

ICSR RH - 6

RESEARCH HIGHLIGHTS



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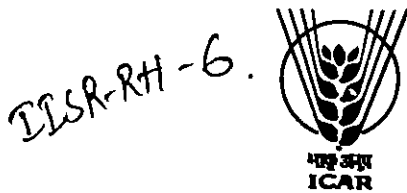
NATIONAL RESEARCH CENTRE FOR SPICES

(Indian Council of Agricultural Research)

CALICUT - 673 012, KERALA

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1992-93



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May, 1993

Published by :

Director
National Research Centre for Spices
Calicut 673 012
Kerala, India.

Typeset and Printed at :

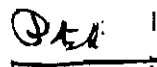
Carmel Industries, Cochin-35.

INTRODUCTION

The National Research Centre for Spices (NRCS), established in the year 1986 has the mandate to conduct and coordinate research on spices. During the year 1992-93, two new research projects, one on 'In vitro conservation of black pepper and cardamom germplasm' and another on 'Rapid multiplication of tree spices' were sanctioned and are progressing in the right direction. Regeneration of plantlets from stem and leaf explants of betelvine (*Piper betle*) was achieved for the first time in the country. Enrichment of germplasm repository of black pepper, ginger, turmeric and tree spices continued with more vigour and this included isolation of a variant of *P. attenuatum* with 2n=104 and three collections of *Kaempferia galanga*. The performance of two black pepper hybrids viz., 732 and 813 were found superior in trials at Valparai. Among the open pollinated progenies of turmeric C-10 was promising for dry recovery and curcumin.

Studies on crop management aspects of spices have made significant headway towards characterizing nutrient deficiency symptoms of spices and nutritional requirement of black pepper and turmeric. Eight species of *Piper* were found to be relatively resistant to 'pollu beetle' affecting black pepper. Seven genera of nematodes were found to be associated with ginger. In bio-control studies over 100 isolates of *Trichoderma* were collected and identified. *Pythium aphanidermatum* associated with rhizome rot of ginger was found to be suppressed by four species of *Trichoderma*. During the year there was a significant increase in the quantum of distribution of nucleus planting material of black pepper and turmeric. A total of Rs. 1.567 crores were spent during the year towards research and the development of infrastructure at NRC spices, Calicut. Transfer of technology in spices received further momentum with the sanctioning of a Krishi Vigyan Kendra at Peruvannamuzhi. The All India Coordinated Research Project on Spices with 14 coordinating centres made significant contributions during the year. High yielding lines of black pepper (culture numbers 1558, 5128 and 5834), small cardamom (selection No. P-3 and P-5), large cardamom ('Pink Golsy' and 'clone-4') and turmeric (PTS-19 and TC-2) were found promising.

The Research Highlights of NRCS are presented in this publication to provide an overview of spectrum of major research activities. More comprehensive research information on each project are available in the Annual Report of the Institute.



(K.V. PETER)
Director

Calicut - 673 012,
May 10, 1993

GENETIC RESOURCES

Black Pepper

A total of 131 accessions of wild types of *Piper* and seventy cultivated black pepper types were collected from the forest ranges of southern districts of Kerala and Dakshina Kannada district of Karnataka and added to the genetic stock available in the repository.

Thirty six cultivated black pepper accessions and ten wild *Piper* accessions were cytologically indexed and all of them were found to have chromosome number of $2n=52$, except that of *Piper attenuatum* which had $2n=104$.

Ginger and Turmeric

Five hundred and forty three accessions of turmeric and 343 accessions of ginger were maintained. Fifteen accessions of ginger including three collections of *Kaempferia galanga*, and fifteen accessions of turmeric were collected during this year. Cataloguing of 81 accessions of turmeric was completed.

Tree spices

Three wild nutmeg types, 6 cultivated nutmeg accessions, 2 clove accessions and 20 cinnamon collections were added to the germplasm. Germplasm maintenance was extended to Chelavur campus.

CROP IMPROVEMENT

Black pepper

The trial conducted at Valparai (1067 m above MSL) showed that the

hybrids 732 and 813 were found to be superior during this year also. The mean yield of these entries were 1.125 kg and 0.95 kg fresh berries per vine with a dry recovery of 35.5 and 34.4 per cent respectively. This is the second yielding year of this trial.

