ALL INDIA CO-ORDINATED SPICES AND CASHEWNUT IMPROVEMENT PROJECT

PROCEEDINGS OF THE SIXTH WORKSHOP

HELD AT
CPCRI REGIONAL STATION, CALICUT
ON
NOVEMBER 10–13, 1983

Project Co-ordinator
M. C. NAMBIAR

ICAR

CENTRAL PLANTATION CROPS RESEARCH INSTITUTE
(INDIAN COUNCIL OF AGRICULTURAL RESEARCH)
KASARAGOD–670 124
KERALA

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INAUGURAL SESSION

The Inaugural Session of the Sixth Workshop of All India Coordinated Spices and Cashewnut Improvement Project was held on 10th November 1983 at 10.30 am. at Central Plantation Crops Research Institute, Regional Station, Calicut. Shri E.V.Nelliat, Head Division of Agronomy, CPCRI, Kasaragod welcomed the Guests, Invitees, Scientists from participating centres and Universities, Officers from State Departments of Agriculture/Horticulture, Corporation and other participants. Dr.K.V.Ahamed Bavappa, Director, Central Plantation Crops Research Institute presided over the inaugural session. In his presidential address, Dr.Bavappa highlighted the following aspects of Cashew and Spices Production, research and developmental aspect.

Though the processing capacity of the factories in this country is about 4.5 lakh tonnes of cashew, the production is only about 1,85,000 tonnes per annum leaving a gap of more than 50% to meet the processing requirements of factories.

Though we used to import cashew to supplement our internal production in the past, the import figures for the last year shows a steep fall and virtually we are facing a crisis in cashew industry.

Though the average yield of cashew is only about ½ kg per tree per year, we have developed varieties such as M 44/3 with very high yield potential and some of the hybrids like H-19 have the yield capacity of 24 kg per tree/year by seventh year of orchard life. This indicates that we have got the varieties as well as technology to increase the yield of cashew many more times and there should not be any difficulty in achieving self-sufficiency in cashew production to meet the demands of the processing

units. The programme of this workshop should be to give a new direction in production technology of cashew so that more participation in terms of transfer of technology is stressed and ensured.

Dr.Bavappa noted that the situation in the other important crop with respect to foreign exchange earning capacity, namely, pepper is still worse in spite of the fact that we have the scientific know-how to increase production as well as the productivity by many fold. The average yield of pepper in this country at present is only 266 kg per ha which is less than one-tenth of the productivity realised in Malaysia. The country has varieties like Panniyur-I, the hybrid pepper and karimunda which are suitable for monocropping system, and the mixed cropping system respectively, and with very high yield potential. However, the devastating disease of pepper namely, quick-wilt takes a heavy toll of vines in plantations and on the research side our efforts should be to intensify work on quick-wilt disease on pepper and to breed resistant varieties as well as to evolve control measures against the disease.

Cardamom which earns a foreign exchange of more than Rs.240 million annually, the production has suffered during the current season due to drought. It is generally agreed that the production for the next two or three years are likely to be only about 60% of the realised yield in 1982-83. This is likely to result in a crisis as far as the cardamom production is concerned. We must have production technology for the future to face natural calamities such as drought.

In ginger and turmeric newer varieties have emerged out of the coordinated trials and the research work carried out at the institute. In these two spices, there is immense possibility of increasing the production through the distribution of high yield varieties to the farmers. In conclusion he noted that the research results so far

obtained has reached a take off stage for production in cashew and spices coming under the purview of the project. It should be our endeavour to take the results to the farmers field and earnest efforts should be made to bridge the production gap during the next 2-3 years. On the part of the Government these groups of crops are given emphasis in the Seventh Plan proposals that are being drawn up. It is upto us here to give serious thought and give out technologies and advices to various agencies so that country's long term interest in terms of foreign exchange earning capacity is not only safe-guarded but geared up.

Dr.J.P.Singh, Assistant Director General of Horticulture, ICAR, New Delhi, in his inaugural address analysed the production level at present in pepper, cardamom, ginger and turmeric as well as minor spices. He also briefly dealt with the yield gap existing in these group of crops. He emphasised that as far as pepper is concerned, a ten-fold increase in yield should be possible though it may appear exagerated, if we could manage to overcome the production constraints we are facing at present. He expressed his happiness that under the coordinated project as well as at the institute level work is progressing to overcome the production constraints such as the quick wilt of pepper caused by Phytophthora and slow wilt caused by nematodes complexes. He emphasised the need to evolve the resistance/tolerance to diseases as well as drought as one of the major objectives of the breeding programme. He also noted that the production of cardamom has almost remained stagnant for the last many years and the production is besieged with diseases like 'Katte' and 'Azhukal' combined with the drought faced by this part of the country during last season. Since countries like Guatemala is coming into the world market on a big way, he felt that, there is necessary to device short and long term production strategies. The breeding programme should not only be a programme for evolving high yielding resistant varieties but also

identify clones tolerant to drought situation since last season's drought has damaged about 20,000 ha. of cardamom plantations in this country. As far as ginger and turmeric are concerned, he asked the participants to look into the recommendations emerged during the National Seminar on Ginger and Turmeric conducted earlier at this institute, and evolve programmes to implement some of the important recommendations emerged from that seminar. Among the minor spices crops, he emphasised the needs for giving sufficient importance for the overall improvement of coriander, cumin and fennel.

He noted that India has been enjoying a near monopoly of processing the cashew kernels in the international market in early 1960. The foreign exchange earnings from this major money spinner has been declining steadily over the last few years. Among other reasons, scarcity of raw materials, high production cost and the setting up of a mechanised processing units at other producing countries such as East Africa are some of the reasons for the crisis can be overcome only by increasing the cashew production in this country. The useful results accumulated and emerging within the coordinated project schemes should be effectively and efficiently transferred to the field for implementation. He asked the experts assembled in the Workshop to give thought to the feasibility of setting up a clonal orchard in cashew by mixed planting, some of the high yielding selections identified. He identified the major areas where the thrust should be in finalising the future programme.

1. Collection and conservation of genetic resources of spices and cashew.
2. Rapid multiplication of elite planting material.
3. Evolving integrated disease/pest management programmes.

4. Evolving drought tolerant and physiologically superior cultivars.

Dr.M.C.Nambiar, Project Co-ordinator, presented the Co-ordinator's report for the year 1982-83 (the detailed report follows). The inaugural session came to a close with vote of thanks by Dr.M.K.Nair, Joint Director, CPCRI Regional Station, Calicut.

CO-ORDINATOR'S REPORT

Dr.M.C. Nambiar
Project Coordinator

The All India Co-ordinated Spices and Cashewnut Improvement Project was sanctioned in the IV Plan to take up coordinated research on spices and cashewnut to increase the production and productivity of these crops. The project started functioning in 1971 with the headquarters at CPCRI Kasaragod and 10 participating centres located in different agro-ecological regions of the country where these crops are grown. The project originally covered cashew, pepper, cardamom, ginger and turmeric. During the V Plan four more crops namely coriander, cumin, fennel and fenugreek were included. With more centres added in the VI Plan, the project has at present 21 participating centres located in ten states and covers nine crops. The VI Plan budget for the project excluding coordinator's cell is 104.92 lakhs.

The project envisages coordinated research on spices and cashewnut with the main objectives of:

1. evolving high yielding varieties resistant/ tolerant to pests and diseases.
2. standardising agrotechnique for the crops under different agro-climatic conditions.
3. evolving control measures for major pests and diseases.

With the above objectives in view, the First Workshop held at CPCRI, Kasaragod in 1971 reviewed the information available on cashew, pepper, cardamom, ginger and turmeric, identified the problems and drew up detailed technical programme for research in different disciplines.

The Third Workshop held at Coimbatore in 1975 drew up technical programme for research on minor spices (condiments). Group discussions were also held to identify problems of individual crops. The progress of work was reviewed at the biennial workshops held at Trivandrum in 1972, Coimbatore in 1975, Panaji in 1978, Trichur in 1981. Group meeting on annual spices held in 1982 at Jobner, and detailed technical programmes were drawn up whenever modification of the ongoing programme or taking up new programmes were found necessary. Thus, 44 experiments which include 19 experiments on breeding, 11 on agronomy, two on horticulture, seven on pathology and five on entomology, covering the crops had been formulated and all the programmes have been implemented with the support received from the respective universities and CPCRI, Kasaragod.

The major achievements under the project and important problems/constraints in the effective implementation of the programmes at the participating centres are highlighted in the following pages.

The major crops covered under the project area of perennial nature and conceivably the programmes take longer periods to give valid results. Thus, though the project started functioning in 1971, the first variety of cashew could be released only by 1981-82. Eleven varieties which include seven selections and four hybrids in cashew and two each in coriander and fenugreek, one in turmeric have been released for cultivation by the respective varietal release committee of the states on the recommendations of the workshops. In addition, 45 cultivars and 32 hybrids of cashew have been identified as the best clone which could be recommended for clonal seed production. Three selections in cardamom, seven selections in coriander, three in cumin two in fennel and two in fenugreek are found to be promising and these are in the advanced stages of evaluation.

In cashew, epicotyl grafting and *in situ* veneer grafting are the most promising vegetative propagation methods that could be adopted on a large scale.

Results of fertiliser trials in sandy and laterite soils showed that response to nitrogen application is highly significant in cashew and the present level of 250 g of nitrogen per plant need revision to 500 g.

Foliar application of 3% urea with endosulphan 0.05% gave significantly higher yield under Vridhachalam condition.

Results of fertilizer trial on pepper at Panniyur with three levels of nitrogen (N_{60}, 120 and 180) showed that N_1 (60g/vine) level is significantly superior to N_2 and N_3 levels. The results of factorial confounded experiment with three levels of N, P and K also indicated that lower levels of nitrogen (50 g/vine) is superior.

The yield response of coriander to nitrogen application was significant at Jobner and Jagudan.

The highest yield of fennel was recorded in treatment $N_{45} + P_{30} + Zn + B$ with net increment benefit ratio of 1:5.

Bordeaux mixture spraying and drenching were found to be effective in controlling the Azhukkal disease of cardamom. For containing 'Katte' disease of cardamom, systematic roguing of affected plants and adopting phytosanitary measures are recommended.

Spraying of Bordeaux mixture in June, July and August was found to be effective in controlling the 'pollu' disease of pepper caused by *Colletrotrichum glyosporiodes*. For pollu beetle control, 2 sprayings of 0.05% endosulfan/quinalphos/methamedophos or methyl parathion, during last week of September or first week of October (second spray) has been found effective.

Among the participating centres, Bapatla, Vridhachalam, Madakkathara, Vengurla, Bhubaneswar and Vittal have made valuable contributions for improvement of cashew crop. Four varieties from Vengurla, six from Bapatla and one from Vridhachalam have been released and more selections and hybrids are in the advanced stages of trials. Fertiliser and plant protection recommendations have emerged out of field trials and vegetative propagation methods have been standardised for large scale adoption. Standardisation of management practices for transplanted as well as in situ grafts to get beeter success in in situ grafting and field establishment need additional thrust. With the additional support now available from Multi State Cashew Project it should be possible for the above mentioned centres to identify the work on these aspects. Vengurla centre has already taken up large scale multiplication of the released varieties. Low rainfall and frequent changes in the staff working in the project at Vridhachalam has adversely affected the implementation of some of the programmes at this centre. More concerted efforts are required to standardise a method of vegetative propagation for large scale adoption and develop technology for the management of the cashew plantations in low rainfall areas. Vengurla and Vridhachalam centres require additional support by way of man power and physical facilities to implement these programmes.

Mudigere, Pampadumpara and Yercaud are the three centres in addition to CPCRI centre, Appangala for cardamom research. At Mudigere, 75% of the sanctioned scientific posts are vacant for the last three years, and at Pampadumpara 65 to 75% of the scientists were not in position till March 1982. At the new centre Yercaud also the staff position is in no way better. Non availability of scientists to work at these remote areas has adversely affected the progress of implementation of the programme.

A number of clones giving high yield and quality capsules have been identified at Mudigere, Pampadumpara and Appangala and based on progeny performance, clones with high mean progeny yield have also been isolated. Maximum planting material (seedlings and clones) are to be generated from these elite clones for which a technology has to be developed. Germination of cardamom seed is reported to be low after October, probably due to low temperature. If technology is developed to get high percentage of germination of cardamom seed during November-December months (the peak period of maturity) the entire quantity of seed capsule from the elite material could be utilised for generating the planting materials. This is one of the areas where the scientists working on this crop need to concentrate immediately.

Implementation of the programme is quite satisfactory at Jobner, Jagudan (fennel and fenugreek) and Pottangi centres working on annual spices.

Among the six centres sanctioned in the Sixth Plan period Vellanikkara for ginger and turmeric, Jhagram for cashew and Yercaud for cardamom have started functioning, The other three centres namely Chinthamani, Sirsi and Chinthapally are yet to start functioning effectively and need a re-examination whether the centre should continue in the present form and location.

As regards the functioning of the participating centres, the main constraints have been and continue to be the inadequacy of finance and man power. When the project was sanctioned in the IV Plan, adequate support could not be provided even in important disciplines like agronomy and entomology. Even though additional support has been provided in the subsequent plans, it was found quite inadequate and many of the centres still have only an S2 scientist supported by a Jr.Scientist or Research Assistant. The provision of contingency as also the physical facilities are quite inadequate for the effective

implementation of the programmes alloted to the centres. Still more important problems are the delay in filling up the sanctioned posts and frequent transfers of the scientists without even informing either ICAR or the Project Coordinator. In fact in some of the centres, major portion of the T.A. provision is utilised to meet the transfer TA. These problems have been discussed again and again in all the previous workshops and it is going to be discussed in this Workshop also, and I am afraid, the problems will remain to be discussed in future workshops as well.

The Implementation of the programme at the new centres sanctioned during the Sixth Plan are quite satisfactory and their contributions have been substantial. This has become possible due to the coordinated efforts of the participating centres, unreserved cooperation from the concerned universities, support and help from the Director and staff of CPCRI and guidance received from ICAR headquarters. I take this opportunity to express my grateful thanks to every one of them.

PROCEEDINGS OF THE TECHNICAL SESSION

SESSION I: PLANT BREEDING (Cashew, Cardamom & Pepper)
Date: 10 Nov. '83
Time: 12.15-17.30

Chairman : Dr. K.V.A. Bavappa, Director, CPCRI

Rapporteurs : Dr. S. Balakrishnan
Shri P.N.Ravindran
Shri T.Srirama Rao

After the introductory remarks from the Chairman, the work done during the previous two years on cashew was reviewed by Dr. K.V.Jithendra Mohan; Dr. G.Subba Rao presented the review on cardamom and Shri P.S.Ravindran reviewed the work conducted in pepper. Scientists from the coordinating centres supplemented the results A summary of the review and the decision emanating from the deliberation that followed are given below:

1. REVIEW

i) Cashew (Dr. KVJ Mohan)

The breeding experiments in cashew are in progress at Vittal, Vengurla, Vridhachalam, Anakkayam, Bapatla and Bhubaneswar under the AICSCIP and at Ullal as a participating centre.

Germplasm: The germplasm collection ranges from 47 to 371 indigenous types and 4-9 exotic types in various centres. There was considerable exchange of materials between these centres mostly seedling progenies and therefore, a particular accession when transferred to a new centre acquired a new entity different from that of the parent in many respects. There is a good scope for introductions to be made from the centre of origin of cashew as the variability available at present in the country is too small.

