

अनुसंधान विशेषताएं

RESEARCH HIGHLIGHTS

2001-02



केन्द्रीय रोपण फसल अनुसंधान संस्थान
(कृषि अनुसंधान परिषद)

कासरगोड - 671124, केरल, भारत

Central Plantation Crops Research Institute

(Indian Council of Agricultural Research)

KASARAGOD - 671 124, KERALA, INDIA



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CENTRAL PLANTATION CROPS RESEARCH INSTITUTE

(Indian Council of Agricultural Research)

KASARAGOD - 671 124, KERALA, INDIA



Published by :

Dr. V. Rajagopal

Director,

Central Plantation Crops Research Institute

Kasaragod - 671 124, Kerala

Tel No. : 0499 - 430 894-6

Grams : 'RESEARCH' Kasaragod

Fax : 91-499-430 322

E-mail : cpcri@hub1.nic.in

CPCRI Website : <http://cpcri.nic.in/>

Compiled and Edited by :

C.V. Sairam

Anitha Karun

P. Balakrishnan

Photo Credits :

K. Shyama Prasad

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Back Cover : Sweet coconut chips, a view of the training programme organised by KVK on chips making and coconut chips packed in aluminium foil

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परिचय

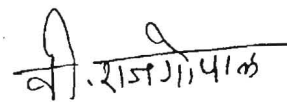
केन्द्रीय रोपण फसल अनुसंधान संस्थान, कासरगोड तथा अखिल भारतीय समन्वित ताड़ अनुसंधान परियोजना के 14 केन्द्रों की मुख्य फसलों जैसे नारियल, सुपारी एवं कोको के लिए कृषि प्रौद्योगिकियों में नई पद्धतियों को सार गर्भित रूप में इस प्रकाशन में प्रस्तुत किया गया है। फसल सुधार, फसल उत्पादन, फसल संरक्षण, शरीरक्रिया विज्ञान, जैव रसायन तथा कटाई उपरान्त प्रौद्योगिकी एवं सामाजिक विज्ञान की विशेष उपलब्धियों का प्रस्तुतीकरण किया गया है।

मुख्य फसलों के जननद्रव्य को मज़बूत करने तथा जननद्रव्य उपयोग पर प्रयास जारी हैं। वर्ष 2001-2002 अवधि की विशेष उपलब्धियों में 34 नारियल प्रजातियाँ (19 देशीय एवं 15 विदेशी) 12 सुपारी प्रजातियाँ तथा 9 कोको प्रजातीय जननद्रव्यों का संग्रहण सम्मिलित है। आई. सी. जी.एस.ए. (अन्तर्राष्ट्रीय नारियल जननद्रव्य-दक्षिण एशिया) की स्थापना तथा बीज फार्म केन्द्र, किडू का इस संस्थान के अनुसंधान केन्द्र के रूप में उन्नयन जननद्रव्य संग्रहण की मुख्य उपलब्धि है। सुपारी में बौनेपन केलिए प्रजनन, कार्बनिक कृषि, बिना सिंचाई उर्वरण, आद्रता संरक्षण, कीट एवं सूत्रकृमि कीटों का जैविक नियंत्रण, एरियोफिड कीटों का नियंत्रण, जड मुर्झा रोग प्रबंधन, नारियल एवं सुपारी का मूल्य वर्धन आदि अन्य विशेष उपलब्धियाँ हैं।

प्रशिक्षण कार्यक्रम, कार्यशालायें, प्रदर्शनियाँ, प्रकाशन, रेडियो वार्ताएँ दूरदर्शन कार्यक्रम, सी.डी. रोम तथा किसान मेला विकास विभाग के सहयोग द्वारा प्रायोजित कर इन फसलों की उपादन क्षमता एवं उपज बढ़ाने की परामर्श सेवाएँ इस संस्थान की ओर से प्रदान की जाती हैं। कृषि विज्ञान केन्द्र, संस्थान ग्राम संपर्क कार्यक्रम, तथा कृषि प्रौद्योगिकी सूचना केन्द्र द्वारा प्रौद्योगिकी हस्तांतरण के क्षेत्र में गतिविधियाँ बढ़ाने के प्रयास भी किए जाते हैं।

नारियल सुपारी तथा कोको में अधिक संख्या में पैतृक सामग्री तथा प्रजनक स्टॉक का उत्पादन एवं वितरण किया गया। आधारभूत सुविधाओं में इस वर्ष की अवधि में कटाई उपरान्त प्रौद्योगिकी प्रयोगशाला तथा कृषि सूचना प्रौद्योगिकी केन्द्र जोड़े गये।

यह प्रकाशन शीघ्र प्रकाशित कराने में सहकर्मियों के सहयोग के लिए मैं उनके प्रति आभार प्रकट करता हूँ।



(वी. राजगोपाल)

निदेशक

27-05-2002

कासरगोड

INTRODUCTION

New innovations in agricultural technologies for the mandate crops namely coconut, arecanut and cocoa at Central Plantation Crops Research Institute and 14 centres of All India Co-ordinated Research Project on Palms are summarized in this publication. The significant achievements in Crop Improvement, Crop Production, Crop Protection, Production Physiology, Post Harvest Technology, Social Sciences and All India Co-ordinated Research Project on Palms are presented.