An induced tetraploid of black pepper was recovered for the first time from the seedlings derived from seeds of Panniyur-1 treated with 0.05 per cent colchicine. The somatic chromosome number was $2n=104$ and plant was vigorous in vegetative characters, with typical cordate leaves, thick stem and purple shoot tip.

Ginger and Turmeric

Among the 16 cultivars of ginger, the performance of accession No. 64 was found to be better with 16.1 kg. fresh rhizome yield per 3 m² bed and 19 per cent dry recovery at Peruvannamuzhi.

Among the open pollinated progenies of turmeric, the performance of progeny C-10 was found to be better consecutively for the last two years at Peruvannamuzhi for dry recovery and curcumin content.

Tree spices

Three progeny trials of clove, involving elite lines of Kallar, Burliar and Nagarcoil were laid out. In the clove progeny evaluation trial at Appangala, cardamom in interspaces of clove and black pepper (variety Subhakara) using shade trees as standards were planted under the All India Coordinated Project

on Spices. Planting materials of elite clove and cinnamon lines were supplied for laying out field trials in Yercaud, Pechiparai, and Thadiyankudisai in Tamil Nadu and Anibalavayal in Kerala.

BIOTECHNOLOGY

Micropropagation and regeneration of plantlets were achieved in stem, leaf and root explants of *Piper colubrinum*, *P. longum* and *P. barberi*. Both direct regeneration and regeneration of plantlets via intermediary callus phase were observed.

Micropropagation protocols for *Vanilla planifolia* were standardized. Tissue culture techniques were used for seed culture of vanilla to build up a population of segregating progenies.

Micropropagation and regeneration of plantlets from stem, leaf and root explants of betel vine (*P. betle*) was achieved for the first time in the country.

Multiple shoots were induced in cinnamon, clove and camphor shoot tip cultures. *In vitro* rooting of cinnamon shoot tips was achieved.

Over 100 accessions of spices germplasm were kept in *in vitro* repository. This included ten species of *Piper*, three species of *Curcuma*, two species of *Kaempferia* and one species of *Elettaria*.

Slow growth was induced in cardamom tissue cultures using mannitol for short term conservation of cardamom germplasm. A promising somoclonal of ginger was isolated for further evaluation.

NUTRITIONAL REQUIREMENT AND CROP MANAGEMENT

Nutrient deficiency symptoms of N, P, and K in black pepper, ginger, and turmeric were characterized and described through Hoagland solution culture in quartz sand medium.

The yield data from the NPK fertilizer experiment indicated that the main effect of nitrogen was non significant. The main effect of potassium and nitrogen x potassium interaction effects were significant. Application of 50 g of nitrogen with 210 g of K₂O per vine recorded the maximum yield of 3.907 kg per vine.

Bimonthly application of NPK @ 1.0:0.5:2.0 g per pot of 10 kg soil continued to show optimum response in terms of nutrient uptake by the plant, availability of nutrients in the soil and yield.

Application of NPK @ 60:60:120 kg ha⁻¹ for short duration varieties viz., Suguna and Sudarshana and 30:25:60 kg ha⁻¹ for long duration variety Alleppey were found to be optimum. The mean yield of dry turmeric varied from 3.9 t ha⁻¹ for Suvarna to 5.6 t ha⁻¹ for Sudarshana. The increase in yield varied from 36 to 40 per cent over control (no fertilizer application).

EVALUATION OF SPICES FOR QUALITY

Black Pepper

Among the black pepper germplasm CLTP-55 contained 5.8 per cent piperine 16 per cent oleoresin and 6 per cent

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essential oil. CLTP 187,61,185 and 55 contained more than 4.5 per cent essential oil.

Cardamom

Among the Wynad selections, Accessions 223, 221, 224, 2217, 195 and 188 contained more than 8 per cent oil. Selections 221, 223 and 188 were superior in quality as indicated by the high alpha terpinyl acetate and related compounds present in the oil.

Ginger

Among the germplasm accessions 14, 122 and 56 contained more than 9 per cent oleoresin and accessions 14, 97, 118 contained more than 2 per cent essential oil. Wynad local and Suprabha cultivated at Muvattupuzha (Kerala) recorded 3 per cent (v/w) oil.

