

**RESEARCH HIGHLIGHTS**  
**1993 - 94**

*IISR-RH-7.*



**NATIONAL RESEARCH CENTRE FOR SPICES**  
(Indian Council of Agricultural Research)  
**CALICUT 673 012 KERALA**

Front Cover

Cardamom under coconut

Back Cover

1. Soil solarization as a component of package in Disease Management of Spices.
2. *Piper galeatum* a collection from Western Ghats.

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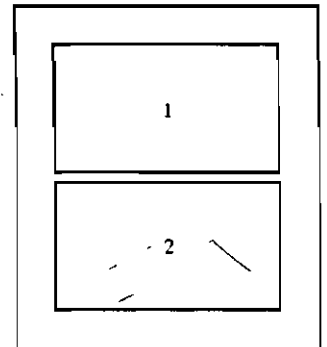
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ICSR-RH-7.

## INTRODUCTION

The year 1993-94 witnessed forward surge in the growth of National Research Centre for Spices, Calicut. The **Quinquennial Review Team (QRT) constituted by the ICAR submitted its report on December 3, 1993 recommended to upgrade the Research Centre to a level of full-fledged institute for effective functioning.** Two projects viz., 'Development of *Phytophthora* resistance in black pepper (*Piper nigrum* L.) through biotechnological approach' and 'Development, production and demonstration of biological pest control agents under integrated pest management' were sanctioned by the Department of Biotechnology, Govt. of India and two ad-hoc schemes viz., (i) 'The parasitic nematode, *Trophotylenchulus piperis* sp. n. Mohandas, Ramana & Raski, 1985 and its interaction with black pepper' and (ii) 'Biological control of scale insects infesting black pepper' were sanctioned by the ICAR. There were 14 projects in operation in Mini Mission I - Increasing production of spice crops through management of diseases and pests, 4 projects in Mini Mission II - Developing agro-techniques for increasing production of spice crops, 13 projects under Mini Mission III - Increasing productivity of spice crops through crop improvement and 3 projects under Supportive Research Programmes. The Krishi Vigyan Kendra at Peruvannamuzhi organized several training programmes to farmers. The NRCS is recognized as a centre for post-graduate studies by the Kerala Agricultural University.

Disciplines of Entomology and Soil science at NRCS are recognized for doctoral studies by the Calicut University. The budget allotted to the Centre during 1993-94 was Rs. 91 lakhs under Non-plan and Rs. 115.89 lakhs under Plan. During the year 1.25 lakhs single noded pepper cuttings and 20 tonnes of turmeric seed rhizomes were distributed to the states of Kerala, Karnataka, Tamil Nadu, Andhra Pradesh, Maharashtra, Orissa, Sikkim and Arunachal Pradesh. In cardamom about 600 kg of seed capsules of CCS-1 were also distributed from Cardamom Research Centre, Appangala.

An effective and cost efficient strategy to manage *Phytophthora* foot rot in black pepper was standardized and put into practice in 1000 hectares in Wynad and Idukki districts of Kerala during the year. The management practice is expected to cover one lakh ha in 5 districts of Kerala viz., Wynad, Idukki, Calicut, Kannur and Kasaragod during 1994-95. This is the first time a technology generated at this Centre is put on a massive scale by an integrated approach through efforts of State Department of Agriculture, State Agricultural University and Directorate of Cocoa, Arecanut & Spices Development. Stunted disease of black pepper caused by virus was observed in Wynad (Kerala) and Gudalur (Tamil Nadu). A folder on stunted disease and phyllody was distributed to development agencies for implementation. The year also saw strengthening the research capabilities. Equipments costing Rs. 37.8 lakhs were imported. They include solar radiation

measurement system, refrigerated centrifuge, HPLC accessories, Nikon microscope and accessories. Ten indigenous equipments costing Rs. 8.6 lakhs were also purchased. The All India Coordinated Research Project on Spices was strengthened by addition of two centres during the year. Researches on cumin, coriander, fennel and fenugreek have received special attention during the year. The year witnessed strengthening of research programmes in the following areas viz., establishing a global gene bank of spices and conserving germplasm collections in *in vitro* repository, evolving high yielding varieties with high quality and resistance to pests and diseases initiating research on seed spices,

spices based cropping systems, pesticide residues, and post harvest technology, intensifying work on biological control of various diseases and pests of spices.