The evaluation of available germplasm has been completed in most of the centres, while the same is due to be completed shortly at Vittal. From the germplasm collections maintained at different centres, a few have been identified as best performers and released as varieties by the respective variety release committee.

Comparative Yield Trial: Promising selections, 4 each from Vengurla, Bapatla, Vridhachalam and Anakkayam have been put under multilocation trials at different coordinating centres. The yield data for the year 1977-83 have been pooled and analysed. In all the centres the differences between varieties have been found significant.

M 44/3 a selection from Vridhachalam was found to perform well at Vengurla, Vridhachalam and Vittal, thus indicating the stability in yield and adaptability under different agro-ecological conditions. The type M 44/3 of Vridhachalam hence qualifies for the consideration for release. As a short term rapid multiplication measure, this type can go in for production of clonal seed.

Hybridization: The two important hybrids generated at Vengurla are Hybrid-5 and Hybrid-11 have been released as Vengurla-5 and V-4 respectively by the State Variety Release Committee. As a next phase, hybridisation was started by crossing Vengurla materials with the Vridhachalam materials particularly M 10/4 and M 44/3.

At Bapatla, Hybrid No.2/11 and 2/12 are the promising hybrids. They are further crossed with the materials like Tree No.4/7 Tuni (bold nut); M 10/4 of Vridhachalam (high nut set/panicle).

The hybrid H-4-7 and H-3-17 are the promising types of Anakkayam evolved earlier. Among the new hybrids H-19 (Algd 1-1 x K 30-1) is the most promising with high yield and bold nut size. The other one is H-26 (Bla 139-1 x H-3-13).

At Vridhachalam the nut size has been significantly improved by crosses involving M 33/3. Inbreeding depression in self-progenies was also noticed with respect to nut size.

Progeny No.2, 3 and 8 of the cross M 33/3 x M 10/4 are promising.

The review was further supplemented with the results from the coordinating centres by Shri P.G.Veeraraghavan (Madakkathara); Dr.Rao Rama Rao (Bapatla); Dr.K.P. Palaniswamy (Vridhachalam); Shri D.P.Sawke (Vengurla); Shri T.Konhar (Bhubaneswar), Shri S.N.Ghosh (West Bengal) and Dr. M.M.Khan (Chintamani).

ii) Cardamom (Dr.G.Subba Rao)

Cardamom research is in progress at Cardamom Research Stations at Mudigere (UAS), Pampadumpara (KAU) and Appangala (CPCRI) from the very inception of AICSCIP. One more centre was added to the project at Yercaud (TNAU) in VI Plan. In addition, Cardamom Board is having a centre in Myladumpara. Earlier some research on germplasm collection of cardamom was conducted at Singhampatti in Tamil Nadu.

Three experiments are in progress in the discipline of genetics viz. germplasm collection and evaluation, comparative yield trials and hybridisation.

At Mudigere, 16 types (cultivars) and 8 species of related genera are being maintained. In 1983, 28 clonal selections were made based on yield, size and shape of the capsules. At Pampadumpara 31 cultivars and 10 wild types are maintained. During the year, 21 new collections were made. PV1, a promising selection from Malabar recorded maximum yield. At Appangala 188 accessions representing cultivars and wild types are being maintained and 180 accessions are being maintained at Myladumpara. Among the

selection at Yercaud, Selection M-18 gave an yield of 1.62 kg capsule during the second year of bearing.

Comparative yield trial with seedling progenies of 15 promising selections laid out at Mudigere in 1974 did not give any conclusive results. However, progenies of CL-664, CL-730 and AS-1286-37 and NPK-254 performed better. At Appangala 5 selections APG 1 to 5 were found to be promising. Malayar types APG-7 a very promising type is under pre-release multiplication. At Mudigere performance of three selections viz.P1, P3 and P5 under multilocational trial was very good with regard to yield.

Diallel crosses involving 6 characters and having 30 cross combinations were planted at Mudigere in 1973-74 season. Progenies D-715, D-141 and D-148 are the most promising. In order to get lines resistant to katte, mutation breeding programme was initiated in 1975 at Appangala. Thirteen irradiated seedlings among 1.5 lakh seedlings have been selected as resistant to katte after repeated six inoculations. The seedlings are being multiplied clonally for further testing and yield evaluation.

Shri K.Vasantha Kumar (Pampadumpara), Shri.G.S. Sulikere (Mudigere) and Dr.K.Nanjan, supplemented the results.

iii) Pepper (P.S.Ravindran)

Pepper Research Station, Panniyur is the only centre under the AICSCIP working on pepper breeding. Outside the project research work on pepper is in progress at CPCRI Regional Station, Calicut and Horticultural Research Station, Perumbavai (TNAU).

At Panniyur, replanting of the old and senile vines in the germplasm started in 1979 on a phased programme, is being continued. During the period, 63 wild types and 4 cultivars of pepper were added to the germplasm.

Intervarietal hybridisation involving 11 parental combinations was carried out. Besides, selfing was also done in seven cultivars involving a total of 150 spikes. A total of 135 seedlings (hybrid + OP) have been selected for multiplication out of 1425 seedlings planted.

Yield data in progeny row study indicated that five cultures gave spike weight ranging from 1000 g to 4010 g. In the comparative yield trial involving 5 varieties, yield data for the last 5 years show that Arakulamunda produced maximum number of spikes while Panniyur-1 gave the highest yield followed by Kuthiravally.

An ad hoc scheme of ICAR was functioning in HRS, Perumbarai since October '82. The experiments in progress are comparative yield trial and evaluation of OP seedling progenies for yield and quality attributes.

At Calicut, the pepper germplasm comprises 110 cultivated types and 72 wild types and are being evaluated for yield, resistance to quick wilt, nematodes and pollu beetle as well as quality parameters. About 25000 OP seedlings from 75 cultivars and 185 hybrid seedlings were raised. A majority of them are being studied for resistance to Phytophthora and nematodes. Remaining were planted to the field. Intervarietal crosses involving 8 cultivars were carried out. An efficient controlled crossing technique using rooted laterals was developed. Six seedlings raised from OP seeds were found to be resistant to Phytophthora on inoculation, and one type from Idukki was resistant to root-knot nematode. Irradiation work was initiated to induce variability for locating resistance to quick wilt. A multilocation trial involving 9 popular cultivars has been laid out at Calicut, Kannara and Palode. A selection programme has been initiated in Karimunda. For this 213 types of Karimunda have been selected and 100 types planted in a completely randomised block design.

Shri K.K.Ibrahim (Panniyur), Dr.P.R.Murthy (Chintapalli) and Dr.Khader Moideen (Thadiyankudisi) supplemented the results.

2. RECOMMENDATIONS.

i) Cashew

(1) In yield evaluation studies, yield data for the first 5 years may be considered for initial selection in the case of clonal materials while seven years' data may be considered in the case of seedlings. In order to reduce the time span involved in the evolution and release of varieties clonal material from such selected lines may be made and put under multilocational trial. When considering selections for release, yield data upto the 10th year must be taken into account and pooled analysis done.

(2) Hereafter clonal material alone should be included in all the multilocation trials.

(3) The following collections/hybrids which have proved to be superior may go into the multilocation trial, in all the co-ordinating centres. Madakkathara - 4 hybrids viz., 1, 2, 5 and 7 (ie. hybrids H-19 (1610), H-26 (1600), H 26 (1601) H-26 (1598). Bapatla - T.No.129, T.No.40 and hybrids 2/15 & 2/16. Vridhachalam - 33/3 (Selfed) and 44/3. Vengurla - Hybrids 5 and 11 (Vengurla 3 and 4).

(4) Each centre should prepare sufficient number of vegetatively propagated progenies preferably on a single rootstock selected and supply to all other centres to lay out the trials.

(5) The trials in all the centres should be initiated simultaneously. Hence the planting material also should be supplied accordingly.

(6) A group under the Chairmanship of Dr.M.K.Nair and consisting of the statisticians was formed to look into the details regarding the multilocational trial to be laid out. This group may also look into the overall breeding programme of all the co-ordinating centres with special reference to germplasm collection and survey. (Annexure I).

(7) The minimum descriptor prescribed should be c completed for all the materials in the ongoing multilocational trials as well as future trials.

(8) An area-wise and season-wise statement indicating the appropriate propagation technique to be adopted in cashew may be prepared. Mr.Nagabhushanam was requested to take up this in consultation with all centres (Annexure II).

(9) For all future crossing programmes centres may be identified and the programmes should be taken up only with specific objectives.

(10) It was decided to multiply the different selections/hybrids already released/under release [illegible] in different centres. (Please see Annexure III under Agronomy).

ii) Cardamom.

(1) There is utmost urgency in laying out a multilocational yield trial, which may include all the promising types that have come out from the different Cardamom Research Centres - like P1, P3, P5, PV1 selection 107 Cl.37 and APG.7 etc. The individual centres may make arrangements to lift clonal materials from the source of multiplication, by collecting the materials personally.

(2) The seed production programme in cardamom needs acceleration. The technology developed at the Mudigere centre with regard to raising of primary nursery in winter may be passed on to the Cardamom Board for testing and

adoption. Selections P1, PV1, PR107, Cl.37 and APG.7 were decided to be multiplied in different centres as per details given in Annexure IV.

iii) Pepper.

(1) All germplasm collections and their maintenance should be toned up and existing material in the country may be collected for conservation within another three years. The maintaining aspect is being considered by a committee under the Chairmanship of Dr.R.D.Iyer which will go into the methodology for conservation including storage at low temperature, through tissue culture etc. A representative of the University may be nominated on to this committee.

(2) The germplasm now existing at the centres should be multiplied and maintained atleast in two centres. Once evaluation is over they can be conserved by close planting in a germplasm conservation. block in these two centres specially identified as banks of germplasm.

(3) It is extremely essential to look into the variability existing in a particular cultivar and there seems to be a great scope in improving yield considerably by selection within a variety. Work has already been initiated in Karimunda and Kottanadan at CPCRI. Extension of this activity to other major cultivars is required and the co-ordinating centres may look into this.

(4) All breeding programmes should be aimed at primarily for the improvement of yield and for improvement of resistance to diseases. A rethinking on the breeding programmes seems to be necessary and the group under the Chairmanship of Dr.M.K.Nair was requested to consider this also.

(5) An efficient strategy for the production and distribution of planting materials needs to be evolved.

A Special Topic on "Current status in the vegetative propagation of cashew" was presented by Shri S. Nagabhushanam, and "Collection, conservation, cataloguing and evaluation of pepper germplasm with special reference to wilt disease" by Shri P.N.Ravindran.

ANNEXTURE I

Proceedings of the group meeting to discuss the breeding programme in Cashew, Pepper and Cardamom.

I. CASHEW

A. Germplasm collection.

1. For planting germplasm collection, initially, closer spacing of 4mx4m will be adopted in view of the limitation of land available in the centres. After preliminary evaluation, the selected materials will be carried for comparitive yield trial at the normal spacing of 7.5mx7.5m. All addition to the germplasm will be made only through clonal materials viz., grafts/layers. Collection of seed materials for germplasm being followed at certain centres may be discontinued. Initial planting in the field may be done in a statistical design to the extent possible.

2. Land is available for further planting only at Vengurla and Bapatla. Fifty more accessions may be obtain during next two years from Anakkayam, Vridhachalam and Bapatla at the rate of four clones per accession. At Bapatla, 20 accessions may be collected from Andhra Pradesh region. Vittal station may undertake the survey of West Coast as well as East Coast by 1985. For survey of East Coast area, centres at Bapatla as well as Bhubaneswar stations may collaborate. For collection from Maharashtra region, centre at Vengurla may extend collaboration. The other centres have no land for planting. They may also collect germplasm available within their region and provide the same to the Project Co-ordinator for arranging planting at Vittal and Vengurla.

3. Proforma for evaluating the varieties was discussed in detail and finalised and it was decided to record only the following characters:

1. Branching habit (number of laterals - unit area).
2. Canopy area
3. Flowering/all in one flush/gradual area spares/ early and late.
4. Percentage of hermaphrodite flowers from ten panicles per tree selected at random.
5. Number of fruits per panicle
6. Apple colour (to be used as a marker)
7. Nut weight (per 100 nos)
8. Shelling percentage
9. Total yield in kg for 3 years (5th, 6th and 7th year)
10. Incidence of pests - stem borer/tea mosquito.
11. Duration of harvest
12. Age of the plant
13. Any other information

B. Multilocation trial:

A new multilocational trial will be laid out in all the centres, subject to availability of land. The design will be RBD with 17 treatments, 3 replications and 6-8 plants per plot with a spacing of 7.5mx7.5m. For planting clonally propagated materials except air layers with a common rootstock only will be used. The seed material required for raising rootstock will be supplied to all the centres from Shantigodu. The requirement of the respective centres will be intimated by March to the Scientist-in-charge, CPCRI Seed Farm, Shantigodu. The planting materials will be supplied by the centres as detailed.

Madakkathara Centre: H 19/16-10, H 26/1680, H 26/1681, H 26/1598

Bapatla : 129, 40, 2115, 2/16

Vengurla : V_2, V_3 & V_4, Hybrid 24, 44/3

Vridhachalam : 33/3, 44/3, 26/2

Vittal : 30/4, 59/2, 44/3

Note: Clonal progenies of M 44/3 will be prepared and supplied from Vittal, Vengurla and Vridhachalam.

C. Review of ongoing breeding programmes at different centres:

Vengurla: The parents utilised in a crossing programme have been selected based on certain desirable characters. The available hybrids may be evaluated for yield and quality characters.

Bapatla: The work was examined and it was found that the crossing programme has been undertaken based on nut characteristics and the work may be continued. The evaluation of the available hybrids may also be carried out.

Mudigere: The existing germplasm collections may be evaluated and available data may be examined for identifying parents with desirable characters as per the proforma supplied.

Vridhachalam: Evaluation of the F1 progenies may be continued. Further crossing work may be taken up only after the breeder joins.

II. PEPPER

1. The pepper germplasm will be maintained at Panniyur, Vellanikkara and Peruvannamuzhi. After evaluation they may be maintained at closer spacing in a germplasm bank. If facilities available a set may be maintained in cement tubs of 75 cm cube.

2. For each germplasm accession, five plants should be maintained in the field and one in pot.

3. The multilocation trial will contain nine cultivars. The centres will be Panniyur, Ambalavayal and Thadiyankudisi. The following cultivars will be used. Panniyur-I, Karimunda, Kuthiravally, Kottanadan, Aimpiriyan, Neelamundi,

Arakulam Munda, Narayakodi and Kalluvally (Wynadan). The trial is similar to the one being conducted now in CPCRI. At Chinthapalli, an observational trial alone will be laid out with these varieties.

Uniform clonal materials in the following cultivars may be supplied by the centres mentioned.

Pepper Research Station, Panniyur: Panniyur-I, Karimunda, Kuthiravally, Kottanadan.

CPCRI Regional Station, Calicut: Neelamundi, Arakulam Munda, Narayakodi, Kalluvally and Impiriyan.

Design: RBD, 6 plants per plot, 4 replications and common boarder.

Sixty cuttings of each cultivar should be supplied for planting.

4. Multilocation trial with new cultures: Separate trial with the improved high yielding cultures available at Panniyur will be laid out at Panniyur and CPCRI farm, Peruvannamuzhi. Culture Nos.120, 331, 527, 239, 54, 1187, 341 and two controls, Panniyur-I and Karimunda.

