Fenugreek UM-143 flowers early (by a week) than its parental source viz., RMt-1
- * Dual purpose fenugreek viz., HM-57 has been identified in Hisar with a seed yield of 2250 kg/ha
- * Air layering techniques as well as conversion of male and "poor yielder seedling trees" to high yielders has been accomplished at Dapoli centre
- * At Vercaud, nutmeg grafts have been successful by using orthotropic scions upon two leaf staged root stock

CROP PRODUCTION AND MANAGEMENT :

Some of the significant achievements are the standardisation of fertilizer dose for black pepper at Sirsi viz., 200:80:280 g NPK/plant, applied in two split doses. In the case of cardamom, Mudigere and Pampadumpara Centres have come out with independent recommendations viz., 75:75:150 kg NPK/ha and 100:100:175 kg NPK/ha respectively; however there was no response for Boron or Molybdenum. In the case of coriander, sowing on 25th October with 30cm row spacing gave 20 Q/ha at Jobner; however at Kumarganj (UP), the indications are in favour of 15th October. For weed control in fennel, Pendimethalin @ 1 kg/ha as pre-emergence application combined with one hand weeding 50 DAS is recommended. Jobner gave maximum seed yield of 16 Q/ha in fenugreek when fertilised at 40:40 kg N & P/ha respectively. Initial leads have been made in Vercaud centre regarding the use of biofertilizers to increase the yield of tree spices; Azospirillum and Phosphobacteria have been identified. For clove plants, drip irrigation @ 8 l/day has been advantageous at Vercaud Centre.

CROP PROTECTION :

Several maladies afflict the production of spices and mostly they are of plant pathological nature. The Phytophthora foot rot disease and slow decline of black pepper, wilt of cumin, rhizome rot of ginger and turmeric, root rot of fenugreek, stem gall of coriander and powdery mildews in seed spices, kotte/azhukal/kokkekandu in cardamom are serious constraints.

Management practices to control Phytophthora foot rot disease of black pepper have been developed as a package in Panniyur and Chintapalli centres. Use of biocontrol agents like Trichoderma viride 150g/vine incorporated in 5 kg FYM is recommended. The nursery diseases have been controlled at Sirsi and Panniyur centres by spraying (and drenching) with 1% BM and 0.2% Akomin respectively. Thrips continue to be a major constraint limiting the production of black pepper in Idukki district, one of the two Spices Districts declared by the Govt. of Kerala.

Damage by thrips to cardamom capsules could be checked by chemical methods as well as use of neem products, at Mudigere. Seed rhizome dipping with Dithane M-45 (0.25%) + Bavistin (0.1%) for 60 minutes, coupled with soil application of Thimet 10G followed by spray with Contof checks the rhizome rot disease in ginger; at Dholi, Ridomil MZ-72 applied @ 3g/l for one hour is useful. To control the pest and diseases of turmeric, prophylactic sprays of Monocrotophos applied at 15 days interval is recommended.

The dreaded disease of cumin wilt could be controlled by adopting a three year crop rotation viz., cluster bean = cumin = cluster bean = wheat = cluster bean = mustard, resulting in a minimum of 250 kg/ha yield at Jobner. Stem gall disease in coriander has assumed serious proportions in Bihar.

DISTRIBUTION OF PLANTING MATERIAL :

Almost all the Coordinating Centres have taken active part in production and distribution of improved varieties of the Spices and participate effectively in the GOI sponsored IPDS. We anticipate a good discussion on various issues connected with this aspect during the exclusive Technical Session on TOT.

STAFF STRENGTH & BUDGET :

The present staff strength of AICRP on Spices consists of 53 Scientific, 26 Technical and 6 Auxiliary/Supporting staff, making a total of 85. The budget of the Project for the VIII Plan period has been Rs.300 lakhs and for the year 1996-97, this has been kept at Rs.80 lakhs, subject to corrections after the V Pay Commission.

FUTURE THRUST AREAS :

- * Enrichment of germplasm including introduction of exotic germplasm especially of seed spices from Mediterranean region
- * Developing descriptors for all the spices
- * Development of cropping systems
- * Development of varieties with tolerance to soft-rot and bacterial wilt, low fibre and high oleoresin content in ginger
- * Evolving black pepper cultivars with multiple resistance for Phytophthora foot rot, slow decline and pollu-beetle.
- * Creating quality awareness and promotion of export-oriented research
- * Research on post-harvest technology and striving for residue-free, clean spice.

Jai Hind

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PRESIDENTIAL ADDRESS

by

Dr. S.P. GHOSH

DEPUTY DIRECTOR GENERAL (HORTICULTURE)

INDIAN COUNCIL OF AGRICULTURAL RESEARCH

NEW DELHI

Hon'ble Vice Chancellor, University of Agricultural Sciences, Bangalore, Dr.G.K.Veeresh, Dr. B.R. Hegde, Director of Research, Dr.R.N.Pal, Asst. Director General (Plantation Crops), Dr. S. Edison, Project Coordinator, Fellow Delegates, Ladies & Gentlemen,

It gives me immense pleasure to preside over this important National Group Meeting of Spices Research Scientists and Development Officials. I consider it an honour for me to associate myself in the Inaugural function of the XIV Group Meeting / Workshop on Spices Research. It is our pleasure to know that the Hon'ble Vice Chancellor of the University of Agricultural Sciences, Bangalore has kindly agreed to inaugurate the Meeting. I also note that a large number of Spices Scientists and Technocrats from all over the country have assembled here and would participate in the deliberations. It is also a happy augury that several Directors from Development Departments, Deans from Agricultural Universities, Officials from the Spices Board and the Managerial and Technical Representatives from the various Horticultural Input Agencies have also joined us to enable an in-depth discussion of the research results on Spices. I am also particularly happy to note that the hosts Karnataka are the most competent to host this Workshop of the Horticultural Division especially because it is Karnataka State (the then Mysore) which started the first Department of Horticulture in the country under the leadership of Dr.H.Marie Gowda. I am thankful to the Vice Chancellor and other authorities for agreeing to host the Group Meeting in the picturesque garden city of Bangalore and the elaborate arrangements made for the same.

"SPICES", the very word induces, attracts and reminds us of the value of it towards palatable food; the aroma, flavour and other components of the Spices makes our life very enjoyable and interesting. The food is palatable and easily digested only when optimum quantities of spice are added. Can we therefore say that there is no life without spice? Yet this group of crops are of paramount importance especially in the export sector, besides a tremendous demand in domestic consumption. As you are aware, India is the 'Land of Spices', having the capacity and agroclimatic requirements to grow over a 100 species and in fact dominates the international trade. It has been estimated that we produce about 23 lakh tonnes of Spices from 21 lakh ha of land and the important among them are black pepper, cardamom, ginger, turmeric, cumin, coriander, fennel, fenugreek, clove, nutmeg, cinnamon and of course chilli, celery, vanilla, saffron, etc. The beauty of our country is that we have ever so many agroclimatic sub regions, that any given spice (or for that matter any crop) can be grown in one or other place of this country and we are also blessed with abundant sunshine. The history of Indian Spices having travelled all over the globe more than a millennium ago and great explorers and navigators like Vasco-de-Gama occupied our territory in the name of Spices trade and we became slaves to British in due course!

The best part of our (Indian) spice is the intrinsic quality and its adaptability to different cuisine. We have been dominating the world trade by contributing almost 30% of its volume and 25% of its value over the years. There has been a spurt in our activity on the export front and during 1996-97, India exported 2.2 lakh tonnes of spices, (including oils, oleoresins etc.) worth Rs.1180 Crores; this was just about 30,000 tonnes and Rs.250 Crores a decade ago. Perhaps there is a conscientious effort on the part of Indian farmers, traders, merchants and exporters to achieve higher targets. It is said that the domestic consumption of spices is also quite high and the exportable surplus is just about 10%. If one compares the domination by India in almost dictating the world trade on spices five decades ago, it speaks volumes of history how we lost in the game of competition. There is therefore an imminent need to raise the productivity levels of spices.

Paradoxically, the research support for spices has been very meagre until we gained Independence. It was in 1949 that the erstwhile Government of Madras initiated research programmes on black pepper at the Government Agricultural Farm, Taliparamba near Panniyur in Kerala State; this was followed by a few research schemes sanctioned for Thodupuzha and Ambalavayal in Kerala, Fulia in West Bengal, Mudigere in Karnataka, Jagudan in Gujarat, Khandaghat in Himachal Pradesh, Dergaon in Assam, etc. However, with the initiation of the concept of the coordinated research programmes from the ICAR, the Council started the first ever major step in organising Spices Research by starting a combined Research Project for Spices & Cashewnut in 1971 with its headquarters at the Central Plantation Crops Research Institute, Kasaragod. This coordinated programme had initially 4 Research Centres to deal with Black Pepper, Cardamom & Ginger and they were located in Kerala, Karnataka and Himachal Pradesh during the IV Plan. This Project slowly expanded its activities and as of date, has 20 Coordinating Centres spread in 15 States and operated through 15 State Agricultural Universities besides an ICAR Research Complex. An important feature has been the delinking of cashew from the purview of the Project since 1986 and the independent status given to spices research and with its new headquarters viz., the National Research Centre for Spices at Calicut. This NRC for Spices has however been upgraded as the Indian Institute of Spices Research since 1996. The mandatory crops of the Spices Project are black pepper, cardamom, large cardamom, ginger, turmeric, cumin, coriander, fennel, fenugreek and tree spices like clove, nutmeg and cinnamon.

The AICRP on Spices has made significant contributions over the last 25 years and hence we are proud to rather celebrate its 25th year and some of the most important contributions of the Project have been

- i) responsible for having released over 70 varieties in various spices and among them more than 50 are quite popular and there is a heavy demand for the seed and planting material.
- ii) effective collection, introduction, exchange and evaluation of germplasm involving the NBPGR.

- iii) evolution of quality consciousness approach especially in the case of high curcumin turmeric varieties, high volatile oil seed spices and low fibre ginger varieties.
- iv) adaptive testing of integrated disease control measures for important diseases like Phytophthora foot rot disease of black pepper, rhizome rot of ginger and turmeric and crop rotation methods in the case of cummin wilt.
- v) biocontrol programmes in diseases of black pepper, cardamom, fenugreek, etc.
- vi) research on basic aspects like mutation breeding, hybridisation and selection etc. to induce variability and assess for disease resistance in coriander, black pepper, fenugreek, etc.
- vii) initiation of coordinated research network activities on tree spices at Vercaud and Dapoli centres.
- viii) a silver lining in the progress of the Project has been the recommendations of the Parliamentary Committee (1994) which enabled initiation of research activities in hitherto neglected areas in Madhya Pradesh, Uttar Pradesh, Maharashtra and West Bengal.
- ix) utilisation of the services of the Scientists under the coordinated programme to produce and monitor the production and distribution of high quality planting material of improved varieties, sponsored through the Centrally Sponsored Scheme of the Department of Agriculture, Govt. of India, Spices Board, etc.
- x) recommendations have been made on spacing, seed rate and seed rhizome size, fertilizer and irrigation schedules, etc.