India made an all time record export of 1.76 lakhs tonnes of spices valued Rs. 540.12 crores during 1993-94 against the target of 1.27 lakhs tonnes valued Rs. 500 crores. India exported 46,650 tonnes of black pepper valued Rs. 179.67 crores during the year against the target of 30,000 tonnes valued Rs. 105 crores. The Research Centre worked in close collaboration with the development agencies to achieve the above target.



(K V PETER)  
Director

## GENETIC RESOURCES

### Black pepper

Forty one lines of cultivated pepper from Kannur and Wynad districts of Kerala; 6 accessions from Kodagu district of Karnataka and 2 from Nilgiris district of Tamil Nadu and sixteen wild *Piper* types from Eastern ghats, 22 cultivated *P. longum* types from the hills of Andhra Pradesh were collected and added to the germplasm repository.

Chromosome number in *Piper magnificum* and *Piper arboreum* were confirmed as  $2n = 26$ . *Piper crocatum* and a wild collection from North Eastern region have  $2n = 52$  and  $2n = 91$ , respectively.

### Ginger and turmeric

Seventy five accessions of ginger were collected from Kerala and Andhra Pradesh including one exotic accession from Jamaica (Courtesy : Chairman, Spices Board). Two accessions of *Kaempferia galanga* were also collected from Muvattupuzha-Koithamangalam regions. In order to assemble maximum variability in turmeric 62 collections of Alleppey turmeric were made from turmeric growing areas of Ernakulam and Kottayam districts of Kerala. Eighteen *Curcuma* species were also obtained from NBPGR centre, Thrissur and added to the germplasm conservatory.

### Tree spices

Twenty two cultivated cinnamon accessions, 4 wild cinnamon types, 5 camphor types, 42

cultivated types, 5 wild nutmeg types and 4 clove accessions were collected and added to the germplasm. The most important nutmeg collection is an intersex type from Yercaud, 4 double nut types, 21 elite lines, of which 3 are about 150 years old from Palai in Kottayam district of Kerala.

## CROP IMPROVEMENT

### Black pepper

The trial conducted at Valparai (1067 m above MSL) showed that the hybrids 732 and 813 were superior for the third consecutive year. In the hybridization programme a total of 17 cross combinations were attempted. Moderate to good berry setting was observed in most cases. In 8 of the crosses the triploid line, 'Vadakkan', ( $2n = 78$ ) was used as the female parent.

### Cardamom

Exposure of 16 lines of 'Katte' resistant plants in hot spot areas to natural infection for 18 months further confirmed the field resistance of these lines.

### Ginger and turmeric

On the basis of the cumulative yield data obtained for the last two years at Peruvannamuzhi and Muvattupuzha, accession No. 64 performed better with a mean fresh rhizome yield of 27.08 t/ha. The mean values for dry recovery, essential oil and oleoresin content were 19.9, 1.9, and 6 per cent, respectively.

Among seven seedling progenies of turmeric evaluated along with 3 controls at Peruvannamuzhi and Muvattupuzha, the yield varied from 10.5 (Acc.367) to 22.0 (PCT.14) kg/3 m<sup>2</sup> bed while dry recovery varied from 9.8 (PCT.14) to 21.5 per cent (Acc.367) at Peruvannamuzhi. The curcumin content of the entries ranged from 3.1 (Acc.367) to 7.4 per cent (PCT.14). Acc 360, a seedling progeny selection of turmeric had the highest curcumin yield/ha. At Muvattupuzha the mean fresh yield of the entries ranged from 13.16 (Muvattupuzha local) to 26.17 (PCT.14) kg/3 m<sup>2</sup> bed. Preliminary investigations on root tip mitosis of a progeny line of turmeric indicated that chromosome number of the progeny line is same as in other cultivated varieties (2n = 63).

### Tree spices

In the Progeny Evaluation Trial on Nutmeg, out of the 91 trees, 90 have flowered. Sex ratio of them is observed to be 50 : 45 : 5 for male, female and bisexual types, respectively. A nutmeg type with a very big, bold and round fruit (Accession No. 150-A9 progeny of Tree No. 47, Kannampally, Chalakkudy) was identified. Ten nutmeg accessions (A11/29, A11/70, A9/20, A9/22, A9/25, A9/79, A9/86, A4/12, A4/22 and A4/52) with higher yield were identified as promising from the germplasm conservatory.

## BIOTECHNOLOGY

Micropropagation protocols were standardized for multiplication of large cardamom (*Amomum subulatum*). *In vitro* rooting was successfully

induced in shoot tip cultures of camphor (*Cinnamomum camphora*) and Cassia (*Cinnamomum aromaticum*).