Design: RBD, 6 plants per plots and 4 replications with common boarder. In view of limited availability of planting materials, the trial will be laid out only at two centres. The Pepper Research Station, Panniyur will supply nucleus material for further multiplication.

5. Intra-varietal evaluation is going on in two cultivars at Calicut. In view of the paucity of staff, more selection work cannot be taken up.

6. Crossing programme: The following parents will be used in different combinations. Balankotta and Karimunda for shade tolerance; Nilgiris and Kottanadan for quality; Kalluvally for drought; Narayakkodi and Uthirankotta for

disease tolerance; and Kuthiravally for spike length and yield. Seeds from controlled crossing and also open pollinated can be used for screening and yield resistance. As far as possible, the crossing work should be done using laterals under controlled conditions.

III. CARDAMOM

A multilocational trial may be laid out during June 1984 at five centres viz., Mudigere, Appangala, Pampadumpara, Myladumpara and at Yercaud with the following clonal selections. The material are to be lifted by the concerned scientists of the centre.

1. P1
2. P3 } From Mudigere Centre.
3. P5

4. PV1
5. PR-107 } From Pampadumpara Centre.

6. CL-37
7. APG-7 } From Appangala Centre.

with control (local) of respective centres.

The details of the trial are as follows:

Number of plants per treatment	: 9
Replication	: 3
Design	: RBD
Spacing	: 2m x 1m

Specifications of vegetative planting unit must have one grown up pseudostem with one or two growing suckers having 4-6" long rhizome. It is the responsibility of the respective centres to keep material ready by the end of May 1984 and intimate the other centres to lift the material.

Periodical observations to be recorded.

1. Number of suckers
2. Height of suckers
3. Number of leaves
4. Total number of panicles
5. Number of panicle per bearing sucker
6. No. of capsules per panicle for five plants
7. Wet weight of capsules
8. Dry weight

Although only 9 suckers are required per treatment as per the plan, it is suggested that 35 suckers per selection may be supplied considering mortality of plants during transit and after planting in the field.

ANNEXTURE II

Cashew propagation techniques to be adopted at different centres in different seasons.

For large scale multiplication of vegetative progenies, it is necessary to build up a clonal orchard as a primary step. The clones may be planted at a closer spacing of 4mx 4m accommodating 625 clones per ha. Under judicious management, it is possible to procure scion stocks/bud wood/shoots for multiplication from second year onwards from the clonal orchard.

The following propagation techniques are suggested for different centres on the basis of the success achieved and reported in different seasons.

S.No.	Name of the Station	Period	Suggested techniques for multiplication
1.	CRS, Vengurla (Maharashtra)	Feb. to March	Epicotyl grafting.
		May to November	Softwood grafting
2.	CRS, Madakkathara (Kerala)	March to May	Epicotyl grafting
3.	MSCP, Ullal (Karnataka)	February to April	Airlayering
4.	CRS, Vridhachalam(Tamilnadu)	June to August	Airlayering and in situ patch budding.
5.	CRS, Bapatla(Andhra Pradesh)	June to November	In situ veneer grafting and in situ patch budding.
6.	CRS, Bhubaneswar (Orissa)	June, Sept. Oct.	Vencer grafting.
		June to February March to July	Epicotyl grafting and softwood grafting.

7. CPCRI RS, Vittal/Shantigodu, Karnataka	June to September	Epicotyl grafting veneer grafting
	October to December	Patch budding
	January to March	Airlayering Patch budding
	April to May	

ANNEXTURE LII

Cardamom selections approved for multiplication by the VI Workshop on AICSCIP

Name of the centre	Selections to be multiplied.	No.of suckers available for planting during 1984*	Seed capsule available from different high yielding clones for distribution
Mudigere	P_1	500	100 kg
Pampadumpara	PV_1	200	50 kg
	PR 107	100	10 kg
Appangala	Cl 37	500	200 kg
	APG 7	100	10 kg
Cardamom Board Saklaspur	Cl.37**	300	

*After meeting the MLT and NPK experiment requirements.
High density planting 2m x1m (5000 plants/ha)

**Appangala will supply

SESSION II: PLANT BREEDING (ANNUAL SPICES) Date:11 Nov., '83 Time:09.00-11.00

Chairman : Dr. P.C.S.Nair
Director of Research, KAU

Rapporteurs : Shri T. Srirama Rao
Shri P.N. Ravindran

The review paper on ginger and turmeric was presented by Dr.(Mrs.) M.J.Ratnambal. Dr.R.K.Sharma reviewed the work on condiments (coriander, cumin, fennel and fenugreek).

I. REVIEW

i) Ginger and Turmeric (Dr.(Mrs.)M.J.Ratnambal)

The coordinating centres at Kasaragod (CPCRI), Solan (HPAU), Pottangi (OUAT) and Vellanikkara (KAU) are doing research on ginger and turmeric. Work is in progress also at Calicut (CPCRI) and Coimbatore (TNAU) as non-participating centre.

Ginger: Among 38 germplasm collections evaluated at Kasaragod the highest yield was recorded in cultivar Wynad Local for the two years under report followed by Burdwan and Nadia.

At Solan, 100 accessions were under evaluation during 1981-82, accession No.645 gave maximum yield and during 1982-83, accession No.600 was the best yielder.

At Pottangi, the germplasm had 81 accessions. The percentage recovery of dry ginger was maximum in PGS-6 (35%).

At Vellanikkara centre, among 25 accessions evaluated during 1982-83, Nadia was the best yielder followed by Maran.

At Calicut 85 accessions were evaluated and Maran was found to be the highest yielder (7.8 kg/3 Sq.m.). The percentage recovery of dry ginger was maximum in Karakkal (23%). Maximum percentage of oil oleoresin and fibre was found in Himachal Pradesh (3.0%), Ernad Chernad (8.1%) and Mananthody (6.8%) respectively.

Preliminary yield evaluation of selected clones from the germplasm accessions was in progress at Solan and Pottangi. Among the 22 clones under evaluation at Solan during 1981-82, accession No.564 was the highest yielder followed by accession 646, and during 1982-83 accession No.646 gave the maximum yield.

At Pottangi cultivar Ernad Manjeri was the highest yielder (5.1 kg/3 Sq.m.) during 81-82 and PGS-19 during 1982-83 (5.2 kg).

In a comparative yield trial involving 9 cultivars at Kasaragod, Wynad Local, Burdwan and Nadia were good yielders in that order.

At Pottangi in the comparative yield trials during 1981-82, Cultivar Vengara performed better (5.2 kg/3 Sq.m.) followed by PGS-19 (4.9 kg). PGS-19 gave maximum percentage recovery of dry ginger (24%).

A multilocation trial with eight ginger types has also been initiated during 1983 at Pottangi, Solan and Trichur.

Turmeric: One hundred and two accessions and 62 clonal selections were maintained at Kasaragod. Cultivars Vontimitta, Wynad Local, Ethamukula were good yielders (10.9 kg, 10.6 kg and 10.4 kg/3 sq.m. respectively) in 1981-82 and cultivar Ethanukula was the highest yielder (14.4 kg/3 sq.m) in 1982-83. Selections IC, 2A, 3D, 15B and 21A were the highest yielders (32-35 tonnes per ha) during 82-83.

At Solan during 1981-82 accession Nos.59 and 769 were the best yielders, while during 1982-83 the yield was maximum in accession No.62 followed by accession No.745. At Pottangi CLS-13 was the highest yielder during the two seasons under report. At Trichur 103 collections were evaluated and the maximum yield was recorded in cultivar Garpam.

At Coimbatore the mutant clone 5307-1-1 was the best yielder followed by 5380-2-3.

At Calicut among 180 accessions cultivar Kongpong was the highest yielder (13.2 kg/3 sq.m. bed). The percentage recovery of dry turmeric was maximum in cultivar Amrithapani Kothapetta (32.4%).

The percentage of curcumin was maximum in cultivar Edapalayam (10.9%) follo ed by cultivars Palapally, Trichur (10.7%), Erathukunnam, Adimali (10.3%). The oil content varied from 1.0% (Duggirala) to 9.5% (Kahikuchi). The cultivar Konni had the highest percentage of oleoresin (19.2%).

From the germplasm 27 clones were selected for preliminary yield evaluation at Pottangi. Recovery of dry turmeric was maximum in PGS-10 (31%).

The preliminary yield evaluation with 15 accessions at Coimbatore indicated that 5378-3-1 was the highest yielder (20.3 kg/8 sq.m.) Duggirala had the maximum oil content 3.3% and oleoresin control (6.6%).

The comparative yield evaluation of six clonal selections at Kasaragod did not indicate any significant differences among the selections, the yield varying from 33-35 tonnes per ha in both the years under report.

Comparative yield trial with five promising clones indicated that clone PTS-38 and PTS-10 during 1981-82 and 1982-83 were the best yielders. The percentage recovery

of dry turmeric was maximum in PTS-9 (27%) and curing percentage (31%) maximum in PTS-10.

At Coimbatore, 19 accessions were taken for comparative yield trial and clone 5307-1-1 was the most promising.

A multilocation trial was laid out at Pottangi, Trichur and Coimbatore with nine turmeric cultivars. At Pottangi and Coimbatore selection PTS-10 gave the maximum yield (10.1 kg/3m^2 and 6.4 kg/3m^2 respectively).

Nine high yielding cultivars selected at Calicut are under a multilocation trial at Calicut, Kasaragod and Palode. The trial is in progress.

The review was further supplemented with the results from the coordinating centres by Dr.U.K.Kohli (Solan), Shri D.C.Mohanty (Pottangi), Shri E.V.Nybe (Trichur) and Dr.Seemanthini Ramadas (Coimbatore).

ii) Condiments (Dr.R.K.Sharma)

Jobner (Rajasthan), Jagudan (Gujarat), Lam Farm, Guntur (Andhra Pradesh) and Coimbatore are the four centres for research on condiments (coriander, cumin, fennel and fenugreek). The breeding programmes include germplasm collection, maintenance and evaluation and multilocation trials on all the above four crops.

The germplasm assemblage at all the centres were evaluated for their yield and quality parameters. Reactions to pests and diseases were also scored for all the centres.

Coriander: The germplasm collection in coriander at present consist of 144 types at Coimbatore, 140 at Guntur, 154 at Jagudan and 200 types at Jobner.

A comparative yield trial with 14 varitieshave been laid out at Guntur, Jobner, Jagudan and Coimbatore.

Based on yield and quality, coriander variety UD-41 (Karan) and UD-20 from Jobner, culture 270 of Coimbatore, GAU-1 from Gujarat have been recommended for release by the respective Varietal Release Committee. The selections The selections CS-2, CS-4, and CS-6 of Lam Farm (Guntur) were recommended for pre-release multiplication.

Cumin: Germplasm collections of cumin are being maintained and evaluated at Jagudan and Jobner.

At Jobner, 24 entries were evaluated in a replicated trial. Differences between entries were found significant for number of grains per umbel and grain yield. The highest grain yield of 6.42 q/ha was recorded by the entry UC-198 which was significantly higher than the check entry RS-1. This variety has also shown high degree of field tolerance to wilt, blight and powdery mildew diseases.

At Jagudan, 59 entries were maintained and evaluated for their growth and yield characters during the year.

A multilocation trial has been laid out at two locations each in Gujarat and Rajasthan with four high yielding selection from Jobner and three from Jagudan.

Vijapur-5, a high yielding cumin selection from Gujarat has been recommended for release by State Varietal Release Committee. UC-198 is a cumin selection from exotic collections of Jobner. It has high tolerance to wilt disease and is under multilocation trials in Gujarat and Rajasthan. UC-19 is another high yielding selection from Jobner.

Fennel: A total number of 303 germplasm collections available at Jobner (100), Jagudan (179) and Guntur (24) are being evaluated for yield and associate characters.

Based on the results of CYT, the entry PF-35 of Gujarat and UF-32 of Rajasthan have been recommended for release by the State Varietal Release Committee. A

multilocation trial with two entries from Gujarat (composits JC-2 and JC-3) and three entries from Jobner (UF-1, UF-112 and UF-90) is in progress.

Fenugreek: Under the germplasm collections and evaluation of fenugreek, 36 entries were evaluated at Jobner, 40 at Guntur, 26 at Coimbatore and 69 at Jagudan (Vijapur).

A multilocation trial with 10+1 entries have been laid out at Jobner, Jagudan, Coimbatore and Guntur centres. The fenugreek leaves are widely used as green vegetables. A trial to evaluate the collections for grain as well as leafy vegetables has been laid out.

The selection NLM from Jobner has been recommended for release.

Dr.(Mrs.)Seemanthini Ramadas (Coimbatore), Shri T.Srirama Rao (Guntur) and Shri B.T.Kachhadia (Jagudan) supplemented the results.

II. DISCUSSIONS AND RECOMMENDATIONS.

i) Ginger and Turmeric.

1. The germplasm evaluation and multilocation trials will be continued. Germplasm can be enriched wherever possible.

2. Uniform pattern in reporting data may be followed in vegetative parameters, yield and quality. The quality analysis may be made in respect of all the types in the germplasm collection and in the multilocational trials. Pests and diseases scoring may be undertaken in all the trials and the data may be presented in future. Yield data may be recorded in Kg/3m^2 bed and or per ha.

3. The minimum descriptor supplied by the Project Coordinator for all the centres for description of the types in case of all ginger and turmeric types should be made use of.

4. It was suggested that the following fundamental work on breeding may be undertaken by CPCRI and Agricultural University, aapart from the coordinated trials. This has been allotted to the following centres as mentioned below:

Polyploidy breeding, mutation breeding, crossing including somatic cell hybridisation	:	C.P.C.R.I.
Polyploidy breeding	:	Solan
Mutation breeding	:	Kerala Agricultural University

5. There was a discussion regarding the extractant that is to be used for obtaining oleoresins in case of ginger and turmeric. It was also discussed that data varies widely depending upon the extractant used. Several solvents were suggested. Therefore, it was decided that the CPCRI scientists will look into the data available using different extractants and suggest a suitable extractant for all centres. In case sufficient data is not available for recommending a specific solvent, a trial should be initiated at CPCRI to suggest a suitable solvent.

6. The multilocational trial on turmeric may also be undertaken in Lam (Guntur) or any other suitable locations in Andhra Pradesh.

ii) Condiments

1. Although two types of coriander were found performing well (695 from Coimbatore and composite 4 from Jobner), it was decided to include these two entries in the multilocation trials, after obtaining data for 3 more years

2. Exotic collection in case of cumin should be enriched further as some of the exotic collections have proved to be good especially in respect of disease tolerance/ resistance to wilt.

General

1. Seed materials should be collected by the concerned scientists from the respective stations by deputing scientists. While supplying the seeds proper care should be taken to see that disease and pests from free materials are supplied. Prophylactic measures ar to be taken to see that the disease is not being carried through seeds.

2. The workshop felt that there is no justification for shifting the present site at Lam since it will hinder the normal continuous work of the experiments, particularly on coriander.

A paper on a special topic "Collection, conservation cataloguing and evaluation of indigenous and exotic germplasm of minor spices" was presented by Dr.R.K.Sharma.

SESSION III: ENTOMOLOGY

Date: 11-11-1983
Time: 11.15-13.15

Chairman : Shri G.B. Pillai

Rapporteurs : Dr. Sitarama Rao
Dr. T.Premkumar

The Chairman, in his introductory remarks briefly indicated the problems in cashew and spices and salient achievements. Dr.C.P.Radhakrishnan Nair, reviewed the current status of cashew entomology and highlighted the salient results of investigation and on-going programmes at different participating centres under the Project. The scientists from the coordinating centres, Dr.Sitarama Rao (Madakkathara), Dr.Tej Kumar (Bapatla), Dr.Ganeshkumar (Vridhachalam), Shri SK Godase (Vengurla) and Dr.Mallik (Ullal) supplemented the results.