Research efforts on strengthening the germplasm of mandate crops and their utilization are being continued. The significant achievements during the year 2001- 02 include addition of 34 coconuts accessions (19 indigenous and 15 exotic), 12 arecanut accessions and 9 cocoa accessions to the germplasm collections. Establishment of ICG-SA (International Coconut Germplasm for South Asia) and up gradation of seed farm at Kidu to Research Centre are the major achievements made in germplasm collection and conservation. Significant results were also obtained from breeding for dwarfness in arecanut, organic farming, fertigation, moisture conservation, biological control of insects and nematode pests, eco friendly control of eriophyid mite, management of root (wilt) disease and value addition of coconut and arecanut.

The institute also provides consultancy services for increasing the production and productivity of these crops through the cooperation of developmental departments by sponsoring training programmes, workshops, demonstrations, publications, radio talks, TV Programmes, CD ROMS and Kisan mela. Efforts are also made to enhance the extension activities in the field of transfer of technology through KVK, IVLP and ATIC.

The Institute also produced and distributed large number of parental materials and breeders stocks in coconut, arecanut and cocoa. Infrastructural facilities added during the year include the post harvest technology laboratory and the Agricultural Technology Information Centre (ATIC).

I acknowledge the helps rendered by my colleagues in bringing this publication promptly.

27-05-2002
Kasaragod


(V. Rajagopal)
Director

CROP IMPROVEMENT

Collection, conservation, cataloguing and evaluation of germplasm

- ❑ Coconut germplasm collection was strengthened by adding 19 indigenous collections (Goa -5, Maharashtra -6 and Assam- 8) and 15 exotic collections (Sri Lanka-4 and Bangladesh- 11) thus making a total of 301 accessions (128 exotic and 173 indigenous)
- ❑ Isozyme analysis of coconut cultivars indicated that Kulasekharam Orange Dwarf had diverged from MYD due to introgression with native population.
- ❑ In the experiment on evaluation of germplasm collections, significant differences between the treatments were observed in 16 cultivars planted in RBD during 1972. Bunch production was highest in Java Giant(11), highest nut yield in Laccadive Micro (185.7 /palm/year) and copra yield in Cochin China Tall (21.3 kg/ palm/year). Fruit component analysis in these cultivars showed that fruit weight ranged from 480.6g in Laccadive Micro to 1381.2g in Andaman Giant. Kernel weight and copra weight were highest in Cochin China (435.5g and 256.6g respectively). The percentage of husk to whole fruit weight ranged from 29.9 in MYD to 39.8 in Andaman Giant. Fruit component data subjected to PCA and cluster analysis to determine their genetic diversity indicated that MYD is a single accession cluster.
- ❑ In the survey and collection of arecanut germplasm from Maharashtra and Goa twelve distinct accessions were added to the arecanut germplasm, making the total strength to 140 at Vittal. Accessions collected are Velling gautham, Curti, Ponda SR, Ponda MO, Keri MO, Khandala, Tamsula, Banasthari, Keri B, Talkatta, Vengurla and Dapoli.
- ❑ Nine cocoa exotic accessions were introduced to Vittal through NBPGR, New Delhi from University of Reading, UK. The accessions are PA 56, RIM 10, AMAZ 12, REDAMEL, UF 11, UF 667, UF 221, EET 397 and IMC 6. Some of them are showing resistance to VSD, *Phytophthora* and Witche's broom.
- ❑ In arecanut, the crosses involving Hirehalli dwarf, F₁ showed significant reduction in height, crown length and crown area. The nuts were medium in size. The F₂ population showed segregation in three distinct categories viz. dwarfs, intermediates and tall.

Biotechnology

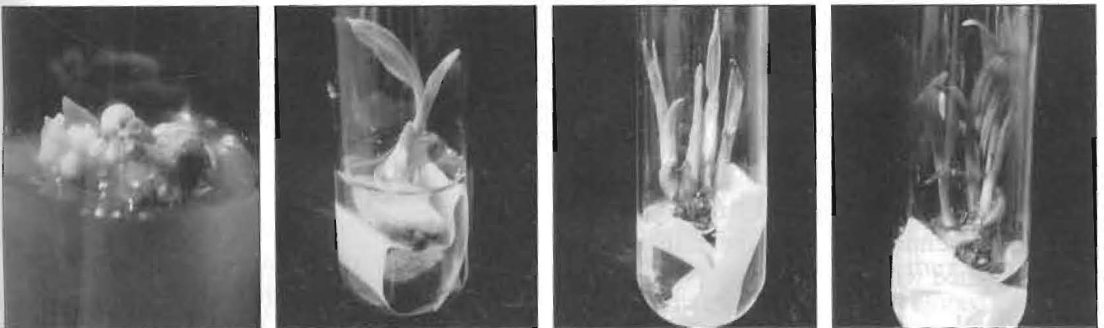


Fig : 1. Induction of somatic embryos /meristemoids from plumular calli. Fig : 2. Germination of somatic embryos, Fig : 3 & 4. Shoot meristemoid formation from plumular calli.