Turmeric

The curcumin, dry recovery, and oleoresin content of turmeric vary with cultural practices adopted, agroclimatic conditions and total bright sunshine hours.

CROP PROTECTION

Fifteen wild species of *Piper* were screened against 'pollu' beetle *Longitarsus nigripennis* and among them *P. colubrinum*, *P. betle*, *P. hymenophyllum*, *P. attenuatum*, *P. barberi*, *P. mullesua*, *P. arboreum*, *P. longum* and *P. chaba* were relatively resistant to the pest.

Among the four commercial neem based products tested against 'pollu' beetle, Repelin was promising, causing 90 per

cent feeding deterrence at 2% concentration, 24 h. after treatment.

Surveys conducted in Uttara Kannada and Shimoga districts of Karnataka, Palakkad and Malapuram districts of Kerala indicated that infestation by scale insects *Lepidosaphes piperis* and *Aspidiotus destructor* was higher in Karnataka, with up to 11.0 and 26.7 per cent infestation respectively.

Studies on population dynamics of *A. destructor* and its natural enemies at Kalpetta indicated that the pest population was higher during August-March. The population of *Cybocephalus* sp., an important predator of *A. destructor*, was higher during September-October.

Studies on seasonal incidence of *Apanteles cypris*, an important hymenopterous parasite of top shoot borer *Cydia hemidoxo* indicated that the parasite was active in the field at Peruvannamuzhi during September-November with a maximum of 20 per cent parasitisation during October.

Surveys conducted for plant parasitic nematodes associated with ginger crops in Ernakulam, Kottayam and Idukki districts showed that seven genera viz., *Meloidogyne*, *Rotylenchulus*, *Helicotylenchus*, *Xiphinema*, *Longidorus*, *Cricoidemoides* and *Tylenchorhynchus* are associated with the crop.

Pot culture studies to assess the damage potential of *Meloidogyne incognita* on growth and yield of improved varieties of turmeric (Suvarna, Suguna,

Sudarshana and Alleppey) showed that the nematode could cause reduction in yield of rhizome ranging from 11.93 to 18.19 per cent. Cultivar Alleppey is least affected by the nematode infestation among the four varieties tested.

Application of phorate @ 2.5 and 5.0 g a.i per clump increased the yield of cardamom by 36.5 and 57.1 per cent respectively (yield 69 g wet weight). Treating with phorate reduced thrips damage by 32.1 to 37.0 per cent.

Screening of germplasm has shown that 'Malabar' types are relatively more susceptible to root knot nematodes.

Five isolates of *Glomus* and two isolates of *Gigaspora* were identified as efficient isolates of black pepper based on their activity to enhance rooting and promote growth. These isolates were further tested for their effect on 4 cultivars of black pepper viz., Sreekara, Subhakara, Panniyur-1 and Kottanadan. Sreekara and Subhakara responded well to VAM incorporation than Panniyur-1 and Kottanadan. An isolate of *G. fasciculatum* promoted growth of all the varieties tested.

Twenty five isolates of *Pseudomonas solanacearum* isolated from wilted plants of *Zingiber officinale*, *Curcuma longa*, *Lycopersicon esculentum*, *Capsicum annum*, *Capsicum fruitenscens*, *Tagetes erecta*, *Ageratum conyzoides* and *Chromola odorata* from experimental plots at NRCS, Peruvannamuzhi and farmers field in Wynad and Trichur districts of Kerala. The strains of

P. solanacearum were identified as biotypes III and IV.

Over 100 isolates of *Trichoderma* collected from Ginger growing areas in Kerala were identified and they belong to the following 8 species. *T. viridae*, *T. harzianum*, *T. hamatum*, *T. polysporum*, *T. longibrachiatum*, *T. koningii*, *T. pseudokoningii* and *T. aureoviridae*. Among these, *T. viridae*, *T. harzianum*, *T. polysporum* and *T. hamatum* were effective in suppressing *Pythium aphanidermatum* in *in vitro* studies.

Pythium aphanidermatum was found to be associated as causal organism of rhizome rot of turmeric in Ernakulam, Idukki and Kottayam districts of Kerala during 1992.