I. REVIEW

i) Cashew (Dr.C.P.Radhakrishnan Nair)

Cashew Anacardium occidentale L. is infested by a a wide range of arthropod fauna comprising insects and mites. The stem and root borer, tea mosquito, leaf and blossom webber, leaf miner, apple and nut borers etc. are considered to be the major pests.

1. Stem and root borer, Plocaederus ferrugineus L. (Cerambycidae)

P. ferrugineus is the most dreaded enemy of cashew in all cashew tracts of India. Incubation period lasted for 4-6 days grub stage 6-7 months and pupal period 20 days without cocoon and 60 days with cocoon. The adult beetle lays eggs on loose tissues in the exposed roots or in collar region.

Field trials carried out at CPCRI, Kasaragod show that the infestation if detected in the early stages, removal of the affected tissues along with various immature stages of the pest and swabbing with 0.1% BHC suspension would be effective. However, phytosanitary measures is most important for the control of the pest.

Recent studies carried out at CPCRI, Research Complex, Goa revealed that early stage of infestation could be controlled with bark treatment with monocrotophos. The insecticide was applied @ 30 ml/tree with cotton wool, after removing a flap of live bark. At present chemical control trials against this pest are in progress at various cashew research centres like Bapatla, Vengurla, Vridhachalam and Madakkathara in addition to the ongoing trials at CPCRI, Kasaragod.

Several reports on the attempts of biological control methods against this pest also are available. The nematode cum bacterium culture DD-136 (Neoaplectana carpocapsae and Achromobacter nematophilus) gave 50-60% mortality of grubs within 24 days at an inoculum level of 100 nimas/g body weight of hot grub in the laboratory when the inoculum was mixed with the feed (cashew bark) Pillai et al. 1976.

2. Tea mosquito Helopeltis antonii Sign. (Miridae)

Tea mosquito is the most serious pest of cashew. The biology of the pest has been fully studied. The female bug lays eggs singly deep inside the tissues of tender shoots or panicle. The incubation period lasts 6-7 days and nymophal period lasts for 10 days comprising five instars. In the laboratory the female bugs has a fecundity of 25. The longevity of male bug is 9.5. Studies on the population fluctuation of tea mosquito showed that the build up from October onwards synchronises

with the emergence of new flushes after the cessation of rains. The population reaches its peak during the blossom period.

Studies on the role of tea mosquito and the fungi in the incidence of inflorescence blight show that infestation by tea mosquito alone was primarily responsible for the malady.

Chemical control trials at CPCRI, Kasaragod have revealed that endosulfan 0.05% was most effective followed by quinalphos 0.05% and formothion 0.05% for the control of tea mosquito.

Kerala Agricultural University recommended the use of carbaryl 0.05% or phosphamidon 0.03% or quinalphos 0.05% for the control of pest.

As timely plant protection operation is quite imperative for the effective control of tea mosquito, it was suggested that aerial application of pesticides would be more feasible particularly in larger plantations. A trial on this is in progress under the aegis of the Madakkathara centre of the Kerala Agricultural University using ULV formulation of carbaryl, endosulfan, quinalphos phosalone and phosphamidon.

No effective natural enemies have been reported so far on tea mosquito. However, reports are available on a natural enemies of the pest in India. Ambika and Abraham (1979) reported Crematogaster wroughtoni Forel as a predator of the tea mosquito nymphs. Sundararaju (1983) has reported various reduvid predators viz., Sphedanolestes signatus Dist., S. minusculus Berger, Endochus cingalensis Stal., Alcmena sp., Seycanus collaris Fabr. and Irantha armipes stal. from Goa. Four unidentified species of spiders are also found to feed on nymphs of H. antonii in the field in Karnataka (Devasahayam 1983).

Sathiamma (1979) studied the varietal reaction of cashew to tea mosquito at CPCRI Regional Station, Vittal, Karnataka. The mean percentage of shoot attack in different accessions ranged from 1.8 to 43.3 panicle attack 5.5 to 54.3 and mean pest population from 1.5 to 105.5 per 100 shoot/panicles per tree. Damage and pest population was high in VTH 54 (10/8 Epurupalam, Bapatla) and low in VTH 153 H-3-17 (Anakkayam).

Leaf and blossom webber Lamida moncusalis Walker (Pyralidae) Orthaga exvinacea Hamps.

Lamida moncusalis has attained the status of a major pest in East-Coast of India particularly in the coastal districts of Andhra Pradesh. Two species of Apanteles and a braconid parasite have been recorded on this pest.

For control of the leaf and blossom webber, which is serious problem in the east coat tracts as at present, the Bapatla centre had recommended carbaryl 0.15% and malathion 0.15%.

Monocrotophos and phosalone 0.05% were effective in the control of leaf minor as per the results presented from the Vridhachalam centre. Maximum reduction in thrips infestation of cashew foliage was obtained with monocrotophos and phosphomidon 0.05%.

General recommendations

1) A systemic survey on the intensity of incidence of various pests infesting shoots, leaves, panicles and apples and nuts may be undertaken by the respective centres.

2) Based on the consistant results obtained from different centres the insecticides such as endosulfan, carbaryl, quinalphos, monocrotophos and phosphomidan can be recommended for the field control of cashew pest complex.

3) As younger plantations afford facility for the multiplication of tea mosquito almost throughout the year need based plant protection may be adopted in such cases.

4) The field reaction of cultivars/hybrids under the multilocation trials may be scored using the proforma and the same may be reported.

5) More detailed studies on the intensity of natural parasites of different pests may be undertaken.

6) Strict surveillance on potential pests like flower thrips, foliage thrips, mites and leaf beetles should be taken particularly in endemic areas.

ANNEXURE I

Programme on management of stem and root borer

1. Survey on the intensity of infestation (proforma appended)

2. Bio-ecology of the pest including the field activity of the adults.

3. Observation trials on trapping beetles using logs of cashew, Ceiba, Bombax and Moringa logs smeared with crude extracts of cashew shell and resinous exudate from the stem.

4. Field control trials.

Prophylactic treatments

Painting of the mainstem and exposed portions of roots with suspension of the following up to 1 M height. Care should be taken to select the trees for treatment centering around an already dead tree or badly affected tree.

Treatments		Dosage
1. BHC	..	2 kg ai/ha
2. Aldrin	..	1.5 kg ai/ha
3. Heptachlor	..	1.5 kg ai/ha
4. Chlordane	..	1.5 kg ai/ha
5. Carbaryl	..	2 kg ai/ha
6. Coal Tar & Kerosine		100 g in 400 ml kerosine
7. Control (No treatment)		

Note: For computing dose per tree, the number of trees/ha is to be taken as 200.

No. of replications : 2

Time of application : 1. Early December
2. Early April

Observations: Number of bore holes/presence of frass/gum in treated bark at monthly intervals.

ANNEXURE II

ANNEXURE II

Proforma for surveying and monitoring of stem and root borer incidence.

1. Date :
2. Location Village/Taluk/Dist.:
3. No. of field/plot and address of the farmer :
4. Total No. of trees in orchard :
5. No. of borer infested trees :
6. Tree type :
7. Age of tree :
8. Nature of the trunk : Soft/rough with crevices
9. Condition of the trees*

Mild Medium Severe Dead

10. Count of the pest stage :
11. Condition of adjoining trees :
12. Control measures adopted/ recommended :

Mild	Medium	Severe	Dead
Gummosis, Extrusion of Frass	Gummosis, extrusion of frass and yellowing of leaves	Gummosis, extrusion of Frass yellowing and shedding of leaves drying of twigs.	Totally dried up.

ANNEXURE III

Insecticidal control of pest complex in cashew.

The proposed trial envisages evaluation of suitable insecticidal control schedules against the major pests of cashew foliage and inflorescence, particularly tea mosquito, leaf miner, shoot and blossom webber, shoot tip caterpillar, foliage and flower thrips and apple and nut borer.

Treatments:

1. Endosulfan 0.05% (Hildon/Thiodan - Hindustan Insecticides - Hoechst)
2. Quinalphos 0.05% (Ekalux - Sandoz India)
3. Monocrotophos 0.05% (Monocrotophos - Ciba geigy)
4. Carbaryl 0.1% (Sevin - Union Carbide)
5. Methyl Parathion 0.05% (Metacid of Bayer India)
6. Phosalone 0.07% (Zolone - May & Baker)
7. Dimethoate 0.05% (Rogor - Rallis)
8. Control

(only formulations indicated in brackets to be used)

Number of sprayings: 3 (coinciding with emergence of flushes inflorescence and fruit sett setting)

I spray : New flush emergence
II spray : 30 days after I spray
III spray : 30 days after II spray

Design: RBD

No. of trees per treatment : 2
No. of replications : 3

Layout: Two trees in each treatment should be separated from the adjoining set of treatment trees atleast by one row of guard trees all around. These guard trees should also be sprayed with the same insecticide of the respective treatment. In case there is only one row of the guard trees, the corresponding half portion of the canopy facing the treated trees should receive the respective insecticide treatment.

Observations: Ten leaders should be selected and tagged in each observation tree before the first round of spray. Pretreatment observation is to be recorded 2 days prior to each spraying and two post treatment observations, 10 and 20 days after each spray. Observations on incidence of the following pests are to be recorded. Tea mosquito, foliage and inflorescence thrips, leaf minor leaf and blossom webber, apple and nut borers shoot tip caterpillar and other pests of regional importance like mealy bugs, mites, aphids etc. The observations should be recorded using the proforma appended.

Tea mosquito: For scoring the intensity of tea mosquito infestation, 0-4 scale described by Ambika et al (1979) (Proceedings of PLACROSYM II) should be followed.

Score

0 - No lesions or streaks

1 - Up to three necrotic lesions or streaks the general vigour of the shoot or panicle is not affected.

2 - 4-6 coalescing or non-coalescing lesions or streaks

3 - Above 6 coalescing or non-coalescing lesions or streaks

4 - Lesions or streaks confluent - complete drying of the affected shoot or panicle

Leaf thrips and mites (Oligomychus sp.)

Visible stages (adults & nymphs) should be counted on mature sample leaf in each leader.

Leaf and blossom webber: The number of webbed tips of the laterals and number of caterpillars are to be recorded.

Shoot tip caterpillar: The number of laterals with damaged shoots to be recovered.

Leaf miner: Five leaves from the tip of each lateral are to be observed and the number of infested leaves recorded.

Inflorescence thrips: Presence of scabs on the inflorescence stalk should be recorded. To record thrips on apple and nuts, 25 apples and nuts should be collected at random 7, 15 and 25 days after spraying, corresponding to peanut, green nut and full maturity stages. The damage intensity should be recorded per the following scale.

Score	
0	No damage
1	1 to 20% nut or apple surface damaged
2	21 to 40% -do-
3	41 to 60% -do-
4	61 to 80% -do-
5	81 to 100% -do-

Apple and nut borer: All the apples and nuts in a leader should be examined and the number infested to be recorded.

Residue analysis: Samples of green nuts, mature nuts and apples to be analysed for determination of insecticide residues, if any. This work will be taken up at two or three centres where the facilities for undertaking this work are available.

ANNEXURE IV.

Proforma for recording the pest complex of cashew in the experimental plot

Locality Date Treatment No. Replication

Tree No.	Tea mosquito scoring	No. of leaf thrips per leaf per leader	No. of leaf miner infested leaves	Shoot tip caterpillar infestation	Leaf and blossom webber: Webbing	Leaf and blossom webber: No. of caterpillars	Inflorescence thrips: Scabs on stalk of inflorescence	Inflorescence thrips: Scoring	Inflorescence thrips: Scoring on apple	Apple and nut borer: No. of apple nut examined	Apple and nut borer: No. infested	Other pests: Mites	Other pests: Mealy bugs scales	Other pests: aphid
	0 1 2 3 4		0 1 2 3 4 5	P A	P A		P A	0 1 2 3 4 5	0 1 2 3 4 5					
	0 1 2 3 4		0 1 2 3 4 5	P A	P A		P A	0 1 2 3 4 5	0 1 2 3 4 5					
	0 1 2 3 4		0 1 2 3 4 5	P A	P A		P A	0 1 2 3 4 5	0 1 2 3 4 5					
	0 1 2 3 4		0 1 2 3 4 5	P A	P A		P A	0 1 2 3 4 5	0 1 2 3 4 5					
	0 1 2 3 4		0 1 2 3 4 5	P A	P A		P A	0 1 2 3 4 5	0 1 2 3 4 5					

SESSION IV: AGRONOMY

Date: 11-11-1983
Time: 14.15-17.30hrs.

Chairman : Shri E.V.Nelliat

Rapporteurs : Shri G.S.Sulikere
Shri K Sivaraman

In his introductory remarks, the Chairman suggested that the review should briefly indicate the problems and achievements at the centres. Dr.R.C.Mandal reviewed the work on cashew, Shri G.S.Sulikere on cardamom, Dr. A.K. Sadanandan on pepper, Shri E.V.Nybe on Ginger & Turmeric and Shri T.Srirama Rao on Minor spices.

1. REVIEW

i) Cashew (Dr.R.C.Mandal)

Cashew is traditionally grown in poor soils and marginal lands and farmers do not adopt any improved cultural or manurial practices. A review of the available information show that cashew responds to nitrogen application significantly in all soil types and response to phosphate fertilisation though not consistant, was also indicated by several workers.

Under the project, NPK fertiliser experiment has been in progress at five coordinating centres (Bapatla, Anakkayam, Vengurla, Vridhachalam and Bhubaneswar) since 1976-77 and from 1982-83 the trial has also been initiated at Jhagram.

*

At Anakkayam - Madakkathara centre there was no significant difference in yield during 1978 and 1982 and hence no yield data has been furnished. However, a scrutiny of the data for four years showed an increasing trend in yield for application of nitrogen upto 500g/tree.

A new experiment has been laid out at Madakkathara centre to find out the efficient method of fertiliser application to cashew.

*There was a heavy cyclone in the East Coast during 1977-78 and 1/3rd the standing trees at Bapatla centre were heavily damaged. Hence a new trial is proposed to be started.

The fertilizer trial laid out at Vengurla centre in Ratnagiri hill belt (laterite scil) during 1969 was not according to guidelines of coordinated programme and the fertiliser was applied in kg/ha basis and it was decided to discontinue the trial in 1981 workshop and a new trial has been laid out in June 1981 at Wakawali Experiment Station on a new site, following the 27 NPK treatment combinations of N=0, 300, 600; P_2O_5 =0, 200, 400 and K_2O =0, 300, 600g/plant, using high yielding variety, Vengurla-2.

Another manurial cum spacing trial was laid out during 1970-74 (not a coordinated trial) and the overall yield data available indicated that added dose of nitrogen (250g/plant) and FYM (5.6 t/ha) were beneficial for cashew production. The spacing of 7.2 x 7.2 m was also found to be optimum.

At Vridhachalam centre, the yield data of the fertilizer trial for only two years (1980, 1982) were available. It is reported that during 1978-79 there was no significant difference; during 1980-81 and the North East monsoon had failed and during 1982-83 there was a heavy drought.