- Regeneration in coconut tissue culture was achieved using plumular tissues as explants by supplementation with polyamines in the tissue culture media.
- The cryopreservation of mature zygotic embryos of coconut has been standardized.

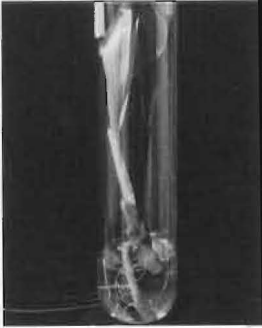


Fig : 5. Eight-month-old plantlet retrieved after cryopreserved embryo- 18 hours of silica gel pre-treatment

- Initial leads on somatic embryogenesis in arecanut tissue culture obtained.
- Through embryo culture technique in

coconut, germplasm from Sri Lanka was collected and a total of 56 plantlets are cultured in the pots. 157 embryos collected from Bangladesh were inoculated in the medium.

- Fingerprints of 181 palms of coconut using RAPD indicated the phylogenetic relationship among 58 coconut accessions (both indigenous and exotic).
- Standardized the protocols for AFLP, DAF and microsatellite of coconut DNA for tagging resistance genes for root (wilt) disease.
- Sufficient DNA samples were extracted for mapping population for root (wilt) resistance. Polymorphism between susceptible and resistance palms obtained with DAF using UBC primers.
- Bioinformatics center has compiled coconut literature on biotechnology in full text form in CD-ROM

CROP PRODUCTION

Cropping/farming systems

- In the coconut based high-density multispecies cropping system at Kasaragod, the coconut yield ranged from 128 nuts/palm/year under no fertilizer treatment to 162 nuts/palm/year at 2/3rd of the recommended fertilizer dose. The highest net returns of Rs. 59,785/- (Benefit Cost Ratio 2.16) was realized with 2/3rd recommended dose of fertilizer with organic matter recycling. Removable biomass in coconut ranged from 23.51 t/ha in recommended dose to 19 t/ha in no fertilizer treatment. Microbial flora was optimum at moderate doses of mineral fertilizer input (1/3rd and 1/4th of recommended doses) especially when combined with vermicompost.
- Under Lakshadweep conditions, it was found that intercropping is technically

feasible in coconut gardens with vegetables, tuber crops, maize, sorghum, banana, red gram and betel vine.

- In areca based cropping system experiment at Vittal having cocoa, clove, banana, pepper and coffee as mixed crops, about 7 tonnes of recyclable biomass was composted using earthworms and recycled within the system.
- In the North-East Region, experiment results indicated the technical feasibility of intercropping in arecanut gardens with vegetables and ornamental plants.
- By adopting integrated nutrient management and intercropping, the system productivity of root (wilt) affected coconut garden can be enhanced. The yield of coconut palms under different categories of disease incidence increased and a net

return of Rs. 45, 410/- per ha was realized.



Fig : 6. HDMSCS Model for root (wilt) affected coconut garden

- Intercropping experiments in coconut gardens with ornamental, medicinal and aromatic plants at Kasaragod indicated the feasibility of growing heliconia, anthurium, jasminum, long pepper and patchouli in coconut gardens.
- In the experiment to study the sustainability and profitability of coconut based mixed farming system comprising coconut, grass, dairy, poultry, sericulture and pisciculture, a net return of Rs 73,142 per annum was realized. The total nutrient contribution from the wastes generated in the system was 156 kg nitrogen, 77 kg phosphorus and 142 kg potash, which can supplement to the extent of 74.2, 100 and 81.8 % of N, P and K through systematic recycling in one hectare of coconut garden.
- The changes undergoing in the rhizosphere microbial population of the coconut and the intercrops in the HDMSCS garden of the root (wilt) affected block were studied during the pre-monsoon, monsoon and post-monsoon periods. The weather as well as the agronomic/plant protection practices caused appreciable changes in the microbial numbers with the individual group showing different patterns. On the

whole, the banana rhizosphere gave higher microbial population. Around 6 efficient phosphate solubilizers, 4 N_2 -fixers and one N_2 -fixer with $CaCO_3$ dissolving property were isolated from this study.

