

# Research initiatives under Technology Mission on Coconut

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Coconut Development Board has been implementing the scheme 'Technology Mission on Coconut' (TMOC) since 2001 for supporting the research for the development, demonstration and adoption of technologies for the management of insect pest and diseases in coconut. One of the focus areas of TMOC is Research and Development, wherein Board acts as a facilitator and the funding agency for carrying out research programmes for alleviating pest and disease problems by carrying out specific research and implementing technology demonstrations to sort out the problems of insect pest and disease affected gardens.

Technologies on integrated management of most of the major pests and diseases have been developed but the technologies available are not sufficient to meet the requirement. Therefore the projects are taken up on a mission mode with each research project having a specific objective, definite technical programme and pre-designed time frame. In exceptional cases, research projects call for additional time period to attain the envisaged objective, so that ultimate benefit reaches the coconut farmer. ICAR institutes, SAUs, State Agriculture horticulture departments, NGOs and any institution having the capability to take up and execute the project can submit suitable research proposals which shall be funded by the Board, subject to the norms of TMOC.

The implementation of research projects for improving productivity

through management of pest and diseases have prevented the intensity and spread of major diseases like root wilt, bud rot, leaf rot and major pests such as rhinoceros beetle, red palm weevil, black headed caterpillar etc in major coconut growing areas of the country. The implementation of research projects has also facilitated creation of infrastructure facilities in Central Plantation Crops Research Institute (CPCRI), Tamil Nadu Agricultural University (TNAU), Kerala Agricultural University (KAU), University of Agricultural Science (UAS), Department of Agriculture, Tamil Nadu, Department of Horticulture, Karnataka and other research institutes for the large scale production of bio-agents against leaf eating caterpillars and facilities for large scale production of anti-serum for identification of disease (RWD) tolerant mother palms and commercial production and distribution of root (wilt) tolerant coconut seedlings.

Research projects for managing pests and diseases in coconut is being taken up mainly by Central Plantation Crops Research Institute, Kerala Agricultural University, Tamilnadu Agricultural University, Coconut Research stations under ICAR/ SAU, State Agriculture Departments etc. The mode of financial assistance is as below:

**Development of Technologies:** 100% of the project cost limited to Rs.50.00 lakhs for ICAR (CPCRI), State Agricultural

Universities, State Department of Horticulture/ Agriculture and cooperative sector and 50% of the project cost limited to Rs.25.00 lakhs for NGOs/ other organisations.

**Demonstration of Technologies:** 100% of the project cost limited to Rs.25.00 lakhs to ICAR (CPCRI), State Agricultural Universities, State Department of Horticulture/ Agriculture, and public sector units and Co-operative societies. 50% of the project cost for individuals/ group of farmers/ NGO's, private companies limited to Rs.10.00 lakhs.

**Adoption of Technologies:** 25% of the cost of technology adoption to farmers/ NGOs/ other organizations.

Research projects are also being funded under the subcomponent Technical Support and Emergent Requirements considering the need and urgency of the proposals.

So far, 47 research projects on pest and disease management have been completed under TMOC for which an amount of Rs 24.85 crores has been sanctioned and an amount of Rs 22.69 crores has been released.

## **Root (wilt)**

One of the serious threats faced by the coconut holdings are the incidence of the root (wilt) disease, caused by *Phytoplasma*. The debilitating nature of the disease causes considerable loss to coconut palm and there is no cure for the total eradication of the disease.

Research projects have been taken up by Central Plantation Crops Research Institute, under the sponsored project of Board for identifying disease free mother palms from disease endemic areas/hot spots and has demonstrated integrated management practices to create proper awareness among coconut growers in adopting the technologies for managing the disease. As an impact of these projects, serological testing could be made simpler and disease free seedlings are being produced and distributed to farmers.

Advanced research is being carried out at CPCRI, Kasargod for the development of simple DNA extraction protocol for coconut *Phytoplasma* and standardization of real time PCR techniques for the detection of root (wilt) coconut palms in the project Quick detection of root wilt diseases of coconut using molecular kit and the project is in progress.

The Board has also supported State Agriculture Department for cutting and removing root wilt affected palms. 6,94,261 rootwilt diseased palms were cut and removed and replanted with 3,36,807 quality seedlings and also adopted better management practices in 73,524 ha.