The Project has also been responsible to create good infrastructure facilities like propagation shed, storage shed, lab facilities like Ultra Microscope, Personal Computers, Analytical equipments in various Centres. The IX Plan document which gives importance to Horticulture by suggestions towards crop diversification, utilisation of value added products, residue analysis and awareness in the end products etc. have been considered while formulating the IX Plan of the Spices Project. The budget of the Project has been Rs.300 lakhs during the VIII Plan, with 53 Scientific and 32 other staff members. The need for organic spices as well as the "Indian Spices" being awarded the ISO 9002 are also very much awakening the efforts of our Scientists. The QRT of the ICAR which submitted its report recently has gone into depth the working of the Project and has commended its performance. However, there are some more areas of apparent weaknesses in our efforts and for e.g., the reliability of a fool-proof disease and pest control system for the major pests and diseases, inadequacy of germplasm of seed spices, increasing the productivity of marginal and sub-marginal spice lands and the effective transfer of technology network. Of course, the KVK concept as well as the consultancy services engineered by the ICAR need to be looked into more pragmatically and ensure higher productivity levels. Last but not the least, it is also my duty to mention here that the ICAR has decided to create a National Research Centre on Seed Spices in Rajasthan in order to provide undivided attention to these group of crops; the proposal has already been approved by the Planning Commission and hopefully the NRC would start functioning soon.

Ladies & gentlemen, you will agree with me that the strength or weakness of any research system depends on a free & fair and in-depth discussion of its envisaged technical programme, critical analysis of the results obtained, evaluation of the technologies that are transferred as well as its proper utilisation by the clientele. In this context, the presence of

the Directors of Horticulture, Agriculture and other Development Agencies over here adds a valuable input to our deliberations. For eg., the release of a variety for a particular crop for a particular region cannot be successful unless and until it meets the local requirements vis-a-vis the concerned NARP mandate and priorities. The presence of the technical representatives of the various Horticultural Input Agencies will also add the much needed input to such deliberations. I am sure that we will have elaborate discussions during the next three days of the Spices Workshop and come out with very meaningful recommendations and guide this Project to its bright future. I take this opportunity to profusely thank the Vice Chancellor for having inaugurated the Workshop amidst his pressing responsibilities and pre-occupations.

I wish you all success.

JAI HIND

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TECHNICAL SESSION I : ACTION TAKEN REPORT

Chairman : Dr. S.P. Ghosh

Rapporteur : Dr. S. Edison

Dr. S.P. Ghosh, Deputy Director General (Horticulture) chaired over the first Technical Session which was a General Session and discussed about the various recommendations made during the XIII Workshop of the Project held at Jaipur (July 1995) as well as some of the comments received after the last Workshop. The report on the action taken was summarised by the Project Coordinator and a detailed discussion followed under the Chairmanship of Dr.S.P.Ghosh.

The DDG while reviewing the ATR, made several general and specific observations as briefly mentioned below:

1. In genetic resources, the NBPGR may be advised to identify just five or six locations and also prioritise the crops to be covered. This should be in accordance with the catchment area of the crop. The Scientists of the Coordinating Centres must be involved in the multi-Institutional Team to conduct the survey etc. for genetic resources.
2. The concept of crop cafeteria must be introduced in all the Centres wherein the proven varieties must be grown as an exhibition plot for the benefit of progressive farmers, visiting officials from the Development Departments as well as the trainees visiting the Research Centre. He appreciated the efforts made in this direction by the Vercaud, Pottangi, Sakleshpur, Panniyur and Jobner Centres in this regard. Every Centre must have a cafeteria on Spices.
3. It has been observed that while seed material is received for conducting MLTs, there has been a shortage of the same and the Centres may be advised to adopt new technologies and utilise the available protocols for multiplication of the planting material. It is essential to ensure the analysis of plant and soil samples before and after laying out experiments - especially relating to those on irrigation, fertiliser etc. - and, in this connection, the

locally available facilities must be utilised. Wherever the cost : benefit ratio is mentioned, the fixation of price for the produce must be done in consultation with the market arrival rates/prices as documented by the National Horticultural Board (NHB) wherever possible.

4. Wherever training programmes are to be arranged for the benefit of the Scientists under the AICRP System, this could be done at IISR, only after ascertaining that at least 75% response to the proposal/decision.
5. In the case of plant quarantine activity, it may not be possible for each Centre to have necessary staff in all relevant disciplines to take care of this issue; however, this responsibility can be vested with the IISR.
6. Whenever new germplasm is collected, "passport data" must be prepared and the Centres must send a copy of the same to the IISR for posterity; a duplicate set of the collection will also be given to the IISR wherever feasible.
7. The experiments on nursery management and developing a suitable package must be conducted in all the Centres so that the nursery code/certificate becomes a reality in the near future.
8. The DDG appreciated the role played by the Pottangi Centre in large scale production and distribution of improved varieties of ginger and turmeric. However he cautioned about the quarantine care that should be attended in view of the national problem of rhizome rot. The DDG welcomed the idea of including Ajowan (Bishop's weed/Omum/Vamu/Ayamodakam) in the Coordinated network and the information provided by the Project Coordinator about the availability of germplasm of this crop at Guntur, Dholi, Jagudan/Jamnagar and Hisar was appreciated. Even though there appears to be a total of 110 germplasm lines available in Ajowan, it will be necessary to obtain a description of this from the relevant centres.

Item-wise / crop-wise points of decisions taken with comments on the action taken etc. are provided in the following pages.

ACTION TAKEN ON THE RECOMMENDATIONS OF THE XIII WORKSHOP ON SPICES HELD AT JAIPUR DURING JULY 1995

Decisions	Action taken / Remarks
GENERAL	
1. Emphasis should be given for collecting germplasm from local areas of coordinating centres. Passport data should be maintained for all the germplasm collected and separate minimum descriptor has to be prepared for every spice	As per the suggestions, surveys are being taken up and collections are being made. The NBPGR Regional Stations at Hyderabad and Trichur have been involved in the programmes. Separate minimum descriptors have been provided for Black pepper, Cardamom, Ginger and Turmeric.
2. Any variety for release has to be considered based upon the yield increase of 10-15% over the standard check varieties or they should possess desirable characters like better quality, adaptability or resistance to biotic and abiotic stresses.	Black pepper variety Panniyur-5 has been released by the KAU. Coriander variety UD-40 from Jobner has been sent for notification. The mango ginger variety viz., Amba and turmeric variety viz., Sonali are still pending finalisation for release. Due to certain deficiency in data, the proposals have been advised for resubmission.
3. Crop cafeteria of all released varieties to be established to serve as a demonstration block.	Only at Vercaud, Panniyur, Pottangi, Coimbatore and Jobner Centres, this activity has been exhibited. Other Centres have been advised to repeat the same.

4. The MLT experiment have to be initiated and laid out only sufficient planting material in all the entries are made available, only the best released/pre-released varieties should be entered in the MLTs.

5. Promising cultures under MLT should be evaluated in farmers' field besides being evaluated at the Research Station.

6. In all the manual experiments, the soil and plants analyses should be taken up immediately.

7. In all the experiments, Cost : Benefit ratio are to be worked out.

8. In view of the growing awareness to environmental pollution and eco-friendly produce, more emphasis on reaction to pests and diseases wilt have to be laid during varietal screening.

9. The Pathologist of the Scheme at Solan will find out the suitable date for obtaining training on the VAM technology, toxin isolation and tissue culture techniques from IISR.

10. The IISR may organise short term training on isolation, mass multiplication and application of biocontrol agents used in management of soil borne pathogens of spices.

Being followed by all Centres.

Has been taken up by centres which have released varieties.

This has been initiated; but there is lack of initiative in some Centres to recognise this important suggestion.

The C : B ratio have been worked out in the concluded trials and the data incorporated in the Reports.

Being attended to by all centres.

Training has already been given at IISR to the Pathologist from Solan Centre during October 1996. The Scientists from Chintapalli, Panniyur and Jagtial centres did not turn up although a well drawn programme was arranged at the IISR. The Scientists need to be motivated to undergo this important requirement.

Being organised in consultation with the Centres.

11. Need to create plant quarantine units in Centres in view of the threat for inter-State transmission of diseases and pests.
12. Provision of passport data and minimum descriptor for each spice
13. Project Coordinator may update information on seed stock of improved varieties of various spices and pass on the same to user agencies and ensure the Transfer activity
14. Frequent transfer of Scheme Scientists affect the work and long term vacancies like Horticulturist at Guntur, Breeder at Pampadumpara etc. need to be pursued.
15. Efforts on research on large cardamom are inadequate and hence we may initiate some programmes through the ICAR Research Complex

CARDAMOM

1. The promising, short listed cardamom lines of Mudigere need to be mass multiplied through tissue culture. The ICRI, Myladumpara will take up the multiplication programme.

The importance has been highlighted to the Centres and perhaps during the IX Plan, special steps will be taken to create this facility.

Necessary proforma have already been provided to all the Coordinating Centres and in fact duplicate sets have been sent to them again. The Centres may be advised to undertake this item urgently.

PC is periodically monitoring the issue and needful has been done for Kerala, Karnataka, Andhra Pradesh, Tamil Nadu, Orissa, Gujarat, Madhya Pradesh, etc.

SAUs have been periodically reminded on this; vacant positions have been repeatedly reminded to SAU authorities.

The Gangtok Centre is not very much active and all efforts have been taken to obtain reports from the Centre; Director has been requested to sponsor Scientists to attend our Workshops.

Mudigere centre has been equipped with a micropropagation laboratory recently and work has been initiated at Mudigere itself.

This is being done.

Needful has been done.

Centres have been reminded to attend to this.

2. All the centres working on cardamom will collect data on the tiller, no. of bearing tillers, no. of panicles, no. of capsules per panicle, no. of capsule per node and yield per clump.
3. The voluntary centre at Thadiyankudissai will have to relay the MLT in cardamom.
4. All the data pertaining to the ecology and management of thrips in cardamom may be compiled by Mudigere & Pampadumpara. Residue analysis may be carried out in all the chemical control trials.