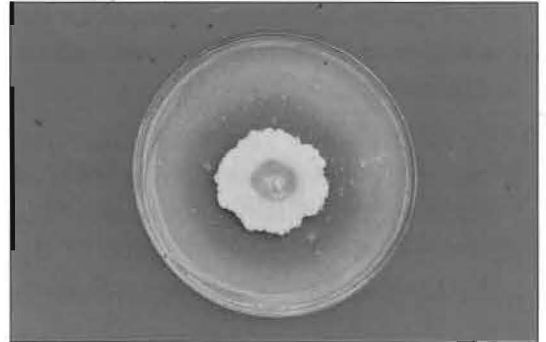


Fig : 7. Phosphate solubilizing fungal from coconut rhizosphere of root (wilt) affected HDMSCS garden

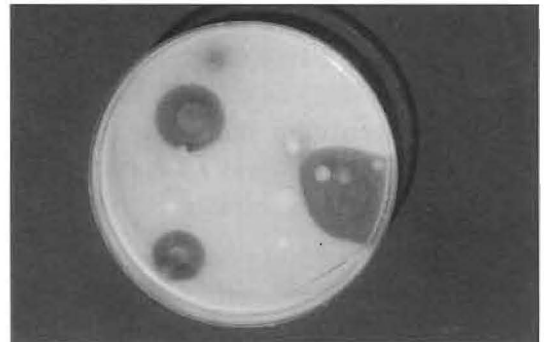


Fig : 8. N_2 -fixer bacteria with $CaCO_3$ dissolving property from HDMSCS plot of root (wilt) affected coconut garden

Soil and water conservation

- At Kidu, it was observed that on 28 % sloppy land, growing of vegetables and grass could reduce the soil loss to 0.1 t/ha/day as compared to 1 t/ha/day in a plot without any conservation measures.
- A fuzzy neural network system with independent variables as temperature, RH, sunshine, soil moisture deficit and alternate bearing was developed to predict coconut yield ($R^2 = 0.98$). This model could simulate the impact of different

factors (climate and irrigation management) on coconut yield.

Nutrient management

- In the long-term manurial experiment on coconut, highest net returns of Rs 40,200 (B-C ratio 3.54) was obtained in the treatment cultivation + inorganic fertilizer application.
- In littoral sandy soil, West Coast Tall coconut palms showed higher level of response to fertilizer applications at NPK level (1500 g N, 750 g P₂O₅ and 1750 g K₂O) along with Ca and Mg application.
- In a field experiment with different levels of potassium on adult coconut palms in farmers plot, highest coconut yield (62 nuts/palm/year) was recorded in the treatment of 2 kg KCl/ palm/year. The laboratory study on sulphate transport in the soil column indicated that the adsorption of SO₂ was not linear in the lower solute concentration.
- Application of 500 g borax per palm per year was found to be effective to alleviate the symptoms of boron deficiency in adult coconut palms in root (wilt) affected tract.
- Fertigation studies on adult coconut palms in red sandy loam soil indicated that the yield of coconut was at par in the treatments 50 and 100 % of NPK fertilizers supplied through drip irrigation system.
- A saving of 50% NPK fertilizers was indicated in the fertigation studies with young arecanut palms at Vittal.
- In the large scale vermicomposting of coconut wastes using the local strain of epigeic earthworm, *Eudrilus* sp. in cement tanks, 70% recovery of vermicompost was obtained. A technique for mass multiplication of the local earthworm species in cement tank has been standardized.
- During the year, over 44,000 earthworms belonging to the local isolate (*Eudrilus* sp.) have been distributed to the farmers for the popularization of the technology.
- The field experiment on evaluation of vermicompost as a substitute for chemical fertilizers in coconut revealed that vermicompost application after withdrawal of inorganic fertilizers did not affect the N and K nutrition. However, Ca, Mg and micronutrient contents increased with the increase in quantities of vermicompost application to coconut palms.
- The growth of young areca palms was significantly higher in 100% vermicompost treatment when compared to different levels of vermicompost and fertilizer treatments.
- Biofertilizers of *Azoarcus*, *Arthrobacter* and *Azospirillum* were found to be effective bacterial inoculants for production of vigorous and healthy coconut seedlings.

Organic Farming Technologies

- Bioconversion of coir pith to compost was found feasible by mixing coir pith with coffee husk in different proportions (1:1,
- Application of biofertilizers with vermicompost resulted in greater level of increase in microbial population. Enhanced coconut yields were obtained from biofertilizers treated palms.

PRODUCTION PHYSIOLOGY

Mean nut yield in the released cultivars (WCT, LCT, Benaulim) and hybrids (COD x WCT, WCT x GBGD, LCT x GBGD, LCT x COD) showed an increase in yield ranging from 51% (Benaulim) to 165% (WCT x GBGD) over the years. Nut yield per palm per year was found to be more than 70 in all the cultivars/hybrids. Water use efficiency (WUE) showed differences between the cultivars and the hybrids (range 3.01 to 3.20 $\mu\text{mol mmol}^{-1}$). The observation clearly showed that among the released cultivars/hybrids, WCT x GBGD performed in terms of leaf traits, dry matter production and yield attributes followed by Benaulim and LCT x GBGD.