Multiple shoots were induced in seedling explants of clove and cinnamon. Suspension cultures of camphor were established. Ten seedling progenies of vanilla propagated through tissue culture were established in soils. Thirty each of *Piper longum* and *Piper colubrinum* propagated through tissue culture were planted in field. Cardamom cultures could be stored up to 1 year without subculturing on half strength MS medium supplemented with 10 g l<sup>-1</sup> sucrose and 10 g l<sup>-1</sup> mannitol without growth regulators in screw capped culture tubes at 21 ± 2° C and 10 hrs photoperiod of 2500 lux. This system is ideal for short term conservation of cardamom germplasm in *in vitro* gene banks. Two hundred and five accessions of spice germplasm (including black pepper, cardamom, ginger, turmeric, vanilla and their related species) are conserved in the *in vitro* repository.

Tissue cultures of two species of *Oscimum* were established.

## NUTRITIONAL REQUIREMENT, AND CROP MANAGEMENT

### Black pepper

Indexing of critical nutrient contents of black pepper variety Karimunda was initiated from the vines selected in Wynad. These vines were classified as low, medium and high yielders. Major, secondary and micron-utrients contents

were determined and are being analyzed statistically. The yield data from the NPK experiment indicated that the application of N and K influenced the yield of pepper significantly. The effect of long term application of fertilizers to black pepper showed the positive correlation of leaf potassium with calcium and negative correlation with magnesium and aluminium calling for a judicious management of nutrients.

Application of oil cakes equivalent to the nutrient ratio of NPK @ 1 : 0.5 : 2 g per 10 kg soil increased the spiking intensity, berry volume and yield of pepper in both 'Panniyur-1' and 'Karimunda' compared to control. Among the treatments, groundnut cake was superior compared to other oil cakes (Neem, Cotton, Brassica and Gingelly). Application of groundnut cake @ 14 g per 10 kg pot at bimonthly intervals increased the pepper yield by 184 per cent over control.

### Ginger and turmeric

Field experiments to study the response of turmeric varieties to NPK fertilization and micro nutrients (Mn, Zn, Mo and B) showed that in a laterite soil, application of NPK @ 60 : 50 : 120 was optimum for 'Suguna' and 'Sudarshana'. For 'Alleppey' turmeric application of NPK @ a subduced level of 30 : 25 : 50 was optimum. Alleppey was more responsive to micro nutrient application (20 kg Mn, 5 kg Zn, 0.5 kg Mo and 2 kg B per hectare). Alleppey continued to give high dry recovery and high oleoresin per ha compared to other genotypes. Response function is being fitted to arrive optimum level of nutrients for economic yield. Cost benefit analysis indicated that application

of inorganic fertilizers is cheaper than the organic manures both for ginger and turmeric.

### Cardamom

In the on-farm trial at Hossegadda near Sirsi in Uttara Kannada district of Karnataka, cardamom was successfully cultivated as a mixed crop under the 13 year old coconut palms following high production technology with sprinkler irrigation. A record first year yield of 509 kg of dry cardamom and 6900 coconuts were harvested per acre of this plantation. It amounted to Rs. 2,29,207 from cardamom and Rs. 24,150 from coconut indicating the possibility of growing cardamom under the shade of coconut palms in the upghat regions.

## VEGETATIVE PROPAGATION

Air layering of 2 year old cassia (*Cinnamomum aromaticum* Nees) has been reported for the first time with 87.5% success in November. Drenching the allspice tree basins with Cultar (Paclobutrazol) at low concentration (1g/l) has shown positive response to flowering and fruit setting.

## EVALUATION OF SPICES FOR QUALITY

### Black pepper

Among 22 CLPT accessions evaluated for quality, accession numbers 12, 99, and 210 had more than 3 per cent oil with high limonene and myrcene. Accession number 185 had more than 13 per cent oleoresin.

## Turmeric

Out of 256 accessions of germplasm samples analyzed for curcumin and oleoresin, accessions with more than 6% curcumin were 109, 126, 199, 210 and 257 and accessions with high oleoresin were 126, 199 and 361.

## Ginger

Out of 15 cultivars grown at Muvattupuzhá and Calicut accession No. 251 had high and oleoresin at both locations. Accession Nos. 51, 53, 65 and 151 performed well at Calicut (Peruvannamuzhi).