BLACK PEPPER

1. The MLT-IV 1991 will be laid out in all the pepper and cardamom centres. MLT on black pepper 1991 Series IV is to be discontinued at Chintapalli. The Project Coordinator may visit the Chintapalli Centre for a review.

2. Experiment on Phytophthora foot rot and nematode disease management to be continued.

3. The incidence of pests on black pepper in irrigation-cum-fertilizer trial / experiment to be recorded at Sirsi. It was suggested to replace the necessary loss due to disease

4. New experiment on disease management of black pepper consisting of chemical and biocontrol measures may be laid out.

As per the Jaipur Workshop decision, the MLT-1991 is dropped at Sirsi and the new MLT has been initiated. The Project Coordinator has visited the Chintapalli Centre and the progress has been satisfactory.

Being continued.

About 20% of the vines were destroyed due to foot rot disease and replanting work and necessary control measures have been adopted. The missing accessions are being replaced at Sirsi.

New technical programme has been communicated to all the Centres and the trials already laid out.

5. An Adhoc Scheme proposal on feasibility of pepper cultivation in tribal areas in Orissa to be prepared by Pottangi Centre
 6. The Pottangi Centre will also take up a MLT on black pepper with released varieties
 7. The nursery management results may be compiled and new schedule of treatment may be finalised
 8. Solarisation of nursery mixture and incorporation of antagonists can form part of nursery management technology in black pepper by all Centres
 9. As observation trial on impact of basin management with marigold may be assessed in relation to population of pathogenic nematodes of pepper. The required seed materials of marigold seeds will be supplied by M/s. Synthite Industrial Chemicals Ltd., Kozhenchery
 10. Plantation of pepper may be monitored periodically in March, June-July-October by Mudigere to assess the pest incidence in hilly regions.
 11. The experiment on irrigation cum fertilizer level at Panniyur may be concluded and one new experiment on drip irrigation cum fertilizer may be laid out with latest, released varieties (one each in OP & hybrid)
- Centre has been reminded to give the proposal.
- Centre has been reminded to take up the programme.
- Panniyur centre has been reminded to finalise the matter soon.
- Centres advised to follow this decision
- The seeds have since been supplied by M/s. Synthite and the results are expected from the Centres.
- Centre did not take up the programme due to want of manpower and finance. The University authorities may be requested to provide additional support to the Mudigere Centre.
- The trial has been laid out.

GINGER

1. The trial on maximization of ginger will be taken up at Solan. Has been done at Solan.
2. A greater attention for developing low fibre varieties will have to be done. Solan and Pottangi centres were advised.
3. The experimental results on ginger at Chintapalli centres are to be compiled and sent to PC. Details have since been received but the Centre is advised to provide the consolidated progress report for three years.
4. Planting material of released varieties may be supplied to needy States by Pottangi Centre. The Centre has supplied 14 Q Suprabha to Maharashtra and 18 Q Suprabha to West Bengal.

TURMERIC

1. An Ad hoc Scheme on rhizome rot and leaf spot diseases of turmeric will be prepared by PC and the Project will be located in three selected centres. Jagtial centre has been advised to take up the programme and discuss with the PC.
2. To confirm etiology of disease and associated pathogens/pathogenicity of Pythium sp. and Fusarium sp. singly and in combination, studies may be undertaken by Jagtial centre. Work has been initiated.
3. Planting material of released varieties may be supplied to needy States. Pottangi Centre has supplied 14 Q Roma to Madhya Pradesh

TREE SPICES

1. It was suggested to try multiplication of Orissa Cinnamon through air layering in the month of June-July at Vercaud
2. The Vercaud Centre will study the quality aspect of cinnamon bark on harvest during September 1995
3. All experiments on tree spices at Vercaud will continue. Seeds of wild nutmeg available in the Kolli hills region may be used for grafting
4. In the biofertilizer trial on tree spices at Vercaud, the method of application may be standardised. The soil microflora may be monitored continuously throughout the year.
5. Periodical monitoring may be undertaken in identifying the pest & disease problems in tree spices in all centres.

SEED SPICES

1. The available fenugreek germplasm may be evaluated for "green purpose" and simultaneously, the germplasm from Jobner may be collected and evaluated at Guntur.

Vegetative propagation programme with Orissa Cinnamon has been initiated at Vercaud in December 1995; unrooted cuttings treated with Seradix gave 76% success in 45 days; further trials with air layering are under evaluation.

As per PC's suggestion, the coppicing of cinnamon during September 1995 was postponed as the plants have not attained the proper height and growth; coppicing will now be done in late 1996 and quality analysis confirmed at IISR. Results awaited.

Arrangements were made to procure wild nutmeg from the Kolli hills and the centre is yet to report on the further progress.

Adequate care has been taken during the year for the application of biofertilizers. A time gap of 15 days has been given after application of Azospirillum & Phosphobacteria for the inorganic fertilizer. The soil population dynamics is being monitored periodically.

Being done in all centres.

Being done.

2. The Coimbatore Centre has been asked to collect germplasm materials in coriander and fenugreek at least 4 different districts in Tamil Nadu viz., Madurai, Ramanad, Kamarajar and Kattabomman, during 1995-96.
3. Hisar centre advised to take up quality analysis of leafy type in coriander.
4. Germplasm material of Ajowan in Guntur, Dholi and Hisar Centres may be exchanged.
5. The quality analysis facilities available at Jobner has to be availed by all seed spices centres. It is suggested that an exploration for exotic types for oil content could be taken up on priority; the role of variety and agro climatic situations on the quality of oil has to be established.
6. The new MLT in coriander and fenugreek with the identified entries to be taken up in all Centres.
7. Promising cultures from screening programme since 1972 may be short listed and made use in future MLT by all centres.

Material has since been collected and evaluation commenced.

Work has been initiated .

Correspondence initiated between centres in this regard.

Jobner centre is already extending this facility. Exploration work is yet to be initiated outside Rajasthan; a beginning has been made for Fennel in Madhya Pradesh.

Since initiated in all centres.

Centres have been required to provide this information.

SESSION II

GENETIC RESOURCES

Chairman : Dr. Mansoor Kazim

Repporteurs : Dr. K.C. Velayudhan
Dr. B.N. Korla

No. of Centres participated : 27
Centres where work was done : 33
Non performing : 6
Salient results reported :

The coordinating centres presented their reports of different spice crops. The present germplasm collections maintained at the coordinating centres are listed below.

Table.5 Germplasm holdings at AICRPS centres as on 31-03-1997

Crop/Centres	Indigenous		Exotic	Total
	Cultivated	wild & related sp		
Black pepper				
Panniyur	65			65
Sirsi	70	20		90
Chintapalli	13	24		37
Yercaud	102	4		106
Dapoli	7			7
Cardamom				
Pampadumpara	77	14		91
Mudigere	245			245
Large Cardamom				
Gangtok				
Ginger				
Pottangi	153	2	3	158
Solan	176			176
Chintapalli	5			5
Turmeric				
Raigarh	5	1		6
Solan	185			185
Pottangi	178	22		200
Jagtial	188			188
Dholi	56			56
Pundibari	26			26
Kumarganj	15			15
Clove				
Yercaud	13			13
Pechiparai	16			16

Crop/Centres	Indigenous		Exotic	Total
	Cultivated	Wild & related Sp		
Nutmeg				
Pechiparai	12			12
Dapoli	16			16
Cinnamon				
Yercaud	10	1		11
Pechiparai	12			12
Coriander				
Jobner	625		105	730
Jagudan	140		26	166
Coimbatore	211			211
Guntur	230		5	235
Hisar	98			98
Dholi	92			92
Raigarh	28			28
Cumin				
Jobner	241		10	251
Jagudan	205		7	212
Fennel				
Jobner	162		8	170
Jagudan	259		21	280
Hisar	58			58
Dholi	34			34
Fenugreek				
Jobner	308		12	320
Jagudan	71		2	73
Coimbatore	169			169
Guntur	76		8	84
Hisar	92			92
Dholi	92			92
Raigarh	24			24

General Observations :

1. All the centres except Gangtok for Large Cardamom; Dhôli for Ginger, Turmeric and Seed Spices; Pechiparai, Thadiyankudissai for Tree Spices presented the evaluation data of the germplasm being maintained at the respective centers.
2. The four new co-ordinating centres must try to collect local germplasm besides obtaining from other centres.
3. The efforts may be made to collect the germplasm in collaboration with the NBPGR main/regional offices as sufficient infrastructure facilities are available with the Bureau.

The NBPGR will take the lead.

4. The exploration must be followed in high priority crops in a phased manner.
5. The local germplasm collected (one set) must be passed on to the NBPGR along with the passport data so that proper 'LC' numbers are assigned.
6. The concern about the erosion of local germplasm was also highlighted.

SESSION-III

CROP IMPROVEMENT, PHYSIOLOGY AND BIOCHEMISTRY

Chairman : Dr.R.K.Sharma **Rapporteurs :** Dr.T.Thangaraj
Dr.H.M.Chandrappa

1. No. of papers presented : 42
2. Centres where work has done : 20
3. Non performing centres, if any : Four (Chintapalli, Gangtok, Dholi & Dapoli)
4. Brief description of the work done and salient results reported :

Black pepper :

In pepper, culture 239 and culture 331 have been released as Panniyur 5 and Panniyur 3 respectively from Panniyur centre. Kuthiravally, Neelamundi and Arkulamunda among varieties and culture 5489, culture 5403 and culture 7156 among OP progenies have been found promising with higher yield at Panniyur. Culture 54 has been found to be less susceptible to *Phytophthora* foot rot disease.

Cardamom:

In cardamom, MCC 85 has recorded highest yield among Mysore type varieties at Myladumpara. MLT Series III with Malabar and Mysore type have to be relaid out in all the centres since the results are inconsistent.

Ginger:

In ginger, V1 E8-2 and V1S1-8 at Pottangi, INFR, SG 682 and SG 687 at Solan have been found promising. SG 666 has been released as a variety for Solan.

Turmeric :

In turmeric highest yield has been recorded in PTS 43 and PTS 15 at Pottangi and PTS 10, PTS-12, 21A, CLI 317, CLI 330, PCT 13 and PCT 14 at Jagtial. PTS 19 has been proposed release from Pottangi; it gives a fresh yield of 21Q/ha with 5.6% curcumin content.

Cinnamon :

Selection 203 at Yercaud and Sel 189 and Sel 63 at Ambalavayal have been found promising in Cinnamon.