In situ drought tolerant palms were identified in farmers' fields located in drought prone areas at Arsikere, Ambajipeta and Ratnagiri. Morpho-physiological studies indicated that tolerant palms had higher net photosynthetic rates, instantaneous water use efficiency, apart from having more number of leaves in the crown, number of bunches and nuts/bunch compared to the other palms in the vicinity.

The project on pruning trials of cocoa had the objectives of studying the effect of different pruning regimes for canopy size, growth, physiological performance and yield. The trial was laid out in arecanut garden with two spacing of cocoa (2.7 x 2.7 m and 2.7 x 5.4 m) and three canopy sizes (small, medium and large). The growth and canopy characters viz., stem girth and canopy spread showed

significant variations with P3 (large) canopy recording highest values, while plant height and canopy height did not vary significantly. The canopy area and leaf area were also higher in P3 treatments. Canopy photosynthesis, which was computed from total leaf area and leaf P_n , was higher in large canopies. Correlations studies between the yield and canopy characters showed positive relationship with canopy area and leaf area.

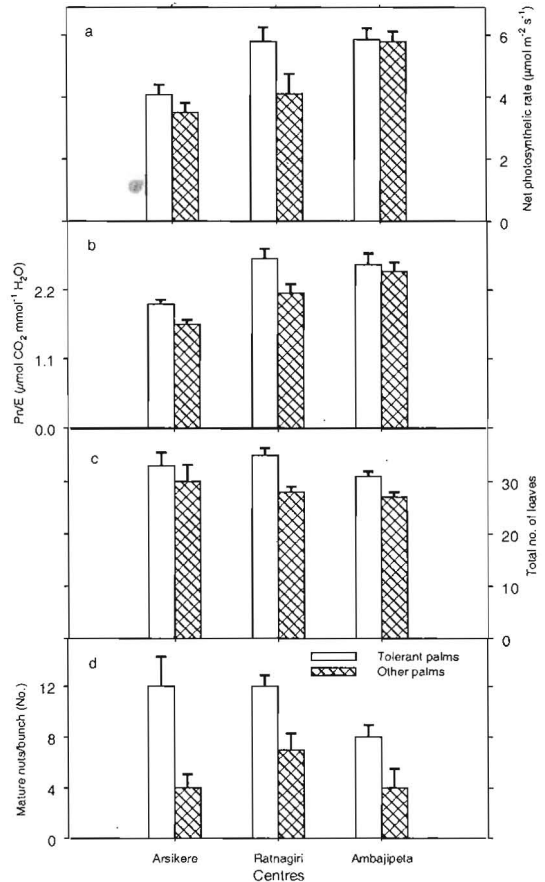


Fig : 9. Morpho-physiological (a- net photosynthetic rate; b- instantaneous water use efficiency; c- total number of leaves; d- number of mature nuts/bunch) efficiency of *in situ* tolerant palms compared to other palms in the farmers field at different centres

CROP PROTECTION

Integrated Management of insect and nematode Pests

- ❑ Coreid bug has been found to be increasing in eriophyid mite infested areas, thus compounding the crops loss.
- ❑ Studies proved that *Galleria mellonella* a collateral host of *Opisina* and its parasitoids can be used successfully by the parasite breeding laboratories for the large scale production of parasitoids.
- ❑ The survey on eriophyid mite in Kerala indicated an overall reduction in the pest incidence. Field trails initiated during the year revealed the efficiency of neem formulations containing azadirachtin when administered through roots.
- ❑ Field trails on the management of root grubs affecting coconut and arecanut have shown the effectiveness of formulations like chlorphyryphos, Carbosulfan and tefluthrin in the management of the pest. However, it is observed that before recommending these new formulations, studies are to be taken up on the dissipation of the pesticides in the soil and also on their secondary metabolites, particularly that of carbosulfan.
- ❑ Production of pheromone for the management of red weevil on coconut has been standardized.
- ❑ Studies on integrated management of nematodes in arecanut based cropping system revealed the beneficial effects of neem and castor oil cakes and green leaf mulching on the management of plant parasitic nematodes. Investigations on the bio-control agents of burrowing nematode and root knot nematode have helped in identifying the potential bio-control agents, members of *Steinernema* and

Heterorhabditis have been found to be effective in the management of key pests like black beetle, red weevil and white grubs.

Disease management on palms and cocoa

- ❑ *Penicillium pinophilom* has been identified, as a potential antagonist against *P.palmivora*, causing bud rot disease of coconut.