Another manurial trial was laid out at Vridhachalam centre during 1965 in which FYM, NPK alone and in combinations were studied for 4 years (1975 to 1978). The levels of N, P and K were 600g, 480g and 580g/plant, respectively and FYM @ 25 kg/pit.

The yield data clearly indicated that nitrogen could influence the yield significantly. Further, the combination of N and P would be the ideal for cashew yield improvement under Vridhachalam condition. The application of 600g, nitrogen and 480g, phosphate was found better than other treatments.

At Vridhachalam centre, attempts were also made for spray fertilization with urea as N alone and in combination with endosulphan and results of three years (1980-82) as compared to pre-treatment yield available clearly indicated that spraying of insecticide (endosulfan) is essential to control teamosquito and thereby increase in yield. If urea is added in the same spray solution, further increase in yield. If urea is added in the same spray solution, further increase in yield is assured. In the control plot with no spray plot 5.58 kg/plant yield was recorded, while the trees sprayed with endosulfan along with 3% urea (3 spray) yielded 8.89 kg/plant about 60% more yield.

The NPK trial at Bhubaneswar is continued since 1976-77 but the trend in yield was not encouraging. This is mainly because the trial was conducted on an existing plantation of Soil Conservation Department.

The mean data on yield of nut for four years at Bapatla, Anakkayam, Vengurla and Bhubaneswar; 2 years at Vridhachalam and only one year in case of Jhagram, are available (Table-1) and the data revealed that; (i) application of nitrogen upto 500g/plant is required to increase the cashewnut yield significantly (ii) application of phosphate upto 200g/plant is also found to be essential in certain areas, particularly at Vengurla, Vridhachalam and (iii) response to potash upto 250g/plant has been observed at Vengurla and upto 150g at Bapatla.

Shri PG Veeraraghavan (Madakkathara), Dr.Rao Rama Rao (Bapatla), Dr.Veeraraghavathatham (Vridhachalam), Shri DP Sawke (Vengurla), Dr JM Panda (Bhubaneswar), Dr SN Ghosh (West Bengal) and Shri Harishukumar (Vittal) supplemented the review.

Table 1. Mean nut yield data (kg/tree) at different centres (average of 4 years)

NPK levels (g/plant)	Bapatla (1979-82)	Anakkayam (1977-81)	NPK levels (g/pl)	Vengurla 1977,78,'80, 81 (g/pl.)	NPK	Vridhachalam 1980 & 1982	NPK levels (g/pl)	Bhubaneswar 1977-80	NPK levels (g/pl.)	Jhagram 1983
N_0	3.88	1.97	N_{125}	0.49	N_{100}	1.62	N_0	0.52	N_{200}	3.1
N_{500}	5.04	2.32	N_{375}	1.22	N_{300}	1.99	N_{250}	0.99	N_{300}	4.7
N_{1000}	6.00	2.19	N_{625}	1.30	N_{500}	2.42	N_{500}	1.13	N_{400}	5.3
P_0	4.74	2.06	P_0	0.47	P_0	1.99	P_0	0.85	P_{100}	4.2
P_{200}	5.12	2.04	P_{125}	1.82	P_{100}	1.96	P_{125}	0.85	P_{200}	4.4
P_{400}	5.09	2.43	P_{250}	2.09	P_{200}	2.09	P_{250}	0.86	P_{300}	4.5
K_0	4.73	2.10	K_0	0.80	K_0	1.94	K_0	0.81	K_{100}	4.1
K_{500}	5.10	2.27	K_{250}	1.26	K_{150}	2.01	K_{150}	0.94	K_{200}	4.4
K_{1000}	5.04	2.12	K_{500}	1.28	K_{300}	2.08	K_{250}	0.88	K_{300}	4.6

ii) Cardamom (Shri G.S. Sulikere)

Cardamom research in the country is in progress at four centres, namely Pampadumpara (Kerala), Mudigere and Appangala (Karnataka) and Yercaud (Tamilnadu). Earlier investigations have generated valuable information on nursery practices, especially on season of sowing and germination, viability of seeds, effect of mulching of nursery beds, age of transplanting of seedlings in secondary beds and shade requirements of cardamom nursery. Studies on cultivation practices have also been standardised at Mudigere and Pampadumpara. Preliminary studies at Yercaud on population densities showed that high density planting at 1m x 1m spacing give better yields compared to spacing of 2.5 m x 2.5 m.

Nutrient uptake studies carried out at Mudigere showed that removal of potash was maximum (20.01 kg/ha) followed by nitrogen (12.17 kg/ha) and calcium (8.84 kg/ha), phosphorus (1.4 kg/ha) and Magnesium (2.32 kg/ha). For one kg of cardamom capsules, 0.122 kg N, 0.014 kg P and 0.200 kg potash are removed. Based on the nutrient removal studies it was found that potassium requirement is greater compared to other nutrients. The ratio of N, P, K, Ca and Mg present in cardamom is 6:1:12:3:0.8.

NPK Fertilizer: An experiment was conducted at Mudigere in split plot design (2^3x3), with two main treatments., viz., soil application and soil cum foliar application with 8 sub-treatments. The first level was maintained at zero for all the ingredients and second level was maintained at 32.5 g of N (N_1) 25 g of P_2O_5 (P_1) and 50 g of K_2O (K_1) per plant as urea, super phosphate and muriate of potash respectively. For foliar application, urea (0.5-1.0%) were used. Maximum number of suckers were produced by the plants which received NPK and minimum was found in control (Table).

Mode of application of nutrients did not show any significant influence in the dry matter production and uptake of nitrogen phosphorus and potash.

Effect of N,P,K on the growth and dry wt. of cardamom*

Treatment	Average number of suckers per clump	Average number of leaves per clump	Average height of suckers(cm)	% dry wt. M1	M2
$N_0P_0K_0$	12.31	62.00	50.51	14.15	12.91
$N_1P_0K_0$	17.51	72.96	53.75	14.82	11.77
$N_0P_1K_0$	18.12	94.83	61.77	15.44	14.17
$N_1P_1K_0$	23.74	110.62	54.08	15.84	12.07
$N_0P_1K_1$	18.09	89.08	60.30	10.14	11.19
$N_0P_0K_1$	22.31	110.65	65.53	12.29	11.20
$N_1P_0K_1$	19.22	92.16	52.08	14.21	12.93
$N_1P_1K_1$	31.84	171.20	64.46	15.48	18.22
C.D. at 5%	4.95	29.90	6.78		
C.D. at 1%	6.67	40.33	NS		

*Observations recorded 11 months after planting

The plants provided with $N_1P_1K_1$ treatment have shown high uptake of N (93.78 kg/ha), P (13.41 kg/ha), K (67.49 kg/ha) Ca (33.48 kg/ha) and Mg (8.55 kg/ha) compared to that of all other treatments. Plants fertilized $N_1P_1K_1$ recorded highest total dry matter (18.22% followed by N_1P_1 (15.84%) P_1K_0 (15.4%) and lowest in control (12.9%).

Based on nutrients uptake and the factors affecting their availability a fertilizer dose of 75 kg N, 75 kg P and 150 kg K/ha in two splits, the first one before the onset

of monsoon (May) and second at the end of monsoon (September October) was recommended (Pattanshetti and Rafeeq 1973).

Additional fertilizer doses of 0.65 kg N, 0.65 kg P and 1.3 kg K/ha has to be applied for every increase in the yield of 2.5 kg of capsules over the normal yield.

Shri G.K.Balachandran Nair (Pampadumpara) and Dr.K.Nanjan (Yercaud) supplemented the review.

iii) Pepper (Dr.A.K.Sadanandan)

The work in progress on the agronomical and physiological aspects of pepper at Panniyur centre under AICSCIP and at CPCRI Regional Station, Calicut are reviewed in this paper and the progress is indicated experiments.

Fertiliser experiment

Consolidated data for the past seven years have been presented. It is stated in the report of 1981-82 that the requirement of 50gN, 100g P_2O_5 and 140 g K_2O/vine/year for Panniyur-I pepper. However this has been arrived at in the absence of a statistical analysis. In the report of 1982-83 the results of 8 years have been presented without any statistical backing.

In the technical programme of work it is found that the aim of the experiment is to find out the effect of graded dose of N for pepper. Lime at two levels has also been included as another treatment. It has not been reported whether the two levels of lime resulted in distinct change in soil pH.

Work done outside Co-ordinating centre.

CPCRI Regional Station, Calicut.

1. Nutritional requirement of pepper.

A field experiment with 3^3 partially confounded design having four replication and three levels each of

N, P and K was laid out in 1979. The pepper variety was Panniyur I on Erythrina indica as standard. During the year 1982, 111 out of 648 vines flowered and the maximum yield obtained in a vine was 344 g. The data has not been statistically screened for want of sufficient yielding population. During 1982 the highest yield were obtained in vines receiving 50g N, 40g P_2O_5 and 280 g K_2O . This has got to be confirmed by statistical analysis.

2. Spacing requirement of pepper.

A strip plot design with three varieties (Panniyur-1, Karimunda and Ayimperian) four spacing (3x3m, 2.5x2.5m, 3x1.5m and 2.5x1.5m) was laid out in 1982 with four replications.

3. Standards and spacing for pepper.

An experiment of strip plot design having five standards (Erythrina indica, Garuga pinnata, RCC posts, Granite pillars and Teak poles) and two spacings (3.3x3.3m and 3x2m) was laid out in 1976 with four replications. The data indicated that the performance of vines grown on non-living standards was better compared to living standards. With regard to spacing it was observed that 3x2m was superior, similar results were obtained in 1982. There was heavy incidence of wilt disease and very high mortality of vines. The experiment is therefore being replanted in 1983 by interplanting with banana as shade crop. Soil analysis in 1982 indicated that in the treatment involving non-living standards, the soil availability of nutrients (except organic carbon) were higher.

4. Mineral nutrition of pepper in relation to wilt disease.

This experiment was initiated in 1982 with the objective (1) of finding out the representative leaves of pepper which would correctly reflect the status of mineral nutrition of plants. (2) finding out soil sampling

(optimum distance and depth techniques) for obtaining the correct picture of the nutrient status with minimum variation (3) relating the nutrient status and soil and leaf with the wilt disease of popper.

The results from this experiment indicated collection of soil samples at 30 cm away from the base of the vine to a depth of 30 cm is optimum as evidenced by the least coefficient of variation. Analytical data for the leaf samples showed that collection of the youngest matured leaf from the laterals correctly reflected the nutrient status of the plant and hence is the proper area of sampling.

Shri V Sukumara Pillai (Panniyur) supplemented the review.

iv) Ginger and Turmeric. (Shri EV Nybe)

Ginger

Season: Earlier studies have revealed that 1st week of April was the best time of planting for getting maximum yield under Kerala condition.

Seed rate: A seed rate of 1200-1400 kg/ha was recommended based on trials conducted at Ambalavayal. Studies at Ambalavayal and Pottangi indicated a positive correlation between yield and size of seed rhizome. At Pottangi maximum yield was recorded for seed bits weighing 20-24kg. However, the recommendation for Kerala is to use seed bits of 15g weight for economic yield. As per report from CPCRI, Kasaragod 1250 kg seed rhizome per hectare was the best for better tillering, growth and yield. (Jayachandran et al 1980).

Mother rhizome could be separated three months after planting without adversely affecting further growth of the plant and the separated rhizome can be used for vegetable purpose.

Studies conducted at Ambalavayal and CPCRI, Kasaragod revealed that pit method was the most efficient method of storing ginger seed rhizomes.

Planting: From the trials conducted at the coordinating centre, Pottangi, it was concluded that raised beds and flat beds were on par with regard to their effect on yield of ginger. While in Kerala raised beds are found to be superior. Planting the seed rhizome at a depth of 4 cm was found to give increased yield under Himachal Pradesh. Kerala Agricultural University recommend a spacing of 20x20cm to 25x25cm for better yield.

Nutrition: Increased yield was reported with 25-30tonnes of FYM + 450 kg of 8:8:16 NPK mixture per hectare. Under virigin soils, 10 tonnes of FYM and 7.2 tonnes of green leaf mulch per hectare was sufficient to produce an economic crop of ginger. Under Himachal Pradesh condition a fertilizer dose of 100:50:50 kg N, P and K per hectare was recommended for better growth and yield. A bumper crop of 43 tonnes green ginger per hectare from the variety Rio-de-Janeiro by the application of 100 kg N, 100 kg P_2O_5 and 200 kg K_2O/ha was reported from Kerala. Importance of N at the active growth (120-135 days after planting) and tillering stages has been reported from Andhra Pradesh. There are also reports that boron at 50 kg/ha increased the number of tillers and leaves per clump and reduced the incidence of soft-rot disease. Studies conducted at the college of Horticulture, Vellanikkara during 1979 indicated that a fertilizer dose of 80:30:40 kg N, P and K per hectare was optimum for maximum yield. It was also observed that the oleoresin content could be increased by foliar application of planofix 400 ppm alone or urea (2%) + planofix (400 ppm). The fertilizer recommendation under Kerala condition is 75:50:50 kg N, P and K per hectare.

Turmeric

Season: Turmeric investigation at Andhra Pradesh, Kerala and other turmeric growing regions have generated very useful information on turmeric cultivation especially in season, seed rate, planting system, nutrition, intercultivation and harvesting time etc.

Nutritional studies have indicated that the curing percentage of turmeric was influenced by fertilizer application. Application of 25 tonnes FYM and 63 kg N/ha as oil cake was found to be the optimum for better yield in Andhra Pradesh. In Kerala the effect of N and K on plant height, tiller production and yield was significant while the response to P_2O_5 was negligible. In Kerala the fertilizer dose recommended is 30:30:60 kg N, P & K per hectare. In Andhra Pradesh 15-20 irrigation in clay soils and 40 in sandy soils were recommended.

Turmeric is being recommended as an intercrop in coconut and arecanut gardens. The crop comes up well under partial shade but thick shade effects the yield adversely. Turmeric can be successfully grown as a mixed crop with chillies, colocasia, onion, brinjal and cereals like maize, vegetables etc.

Based on the above review, the following gaps in agronomical aspects of ginger and turmeric have been identified which require more comprehensive research work.

Standardization of an efficient and economic method of weed control.

Standardization of the type and quantity of mulch to be used with a view to reduce soft rot incidence.

Detailed investigation regarding the suitability of different types for inter and mixed cropping.

Irrigation experiments to find out the water requirement of ginger and turmeric and standardization of agro-techniques for irrigated condition.

Investigation to find out the cost benefit ratio of various recommendations in ginger and turmeric.

Dr.UK Kohli (Solan) and Shri DC Mohanty (Pottangi) supplemented the review.

v) Minor spices (Shri T. Srirama Rao)

Coriander, cumin, fennel and fenugreek are the crops covered under the Project and the research on these crops are now in progress at Jobner (Rajasthan) Jagudan (Gujarat) Lam Farm (Guntur (AP) and Coimbatore (TNAU). Results of fertiliser trials conducted on these crop are reviewed in this paper.

Coriander

In the fertilizer experiments conducted during the last five years at Lam, Guntur (AP) with graded doses of NPK with and without farm yard manure and also foliar sprays with Boron and Zinc did not yield any significant results. There is very little response for fertilizer application to coriander in black cotton soils under rainfed conditions. Chemical analysis of the soils revealed that they are rich in P and K. Recent studies indicated field response for N application at 30 kg/ha.

In Tamilnadu the crop responded best to a nutrient schedule of 10-15 tonnes of organic matter plus N 20 and P 40 kg/ha. K has not shown any beneficial effects.