Coriander :

UD 446 at Jobner, CC 946 and ATP 77 at Coimbatore, DH 36 at Hisar, ATP 77 and LCC 15 at Guntur have been found promising with higher yield.

Cumin :

EC 278081 at Jagudan and UC 223 at Jobner have been found better for yield.

Fennel :

ACC390 and CF 464 at Coimbatore and HM 57 and HM 103 at Hisar, UM 44 and JF 102 at Guntur, JF 145 and HM 103 at Jagudan; and UM 143 and UM 305 at Jobner have been found promising for yield.

5. Recommendations / decisions (crop wise) :***Cardamom :***

MLT series III (1993) with both Mysore and Malabar types to be relaid out in all the centres.

Ginger and Turmeric :

Guidelines already sent previously by the Project Coordinator are to be followed in analysing for quality. IISR, Solan, Pottangi, Kumarganj, Coimbatore and Dholi centres will take up a new trial of promising varieties and send the material to IISR, Spices Board and Dr. YSPHUF, Solan for quality analysis. This will be in accordance with the decisions taken up by the duly constituted Committee for a trial to test the effect of altitude on the quality in turmeric. Technical programme is enclosed.

Seed Spices:

There will be only one MLT along with the year of start of the experiment hence forth to avoid confusing nomenclature, a committee was set up and the recommendations are enclosed for guidance.

- | | |
|---|--|
| 6. Programme proposed for the next year :
(Cropwise and with experimental details) | All experiments are to continue. A new CVT for turmeric with released varieties are proposed to test the effect of environment/ location on quality. A new CVT on fennel is also proposed. |
|---|--|

New experiment

Turmeric - Curcumin content experiment

- 1) Title of experiment : The impact of environment on quality aspects of turmeric
- 2) Locations of the experiment : Centres - five (Calicut, Coimbatore, Jagtial, Pottangi, Solan)
- 3) Objective : To find out the interaction of environment on quality aspects of Turmeric.
- 4) Techniques to be adopted :
 - a) Treatment (varieties) - 6
 - 1) Acc 360 2) Suguna 3) Roma,
 - 4) Rajendra Sonia, 5) BSR-2, 6) JTS-2
 - b) Replications- Three
 - c) Plot Size - 3 x 1m
 - d) Spacing - 30 x 20 cm

Not less than 3 Kg material in each entry is to be supplied by the donor centres to all the participating centres before the planting season and under intimation to the Project Coordinator.

- 5) Observations (I) Analysis of curcumin
 - (a) Sample : Compound sample (Mother : Primary fingers and secondary fingers at the ratio of 40:35:25. Only dried samples 100 grams (Not powdered) should be sent for analysis.
 - (b) Analysis : Analysis will be carried out for all entries at
 - (a) IISR, Calicut
 - (b) UHF, Solan
 - (c) Spices Board, Kochi

11. Stage of sampling - Full maturity

III. Packing - Polythene covering with cloth bags.

IV. Duration of study - Two years (commencing 1998 March)

Recommendations of the committee on Seed Spices:

A committee was constituted to go in to details of trials on crop improvement on seed spices met at 3.30pm on 9/07/97 under the chairmanship of Dr.B.S.Dhankar with the following members:

1. Dr.T.Thangaraj
2. Dr.G.R.Chaudhary and
3. Mr.N.Hariprasad Rao

and following are the recommendations:

- a) There is a need to restrict the number of trials handled by each centre looking at the fact that each centre is handling 2-4 crops besides having the responsibility of evaluation and maintenance of large number of germplasm in each crop.
- b) Each centre will take up only one coordinated varietal trial (CVT) for each crop for period of 3 years/seasons.
- c) The entries for CVT will be accepted from the centres based on 2 years' consistent performance under IET in respect of yield besides quality. Each centre will have to include their latest recommended/released variety as check under IET. The data on contribute not exceeding three entries to the CVT.
- d) The present CVT on coriander, fenugreek and cumin will continue for 2 more years with the same entries No. new MLT is recommended for these crops.
- e) In respect of fennel a new CVT is recommended with the following entries drawn from various centres: (CVT 1998)

1. HF 33 Hisar	5. JF 200 Jagudan
2. HF 39 Hisar	6. UF 101 Jobner
3. JF 186 Jagudan	7. UF 143 Jobner
4. JF 192 Jagudan	8. UF 144 Jobner
- 6) Though there is need to test the entries under CVT for 3 years, the centres can propose any entry for adaptive / on farm research if it performs well consistently for two years and seek the approval of the varietal release committee at the Group Meeting. The third year trial and the field testing can run concurrently to save time.
- 3) the Project has to provide necessary infrastructure and funds like vehicle etc for taking up this work on a campaign basis.
- 4) The NBPGR will be pursued to strengthen the programme for systematic introduction of germplasm material from other countries particularly from centres of origin/diversity.
- 5) The passport data and characterisation of all available germplasm entries in all centres have to be completed and updated.

Future thrust

- 1) The breeding approaches are to be streamlined utilising the avenues offered by biotechnology for full exploitation of genetic potential in all crops.
- 2) The genetic base has to be widened in all crops.
- 3) The quality standards are to be upgraded along with the yield in all spice crops.

Session IV

Plant Pathology and Entomology

Chairman : Dr. Y.R. Sarma
Co-Chairman: Dr. J.D. Bagyaraj

Rapporteures: Dr. M.N. Venugopal
: Dr. N.P. Dohroo

1. No. of papers presented: Except Dholi and Gangtok centres, all centres presented the report.
2. Name(s) of centres where work was done:

Pepper: Panniyur, Sirsi, Chinthapalli, Mudigere.

Cardamom: Mudigere, Pampadumpara.

Ginger: Solan, Dholi, Pundibari.

Turmeric: Jagtial, Dholi.

Seed spices: Jobner, Jagudan, Coimbatore, Dholi.

3. Non-performing centres, if any: - Nil -

4. Recommendations / decision :

Black Pepper:

- 1) New disease management strategy may be formulated using the leads from concluded experiments and tested at Panniyur, Sirsi and Chinthapalli.
- 2) Treatment schedule in new programme for the management of nursery diseases of pepper will be provided by IISR, Calicut.
- 3) Survey work on pests of pepper at RRS, Mudigere should be continued and monitoring extended up to March.
- 4) At Pampadumpara, management trial on pests of pepper should be undertaken in pest- prone areas.

Cardamom

Ongoing chemical control trial on thrips and capsule borers at Mudigere may be concluded and new programmes may be started in consultation with PC & IISR, Calicut.

Ginger

Proposed treatment schedule for two experiments at Solan Centre, should be finalised in consultation with PC & IISR, Calicut.

At Pundibari, associated pathogens of soft rot of ginger should be isolated and their pathogenicity confirmed. Required training and expertise will be provided by IISR, Calicut.

Turmeric

Management trial of turmeric soft rot at Jagtial may be modified in consultation with IISR, Calicut.

Coriander

Non participation of Dholi centre may be viewed seriously and PC (Spices) may ensure the participation of all the centres to achieve the mandate of co-ordinated effort to contain pests and diseases of spices.

Cumin

Tolerant / resistant lines should be short-listed and passed on to the PC (Spices) within 1 month.

6. Programme proposed for the next year:

Ongoing programmes for 1996-97 will continue and new programmes will be finalised in consultation with IISR, Calicut.

7. General decisions :

- 1) All the centres should follow the uniform technical programme as decided in the Workshop. If necessary, 1 or 2 treatments as per local requirements may be included without altering the original treatment schedule.
- 2) Variability in the pathogen and bio-control agents, fixation of dosage using uniform carrier media, applicable to different agroecological zones should be given due priority in formulating new programmes.
- 3) Priority should be given to local promising isolates; the inoculum potential of bio-control agents on different media may be quantified.
- 4) Integrated strategy should be evolved using different bio-control agents to achieve desired level of pathogen suppression.
- 5) Three major diseases viz. Foot rot of pepper, Rhizome rot of Ginger and Wilt of cumin

should be considered as diseases of national importance. A standing committee should be formed to review the work formulation of technical programme and to fix locations where work has to be carried out. Committee also reviews the implementation of recommendations at farmers' level.

- 6) All the centres should compile results of various disease and pest management trials of the last 5-6 years and submit the same to PC (Spices) for finalising the treatment schedule for 1997-98 season. This may be done in 6 weeks' time.
- 7) Bio-control agents from different co-ordinating centres may be isolated/maintained at IISR, Calicut for future use and reference.

8. Future thrust:

- 1) *Developing location specific integrated pest and disease management strategy using local effective isolates of biocontrol agents.*
- 2) Studies on pesticide residue in spices.
- 3) Studies on post-harvest problems of spices with emphasis on spoilage in storage by insects and microbes and their control.

SESSION V

AGRONOMY AND SOIL SCIENCE

Chairman: Dr. S.N. Potty

Repporteurs : Dr. P. Rajagopalan
Mr. K. Kandiannan

1. No. of papers presented : 12
2. Name(s) of centres where work was done : 7 centres Panniyur, Sirsi, Mudigere, Pampadumpara, Yercaud, Pottangi, Jobner.
3. Non-performing centres, if any : Dholi, Pechipari, Dapoli Thadiyankudissai and Hisar are not presented any results.
4. Brief description of the work done and salient results reported

Black Pepper:

Two series of irrigation experiments; of which one is in progress at Panniyur and Sirsi centres. Two cultivars were tried at both the centres at three levels of irrigation and fertilizers. In Sirsi centre, papper is raised as a mixed crop with Arecanut. The second series of irrigation experiment was initiated adopting drip system in 1996 at Panniyur centre.

Studies at Panniyur show that irrigation at IW/CPE ratio of 0.25 (100 lit. of water) applied once in 8-10 days during December-May was effective in increasing the yield of Karimunda.

At Sirsi, no significant difference was observed for irrigation levels with respect to plant height and green berry yield.

Cardamom:

Two experiments are in progress at Mudigere centre; one with 6 levels of fertilizers and the other one is on the effect of micronutrients on cardamom yield. Besides this one experiment on integrated nutrient management is also in progress as our Institute project.

The experiment in Pampadumpara centre on the effect of micronutrient on cardamom was relaid out in 1996.

Micronutrients had no significant impact on cardamom yield. Similarly integrated nutrient management with organic and inorganics also had no significant response at Mudigere.

Ginger:

One experiment on fertilizer requirement has been in progress at Pottangi centre for the last six seasons and the findings are ready for consideration of Transfer of Technology. Application of 125:100:100 kg NPK/ha in ginger SURUCHI gave significantly high fresh rhizome yield (16.94 t/ha) with cost benefit ratio of 1:1.23.