Fig : 10. *Penicillium Pinophilum*

- ❑ The association of *Lasiodiplodia*, *Collectotricum* and *Fusarium* with the nut rot/fall of coconut was established and pathogenicity of *Lasiodiplodia* was proved.
- ❑ The association of *Graphium basitruncatum* (Perfect stage of *Ceratocystis fimbriata*) with the Shot hole borer beetle *xylosandrus compactus* in inciting the wilt disease of cocoa (which is widely prevalent in Mysore) has been elucidated and the disease cycle understood. Field control of the disease is obtained by using a combination of tilt (fungicide) and Monocrotophos (insecticide) twice a year during the post monsoon period.
- ❑ Aureofungin-sol (fungicide) has been found to be having the least deleterious

- effect on the AM Fungi of coconut and hence can become a component in the Integrated Disease Management (IDM) package for soil borne disease of coconut.
- The aqueous extract of two plants viz., *Strichnos nux.vomica* and *Clerodendron infortunatum* are effective against the *Ganoderma* isolates of arecanut collected from different parts of India when tested *in vitro* conditions.
 - In the case of crown rot of arecanut, *Phytophthora meadii* has been found to be the incitant. Extract of Eucalyptus leaves were found to inhibit the fungus *in vitro*.
 - *Phytophthora meadii* has been found to cause Mahali of coconut in coorg.
 - *P. heveae* has also been found to be causing Mahali in arecanut.
 - Artificial pollination was carried out in farmers' fields involving 71 WCT, 79 CGD and 7 COD mother palms to generate planting materials for establishing nucleus seed gardens and to develop a high yielding coconut variety, resistant / tolerant to root (wilt) disease. Starting from 1995, five nucleus seed gardens consisting 5975 seedlings have been established in the four root (wilt) prevalent districts.
 - Phytoplasma was purified from spear leaves of root (wilt) diseased coconut, yellow leaf diseased arecanut and spear rot diseased oil palm by Percoll Density Gradient centrifugation. EM examination of the ultra thin sections of the purified fraction revealed the presence of phytoplasma with structural details.

PRE AND POST HARVEST TECHNOLOGY

- Design of solar cum electrical drier with agricultural waste as the third source of energy' was made. The drier consists of a display circuit for continuous monitoring of temperature in the drying chamber, a panel meter to note the set points and an alarm to indicate the completion of drying. A new heating chamber with agricultural waste as fuel has been designed and fabricated, with a fuel capacity of 2 kg. husk. Once fuel is loaded it takes around 40 minutes to increase the output temperature to 140°C. It was estimated that an excess of 200 mega calorie of heat energy will be available, in addition to the solar energy, and so the capacity of the dryer can be increased from 2000 to 3000 coconuts/ batch with out changing the dryer dimensions.
- The Snow Ball Tender Nut (SBTN) making machine is further modified for easy operation, by providing individual adjusting lever on both sides of the depth-adjusting frame. By decreasing the length of the main shaft, the power requirement was reduced and also number of bearings decreased from four to two, thus the cost of the machine was decreased to Rs. 22,500/-. By avoiding the side and top cover of the machine and additional frame support, the cost of the machine can be further reduced to Rs. 12000/-. Anti vibration mount was provided for noise free and vibration free operation.
- SBTN can be packed in LDPE film of 200 G and stored for 15 days at about 15°C (in fridge) and for one day at ambient condition without affecting quality.

- ❑ Process for the production of the coconut chips with different flavours, such as medicated, spicy as well as instant coconut chips by using microwave-oven has been developed. The shelf life of the chips can be increased to more than 6 months by vacuum packaging in aluminium foil laminated with LDPE as well as in modified atmosphere packaging with CO₂ as filling gas.
- ❑ For disintegrating the fresh coconut kernel, the hammer mill type disintegrator is found suitable and a laboratory model of a fluidized bed dryer for drying disintegrated fresh coconut kernel with three hours as drying time has been developed.
- ❑ Power operated arecanut sprayer has been developed. Telescopic pipe assembly using industrial type aluminum

pipes of 3mm thickness has been used to spray up to a target height of 42 ft using 3nos of pipes. Another telescopic pipe assembly has been developed using ultra light weight pipes having titanium alloy using 2 nos. of pipes for a target height of 55ft. A steel wire is provided for lifting and lowering the telescopic pipes. A ratchet mechanism is provided to lock the Al pipes at different heights.

- ❑ Manually operated coconut splitting device has been developed. In this, the impact force splits the nut. The average time taken to split 100 nuts is 12minutes. A machine is also developed to remove the shell from kernel after partial drying. This machine works on a 3hp motor with reduction gear having the output RPM of 10. The shell is removed by impact force.