At Jobner (Rajasthan) application of N (upto 45 kg/ha) as well as P (upto 30 kg/ha) were found to increase the yield. The effect of N application was more significant than that of P. Application of zinc, boron or both together with N and P did not increase the yields of coriander.

At Jagudan (Gujarat) two year data revealed that a combination of N 60, P 60 and K 30 has recorded highest yield of 1056.70 kg/ha (36.26% over the control) 2298.84 kg/ha (145.97% over control) in the 1st and 2nd years respectively. Nitrogen was applied in two splits (one half as basal and the other half just at the flower initiation).

Stage of harvesting and handling of the harvested crop affects the mericarp yield as well as the oil content. The crop must be harvested when the seeds mature in the central umbel. The harvested crop should be staked in shade to avoid loss of volatile oil and breakage of grain.

Fenugreek (Trigonella foenum - graecum)

Singh and Joshi (1980) described the cultural practices in vogue for getting higher yields in fenugreek, and recommended application of 25 kg N, 25 kg P and 50 kg K per hectare for a good grain crop.

Under the AICSCIP fertilizer trials conducted at Jobner (Rajasthan) Pilwai and Jagudan (Gujarat) revealed that the crop response to N is rather not significant. However, the response to application of N 20, P 60 and K 30 appear to be sufficient for this crop in Gujarat. In Rajasthan no positive response in respect of yield was recorded to the application of N or P. In Tamilnadu the optimum fertilizer schedule recommended is N 50 and P 25 kg/ha.

Work on agronomical aspects of this crop is in progress at Jobner and Jagudan.

Cumin (Cumin cyminum L)

Most of the cumin area is in Rajasthan and Gujarat.

Depending upon the agro-climatic conditions cumin is sown from the last week of November to middle of December.

Broadcast sowing of cumin is the usual practice. However, there are reports indicating superiority of line sowing over broadcast method. Line sowing with a row to row spacing of 30 cm was superior over both broadcasting as well as wide spacing of 45 cm.

Recent studies on fertilization of cumin indicated that it responds well to application of both Nitrogen and Phosphorous.

Studies in field experiments at Udaipur indicated that application of higher doses of N and P in addition to the common basal dose of 30 kg/ha each N, P and K. In 78-79 the trial conducted with M.C.43 variety at Jagudan has indicated that a combination N0 [illegible] and P30 has given the highest yield (392.8 kg/ha). There was no evidence of any effect of Zn and B on yield.

To arrive at an optimum schedule for cumin, the trials are being continued in Rajasthan and Gujarat.

Fennel (Foeniculum yuluare)

It is grown as a garden crop under irrigated conditions in India mostly in Rajasthan and Gujarat in light to medium type of soils.

In north it is sown in October-November. In hills it is planted in March-April. Well drained black sandy soils or loams containing sufficient lime are considered good for fennel. Seeds are sown shallow either broad cast or in rows placed at 30-45 cm apart. In some places nurseries are raised and seedlings of 45 days old are transplanted giving a spacing of 30-45 cm in between and along rows. A seed rate of 9 kg/ha is recommended.

It has been reported that fennel responds well to application of N, P and K. The recent fertilizer experiments conducted in Rajasthan revealed that application of

N at 30 and 45 kg/ha has significantly increased the yields where as phosphorus/zinc and boron did not show any positive effect. At Jagudan (Gujarat) application N and P (N 45 kg and P 30 kg/ha) alongwith Zn and B has increased the yields. The magnitude of increase was however not high to warrant fertilizer application in soils receiving 10 tons of FYM of compost/ha.

Further research to work out and recommend package of practices regarding time, date, rate, method of sowing and fertilizer at location in relation to soil types its fertility and varieties used to maximise the hectare yield is in progress at various coordinating centres in the country for the benefit of the farmers.

Dr(Mrs) Seemanthini Ramadas (Coimbatore), Shri DS Bhati (Jobner) and Shri BT Kachhadia (Jagudan) supplemented the review.

2. DISCUSSION AND RECOMMENDATIONS

i) Cashew

1. Fertilizer treatments may be imposed right from the year of planting. Upto the fourth year graded doses of fertilisers may be applied at ¼, ½, ¾ and full during the first, second, tthird and fourth year, respectively.

2. The results of fertilizer experiments conducted in various soil types like sandy and laterite soils had indicated response upto 1000g N/tree though the increase in yield over 500g N per tree was not marked. The data suggested that the present recommendation of 250 g N/tree should be increased to 500 g N/tree, retaining P_2O_5 and K_2O levels at 125 g/tree.

3. Fertilizer experiments that had run for more than ten years may be concluded (Vengurla, Bapatla and Madakkathara) and new fertilizer experiment as per the technical programme formulated in last workshop may be taken up with varieties that are released.

4. In the concluded experiment at Vridhachalam "Effect of foliar application of urea with pesticides", it was reported that there was a net profit of Rs.2000/ha. Dr.P.Rethinam, Dr.PK Das and Shri Veeraraghavathatham were requested to critically scrutinise the data. Their report stated that: (1) spraying endosulfan 0.05% + urea 3% solution thrice an year, viz., flushing time, flowering time and fruitset gave an additional yield of 2.97 kg/tree/year, which had given an additional income of Rs.1472/ha taking into account only 160 trees/ha. (ii) under Tamilnadu conditions with 204 trees/ha the additional income will go up to Rs.1876/- (iii) the finding can also be recommended for Kerala. Considering the general performance of cashew in Kerala, the adoption of the above practice is expected to result in an additional yield/tree of 3.5 kg., which will give an additional income of Rs.1,640/ha at tree density at 160/ha and the prevailing high labour wages.

5. Shri Subramaniaym, Cashew Plantation Corporation of Kerala desired that the economic optimum dose of fertilisers for cashew may be made available for varying price levels of cashewnut. It was suggested that the CPCRI may make available the information based on the available data from fertiliser trials.

Pepper

1. The fertiliser experiment at Panniyur has been in progress for over eight years. A decision on continuance

or otherwise of experiment may be taken up by the Coordinator after examining the pooled data analysis. The present fertiliser recommendation of 100g N/vine may be revised as 50 g N/vine.

Cardamom

1. Clone No.PV1 will be utilised for the new fertilizer experiment at Pampadumpara as well as multilocation trials.

2. At the new centre at Yercaud, the technical programme followed in the other centres may be followed for the experiments to be initiated there.

3. The Kerala Agrl.University shall look into the B, Zn and Mg deficiency reported in the cardamom soils of South Central Kerala.

4. The recommendation of the expert committee for recommending fertilizer dose for cardamom which met under the Chairmanship of Dr.JP Singh on 10-11-83 and attended among others by Dr.KVA Bavappa and Dr.M.C. Nambiar had suggested 75 kg N,75 kg P_2O_5 and 150 kg K_2O/ha/year for cardamom to be applied in two splits before and after south-west monsoon. This was accepted by the workshop, as a general recommendation for cardamom in the three states of Kerala, Karnataka and Tamilnadu. All the participating centres shall initiate the NPK fertilizer experiment as per the technical programme appended. Appendix I.

5. Treatment of cardamom seeds with 25% nitric acid would help in obtaining better germination, especially, during November-December and this enable better utilisation of seeds of promising selections harvested in all the months.

APPENDIX I

NPK Fertilizer Experiment

It is decided to layout 3^3 NPK trial at three places viz. Mudigere, Pampadumpara and Yercaud during June 1984 & Myladumpara during June 1985.

Levels of NPK are as follows.

N: 0,50 and 100 kg/ha
P: 0,50 and 100 kg/ha
K: 0,100 and 200 kg/ha

The levels of NPK are fixed for a normal spacing of 1.8x1.8m. In order to have more number of plants per treatment the spacing to be adopted is reduced to 1.8x0.90m. Thus fertilizer is to be worked out per plant and applied.

Other details of the experiment

Planting material - monoclonal material.

Before planting rhizome and root portion of the suckers are to be treated with 0.2% captan solution for two minutes. Surface planting has to be done. Only swollen base of the stem is to be covered by the soil and it should be supported by staking.

Spacing 1.8x0.90m.

No.of plants per treatment 4 with single guard row.

At Mudigere it is suggested to use P1 clone for the entire experiment as material is available. For Pampadumpara centre PV-1 is suggested. Since there is no sufficient clonal material of single clone available at Yercaud it is suggested to have P1 from Mudigere PV-1 from Pampadumpara and CL-37 from Appangala, one clone for each replication. He can use seedling progeny of any material that is readily available for guard rows.

Design: Factorial

Replications: 3

Shade Pattern: Uniform shade of only one kind of shade tree or uniform shade of coir mating may be used.

Observations to be recorded

1. Number of suckers - growing, mature, bearing
2. Height of suckers
3. Number of leaves
4. Total number of panicles
5. Number of panicles per bearing shoot
6. Number of capsules per panicle for five panicles of each plant.
7. Wet weight of capsule
8. Dry weight of capsules

G.. ger and Turmeric

1. When presenting the results of agronomy experiments on ginger and turmeric, the yield shall be given as tonnes/ha and not as kg/m^2 or 3 m^2.

2. Results of mulching and intercropping trials on ginger indicated that intercropping with redgram and french-bean gave the highest yield under Pottangi conditions.

3. Results of turmeric trials conducted at Pottangi for the last four years showed that application of FYM at 7.2 tonnes/ha as basal dressing and green leaf mulch at 2.5 kg/m^2 combined with chemical fertiliser $N_{60}P_{30}K_{90}$ gave the highest yield of 3.4 tonnes/ha.

4. The work done at TNAU had shown that planting turmeric in beds of size 50 cm x 15 cm gave the highest yield. This may be adopted at other centres where turmeric is grown as irrigated crop for uniformity in planting method. Also cut mother rhizomes may be used for planting as it gives comparable yield to planting of whole mother rhizomes and higher input-output ratio. The population density trial at KAU may be continued for obtaining more valid information.

Minor Spices

1. The existing programmes will continue.

2. In Tamilnadu plucking leaves in the early stages resulted in 26% reduction in yield in fenugreek. The study may be continued.

3. Based on the results of the fertilizer experiment on fennel, the following fertiliser schedule was recommended.
   Application of 45 kg N + 30 kg P_2O_5 + Zn + B as under:
   i) 1/3 N + full P as basal dose at the time of transplanting.

ii) 1/3 N as top dressing after one month of transplanting

iii) 1/3 N as second top dressing after two months of transplanting and

iv) three foliar sprayings of Zn and B of stock so[illegible] of 0.6% Zn (in the form of $ZnSO_4$) + 0.3% lime be[illegible] prepared and then mixed with 0.2% B (in the form Borax) solution. Dilute the mixture with wate[illegible] spray at 5 lit/ha with low volume.

There were lectures on special topics on the R & D effort for increasing the productivity and production of(a) a) cashew and pepper by Dr.CK George; b) Cardamom by Shri John M John; and c) Ginger & Turmeric by Shri E.Velappan. Dr.R.C.Mandal gave a special talk on the production of planting material of cashew and Shri P.N.Ravindran presented a paper on production of planting materials of spices. In the discussions that followed, the following suggestions emerged.

Cardamom

1. The research centres should devote greater attention towards developing suitable agrotechniques for that region. Identification, multiplication and distribution of quality planting material is of paramount importance, and this must receive greater stress. Necessary acti[illegible] plan may be formulated in these matters. The clonal [illegible] gardens of about 0.5 ha each as detailed below shall [illegible] maintained at the various research centres for genera[illegible] ing planting material for multiplication. The availabl[illegible] seeds from these selection under various trials/experi[illegible] ments shall also be utilised.

   i) Pampadumpara: Variety PV1 used for multilocation trial, Fertilizer trial and multiplication.

   ii) Mudigere : P-1.

   iii) Appangala : APG 7 and clone 37.

2. It was suggested to intensify the efforts for developing and popularising driers using farm wastes for cardamom processing.

3. The possibility of updating the field staff with the latest research results by the CPCRI may be looked into.

4. The Project Coordinator and the ICAR may consider the possibility of including the ICRI, Myladumpara as a non-financed participating centre under the All India Co-ordinated Spices & Cashewnut Improvement Project so that the technical programme of the centre could be presented and got approved at the workshop and the scientists at Myladumpara shall not work in isolation.

5. Two experiments one on Evaluation of types and varieties of cardamom for drought tolerance and the other on Studies on mineral nutrition in cardamom were approved. The technical programme are given in Annexure.

Cashew and Pepper

1. A committee was formed under the Chairmanship of Dr.CK George to formulate the action plan for increasing the production and productivity of cashew and pepper.

2. For rapid multiplication of pepper, it was requested to find out a suitable alternative for the bamboo, which has become very expensive.

ANNEXURE I

CARDAMOM RESEARCH STATION, MUDIGERE

New Project Proposal

1. Project Number :
2. Department : Crop Physiology
3. Project Title : Evaluation of types and varieties of cardamom for drought tolerance.
4. Personnel available :
   a. Project Leader : B.R.Gurumurthy
      Jr.Plant Physiologist
   b. Associates : G.S.Sulikeri
      Agronomist (Hort.)

      H.V.Pattanshetti
      Regional Associate Director
5. Co-operative arrangement : Plant Breeding and Soil Science Depts.
6. Location : Regional Research Station, Mudigere.
7. Objectives : To understand nature of drought tolerance and to screer types and varieties for drought tolerance.
8. Practical utility : Due to vagaries of monsoon, cardamom crop faces severe drought situations. In summer it is necessary to suppliment the crop with several irrigations for successful growth but the crop is grown on hilly slopes where summer irrigation is a great problem. Therefore it is of immense importance to study drought tolerance in cardamom.
9. Status of the problem: Twentyfive high yielding clonal selections have been made at the regional research station and they have not been screened for drought tolerance.

10. Techniques to be adopted : Twelve clones as detailed below will be screened.

1. Clone P_1 } Clones from 'P' series (Malabar type)
2. Clone P_2 }
3. Clone P_3 }
4. Clone P_5 }
5. Clone P_6 }
6. Clone P_8 }
7. CL -757 } Malabar Type
8. CL -668 }
9. CL- 664 }
10. CL -670 }
11. Pl -258 Bulk
12. V -179 Semierrect type

B. Other details of the experiment:

Spacing: 6 x 2 ft. (1.8mx0.6m)

Design: CRD

C. Parameters to be studied:

Above clones will be planted under uniform shade of coir matting with high density planting to have more number of plants per treatment when the plants putforth suficient growth the following parameters will be studied to understand the nature of drought tolerance:

Morphological characters:

1. Root to shoot ratio
2. Stomatal frequency
3. Stomatal size
4. Stomatal index
5. Leaf area and leaf thickness
6. Relative water content

*Biochemical studies:

Membrane systems as affected by the drought

11. Duration of investigation : 4 years
12. Facilities :
    a. Available : Land
    b. Required : Colorimeter
       Diffusive resistance meter

*He may take up this study in case he has sufficient time.

ANNEXURE II

CARDAMOM RESEARCH STATION, MUDIGERE

New Project Proposal

1. Project Number	:	
2. Department	:	Crop Physiology
3. Project title	:	'Studies on mineral nutrition in cardamom'.
4. Personnel available:		
a. Project Leader	:	B.R.Gurumurthy, Jr.Plant Physiologist
b. Associates	:	H.V.Pattanshetty Regional Associate Director
5. Co-operative arrangements	:	Plant breeding and soil science departments
6. Location	:	Regional Research Station, Mudigere.
7. Objectives	:	a. To identify the deficiency symptoms. b. To understand natures of physiological changes under different mineral deficiencies.
8. Practical utility	:	Cardamom is grown in heavy rainfall area where in rainfall ranges from 2000 to 4000 mm. Most of the bases leach away from the soil and soil become acidic. Low pH of the soil also makes several nutrients unavailable. Thus cardamom suffers from deficiency of one or the other elements. Hence this study is of great value.
9. Status of the problem	:	Very little information is available on the deficiencies of various elements.