Tree Spices:

Trials on drip irrigation and biofertilizer were in progress at Yercaud centre. The experiment on biofertilizers is concluded and is ready for consideration for Transfer of Technology.

In nutmeg, application of 100 kg FYM, 400 g N, 300 g P₂O₅ and 1200 g K₂O/tree/year along with 50 g each of *Azospirillum* and phosphobacteria increased yield. Similarly in clove, 100 kg FYM, 400 g N, 350 g P₂O₅ and 1200 g K₂O/tree/year in combination with biofertilizer recorded higher yield in 15 year old trees.

The observation from drip irrigation studies with clove show that dripping 8.0 lit of water/day/tree recorded highest plant height and number of branches per plant.

Seed spices:

Experiments on response of coriander to date of sowing, row spacing and seed rates were concluded and ready for consideration for Transfer of Technology.

- i) Sowing coriander on 25th October at 30 cm row spacing produced maximum mean seed yield of 12.73 q/ha at Jobner.
- ii) The variety UD-20 gave maximum seed yield of 14.17 q/ha at the seed rate of 14 kg/ha.

The experiment on response of fenugreek to N, P and *Rhizobium* inoculation was also concluded at Jobner and recommendations are ready for transfer.

40 kg N/ha, 40 kg P₂O₅/ha recorded the maximum yield of 19.15 q/ha and 18.86 q/ha, respectively. Similarly inoculation of *Rhizobium* also recorded a significantly higher yield of 18.70 q/ha.

5. Recommendations/decisions

Black pepper:

Experiment at Panniyur is concluded and the findings are ready for consideration for transfer of technology.

The experiment at Sirsi may be continued. The stand of Karimalligessara is poor and therefore gap filling is necessary where ever revival of the previously planted vine is not possible.

The minimum stress period required for induction of flowering may be ensured in all the irrigation experiments on pepper.

Cardamom:

All the experiments will continue and observations will be recorded as per the technical programme.

Ginger:

In all the future fertilizers and irrigation trials in ginger, percentage of dryage and fibre content should also be estimated.

Tree Spices:

Drip irrigation project will continue.

Seed Spices

- i) Effect of stage of maturity on the oil content of coriander varieties may be studied.
- ii) Integrated nutrient management with components like biofertilizer organic manures etc on seed spices needed to be experimented.

Session-VI

Transfer of Technology

Chairman : Dr. G.K. Vasanthkumar

Rapporteurs : Mr. Hemant G. Hegde
: Dr.G.R. Choudhary

The Chairman expressed that since many of the spice crops are grown as an inter or mixed crops and the cultural practices adopted by farmers too differ from one agroclimatic region to another, the technologies must be developed regionwise. He stressed for greater coordination between development, financial and the other user agencies. He emphasized the need for training the Field worker so that the technology is adopted in a systematic manner or else the system could fail. In his remarks he suggested to adopt a two- pronged approach, viz., (i) one to tackle the immediate needs and the other to take care of long term problems. He also stressed the need for a thorough testing of the technologies developed in farmers' gardens before releasing for adoption. He also remarked that the Indian Institute of Spices Research take intensive on research on Chillies especially the Bydagi types grown in Karnataka which has been found quite suitable for oleoresin and colour extraction. He pointed out that research on end- products and development of value-added products must be taken.

Dr. G.V. Chelam, General Manager, NABARD pointed out the important role played by NABARD in promoting the cultivation of Horticulture crops with emphasis on spices. He stressed that the technologies developed must be such that it could be easily adopted by the farmers.

Later, detailed deliberations were conducted for recommending adoption of technologies by extension agencies.

Black pepper:

1. *Phytophthora* foot rot and nematode disease managment in black pepper

The disease can be managed by following all cultural practices, neem cake application (@ 1kg/vine), phorate 3G (@ 30g/vine), 1 per cent Bordeaux mixture spray (@31/vine) and drench (@ 51/vine) before onset of monsoon as first round (June). Akomin (0.4%) and Ridomil MZ-72 WP(100 PPM) as spray (@ 31/vine) and drench (@ 51/vine) separately as second (August) and third (September) rounds separately (Sirsi).

2. Biolölogical control of *Phytophthora* foot rot of black pepper

Antagonistic organisms like *Trichoderma viride* applied (@ 150gm/vine) along with 5kg of FYM to the basin of black pepper vine during June will reduce the *Phytophthora* foot rot of black pepper (Sirsi).

3. Chemical control of nursery diseases of black pepper.

Nursery diseases in black pepper like *Phytophthora* foot rot, anthracnose, basal wilt etc can be controlled by spraying and drenching with 1 per cent Bordeaux mixture at 15 days interval (Sirsi).

4. Irrigation in Black pepper:

Basin irrigation at IW/CPE ratio of 0.25 (100 litres of water once in 8-10 days) during Dec-May period for Karimunda which increased yield by 72.2% over "no irrigation". Dr. Peter pointed out that the Panniyur centre had recommended to provide a stress period to induce better flowerings. So the scientist was suggested to take up studies by providing the correct stress period before taking up final recommendation. Present recommendation can be only location specific and irrigation can be allowed only up to March (Panniyur).

5. Black pepper arecanut mixed cropping

Panniyur - 5 was suggested for cultivation as a mixed crop in arecanut gardens. The house felt that Panniyur-5 at the time of release was recommended as it had a characteristic of shade tolerance and hence the present study was considered as an added information to the existing finding (Panniyur).

Cardamom:

In proliferation of suckers in cardamom, growth regulators like Ethrel (250 PPM) and Cycocel (2000 PPM) under different spacings (0.3 x 0.9m; 0.6m x 0.9 and 0.9m x 0.9m) were tried at Mudigere centre. Growth regulators did not influence the sucker multiplication, whereas closer spacing of 0.3m x 0.9m gave higher number of planting units viz., 8.8 suckers/sqm which works out to 88,000/ha as compared to other spacings. So a closer spacing of 0.3m x 0.9m is recommended for proliferation of suckers. (Mudigere)

Clove

Biofertilizer for clove:

Application of 50g each of *Azospirillum* (10^{-6} CFU) and phosphobacteria (10^{-5} CFU) with 400 g N, 350g P_2O_5 and 1200 g K_2O /tree/year in two equal splits namely in May - June and October - November maximises the clove yield. The recommended dose of biofertilizer are to be applied one month before the application of NPK when there is sufficient moisture (Yercaud).

Nutmeg

1. Apply 50 gm each of *Azospirillum* (10^{-6} CFU) and phosphobacteria (10^{-5} CFU) with 400 g N, 350g P_2O_5 and 1200 g K_2O /tree/year in two equal splits namely in May - June and October - November to maximise the nutmeg yield. The recommended dose of

biofertilizers is to be applied one month before the application of NPK when there is sufficient soil moisture. The scientist was asked to give the method of application (Yercaud).

2. Rejuvenation of poor yielding and male plants into productive ones by grafting was a well known method. The house suggested that the information may be used at the local level as the added information. (Dapoli)

Turmeric

1. Turmeric cultivar PTS-19 recorded significantly higher fresh rhizome yield (20.85t/ha) with 20% dry recovery, 5.60% curcumin and resistance to leaf blotch and rhizome rot, it will be proposed for release in the name of Sonali (Pottangi).
2. Mango ginger cultivar CAM-3 with fresh rhizome yield of 30 t/ha will be proposed for release in the name of AMBA which will be the first cultivar in mango ginger for India. Mostly used as pickles and chutney in fresh and dry powdered condition (Pottangi)

Cumin

Twelve years' experimental finding revealed that three years' crop rotation i.e., cluster bean - cumin - cluster bean - wheat - cluster bean - mustard recorded the highest cumin yield of 257.59 Q/ha and the wilt disease incidence percentage of 36.46 per cent as against 61.00 Kg/ha and 81.50 per cent respectively under the one year crop rotation with cluster bean. A three years' crop rotation i.e., cluster bean - cumin - cluster bean - wheat - cluster bean - mustard may be recommended for cumin cultivation to obtain higher yield and to reduce the wilt incidence (Jobner).

Dr.R.K.Sharma gave an elaborate methodology for the production of genetically pure seed spices. The centre produced breeder seeds of coriander, fennel, cumin and fenugreek using the improved technology

Coriander

1. Variety Hisar Anand of coriander has been recommended for cultivation (Hisar)
2. Sowing of coriander crop from 25th October to 4th November at 30 cm row spacing may be recommended for general adoption (Jobner).
3. A seed rate of 14 - 16 Kg/ha for coriander variety RCr-41 and UD 20 (RCr-20) and 12Kg/ha for UD-436 (RCr-436) may be recommended for general adoption (Jobner)
4. Biocontrol of wilt in coriander - seed treatment in the *Trichoderma viride* 1(talc formulation) with CFU 10^{-6} at 4g/kg recorded the lowest wilt incidence of 5.3 percent compared to control (28.3%). Further the seed treatment produced maximum of yield of 387.5 kg/ha which is 139 percent more than control. The cost benefit ratio is also high in the treatment (1:17) as compared to other treatments (Coimbatore)

Fennel

- 1 For Haryana situation, HF-33 of fennel has been recommended for cultivation. Time of sowing in fennel HF -33, first fortnight of October and PF-35 - third week of October at 30 x 20 cm spacing. (Jobner)
- 2 Weed control in Fennel: ***Pendimethalin*** @ 1.0 kg/ha pre-emergance + one hand weeding at 50 DAS was effective to control weed in fennel in Haryana (Hisar).
- 3 The above recommendations were accepted after reaction from the participants about its residual effect and ensuring minimum time lag between application of weedicides and harvest (Hisar)

Fenugreek

1. ***Hisar Sonali*** of fenugreek has been recommended for cultivation. Time of sowing in fenugreek CV-Hisar Sonali - 1st week of November at a spacing of 30 x 10cm was accepted for seed production (Hisar).
2. Biocontrol of root rot in fenugreek - Seed treatment with ***T.viride*** (Talc formulation with CFU 10^{-6} at 4g/kg followed by soil application of neem cake 150 kg/ha recorded lowest root rot incidence of 4.9% followed by soil application of ***T.viride*** (500g mixed with FYM) plus soil application of neem cake (6.0%) . The yield was also the highest in the seed treatment with ***T.viride*** plus soil application of neem cake followed by seed treatment with ***T.viride***. However the cost benefit ratio was higher in the seed treatment of ***T.viride*** which showed 1:41.8 (Coimbatore)
3. Application of 40Kg N and 40Kg P₂O₅/ha and seed treatment with ***Rhizoctonia meliloti*** in fenugreek is recommended for general adoption (Jobner)

Conclusion/remarks :

Despite several findings of importance, there is a large gap between the average and potential yields. Hence many recommendations could come as a package in the integrated management. Coordinated trials with different specialists in various fields is required. Work on dreaded diseases like katte of cardamom, soft rot of ginger, foot rot of pepper require more attention. Crops like Vanilla should be included for trials in potential states.