Fig : 11. View of the Telescopic pipe assembly

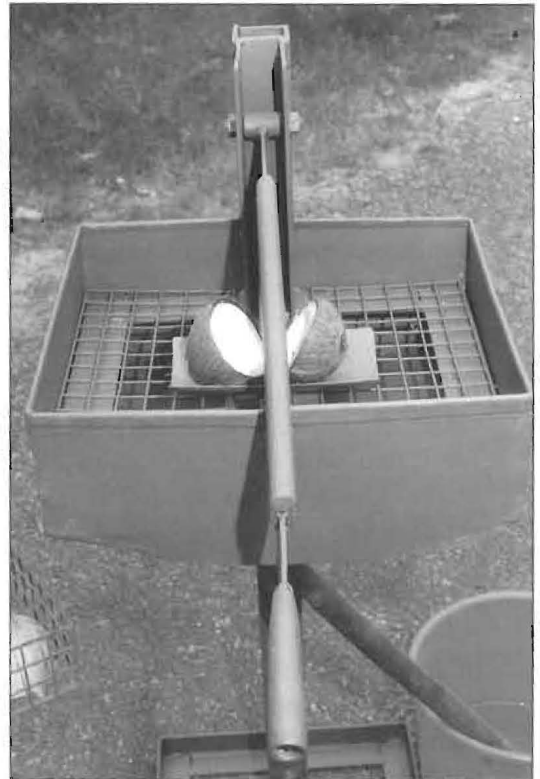


Fig : 12. Manually operated coconut splitting device

SOCIAL SCIENCES

- ❑ Long term supply response studies in arecanut indicated that the area effect on production was more than the productivity effect which is not a desirable factor.
- ❑ Economic analysis of coconut based cropping systems under farmer's field conditions indicated that the realized Marginal Rate of Return from different systems was higher and proved the economic worthiness of adoption of these systems.
- ❑ The ANACOVA technique used in the experiments with plantation crops indicate linear relationship between the response variable and the covariate. However in practice it may not be so. To overcome this, the non-parametric ANACOVA technique, which does not require much assumptions about the functional relationships between the response variable and the covariate was applied to evolve modeling techniques in plantation crops.
- ❑ In the Institution Village Linkage Programme (IVLP), a total of 34 technological interventions was taken up under six micro-forming situations. In the trial on "Assessing the performance of green manure crops in the basins of



Fig : 13. Cultivation of green manure crop *Mimosa invisa* in coconut basin under IVLP



Fig : 14. Demonstration of vermi composting unit under farmer field conditions

- adult coconut palms under rainfed conditions", the total amount of green manure obtained per palm from *Mimosa* (3.05 Kg) was more than from *Calopogonium* (2.42 Kg).
- ❑ Under the TOT programmes of extension section, 14 training programmes for different categories were successfully conducted during 2001-02.
- ❑ Familiarization visit programme for six farmers from Maldives was organised at head quarters during February 2001.
- ❑ CPCRI has participated in three agricultural exhibitions organised at Pilicode, Thodupuzha and Cochin.
- ❑ The results in the demonstration plot on integrated root (wilt) disease management practices at Kayangulam indicated that the average yield of the plot has increased from 47 nuts per palm per year to 75 nuts per palm per year, recording 60% increase in yield over the period 1998-99 to 2000-01. Significant reductions was observed in the incidence of rhinoceros beetle (31.5%) and leaf rot (23.6%).
- ❑ During the period under report, a total of 12,764 farmers have utilized different facilities of Agricultural Technology

Information Centre, which included purchase of quality planting materials, other technological inputs and products. In addition they also availed guidance on the establishment of coconut and arecanut gardens and acquired the knowledge on research and development programmes of CPCRI. It was observed that the varietal performance and crop management technology were the major areas of interest evinced by the farmers followed by crop protection. The total value of sale through ATIC amounts to Rs.10,05,029/-

- Kisan melas were organized at Vittal and Kayangulam.
- Two interface meetings were conducted involving farmers and developmental agencies at Kasaragod and Kayangulam.
- The study on socio-economic aspects of micro irrigation systems indicated that the knowledge level of farmers adopting the systems ranged from medium to high. Availability of subsidy secured first rank among the factors associated with the adoption of drip irrigation systems.
- Documentation of the items of Indigenous Technical Knowledge (ITK) in coconut and arecanut was completed and a publication entitled "Indigenous Technical Knowledge in coconut and arecanut cultivation" was brought out.
- The participatory technology transfer approach is being implemented in root (wilt) affected areas, among the farmers to improve the awareness, knowledge, skill and adoption of technologies recommended by CPCRI. The methodology includes utilisation of personal, mass and group extension techniques in which farmers, scientists and officials from the extension agencies take part to study the technical feasibility and economic viability of various management practices to improve the productivity of root (wilt) affected

gardens.

- The statistical data bases of the mandate crops is strengthened through Integrated Agricultural Resources Information Systems (INARIS).
- Two CD ROMS on coconut descriptor and IPM of coconut pests were released.
- The CPCRI website is updated twice during the year by including the latest research and development items with reference to coconut, arecanut and cocoa. A new facility for the farmers for online registration of their planting material requirements was added to the website.
- A software package for data entry, storing and retrieval of data on performance of different coconut varieties under different management practices is designed.

Krishi Vigyan Kendra

Kasaragod

Training Programmes

- During the period under report 57 on campus and 37 off campus trainings were organized for the benefit of 2176 trainees (945 males and 1231 females). Under women cell activities 31 trainings were organized for 678 women participants.

On Farm Testing

- On Farm Testing on four different topics were conducted in 35 farmers plots.
- Testing the performance of pheromone sachets in trapping coconut black beetle, *Oryctes rhinoceros* was introduced in 6 ha. area belonging to 9 farmers. In six months, 663 beetles were trapped (404 males and 259 females) as against 26 beetles under farmers' practice.
- Role of boron on the productivity of arecanut: When palms showing boron

deficiency symptoms were treated with boron an increase in yield of arecanut chali about 500-550 grams per palm per year was recorded.