10.	Techniques to be adopted	: Sand culture study, leaf and plant analysis
	No. of element to be studied	: N,P,K,Ca,Mg,S,Cl, and Na
	No. of replications	: 4
	Planting material	: Cardamom seedlings
11.	Duration of investigation	: Three years.
12.	Facilities	
	a. Available	: Land, Planting material
	b. Required	: Deioniser unit.

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 ANNEXURE III

Proceedings of the committee on Transfer of Technology

Multiplication of cashew selections/hybrids at different centres.....

1. Planting material of promising varieties identified at the different cashew research stations in different states should be made available in bulk for further expansion of area under cashew. While deciding the varieties the availability of planting material for distribution at each centre was considered. The names of state and varieties recommended are as follows:

State	Varieties
Kerala	BLA-1, BLA-139, H.3-13, H.317, K.22-1 & NDR.2-1
Karnataka	BLA.39-4, M.44/3, M.10/4 and 8/46 and 3/67 for plain areas. For upghat regions 5/61.
Tamil Nadu & Pondicherry	M.10/4 and M.44/3
Andhra Pradesh	EPM.9/8, T.56 and M.44/3
Maharashtra & Goa	V.1, V.2, V.3, V.4, M 44/3
Orissa & West Bengal	M.44/3 & WRDC. V
Thripura	BLA.139-1, WBDC.V, M.44/3

2. Centres for multiplication of planting material:

The following agencies have been identified to take up the large scale multiplication of these improved varieties. The agencies which could not give the details of the centre may furnish the same to the Project Co-ordinator, AICSCIP, immediately.

State	Agencies	Centre
Kerala	Kerala Agricultural University	Madakkathara & Anakayam
	Central State Farm, Aralam	Aralam
	KADP Seed Garden Complex	Nilampur
	Plantation Corporation of Kerala	8 Centres
	CPCRI	Vittal & Shantigodu
Karnataka	Karnataka Cashew Development Corporation	
	Karnataka Forest Development Corporation	
	University of Agricultural Sciences	
	Department of Horticulture	
	CPCRI	Vittal & Shantigodu
Tamil Nadu	Tamilnadu Agrl.University	Vridhachalam
	Department of Horticulture	
Andhra Pradesh	Andhra Pradesh Agrl. University	Bapatla /Kayalty
	Andhra Pradesh Forest Development Corporation	Sathiaveedu, Nallayerla
Maharashtra	Konkan Krishi Vidyapeeth	Vengurla
	Horticultural Department	
Goa	ICAR Research Complex	
	Forest Department	
	Department of Agriculture	

Orissa	Soil Conservation Department	
	Orissa Forest Development Corporation	
	Orissa University of Agriculture and Technology	Bhubaneswar
West Bengal	B.C. Krishi Viswa Vidhyalaya	Jargram
	Department of Agriculture	
Pondicherry	Tamil Nadu Agricultural University	Vridhachalam
Tripura	Department of Agriculture	Nagrachirra

(3) Availability of planting material:

The extent of planting materials which could be supplied from different sources during next year was considered in respect of different varieties and the quantity of material promised by different agencies are given below:

1. Kerala Agricultural University, Madakkathara.

BL. 39-4
BL. 139-1
H.3-13 — 1000 epicotyl grafts each
H.3-17
K.22-1
NDR.2-1

2. Cashew Research Station, Ullal.

8/46 - 1000 layers
3/67 - 250 "
5/61 - 250 "

3. CPCRI, Shantigodu/Vittal

M.44/3 - 600 Epicotyl grafts
M.10/4 - 2000 "
M.10/4 - 600 "

4. Tamil Nadu Agricultural University, Vridhachalam.

M.10/4 - 7000 layers
M.44/3 - 500 "

5. Andhra Pradesh Agricultural University, Bapatla.

CPM.9/8 - 2000 layers
T.56 - 2000 "
M.44/3 - 1000 "

6. Maharashtra Konkan Krishi Vidhyapeeth, Vengurla.

V.1 - 3000 Epicotyl grafts
V.4 - 2000 "
M.44/3 - 100 "

7. Orissa, Bhubaneswar.

M.44/3 - Nil
WBDC.V - 500 Clonal materials

SESSION V: PLANT PATHOLOGY

Date: 12-11-1983
Time: 09.00-11.00 hrs.

Chairman : Dr.Abicheeran
Professor, KAU.

Rapporteurs : Shri N Ramachandran
Dr.P.Karunakaran

After the introductory remarks by the Chairman, Dr.K.K.N. Nambiar presented the review of work done on plant pathological aspects of cardamom, pepper, ginger, turmeric and minor spices.

1. REVIEW

Spices (Dr.K.K.N.Nambiar)

In Cardamom, katte, azhukal (capsule rot) and nursery leaf spot are the diseases on which investigations are in progress at various centres of AICSCIP and CPCRI.

The viral nature of katte, vector virus relationships, nature of spread of the disease etc had already been workout worked out to some extent. Pentalonia nigronvervosa f. caladii is the most efficient vector. There was no relationship between number of insect vectors and age of plant vis a vis disease incidence. The disease spread is slow and it can spread to a distance of 200 Meters from the source of inoculum. The virus was found to be nonpersistent. Mild strain in katte has been observed at Appangala. Management of katte through eradication was recommended by earlier workers like Dr.Deshpande. Recently Dr.Naid has proved the efficacy of this technique through katte clinic programmes taken up in large scale in planters' fields. In Pampadumpara results of roguing show that the incidence of the disease could be reduced from 5.6% to 1.8% in one plot and from 57.9% to 1.7% in a second plot. Since the disease is systemic in nature and the virus is vector

transmitted, locating resistance only is a permanent solution, and with this end in view, screening of seedlings to locate resistance was in progress at Mudigere, Pampadumpara and Appangala centres. Though at large number of seedlings have been screened at Mudigere and Pampadumpara, none of them was found to be resistant. However, at Appangala 13 irradiated seedlings are found to be resistant/tolerant to katte even after repeated inoculation.

Investigations carried out in the early years of the project helped in suggesting suitable remedial measures against nursery leaf spot disease. The etiologic agent of Azhukal disease was found to be fungi like Phytophthora sp. Pythium vixans also was found to be associated with the disease sometimes. It was found that Azhukal could be controlled by Bordeaux mixture spray twice in June-July and September.

On Azhukal disease the results at Pampadumpara show that the pathogen has a wide host range. Nair (1979) studied the epidemiology of the disease and correlated the disease incidence with soil moisture, soil and atmospheric temperature, RH, rainfall etc. He found that the fungus survived as chlamydospores for about 24 weeks in air dry soils.

Pepper

The two projects on pepper diseases are 1) studies on wilt diseases and 2) control of pollu diseases. Detailed studies are in progress at Calicut and Kasaragod centres of CPCRI on epidemiology of quick wilt disease, screening for resistance and disease management. The disease incidence is related with the total rainfall during the year, coupled with high RH (95%) low temperature (20-22°C). Studies on the ecology of root rot, symptomatology vis a vis the weather conditions are in progress at Panniyur.

The studies at CPCRI show that the pathogen belongs to MF_4 of Phytophthora palmivora. The disease spreads in a centrifungal fashion from a central point initially with scattered infection occurring later. Biological agents like ants, termite and snails, and irrigation and drainage water aided dissemination of the pathogen. The pathogen was found to be dispersed through rain splashes from soil upto 75 cm above ground level and this fact was taken into consideration while recommending the plant protection schedule for wilt control. Field trials with fungicides indicates the effectiveness of metalaxyl and Bordeaux mixture. An elaborate field experiment on the management of the disease has been laid out at Calicut. Based on in vitro testing, seven fungicides including systemic fungicides are being tested in the field at PRS, Panniyur, using Karimunda variety. At Calicut centre large scale screening of seedlings, rooted cuttings of hybrid progenies and wild types and irradiated seedlings is in progress. A survey conducted in Calicut district on wilt disease incidence showed that the overall mean incidence was 6.17%.

In the case of slow wilt the earlier work done at CPCRI showed that fungi, nematodes, moisture stress and nutrient deficiencies are associated with the disease. It brought out the necessity of intensifying research on nematode aspects of this disease. Nematicidal trial laid out in the field earlier by CPCRI scientists showed that phenamiphus helped in reducing foliar yellowing. Further studies are in progress at Calicut and Panniyur.

On pollu disease, work is in progress at Panniyur (KAU). The pathogen was found to be Colletotrichum gloeosporioides and all varieties are found to be susceptible in different grades. Maximum infection was noticed during August-September. The pathogen also causes leaf infection. Spraying with Bordeaux mixture during the last weeks of June, July and August was effective in controlling the disease.

Ginger

Soft rot is the most serious disease in ginger and research work is in progress on this disease at Kasaragod and Calicut centres of CPCRI. The work on this line has just been initiated in AICSCIP centres at Vellanikkara and Solan. The research work conducted at CPCRI showed that all the cultivars are susceptible to the disease. Dithane M-45-0.3% and Difolaton 0.2% were found to be superior to other treatments in field control of this disease. Mimegralla and Eumerus were found to be associated with the disease. In storage, Macrophomina sp., Fusarium sp and Aspergillus sp. and Aspergillus sp cause storage rot of seed rhizomes. A combination treatment of fungicides and insecticides was found to be better for reducing disease incidence and giving a better stand of the crop.

Minor Spices.

Among the diseases of minor spices, wilt caused by Fusarium sp. is the most serious in coriander and cumin and powdery mildew in cumin, fennel and fenugreek. Cumin suffers from the attack of wilt in Rajasthan and Gujarat, while it causes severe losses in coriander in Madhya Pradesh and Rajasthan. The pathogen of wilt is seed borne and survives as chlamydospores. There is no effective control against this disease. Coriander variety UD41, UD354, UD360 and MPS365 are relatively tolerant to wilt. In cumin an Egyptian introduction UC-198 shows high field tolerance. Blight is serious in cumin in Rajasthan and Gujarat. The pathogen Alternaria burnsii is seed borne. Difolatan spraying has been recommended to control the disease. Seed treatment with a combination of Ceresan + Dithane M-45 gave the lowest blight disease with a corresponding high yield in cumin under Navasari conditions during 1981-82 period.

Powdery mildew of cumin is serious in Maharashtra and Rajasthan. The disease is carried over from season to season through infected seeds. Spraying with 0.3% sulfex was found to be effective in controlling the disease in coriander in Guntur. No variety was found to be resistant to this disease.

The review was further supplemented with the results from the co-ordinating centres by Dr.PK Unnikrishnan Nair on pepper (Panniyur), Shri Koshy Abraham on ginger (Vellanikkara), Dr(Mrs) Rohini Iyer on ginger and turmeric (Kasaragod), Shri NP Jain on cumin (Jobner), Shri Vinayagakamurthy on coriander and turmeric (Coimbatore) Shri T. Srirama Rao on coriander (Guntur).

2. DISCUSSIONS AND RECOMMENDATIONS

1. The screening of cardamom against katte disease has to be continued at Pampadumpara and Mudigere centres.
2. The Bordeaux mixture applied against quick wilt could control fungal pollu also.
3. Steps should be taken to get the clearance from the Government of India for importing fungicides that are not available in the market, viz., Ridomil etc., and the workshop decided to request the Govt. in this regard.
4. The finalised technical programmes for the new projects proposed to be taken up on different spice crops at various centres are given in Annexure, I.

A Special topic on 'Wilt diseases of pepper a perspective view' was presented by Dr.M.K.Nair and a topic on 'Katte' disease control in cardamom by Dr.R.Naidu.

ANNEXURE I

TECHNICAL PROGRAMMES OF NEW PROJECTS

1. CARDAMOM (Pampadumpara Centre)

a. Katte Disease:

i) Raising cardamom seedlings in trays of 18"x30"x6" @ 250 seedlings in each tray.

ii) Inoculating seedlings with 5-10 aphids per seedling at the 3rd leaf stage by opening the tender leaves. The second inoculation of seedlings to be conducted after 30-45 days. The third inoculation should be done @ 15 aphids per seedlings. After the 4th inoculation resistant seedlings will be transplanted in pots. The characters of the resistant plants will be studied in detail to know the basis of resistance.

It was also decided to depute the Entomologist working at Pampadumpara to Appangala for training in aphid multiplication. This programme will be implemented at Mudigere and Yercaud if and when pathologists are recruited.

b. Etiological studies on clump rot/Azhukal disease of cardamom.

Isolation and purification of all pathogenic organisms associated with various parts of the plant and establishing their pathogenicity. Studying the disease syndrome by way of artificial inoculation of different parts viz., root, pseudostem, clump, inflorescence and leaves of plants grown in pots. This will be done with Pythium & Phytophthora individually and in combination.

c. Epidemiology of Azhukal disease of cardamom.

Epidemiological studies will be undertaken at four locations, viz., Pampadumpara, Udumpanchola, Santhanpara

and Kallar-Vallayar. From each garden 50 plants are to be selected for recording disease incidence. The inoculum potential of the soils in these gardens will be estimated by using selectivemmedia and caster seed baits. The presence of Phytophthora propagules in the running water and on the collatoral hosts in the experimental area will also be studied. The observations are to be recorded at weekly intervals for two years. Only inflorescence infection will be taken for calculating the percentage of disease.

Observations on meterological parameters such as Temperature, Relative humidity, Rainfall, soil temperature, soil moisture etc. will be recorded in each locality.

The incidence and spread of Azhukal disease in relation to climatic factors will be studied by analysing the combined data.

It was also decided to provide drainage channels in the experimental gardens.

(ii) Evaluation of fungicides against Phytophthora sp. causing Azhukal disease of cardamom.

The efficacy of captafol, Ridomil and Bordeaux mixture will be studied under laboratory conditions besides application of Bordeaux mixture and captafol as soil drenches in the field. Foliar application will be done with Aliette, captafol & Bordeaux mixture.

Soft rot of ginger (Vellanikkara)

Fungicides like captafol 5g and PCNB will be tried for seed treatment. An observational trial with captafol will be laid out in the field.

Control of bacterial wilt of ginger

An observational trial at Ambalavayal will be laid out for testing plant protection chemicals to control bacterial wilt of ginger.

Design - Split plot
Main plots - A. hot water treatment
B. control

Sub plots: 1. Bordeaux mixture
2. Plantomycin
3. Kasugamycin
4. Agrimycin
5. Paushamycin

At Vellanikkara an experiment should be laid out for screening all available germplasm against Pythium and Phyllosticta using a plot size of 1 sq.m.

Technical programme for fungicidal trial against root rot of fenugreek. (Coimbatore)

Design : RBD
Replication : 3
Variety : Co-1
Plot size : 5x2m

Fungicides
Brassicel
Bavistin
Emisan
Captan

The above chemicals should be tried for seed dressing and also for soil drenching. The following will be the treatments:

1) Seed dressing at 0.3% followed by soil drenching at 0.1% once.