TECHNICAL SESSION VII : VARIETY RELEASE

Chairman : Dr. B.S. Dhankar
Co-Chairman : Dr. R.D. Singh
Rapporteurs : Dr. K.K. Thakral
Dr. A. Manohar Rao

The following proposals were submitted for consideration during the Session.

- a) For release of varieties :
 - 1) Turmeric ... 2 (by Pottangi Centre)
 - 2) Cardamom ... 1 (by ICRI Thadiyankudissai Centre)
 - 3) Fennel ... 2 (by Jagudan & Jobner Centres)
- b) For identification purposes :
 - 1) Fenugreek ... 4 (by Hisar and Jobner Centres)
 - 2) Coriander ... 1 (by Jobner Centre)

The Chairman in his opening remarks touched upon the fact that the over all productivity of Spices in India is generally lower than some of the developing countries particularly in the case of pepper, cardamom, ginger and turmeric. He highlighted the examples of Malaysia, Brazil, Guatemala and China. In order to break the yield barrier, he emphasized the need to introduce new/exotic material from the countries reporting higher productivity levels. This is especially true in the case of even seed spices viz., cumin, coriander, fennel and fenugreek. It will be also necessary to test and utilise in our breeding programmes, the potential of such materials. Therefore there is a need to conduct an extensive survey of the traditionally spices growing areas and enable making better selections for our future use. He also stated that to exploit the full genetic potential of the existing/new cultivars, emphasis should be given to standardise the high production technologies for the important spices.

Dr. R.D. Singh, who co-chaired the Session also highlighted the need for strict application of the "standards" when proposing varieties for release etc. The proposals received from the various centres were then presented by the concerned Scientist(s) followed by a detailed discussion. The outcome of the discussions are summarised below:

- (1) Fennel .. JF-29 .. This proposal was made by the Jagudan Centre and the important feature of the proposed variety is that the seeds are of medium bold size with a volatile oil content of 2.4%. The selection will give a seed yield of 19.4 Q/ha and has registered 12.53% increased yield over the 'control' viz., Gujarat Fennel-1. The package of practices have also been presented by the Centre. The proposal was provisionally approved subject to the condition that the same will be re-submitted in the prescribed proforma within ten days to the Project Coordinator for further recommendation.
- (2) Fennel .. UF-125 .. This selection has been developed through recurrent selection based on individual plant progeny (half-sib) from EC-243380, an Italian entry. The proposal was presented by the Jobner centre with the sole purpose of identifying this advance selection for further testing in Sirahi, Tonk, Ajmer and Jodhpur areas of Rajasthan. This selection belongs to the early maturity group, has no incidence of leaf spots due to Alternaria and Ramularia, and has a short stature with compact umbels and long & bold grains. This selection has 1.9% volatile oil and has higher yield than any other variety grown in Rajasthan. The relevant package of practices have also been presented. The proposal was considered and the selection UF-125 identified for further testing in the notified areas.
- (3) FENUGREEK .. UM-143 .. The proposal was presented by the Jobner Centre and this variety is developed through recurrent selection based on an individual pure line

selection from a local collection of Jodhpur. The grains are bold, of typical yellow colour with 1000 grain weight ranging from 11.2 to 13.6g. It is found to be superior in yield over the check (RMT-1) in the trials at Jobner. Station/adaptive trials conducted at Jodhpur, Ajmer, Banswara and Chittor during 1989-96 have revealed that UM-143 gives a mean yield of 16.57 Q/ha compared to 12.17 Q/ha from RMT-1; an average yield increase of "+36.15%" has been observed over the check. Incidence of powdery mildew is less in this selection. Relevant package of practices have also been developed for this proposed variety. This variety has been identified for testing in the locations mentioned in Rajasthan.

- (4) FENUGREEK .. HM-103 .. Proposed by the Hisar Centre, this variety is a pure line selection from local germplasm of Haryana; the seeds are medium bold in size, yellow in colour with 1000 seeds weight of 13-15g. It is also resistant to Cercospora leaf spot and moderately resistant to powdery mildew. An average yield of 20.1 Q/ha was realised, and this is 10.4% more than the check viz., Pusa Early Bunching. This variety was also found to be resistant to the leaf spot in Dholi, Bihar. It is identified for further evaluation in Haryana.
- (5)&(6) FENUGREEK .. HM-346 and HM-350 .. These two selections were presented by the Hisar Centre but they were not tested under the Coordinated Project nor more than one Centre was involved in its testing. The proposals are deferred for want of data on multilocation testing.
- (7) CORIANDER .. UD-446 .. The proposal received from Jobner Centre is from a local collection in Jaipur district; it has compact umbels and earliness as the special characters. The seeds are of medium size with a volatile oil content of 0.33%. There is a need to develop a distinct variety for the irrigated areas under coriander

viz., Kota district of Rajasthan. The variety has been tested for this specific situation and has given a seed yield of 16.04 Q/ha as against the check variety (RCr-41) which gave 11.26 Q and the local variety giving only 9.88 Q. The increase in yield over the local variety is 62.35% and over released variety *viz.*, RCr-41 being 42.45%. It also comes to flowering at least 15 days earlier than the local variety. The package of practices have also been made available. The proposal to identify this variety for further testing in Kota is approved.

- (8) CARDAMOM .. ICRI-4 .. The Indian Cardamom Research Institute (Spices Board) proposed a variety that will be suitable to the Lower Pulneys in Tamil Nadu. ICRI-4 (TDK-4) is proposed by the ICRI Regional Station, Thadiyankudissai and has been tested for over six years for the various characters. Multilocation trials have also been conducted in three locations during 1995-97 and the pooled analysis show that the selection TDK-4 gives about 75% higher yield than the local check. Under rainfed situation, it gives 455 kg capsules/ha and under irrigated situation it gives 648 kg/ha. This variety is a Malabar type, prostrate in habit, has medium long green colour panicles, capsules globose and bold; 57% gets retained on 7mm sieve. It is adapted to low rainfall areas *ie.*, up to 1500 mm. An average of 19 seeds per capsule and 35 tillers per clump are important features. The Centre has already distributed 180 kg of seed capsules and 23,000 seedlings to the progressive farmers during the past three years. The proposal has been appreciated by the participants of the Workshop and after its critical examination, it has been recommended for release as a variety for the Lower Pulneys. Incidentally, the Thadiyankudissai Centre is a Voluntary Centre under the AICRP on Spices.

- (9) TURMERIC .. (CAM-3) Curcuma amada sp. under the "Turmeric Group" is however a mango-ginger accession. This accession was selected from Chintapalli forests in Andhra Pradesh by clonal selection and developed at the Pottangi Centre. This mango-ginger variety has an essential oil of 0.8%, oleoresin - 6.4%, dry recovery - 18.7% and curcumin-0.1%. This has been found acceptable as a table purpose and pickle purpose variety for use in the industry. The rhizomes have mango flavour but ginger in taste. It has been found useful for preparation of salad, chutney, pickles, etc. and is a good flavouring agent for special preparations like Pulav and lemon rice. There has been a specific demand from the industry for a high yielding mango-ginger variety and this meets the same. Yield trials have been conducted for five years and it gives a mean yield of about 10 tonnes/ha. Under multilocation testing at four locations in Orissa, it has yielded about 13 tonnes/ha. The variety is resistant to rhizome rot, leaf blotch, shoot borer and scale insects. It has been found acceptable to the hills and plain lands of Orissa and Andhra Pradesh in the eastern ghat zone. The package of practices has already been prepared by the Pottangi Centre of the OUAT. The first ever mango-ginger variety viz., Amba (Selection No.CAM-3) is recommended for release in Orissa.
- (10) TURMERIC .. PTS-19 .. This accession was proposed by the Pottangi Centre, but there are certain variations in the data presented Vs. the already published data on the subject. In view of the anomaly, the proposal was deferred. It may however be re-submitted after necessary review.

The Chairman concluded the Session with the following remarks.

- 1. The CVTs must be conducted with adequate comparison from national check, local check besides a latest released variety of the Centre.*
- 2. For proposals on release or identification of varieties, those not tested under the coordinated programmes may not be presented in the Workshop/Group Meeting.*
- 3. In future, the proposals for identification/release of the variety may be submitted 15 days before the dates of the Workshop to the Project Coordinator so that he could organise a preliminary screening of the proposals by constituting a Committee.*

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PLENARY SESSION

Chairman : Dr. B.R. Hegde
Co-Chairman : Mr. N. Vasudevan, IAS
Rapporteur : Dr. S. Edison

The Plenary Session was held on the evening of 10th July 1997 under the Chairmanship of Dr. B.R. Hegde, Director of Research, UAS, Bangalore; Mr. N. Vasudevan, IAS, Director of Horticulture, Govt. of Tamil Nadu co-chaired the Session. The Chairman, in his introductory remarks complimented the Project Scientists and the Project Coordinator for the detailed exercise done during the last three days of the Spices Workshop at Bangalore and in particular, congratulated the Scientists from 20-odd Coordinating and 8 Voluntary Centres from all over India who have brought Exhibits for the benefit of the participating Scientists, Progressive Farmers, Development Officials, etc. Dr. Hegde mentioned that a special emphasis may be given for the use of environment-friendly pesticides as well as biocontrol agents in the management of pests and diseases. He specifically cautioned about the export-oriented nature of the high value spices and requested that this aspect will be given new consideration. He also expressed his anxiety about the "import" of tree spices and the consequent loss in foreign exchange.

The Co-Chairman Mr. N. Vasudevan mentioned that the Lab-to-Land Programme of the ICAR could be made more cohesive with the active support, understanding and co-operation with the Development Departments, with particular reference to Spices. He was also skeptical that the awareness of the new package of practices or recommendations on transfer of technologies are not easily known to the Horticulturists and perhaps certain amount of re-orientation needs to be given to this group of Officials. He also mentioned about the severity in post harvest losses, taking a toll of above 30% and thereby reducing the

productivity as well as result in avoidable losses. Even the aspects on farm mechanisation are not up to the mark in Horticultural crops, unlike Agricultural. Later, the Chairman appreciated the effective participation from the different Horticultural Input Agencies as well as Development Departments and Industry in particular, in the deliberations of the Spices Workshop. He also expressed a concern that some of the Centres like Gangtok and Dholi could not be represented in the Workshop and the Project Coordinator was advised to take necessary steps to involve their active participation in the Project activities.