Front-Line Demonstration (FLD) Programme

- FLD programme on cereals and horticultural crops was organized in 15.5 ha. area belongs to 32 farmers at Shenay and Enmakaje villages. High yielding rice varieties viz., Karuna and Jaya gave 4.8 tonnes of grains per ha as compared to 4 tonnes in the case of H-4 variety. Their respective straw yield was 5.4 and 4.5 tonnes as against 5 tonnes in H-4 variety.
- KAU - Selection variety of cucumber yielded 16.2 tonnes/ha. as against 14.5 tonnes of local variety. Similarly in the



Fig : 15. Front Line Demonstration programme in rice at Perumbala village

case of cowpea, Vyjayanthi yielded 9 tonnes as against 8.1 tonnes/ha. of local variety.

Other Extension Activities

- Field visits (72), group meetings (8), agricultural seminars (28), field day (one), exhibitions (3), Kisan Mela (1), Radio talks (14), Technical bulletins (2) and Popular articles (18).

Kayangulam

- KVK has been organizing training programmes, front line demonstrations in farmers fields, on farm testing of technologies, various extension activities and other technology transfer programmes.
- During the year KVK has organized 112 training programmes on various topics like agriculture, horticulture, fisheries, animal husbandry, vocational training programmes such as soap making using coconut oil, book binding, mushroom cultivation, bee-keeping, propagation techniques, food processing etc. A total of 2768 beneficiaries' attended the training programmes. The KVK is also collaborating and cooperating with several development departments, agencies and organisations.

ALL INDIA CO-ORDINATED RESEARCH PROJECT ON PALMS

Coconut

Crop Improvement

- At Aliyarnagar, Arasampatti Tall and Malayan Green Dwarf continued to perform well giving 161 and 162 nuts/palm/year respectively.
- At Ambajipeta the highest yield was

recorded in Laccadive ordinary (88 nuts) followed by Andaman Ordinary (86).

- 13 local germplasm accessions native to Orissa were planted along with two local cultivars for evaluation at Konark centre.
- At Ratnagiri, Laccadive Ordinary continued to record the highest average yield of 156nuts/palm/year followed by

Pratap 137 nuts/palm/year.

- In the hybrid evaluation trial at Aliyarnagar, MYD x ECT was promising (133 nuts/palm/year). At Ambajipeta center GBGD x ECT recorded the highest nut yield (61 nuts/palm/year).

Crop Production

- At Aliyarnagar under drip irrigation cum fertilizer experiment on young palms, the increase in mean yield from the treatments, basin irrigation at IW/CPE ratio of 1.0 at 4 cm depth and drip irrigation at 100% Eo was 145 and 143 nuts/palm/year respectively. Whereas the palms that were not receiving any irrigation, recorded only 66 nuts/palm/year. At Veppankulam, the yield data showed that palms under drip irrigation @ 100% Eo recorded the highest nut yield (95 nuts/palm) and under those basin irrigation treatment recorded 84 nuts/palm/year.
- Under nutritional requirements of coconut at Aliyarnagar application of N@ 500g/palm/year increased the number of functional leaves, while N has a positive effect on the setting percentage as well as nut yield. N and K had profound influence on growth and yield characters of coconut palm at Kahikuchi centre.
- In Kahikuchi, the model coconut + black pepper + banana + lemon + pineapple + ginger was found to be more profitable giving highest net return of Rs. 80,370 per ha.). At Veppankulam, among the four models coconut+ banana+ sirukizhangu + Bhendi + Mango +Pepper + seedless lime gave maximum net return of Rs 46,835per ha.

- The trial on integrated nutrient management, at Veppankulam centre revealed that, the treatment 50 kg of FYM and 100% of recommended dose of fertilizer produced significantly highest number of nuts (141nuts/palm/year).

Crop Protection

- In the pathogenicity trial on *Ganoderma* at Aliyarnagar, by split root inoculation technique to the MYD x MGD palms showed 70% of disease incidence. The pathogenic organism *G.applanatum* was reisolated from the infected root portion. At Ambajipeta centre the vertical spread of *Ganoderma* wilt disease on coconut was completely arrested by stagnation of floodwater.

Oil Palm

- At Aduthurai centre, among the eleven cross combinations 104D x 310P showed better performance in growth as well as yield characters (36kg FFB/palm) The performance of exotic and indigenous hybrid trial at Vijayarai, the Papua New Guinea exhibits the superiority over others. The cross combination 104D x 98P recorded mean maximum FFB yield of 121.18 kg/palm followed by 146D x 98P (116.29 kg/palm).

Palmyrah

- Two accessions were added to the centre based on the survey in Nellore district of Andhra Pradesh and identified 59 trees of early bearing nature. Ten more germplasm accessions were added to Killikulam centre during this year.