PRODUCTION OF NUCLEUS PLANTING MATERIALS

One lakh thirty five thousand rooted cuttings of popular high yielding varieties viz., Sreekara, Subhakara, Panchami, and Pournami were distributed as nucleus planting materials to various developmental agencies. Twenty six tonnes of seed rhizomes of high yielding turmeric varieties viz., Suyarna, Suguna, Sudarshana and Alleppey were also distributed for further multiplication. In cardamom, seed capsules of Cl. 37 were distributed to various key developmental agencies and progressive growers.

TRANSFER OF TECHNOLOGY

Fifty eight officials from the department of agriculture/forestry and development agencies from various states

participated in the training programmes on various aspects of spices production technology. Three training programmes on various aspects of cardamom cultivation were conducted in which 55 officials participated. 'Off campus' training programmes on viral diseases of cardamom were also conducted for the officials of the spices board. Krishi Vigyana Kendra started functioning at the centre from this year.

ALL INDIA COORDINATED RESEARCH PROJECT ON SPICES

The project has 14 coordinating centres with Calicut as headquarters for coordinating the research conducted on nine spice crops. During 1992-93 tree spices were also included in the research mandate of the project.

Genetic Resources

Piper hapnium and *P. barberi* were collected from the forest areas of Tirunelveli district of Tamil Nadu and added to the germplasm at Pepper Research Station Panniyur. In large cardamom, a new germplasm was collected from the forest areas of Gangtok at an altitude of 2000 m above MSL. This type belonged to an allied sp. in the genus *Amomum*. Thirty seven exotic germplasm accessions in seed spices viz., Cumin, Coriander, and Fenugreek obtained from NBPGR were multiplied and maintained for evaluation at Jobner and Jagudan centres.

Crop Improvement

Out of 1134 numbers of hybrid progenies of black pepper maintained at Panniyur, 34 cultures were identified as promising. Among the cultures 1558 (OP of Kulluvally), 5128 (OP of Cheriakanjakadan), 5834 (OP of Irumanian) were consistent high yielders and have 5 kg pepper (green) per vine.

Large cardamom cultures 'Pink Golley' and 'Clone-4' identified as promising. High yielding selections in small cardamom viz., P-3 and P-5 are under pre-release multiplication at Mudigere. Other cardamom collections Cl-692, P-20, Cl-683 and Cl-802 at Mudigere, YC-14, YC-1 at Yercaud centre appear promising. Tissue cultured cardamom selections TC-3, and TC-6 appeared promising with respect to pseudostem height and sucker number at Mudigere.

High yielding turmeric mutants viz., PTS-19 (OUAT) and TC-2 (TNAU) are at different stages of release.

Crop Production

In ginger early planting in April was found to be optimum. Sowing at a spacing of 22.5 cm in rows with a seed rate of 12 kg ha⁻¹ is recommended for cumin. In fenugreek sowing in the first week of November, gave a profitable crop and a seed rate of 25 kg ha⁻¹ with 40 kg N and 40 kg P₂O₅ ha⁻¹ have resulted in maximum seed yield. In turmeric the loss of curcumin was negligible up to one month

of storage and the loss was detectable only two months after harvest. About 20 per cent loss in curcumin was observed when rhizomes were stored for one year. At Panniyur, irrigating pepper vines from December to April IW/CPE ratio of 0.25 gave significantly higher yield of 90 per cent over unirrigated control. In ginger, application of NPK @ 125:100:100 kg ha⁻¹ gave maximum yield at Pottangi. For Orissa a compatible crop combination of ginger and soybean has been recorded. In coriander application of 60 kg N ha⁻¹ applied in two splits, half at sowing and the other half 60 DAS, was found to be optimum.

Crop Protection

Nursery diseases in black pepper can be effectively managed by spraying and drenching with 1 per cent Bordeaux mixture followed by Difolatan 0.1 per cent fortnightly. Application of lime @ 1 kg vine⁻¹ in May followed by neem cake @ 2 kg vine⁻¹ and spraying 1 per cent Bordeaux mixture reduced the *Phytophthora* foot rot. Three sprays viz., April with Monocrotophos, June and August with Phosalone significantly reduced the damage to 11.8 per cent from 25 per cent in control. Trials in Jagtial, (AP) showed that Suguna (PCT-13) and Sudarshana (PCT-14) were relatively tolerant to rhizome rot of turmeric.