The Chairmen of various Technical Sessions presented their reports in the following order.

- | | | |
|------|---|--|
| I. | Collection, evaluation & conservation
of germplasm | - Dr. B.N. Korla*
(*for Dr.M.Kasim) |
| II. | Crop improvement, Physiology and
Biochemistry | - Dr. R.K. Sharma |
| III. | Plant Pathology and Entomology | - Dr. Y.R. Sarma |
| IV. | Agronomy & Soil Science | - Dr. S.N. Potty |
| V. | Transfer of Technology | - Dr. G.K. Vasanthkumar |
| VI. | Variety Release | - Dr. B.S. Dhankar |

The presentations by the Chairmen were discussed and approved after making finer modifications/corrections wherever necessary.

An important aspect of this Workshop has been the recommendation for release / identification of the following varieties.

Sl. No.	Centre	Crop	Culture No.	Remarks
1.	Jagudan	Fennel	JF-29 / Guj.Fennel-2	Recommended for release in Gujarat
2.	Thadiyankudissai	Cardamom	TDK-4 / ICRI-4	Recommended for Lower Pulneys in Tamil Nadu
3.	Pottangi	Turmeric (Mango-ginger)	CAM-3/Amba	Recommended for Orissa
4.	Jobner	Fennel	UF-125	Identified for further testing in the notified areas
5.	Jobner	Fenugreek	UM-143	Identified for testing in Jodhpur, Admer, Banswara and Chittor in Rajasthan
6.	Hisar	Fenugreek	HM-103	Identified for further evaluation in Haryana; Resistant to leaf spot in Dholi, Bihar
7.	Jobner	Coriander	UD-446	Identified for further testing in irrigated areas in Kota

Proposals of one turmeric accession (PTS-19) from Pottangi and two Fenugreek accessions (HM-346 and HM-350) from Hisar were however deferred due to some weaknesses in the proposal.

In addition to the above, several recommendations on transfer of technology have been made based on the detailed discussions on crops like black pepper, clove, nutmeg, cardamom and seed spices. An interesting feature of the Bangalore Workshop has been that the Session on Transfer of Technology was held in a very detailed manner, taking almost 4-5 hours so that the various criticisms arising out of our recommendations were discussed in depth. An important concern expressed by the participants was the possibility of residues in the final produce of spices. The recommendations are however incorporated in the concerned Technical Sessions.

As a special activity, the Workshop also organised presentation of special lectures on two most important themes, viz., Biotechnology in Spices and Biocontrol of Spices pests and diseases. The copies of the papers are arranged in this document for the use of the delegates. The Workshop also took the opportunity to have detailed notes and discussion on three major production constraints in spices production by experts on the field as per list below.

1. Phytophthora foot rot disease of black pepper - Dr. Y.R. Sarma
2. Rhizome rot of ginger & turmeric - Dr. N.P. Dohroo
3. Cumin wilt - Mr. M.P. Jain

The discussions also concentrated on development of suitable/modified technical programmes on integrated disease management, discussed in depth during the concerned technical session.

The Chairman in his summarising remarks, complimented the Project Scientists to have deliberated the subject in a very systematic fashion and congratulated the ICAR authorities for having successfully conducted the Workshop at Bangalore.

The Proceedings of the XIV Workshop / National Group Meeting of the AICRP on Spices came to a close at 1830 hrs with a vote of thanks proposed by Dr.S.Edison.

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BIOTECHNOLOGICAL APPROACHES FOR CROP IMPROVEMENT IN SPICES

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Micropropagation

Biotechnology with its unlimited potential especially as a tool for achieving things impossible *in vivo*, is fast gaining importance, especially in agriculture. So is the case with spice crops. The advances made in spices biotechnology are presented below.

Tissue culture protocols, for rapid clonal propagation and production of disease free planting material, are available for over 35 major and herbal spices. They are black pepper, cardamom, ginger, turmeric, kasturi turmeric, mango ginger, tamarind, curry leaf, celery, anise, dill, fennel, cumin, peppermint, spearmint, oregano, marjoram, thyme, *Ocimum* spp, patchouli, *Eryngium* sp, *Acorus*, vetiver etc. Of these, only cardamom, black pepper and vanilla are being produced commercially using *in vitro* techniques.

Plant regeneration from callus for creating variability

Protocols for plant regeneration from callus cultures are also available in black pepper, cardamom, ginger, turmeric, cinnamon, vanilla, fennel, anise, *capsicum*, anise, saffron etc. In black pepper, ginger and cardamom a large number of somaclones are produced to isolate useful genotypes with resistance to *Phytophthora* foot rot, soft rot and viral diseases respectively.

Planting out

Large scale demonstration of efficacy of tissue cultured plantlets in comparison to conventional planting material is conducted by Spices Board and Department of Biotechnology. Tissue cultured plants were found to be superior. Similar field evaluation trials are in progress in black pepper and ginger.

Synthetic seeds

Synthetic seeds, by encapsulation of shoot buds, somatic embryos, callus etc, were found to be good source for conservation and exchange of disease free germplasm, in addition to their utilisation as propagules. Synthetic seed technology is available in black pepper, cardamom, ginger, turmeric, vanilla, cinnamon, camphor, anise, lavender etc.

***In vitro* pollination and embryo rescue**

In vitro culture was used for *in vitro* pollination and development of fruit seed and subsequently plantlets in ginger which otherwise does not set fruit in nature. This gives new dimensions to the crop breeding programmes in ginger as it brings new variability into the population.

Micro tubers and Micro rhizomes

Formation of micro rhizomes and micro tubers can be induced *in vitro* in ginger and turmeric. This could be used as a disease free planting materials for germplasm exchange as in the case of micro tubers of potato.

***In vitro* conservation**

In vitro conservation augments the conventional *in situ* and *ex situ* genebanks, in that, accessions could be conserved aseptically, irrespective of the agroclimatic conditions in which they grow, in one place, that too with minimum labour and maximum safety from endemic diseases and pests. Spices *in vitro* genebanks are established at IISR and NBPGRI with over 400 accessions stored in *in vitro* repository.

***In vitro* selection for resistance to biotic and abiotic stresses**

Successful isolation of *Pythium* tolerant turmeric types, using *in vitro* methods was reported by National Chemical Laboratory, Pune. *In vitro* selection for disease resistance for *Phytophthora* in black pepper, *Pythium aphanidermatum* and *Pseudomonas solanacearum* in ginger are in progress at IISR and Kerala Agriculture University.

Exploiting cell culture system for production of flavours and flavour components

Plant cells produce a range of biochemicals which are difficult to synthesize chemically and this has application in pharmaceutical, food and other industries. Ever since the successful production of shikoniin on industrial scale from cell cultures of *Lithospermum*, many researchers have realised spices are ideal group of crop for similar exploitation. Industrial scale production of Vanillin from *Vanilla planifolia* is also reported. Production of volatiles were reported from *in vitro* cultures of *Mentha* spp., lavender, *Ocimum*, anise, celery etc. There were also reports of production and multiplication of stigma like growth in saffron and mace in nutmeg, through *in vitro* cultures.

Protoplast culture

Somatic cell hybridisation techniques are approaches by which useful genes can be brought into cultivated types from distant species. Isolation of protoplast is a pre-requisite for somatic cell hybridisation. Protoplasts were successfully isolated from black pepper, *Piper colubrinum*, ginger, cardamom and vanilla at IISR.

Gene transfer and production of transgenics

Agrobacterium mediated transformation is one of the most successful gene transfer mechanisms available in dicots. Preliminary studies on Kanamycin sensitivity assay and *Agrobacterium* mediated gene transfer using marker genes, are in progress.

Molecular characterisation using RAPD markers

Random Amplified Polymorphic DNA is one of the efficient mechanism by which germplasm can be characterised easily and efficiently. Preliminary studies on characterisation of black pepper and ginger germplasm are in progress. Marker aided (RAPD) studies for screening micropropagated plants of *Piper* species were reported from M.S. Swaminathan Research Foundation.

Future thrusts

Efforts have to be initiated in developing transgenics in black pepper and ginger by incorporating genes for fungicidal or antifungal proteins for developing genotypes resistant to the serious fungal diseases. Developing transgenics in cardamom by the incorporation of coat protein genes from the Katte virus is an attractive solution to control Katte disease. Isolation of gene for resistance from *Piper colubrinum* and their incorporation into black pepper is again a priority area. Bioprocessing has come to stay and *in vitro* production of spice flavours and oils is going to be of importance in the coming years.

STATUS OF BIOCONTROL TOWARDS DISEASE AND PEST MANAGEMENT IN SPICE CROPS

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Biocontrol becomes an important component of Integrated Pest and Disease Management (IPM/ IDMI) Being eco-friendly it becomes all the more relevant in spice crops which are export oriented. Zero pesticide level in the spice produce is the demand from industry and public. Biocontrol becomes relevant in pest and disease management of spice crops due to following reasons

- 1 Produce should be free from pesticide residues
- 2 Diseases are soil borne and poor targetability of the pathogens to agro chemicals
- 3 Leaching losses of agro-chemicals applied due to heavy rain fall
- 4 Non-availability of high degree of host resistance to major pests and diseases
- 5 Wet and humid condition that prevail are congenial for the multiplication and stabilization of biocontrol agents

Phytophthora foot rot and slow decline in black pepper, capsule rot and clump rot in cardamom, rhizome rot of ginger are some of the disease where biocontrol programmes undertaken so far showed promise and potential. Effective biocontrol agents (parasites, predators/ pathogens) have been identified for scale insects in black pepper, root grubs in cardamom and shoot borer in ginger.

The Biocontrol agents: For disease management in black pepper, cardamom and ginger organism (fungi and bacteria) were isolated from the rhizosphere. They were tested against the target pathogens viz *Phytophthora capsici*, *Pythium aphanidermatum*, *P. vexans*, *Rhizoctonia solani*, *Radopholus similis* and *Meloidogyne incognita*. Among the biocontrol agents obtained *Trichoderma* spp, *Gliocladium virens*, fluorescent pseudomonads, *Glomus fasciculatum* (VAM) were found highly promising and are used in the disease management both in the field and in nursery management.

Production of inoculum *Trichoderma* and *Gliocladium*: At present the efficient isolates are being multiplied on sorghum meal or coffee husk/ pulp in polypropylene bags. Good growth and sporulation are obtained within 10 days after inoculation. Coconut water mixed with coffee husk also did support good growth and sporulation.