2) Soil drenching once at 0.1%

3) Soil drenching twice at 0.1%

The first drenching should be given as soon as the disease is noticed in the field. The second drenching will be given 3 or 4 weeks after first drenching. The intensity of disease and yield data should be collected from each treatment.

Coriander, Cumin, Fennel and Fenugreek (Jobner & Jagudan)

1) For all wilt disease of these crops, screening trials should be initiated at centres where plant pathologists are available. Initial studies must be in pot culture using uniform inoculum. The varieties which were found resistant should be tried in the field.

2) Chemical control of wilt disease using Foltaf, cheshurt compound, captan, captafol granules, Bavistin. Drenching will be done once before sowing and twice afterwards at monthly intervals.

3) A one year, two year, three year and four year multicrop rotational trial with the crops common at the location shall be conducted at Jagudan and Jobner centres for evolving suitable crop rotation and soil amendments, like, neemcake, caster cake for minimising wilt damage in cumin.

4) Studies on the control of cumin wilt using Foltaf, Dithane M-45, Dithane Z-78 and copper oxychloride should be initiated, applying them.

1) One month after sowing
2) 2 weeks after 1st application.

Studies on quick wilt of pepper(Panniyur)

Treatments

1) Cuman L spraying & pasting + drenching with Emisan.
2) Chlorocop 56 spraying and pasting + drenching with Bordeaux Mixture.
3) Cuman L spraying and pasting + application of captafol granules.
4) Chlorocop 56 spraying and pasting + application of captafol granules.

SESSION VI: MULTI STATE CASHEW PROJECT

Date: 12-11-1983
Time: 14.00-15.30 hrs.

Chairman : Dr.J.P.Singh,
Asst.Director-General (Hort.)
ICAR, New Delhi.

Rapporteurs : Shri T.A.Sriram
Dr.Rao Rama Rao

Dr.M.C. Nambiar, Project Coordinator (Cashew and Spices) reviewed the progress of the research component followed by presentation of reports from the participating centres by Dr.R.C.Mandal (CPCRI), Dr.S.Balakrishnan (KAU), Dr. Rao Rama Rao (APAU), Dr.MM Khan (UAS) and Shri T.Konhar (OUAT).

The Session took note of the fact that though the research component was sanctioned in July, 1981, the research activities at various centres commenced late in 1982 in view of the procedural formalities connected with positioning of staff. This led to consequent delays in other fields namely procurement of equipment, civil works and poor off-take of funds particularly under pay and allowances. The work has however picked by considerable momentum and nearly Rs.13.07 lakhs out of the revised target of Rs.37.06 lakhs has been spent so far. The provision under non-recurring costs amounting to Rs.23.59 lakhs are expected to be fully utilized by March 1984.

The technical programme outlined for the centres has been taken up and the experiments are in progress. A number of demonstration cum multiplication plots have been laid out to carry the message of research technology to the farmers with high yielding varieties and recommended package of practices. The training component has also progressed satisfactorily and quite a large number of agricultural

demonstrators and other officers have undergone the training on aspects like vegetative propagation, plant protection etc. A weakness of this programme, was however, noted that there has been no feed back from the trainees as to how far these trainees have actually accomplished at field level. It was felt that the concerned participating development departments should give some thought to this and convey their reaction to the ICAR so that the training could be made more purposeful.

It was pointed out during the discussion that there is very great necessity to take up training programmes in the vicinity of the demonstration plots for the contact farmers to be identified by the centres. The possibility for getting financial support to this programme from the Agricultural Departments has to be explored by the Project Co-ordinator, AICSCIP.

It was impressed upon the centres that the work required to be speeded up to ensure that the IDA support is fully utilized for the purpose for which it is intended.

Some constraints in the working of the project were pointed out and the centres were requested to approach the ICAR with full details and justification. Regarding reimbursement, it was noted that the progress is rather poor and all the comptrollers of Agricultural Universities should immediately send in their claims, periodically and they could seek the help of their sister development departments for the proforma and other details.

At the end of the Session three special papers were presented: (i) Export trend of cashew by Shri V.K.Chandra Kumar, Chief Executive, Peirce Leslie India Ltd., Cochin, (ii) Oleoresin Industry in India by Mr.George Paul,Executive Director, Synthite Chemical Industries, Cochin, and (iii) Spices trade in India by Dr.P.K.Das, CPCRI, Kasaragod.

Details of Demonstration Plots laid out under the MSCP in different centres

Centre	Area	No. of plots	Varieties	Technology transferred
1. Vittal	0.5 ha 1.0 ha	10(Karnataka) 3(Kerala)	4-4-7	Improved variety Fertilizer application NPK 500:125: 125 Plant Protection measures
2. Kerala	0.5ha 1.0ha	Rapid multiplication-2 Varietal plot-12 Package-13	BL.-39-1, BL.-39-4, K-3-17 A-3-13 NDR 2-1 K 22-1	Fertilizer application NPK 500:125. 125 Plant protection
3. Karnataka	0.5-1.0 ha	9	8/46 Thaliparamba	Improved variety - optimum spacing, Fertilizer application (NPK 250:125: 125) Plant protection, mulching
4. Orissa	0.5 ha	6 state plantations, 2 private plantations	Seedlings planted, side grafting will be taken up with H 2/12 WBDC V.	Foliar spraying with urea to the seedlings. Plant Protection - spraying pesticide.
5. Andhra Pradesh	1.0 ha	4	plot selected	Planting has to be done.

PLENARY SESSION Date: 13-11-1983
Time: 10.00-13.00hrs.

Chairman : Dr. J.P. Singh
Rapporteur : Dr. M.C. Nambiar

Before commencement of presentation of the proceedings of the technical programmes, Dr.K.V.A. Bavappa, Director, CPCRI, Kasaragod, gave a talk on rapid multiplication method in pepper based on his work carried out in Sri Lanka. He explained the constraints in the technology now available and highlighted the advantages of the rapid method and its economic viability.

After the introductory remarks from the Chair, the Rapporteurs of the respective sessions presented the reports. The detailed report of each session was discussed and the recommendations emerged therefrom are reproduced elsewhere.

A brief summary of the proceedings and recommendations are given hereunder:-

1. Based on the performance in the multilocation trials covering both East Coast and West-Coast of India and under different soil types, M 44/3, a selection in cashew from Vridhachalam (Tamilnadu) has been recommended for release by the Central Horticultural Variety Release Committee. This variety has given an average of 8.0 kg/tree in the 7th year after planting.

2. In order to ensure that all future cashew plantations will be planted only with high yielding varieties developed under the AICSCIP, different varieties required for multiplication were identified and the responsibility assigned to various agencies.

3. On the basis of response to fertilizer, application of 500 g N, 125 g P_2O_5 and 125 g K_2O has been recommended for adoption in all soil types.

Cardamom

4. Based on the available information on fertiliser response, a dosage of 75:75:150 kg NPK/ha has been recommended.

5. The four selections, P1, PV-1, MPG-7 and Cl.37 in cardamom were identified on the basis of yield performance for large scale multiplication.

Pepper

6. In view of large demand for planting materials, a rapid method of multiplication was suggested to be adopted in all the centres. In addition to Panniyur-I, high yielding Karimunda, Kottanadan and Aimperian selections were also recommended for multiplication.

Condiments

7. For fennel, application of N 45 kg, P_2O_5 [illegible] 30 kg + Zn + B/ha was recommended for Rajasthan and Gujarat States.

General

8. In order to increase the production of cashew and spices, particularly in the context of the drought of 1983, both short-term and long-term measures were discussed and appropriate strategy evolved. These include planting of high yielding varieties in areas where replanting and upgrading are required, application of fertiliser in split doses, adoption of better moisture conservation measures and life saving irrigation whenever possible.

9. To intensify the transfer of available technology, the ongoing programmes were examined and programmes identified for each centre. The scope of this has been widened to include high yielding varieties and appropriate package of practices against targetted yields.

10. In the implementation of the programmes, it was observed that the availability of certain plant protection chemicals is one of the major constraints and action

may have to be taken to import the essentially required chemicals for which no substitute is available in the country, for experimental purpose and field application.

In his concluding remarks the chairman emphasised that the research centres/scientists should carryout the programme outlined at the workshop meetings/group discussions, so that some concrete results could emerge out of the project. No changes should be made without the approval of the workshop/council. He also urged on the Developmental agencies to come forward to transfer the available technology to the field. He congratulated the scientists for their contributions which resulted in the recommendations from the workshop. He thanked the Director, CPCRI, Project Co-ordinator and Dr.M.K.Nair, Joint Director and staff of CPCRI respectively and other organisers in making the workshop a success.

The workshop came to a close with the vote of thanks by Dr.M.C. Nambiar, Project Coordinator.

DESCRIPTOR LIST

CASHEW

1. Locality — Altitude: — Max.min.temp.
2. Collection no. — date:
3. Soil type : Laterite/rocky/sandy
4. Rainfall : Moderate(750-1500 mm)/High(1500-3000 mm)
5. Age of tree :
6. Spread of canopy : NS EW
7. Leaf flush : Pink/Green
8. Leaf size :
9. Canopy : Compact/medium/sparse
10. Leaders : Laterals(fl) laterals(non.fl)
11. Flowering : Early/middle/late
12. Panicles :
13. Perfect flowers :
14. Fruits per bunch :
15. Pests/diseases :
16. Anther colour : W P R
17. Apple colour : Y O R
18. Apple size : Big/medium/small
19. " shape : Round/pear/long
20. " taste : Acrid/sweet
21. Nut size : Large/medium/small
22. Volume of nut :
23. Weight of nut :
24. Density of nut :
25. Shelling percentage
26. Shell thickness :
27. Protein content of kernel

Collection Team :

PEPPER

General — Coll. No. .....

Latin Name :

Local Name :

Locality :

Habit :

Ecological notes :

Leaf

Leaf size : Large/medium/small

Texture : Glabrous/thick, coriaceous/thin papery/pubescent

Leaf shape : Ovate/obovate/elyptic/lanceolate/cordate/variable

Hairs : Absent/sparse/dense

Scales : Present/absent

Spikes

Spike colour : Green/whitish/purple

Spike length : Long/medium/small

Spike filling : Good/average/poor

Nature of bracts : Peltate/cunate

Spike composition : % ♀ ..... % ♀ ..... % ♂

Spike orientation : Pendent/erect/semi-erect

Flower arrangement : Free and spaced/free and close/laterally fused.

Berries

Berry shape : Round/oval/oblong

Berry size : Small/medium/bold

Berry colour(mature) : Orange/red/black

Pungency : Very pungent/pungent/bitter

Other information :

Distribution of anthocyanin pigments:

Estimated yield :

Susceptibility to : pests .....

diseases .....

CARDAMOM

1. Acc. No. 2. Collection location:
   Village :
   Dist/State:

3. Terrain : Slopy/low lying/valley
4. Planting material : Seedlings/Rhizomes
5. Age of plantations :
6. Plant type : Malabar/Mysore/Vazhuka
7. Plant Height
8. No. of tillers
9. Rhizome colour : Green/pale green/Pigmented
10. Shoot colour : Green/pale green/Pigmented
11. Lamina Length :
12. Lamina width :
13. Pubescence (Lower surface) Present/absent
14. Panicle
    i. Errect/Semi erect/prostrate/terminal
    ii. Branched/unbranched
    iii. Length 50 cm/50-75 cm/over 75 cm.
15. Capsule
    i. Pale green/green/Dark green
    ii. Round/oval/oblong
    iii. Small/bold/extra bold
    iv. Shedding: Heavy/medium/low
16. Yield per plant(g): (known/estimate)
17. Wt. of 100 green capsules:
18. Additional information if any:

GINGER, TURMERIC

1. General

   Latin name :

   Local name :

   Habit :

   Ecological notes :

2. Leaf

   Size :

   Shape :

   Colouration :

   Ligule nature :

3. Pseudostem

   Height :

   Colouration :

4. Inflorescence

   Position : Basal/apical

   Inflorescence shape & size :

   Bract colour :

   Bract shape :

   Flower colour :

5. Rhizomes

   Size :

   Colour (inner) :

   Smell :

   Taste :

6. Fruit : Present/absent

   Size :

   Colour :

   Shape :

   Seed coat : Hard/not hard

CORIANDER

1. Days to 50% flowering
2. Days to 50% maturity
3. Plant height
4. Primary branches per plant
5. Secondary branches per plant
6. Umbels per plant
7. Umbellets per umbel
8. Male and hermaphorodite florets per umbel
9. Grains per umbellet
10. 1000 grain weight
11. Yield per hectare
12. Early growth vigour (1 poor to 5 best)
13. Biological yield per hectare
14. Growth habit (bushy, erect and semi erect)
15. Grain colour at maturity (colour of dry seeds on the plant)
16. Grain shape (Oblong, oval, spherical)
17. Pigmentation on the stem (at the time of flower initiation)
18. Volatile oil content (% age of seed)
19. Grain breakability (0, least breakable to 5 most breakable).

Disease and insect incidence

1. Powdery mildew (0, resistent to 9, most susceptible)
2. Blight (0, resistant to 9 most susceptible)
3. Wilt (% age of plant killed)
4. Aphids (0 resistant to 9 most susceptible)

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CUMIN

1. Days to 50% flowering
2. Days to 50% maturity
3. Plant height
4. Primary branches/plant
5. Secondary branches/plant
6. Umbels per plant
7. Umbellets per umbel
8. Grain per umbellet.
9. 1000 grain weight
10. Yield per hectare
11. Growth habit (spreading, erect, semi-erect)
12. Grain texture (smooth surface to rough ridged presence or absence of hair)
13. Grain breakability %, least breakable to 9, most breakable
14. Vidatile oil content %.
15. Grain colour.

Disease and insect incidence

16. Wilt (Percent plant kill)
17. Blight (0 resistent to 9 most susceptible)
18. Powdery mildew (0 resistent to 9 most susceptible)
19. Aphid (0 resistant to 9 most susceptible).

FENNEL

1. Days to 50% flowering
2. Days to 50% maturity
3. Height upto main umbel
4. Plant height (base of the plant to the tallest branch)
5. Primary branches per plant
6. Secondary branches per plant
7. Umbels per plant
8. Umbellets per umbel
9. Grains per umbellet (Sterile grain, seble grain)
10. 1000 grain weight
11. Yield per ha.
12. Volatile oil content
13. Crude fiber content (%)
14. Growth habit (bushy, erect, semi erect)

Disease and insect incidence

15. Rumulania, blight (0, resistant to 9, most susceptible)
16. Jumosis (0, resistant to 9, most susceptible)
17. Die back (0, resistant to 9, most susceptible)
18. Blight (0, resistant to 9, most susceptible)
19. Aphids (0, resistant to 9, most susceptible)

FENUGREEK

1. Days to 50% flowering
2. Days to 50% maturity
3. Plant Height (base of plant to tip of the tallest branch)
4. Primary branches per plant
5. Secondary branches per plant
6. Pods per plant
7. Pod length (cm)
8. Grains per pod
9. 1000 grain weight
10. Grain yield/ha.
11. Biological yield/ha.
12. Early growth vigour (1 poor to 5 most vigorous)
13. Diosgenin content (% grain) } To be recorded at the time of first flowering.
14. Pigmentation on the stem.
15. Pigmentation on the leaf margin
16. Pigmentation on the flower

Disease & insect incidence

17. Powdery mildew (0, resistant to 9, most susceptible).
18. Downy mildew (0, resistant to 9, most susceptible).
19. Root-rot (0, resistant to 9, most susceptible).
20. Aphids (0, resistant to 9, most susceptible).

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