## Cardamom

Accession numbers APG 187, APG 188, APG 189 and APG 194 (Wynad selections) were found to contain more than 9 per cent of oil and high alpha terpenylacetate. Lines with oil more than 9 per cent and high alpha terpenyl acetate are APG 187, 188, 189 and 194.

## CROP PROTECTION

### Distribution

Surveys conducted in Kottayam and Ernakulam districts of Kerala and Nilgiris district of Tamil Nadu indicated that infestation by scale insects *Lepidosaphes piperis* and *Aspidiotus destructor* on black pepper was higher in Nilgiris with up to 24 and 8 per cent infestation, respectively, in various locations. Incidence of stunted disease of black pepper in Wynad district ranged from 0.6 to 66.6 per cent with an average of 10.3 per cent. Based on ELISA

test the causal agent of this disease was identified as Cucumber Mosaic Virus (CMV). This disease was also noticed on *Piper longum* and the causal agent was also found to be CMV.

### Resistance

Seven wild species of *Piper* viz., *P. colubrinum*, *P. chaba*, *P. longum*, *P. attenuatum*, *P. barberi* and *P. hymenophyllum* were resistant to berry damage by 'pollu' beetle *Longitarsus nigripennis*, a major pest of black pepper.

The *Phytophthora* foot rot tolerant line P. 24 along with other tolerant lines showed better establishment and growth at Sirsi in Karnataka.

### Biological control

Seven isolates of VAM belonging to two genera viz., *Glomus* and *Gigaspora* were more efficient in promoting growth of black pepper rooted cuttings. Colonization of these isolates suppressed root rot caused by *Phytophthora capsici* in black pepper to varying degrees of root rot index from 0.6 to 2.4 in a scale of 0-4.

Studies on seasonal incidence of natural enemies of shoot borer *Conogethes punctiferalis* on ginger indicated that entomophagous nematodes and hymenopterous parasites were active in the field during July-September and September-November, respectively.

*Paecilomyces lilacinus* as well as *Trichoderma* spp. suppressed root knot nematodes of cardamom under pot and field conditions. Suppression of root knot nematodes by *Trichoderma* is reported for the first time in



India. *Trichoderma* spp. also reduced the incidence of damping off and rhizome rot diseases in cardamom nurseries by 66 and 43 per cent, respectively. Incorporation of these bioagents coupled with soil solarization gave better results.

### Natural products

Among the various natural products evaluated for antifeedant activity against 'pollu' beetle in laboratory bioassays, leaf extracts of neem, *Chromolaena odorata* and *Strychnos nux-vomica*, neem seed kernel extract and neem oil were more effective.

Crude aqueous extracts from leaves of *Chromolaena odorata* and *Azadirachta indica* showed inhibition of *Phytophthora capsici* in *in vitro* trial. These two extracts affected both vegetative and asexual reproductive phases of *P. capsici*, the causal agent of foot-rot of black pepper.

### Management

*Phytophthora* foot rot incidence was minimum (4.16%) in plots where neem cake and Akomin were applied compared to control where the incidence was 20.8 per cent.

An indexing method was evolved for *Phytophthora* foot rot affected black pepper vines by assigning visual scores of 0 to 4 for the prominent symptoms of foliar yellowing and defoliation. The scores for these symptoms are to be added and commuted as percentage to get a simple index of the disease status of the vine.

Application of phorate @ 1 g a.i/m<sup>2</sup> in cardamom nurseries significantly reduced the nematode and root grub attack. It also increased the biomass of cardamom seedlings by 20 per cent. Combined application of phorate and 0.1 per cent copper oxychloride (@ 5 l/m<sup>2</sup>) reduced the incidence of damping off (48%) and rhizome rot diseases (38%) in cardamom nurseries.

## PRODUCTION OF NUCLEUS PLANTING MATERIALS

One lakh twenty five thousand rooted cuttings of popular high yielding varieties viz., 'Sreekara', 'Subhakara', 'Panchami' and 'Pournami' were distributed as nucleus planting materials to various development agencies. twenty tonnes of seed rhizomes of high yielding turmeric varieties viz., 'Suvarna', 'Suguna', 'Sudarshana' and 'Alleppey' were also distributed for further multiplication. In cardamom 600 kg seed capsules were distributed to various key developmental agencies and progressive farmers.

## TRANSFER OF TECHNOLOGY

Three training programmes were conducted viz., (i) Spices production technology, (ii) Nursery management in spices and (iii) nursery management in cardamom for the officials of agricultural / horticultural departments of state and central governments.