VAM (*Glomus fasciculatum*): The efficient isolates are multiplied on live sorghum roots. Solarized nursery mixture is filled up in 12" pot and base inoculum consisting of root bits and soil with VAM spores is mixed. Surface sterilized sorghums seeds are sown. When the sorghum produces cobs they are cut off to the base. The root mass is cut into bits. This soil and root bits form the inoculum for use.

Nursery management in black pepper and cardamom

Target pathogens

BLACK PEPPER

Phytophthora capsici

Radopholus similis

Meloidogyne incognita

CARDAMOM

Pythium vexans

Rhizoctonia solani

Meloidogyne incognita

Biocontrol agents used: *Trichoderma harzianum*

Gliocladium virens

Glomus fasciculatum

Healthy nursery stock becomes most important since root infection at nursery stage gets carried on to the main field when planted and would become the main source of infection and subsequent spread. Since soil sterilization and fumigation are costly, soil solarization of nursery mixture becomes handy. Fortification of solarized nursery mixture with inoculum of VAM (*Glomus fasciculatum*) and *T. harzianum* and *G. virens* have given excellent results in black pepper and cardamom nurseries, ensuring robust and disease free seedlings. The recovery of plantable seedlings in treated cardamom nurseries was high as 85-90%. *Trichoderma* *Gliocladium* inoculum is @1g/kg and VAM inoculum @100 ml/2kg of nursery mixture, is mixed. This is used for raising rooted cutting.

FIELD APPLICATION:

Black pepper: During May- June period when the soil is moist *Trichoderma* *Gliocladium* inoculum is directly applied @ 50g/ vine. Often this is mixed with 3-5 kgs of FYM or 1 kg of neem cake and applied around the base of the vine and earthed up.

Cardamom: Similar procedure is used for clump rot and capsule rot of cardamom. Neem cake is used @ 500g/ plant. In biocontrol applied plot, the capsule rot reduction is either superior or on par to that of Bordeaux mixture treatment thus providing good protection.

Clump rot of cardamom caused by *Pythium vexans*, *Rhizoctonia solani* complex and *Meloidogyne incognita* were effectively controlled with *Trichoderma harzianum* and *Puccinomyces lilacinus*.

Ginger: Soft rot caused by *P. aphanidermatum* in Kerala, *P. myriophyllum* - *Fusarium solani* complex in Rajasthan and wilt caused by *Fusarium oxysporum* in Himachal Pradesh were effectively controlled by *Trichoderma harzianum*, *T. hamatum* and *G. virens*. These were effective both as a seed treatment and as well as soil application along with organic base either FYM or neem cake at the time of planting.

Bio-control was more effective when combined with soil solarization of the beds prior to planting as reflected by reduced disease incidence, *Pythium* population and weed growth and increased yields.

Incidentally *Trichoderma* and *Gliocladium* were found compatible with metalaxyl and potassium phosphonate and would be of greater potential in Integrated Disease Management (IDM).

Role of vesicular arbuscular mycorrhizae (VAM) on infection in black pepper:

Root rot of black pepper caused by *P. capsici* and *R. similis* and *M. incognita* is severe when these pathogens infect together compared to their individual effects.

G. fasciculatum (VAM) could induce abundant root production and shoot growth in black pepper. It also could suppress infection caused by *P. capsici*, *R. similis* and *M. incognita* individually as well as in combined infection. Abundant root growth and consequent increased nutrient uptake and altered host physiology might be the reasons for this disease suppression. The same effects were reflected in a field trial in reducing the disease incidence when the VAM treated plants were planted followed by VAM inoculum application once during May-June period for three years.

Locally available low cost material like coffee husk, coir dust, saw dust and tapioca refuse etc. should be effectively utilized for the multiplication of biocontrol agents. However, fermentation technology would be ideal for large scale inoculum production.

Further, improvement in bio efficacy of these organisms and their compatibility with agrochemicals through biotechnological approach is imperative as a long range strategy.

BIO-CONTROL OF PESTS

BLACK PEPPER: Pollu beetle (*Longitarsus nigripennis*), scale insects (*Aspidiotus destructor*, *Lepidosaphes piperis*) in black pepper and shoot borer of ginger and cardamom (*Conogethes punctiferalis*) and root grub (*Basilepta fulvicorne*) are serious pests affecting the crops.

Although several natural enemies have been recorded, some are highly promising in pest suppression. Besides natural products, like neem formulations were equally effective. *Beauveria bassiana* was found to infect pollu beetle in black pepper but needs further testing for its field application. However, neem gold (0.6%) application (3 sprays) was more effective in reducing pollu beetle damage.

Chilocorus circumdatus and *C. nigrita* coccinellids were effective in suppressing the scale insects. Mass rearing techniques of these predators have been standardized. Initial indications in pest suppression in the field are promising. Similarly the fish oil rosin and neem oil were also effective on checking the scale insects under green house condition and need field evaluation.

CARDAMOM: *Metarrhizium anisopliae*, *Beauveria bassiana*, the fungi and *Heterorhabditus* the entomogenous nematode were found infecting the root grub under field condition and the efficacy of the former in root grub suppression was established.

GINGER: Commercial formulation of *Bacillus thuringiensis*, the dipel 0.3% with 4 sprays could effectively suppress the shoot borer infestation in ginger.

Although several natural enemies have been recorded on pests of spice crops, their amenability for mass rearing and field efficacy need to be established. The prevailing environmental condition like high RH and low temperature appear more promising in plantations for their survival and multiplication.

Quality standards of biopesticides: It is important that quality parameters like shelf life and their population levels in commercial formulation, are maintained, which at present are lacking. These need to be standardized and implemented to establish the creditability of these formulations, to create a greater confidence in the farming community in this developing technology.

Biocontrol being eco-friendly and environmentally safe, it becomes an important component in the development of Integrated Disease and Pest Management (IPM/IDM) and its potential in spice crop pest and disease management are obvious.

Guidelines for quarantine of diseases and pests in spice crops

Many important diseases causing fungi, plant parasitic nematodes and insect pests spread passively through planting materials particularly in crops like black pepper, cardamom, ginger, turmeric etc., which are vegetatively propagated. Strict quarantine measures are to be adopted during exchange of germplasm and distribution of planting materials.

1. General

- a) A nursery code and certification procedures may be formulated
- b) Incinerator facility may be provided at each centre for the destruction of infected materials.

2. Exchange of germplasm

- a) Only certified materials free from pathogens, insects and nematodes should alone be exchanged.
- b) As far as possible, avoid carrying soil along with the planting materials
- c) The exchanged materials on receipt should be examined by the competent Plant Protection personnel for the presence of pests and pathogens if any.
- d) In case the materials are infested with pests and pathogens adequate control measures are to be undertaken prior to their maintenance.
- e) Some pathogens are specific to certain areas e.g in soft rot of ginger, *Fusarium* is the major pathogen in north and *Pythium* in the south. When diseased samples are taken for experiments, proper care has to be taken to destroy the plant material after isolating the organism to prevent inadvertent introduction of pathogens.
- f) The introduced materials should be kept in a quarantine chamber for the possible development of diseases and pests, if any and only the materials absolutely free from pests and pathogens should be planted in the field.

3). Distribution of planting materials

- a) The nursery soil and the area should be fumigated with Methyl Bromide before setting up the nursery. This should be repeated once in 3-4 years. An alternate site should always be maintained for the nursery. The same site should not be used for nursery for many years.
- b) Planting materials should be checked for the incidence of pests and pathogens at frequent intervals (preferably on a monthly basis) by the subject matter specialists.
- c) Timely application of pesticides should be undertaken to prevent the build up of pests and pathogens in case the materials are infested.
- d) Prior to distribution, the planting materials should be ensured free from diseases and pests.

The suggested pesticides for the control of pests and pathogens are given in annexure.

Suggested pesticides for the control of diseases and pests

1. Soil fumigation - Methyl Bromide @ 500 g/cft soil.

2. Diseases

Black pepper

Phytophthora blight in the nursery : Metalaxyl 200 ppm (Ridomil mancozeb) spray and soil drench. Alternatively, copper oxychloride (0.2%) drenching and spraying the foliage with Bordeaux mixture (1%) or incorporating biocontrol agents in the nursery mixture, such as *Trichoderma harzianum*, *Gliocladium virens* @ 1g/bag (size 15 X 25 cm). Runner shoots/unrooted cuttings should be washed to remove all adhering soil particles and dipped in any fungicide such as copper oxychloride (0.2%) solution before planting in polybags.

Ginger and Turmeric

Obtain seed rhizomes from disease free area. Dip the seed rhizomes in mancozeb 0.3% or Metalaxyl 500 ppm (Ridomil mancozeb) for 30 mts, dry in shade.

Cardamom

To prevent rhizome rot, remove the soil particles and trim the old roots from suckers and treat with copper oxychloride (0.2%). In the nursery to prevent pre and post emergence damping off apply biocontrol agents in the nursery beds.

3. Plant Parasitic nematodes

Black pepper

Phorate 10G @ 1-2g/bag in the nursery.

Phorate 10G @ 3g a.i/vine in the field

Cardamom

Phorate or carbofuran @ 1g a.i/m² after germination and three months thereafter.

Phorate @ 2.5 g a.i/clump in the field.

Ginger & Turmeric

Hot water treatment of seed rhizomes at 55°C for 10 minutes

4. Insect pests

Black pepper

Scale insects ; mealy bugs (on stems/leaves): Spray monocrotophos 0.1% or dimethoate 0.1%;
destroy severely infested plants

Mealybugs (on roots) : Drench monocrotophos 0.075% or dimethoate 0.075%.

Leaf gall thrips, gall midges : Spray monocrotophos 0.05% or dimethoate 0.05%.

Leaf feeding caterpillars : Spray quinalphos 0.05%

Cardamom

Shoot borer : Spray monocrotophos 0.075% or fenthion 0.075%

Root grubs : Apply phorate 10G or chlorpyrifos 0.05%

Shoot fly : Destroy affected shoots and spray dimethoate 0.05% or methyl parathion 0.05%

Ginger & Turmeric

Rhizome scale : Soak seed rhizomes in quinalphos 0.1% for 5 min. prior to storage and sowing

Cinnamon

Leaf miner : Spray monocrotophos 0.05%

Leaf feeding caterpillars: Spray quinalphos 0.05%

Clove and Nutmeg

Scale insects ; mealy bugs: Spray monocrotophos 0.05% or dimethoate 0.05%

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