## ALL INDIA COORDINATED RESEARCH PROJECT ON SPICES

Two more research centres viz., Hisar (Haryana) and Dholi (Bihar) were started during 1993-94

making to 16 research centres under AICRP on Spices. The work on tree spices has been initiated at Yercaud (Tamil Nadu) strengthening the mandate to conduct and coordinate research on 12 spice crops.

### Genetic resources

Exploratory survey conducted for tree spices germplasm identified 13 elite mother trees of clove, and 15 high yielding types of nutmeg from Courttallam, Nagercoil and Kallar areas. Sixty three fennel and 463 cumin plants with variability were collected from Jagudan centre. Jobner centre received 137 indigenous and 38 exotic collections of coriander from the other seed spices centres and thus increased the total collection to 683. At Jagudan, all the 518 entries in Coriander and 185 fenugreek were critically examined, out of which 143 coriander and 40 fenugreek entries were selected having genetic diversity. In cumin, very little morphological variability was observed by examining 285 entries.

### Crop improvement

Black pepper variety Panniyur 5 (Mean yield 3076 kg/ha), cardamom ICRI -3 (Mean yield 599 kg/ha) and Coriander-DH-5 (Mean yield 1500 kg/ha) were recommended for release.

Turmeric cultivar PTS-19 (22.28t/ha) and ginger SGT-547 (16.05 t/ha) were the top yielders under the multilocation trial at Pottangi. The performance of coriander variety UD-20 was better under limited moisture conditions and is proposed for release for rainfed situations in Rajasthan.

### Crop production

Studies conducted at Sirsi indicated that the yield of black pepper and arecanut could be increased with the application of 100 : 40 : 140 g NPK/year each to arecanut and pepper. Application of biofertilizers like *Azospirillum* and phosphobactrin to tree spices was found to increase the performance of these spices. Application of  $N_{125} P_{100} K_{100}$  recorded the highest yield (14.35 t/ha) of ginger with the maximum benefit at Pottangi. Intercropping turmeric with soybean after the first mulching is recommended for Orissa. The yield of cardamom at Mudigere was 75 per cent higher under irrigation than under rainfed condition. Studies at Mudigere under uniform shade indicated that the number of suckers, panicles and yield significantly increased with increase in N and P levels. A seed rate of 25 kg/ha has been recommended for adoption in Rajasthan.

### Crop protection

At Sirsi application of *Trichoderma harzianum* to pepper vines minimized the foot rot incidence (20%) in pot culture as compared to control (80%). Spraying and drenching pepper cuttings with 0.1 per cent difolatan reduced the mortality of cuttings (33.3%) as compared to check (76.6%) under medium light intensity. Spraying carbendazim 0.1 per cent after 20 days of flowering reduced grain mold in coriander. Seed dressing with Bavistin 0.1 per cent consistently reduced the cumin wilt incidence and is recommended for general adoption in Rajasthan. Three cumin cultures were found to be tolerant to wilt and fenugreek entry EC-25 75 66 (Bulgaria) has been isolated as a resistant type for powdery mildew.

## **IMPORTANT EVENTS DURING THE YEAR**

<b>APRIL 1 1993</b>	<b>SEVENTH ANNUAL DAY</b>
<b>MAY 13-14 1993</b>	<b>NATIONAL SEMINAR ON POST HARVEST TECHNOLOGY OF SPICES</b>
<b>JUNE 3-5 1993</b>	<b>SIXTH ANNUAL RESEARCH COUNCIL MEETING</b>
<b>JULY 5-16 1993</b>	<b>VISIT AND DISCUSSION BY QRT</b>
<b>JULY 26-29 1993</b>	<b>NATIONAL GROUP MEETING (12TH WORKSHOP) OF RESEARCH WORKERS OF AICRPS</b>
<b>AUGUST 29 1993</b>	<b>SADBHAVANA DIVAS TO PROMOTE NATIONAL INTEGRATION</b>
<b>SEPTEMBER 7-8 1993</b>	<b>TRAINING ON NURSERY MANAGEMENT IN CARDAMOM</b>
<b>NOVEMBER 22-27 1993</b>	<b>TRAINING ON SPICES PRODUCTION TECHNOLOGY</b>
<b>FEBRUARY 14-15 1994</b>	<b>NURSERY MANAGEMENT IN SPICES</b>

## **TECHNICAL PUBLICATIONS**

**SPICES BIOTECHNOLOGY AT NRCS**

**NURSERY PRACTICES IN SPICE CROPS**