Board has extended financial assistance to the tune of Rs 8 lakhs to Tamil Nadu Agricultural University for undertaking a survey of root wilt affected coconut trees in the districts of Karur, Virudhnagar, Dindigul, Thoothukudi, Madurai and Erode in Tamil Nadu under this scheme. Under the initial survey root (wilt) affected palms have been reported from Dindigul (112 palms) and Virudhnagar (120 palms). Under the post evaluation study root (wilt) affected palms have been reported

from Thirunelveli (7640 palms), Theni (17810 palms), Coimbatore (60 palms) and Kanyakumari (200 palms).

Kerala Agricultural University has carried out research projects for survey and identification of root wilt disease free palms and evolution of resistant genotypes in coconut through selection and hybridization and 50,000 seednuts were collected and 7172 hybrid seednuts were produced under the project. As a second phase of this project, Onattukara regional agri station has been sanctioned a project for evaluating the performance of elite seedlings in farmers fields in Alappuzha and Kollam districts and the project is in progress.

### Bud Rot

Bud rot is another serious fungal disease prevalent in the hilly coconut growing tracts of Kerala during monsoon, caused by the *Phytophthora palmivora*. Demonstration of integrated disease management was taken up by CPCRI, Kasargod during 2007-08 and study revealed that the most promising treatment was pouring of Mancozeb solution coupled with placing Mancozeb sachets in the innermost axils and pouring Akomin to the spindle as prophylactic measure before onset of monsoon. The study also revealed that information on maintenance of the garden, rhinoceros beetle incidence, cultivars, age of the palm, previous history of disease incidence, topography of the area and all the more climatic conditions prevailing in the location is very vital in the management of bud rot disease of coconut.

The Board has provided compensation for the removal of completely damaged Budrot affected palms and to contain the

spread of the disease by adopting disease management practices as recommended by CPCRI in severely bud rot affected areas of Kasaragod district.

### Other diseases

Demonstration programmes have been funded by the Board for creating awareness among the coconut growers about the integrated management practices and organic recycling in coconut based farming systems. Recently a project Field demonstration of integrated disease management technology for management of coconut leaf rot disease including bio control agents was completed by CPCRI, Kayamkulam wherein the farmers provided knowledge about the bio-control agents against leaf rot disease.

The importance of organic recycling and intercropping in coconut based farming system has been well demonstrated in another project Soil and plant health management through organic recycling in coconut based production system by CPCRI, Kaymkulam and an organic recycling package is developed.

### Red Palm weevil

Coconut Development Board through the Department of Horticulture, Tamil Nadu had implemented a project for demonstration of integrated management of rhinoceros beetle and red palm weevil in coconut in 11 districts of Tamil Nadu viz. Coimbatore, Virudhunagar, Thanjavur, Vellore, Salem, Dharmapuri, Erode, Namakkal, Trichy, Tirunelveli and Kanyakumari. Pheromone traps were demonstrated in the fields as per the recommendations of CPCRI, Kasaragod, and the effect of pest control was 60-80%.

**Bio-Control Research** Laboratories, Pest Control India Pvt. Ltd, Bangalore, has carried out projects for demonstration of technology for mass trapping red palm weevil and rhinoceros beetle of coconut using aggregation pheromone lures and traps. Studies conducted on red palm weevil adults clearly indicated the presence of 2 distinct activity peaks between 11.00 to 13.00 hrs and 17.00 to 20.00 hrs, majority of the captured adults were females and most of these females were either virgin or gravid and adults are attracted to the pheromone traps from distances up to 1.5 km.

Another project for control of red palm weevil in Tamil Nadu was also sanctioned during the year 2007-08 by placing 5000 pheromone traps in 5000 ha in 16 districts of the State viz; Kanchipuram, Thiruvallur, Vellore, Cuddalore, Salem, Dharmapuri, Coimbatore, Erode, Trichy, Karur, Thanjavur, Theni, Dindigul, Virudhunagar, Tirunelveli and Kanyakumari.

A project Identifying the pheromone synergists of coconut red palm weevil *rhyncophorus ferrugineus* is sanctioned to CPCRI, Kasargod during 2010-11 for identifying the components present in head space volatiles from coconut palm that stimulates the olfactory receptors in *R. ferrugineus* antennae is progressing.

### **Black headed caterpillar**

A parasite breeding lab is set up in the Regional Office, Bangalore under a TMOC project since 2003 with all necessary infrastructure facilities and equipments for mass production of eggs, larvae and multiplication of parasites (*Goniouzus nephantidis*) for the biological suppression of coconut

leaf eating caterpillar in Karnataka. There was good impact in the areas affected by leaf eating caterpillar where demonstrations have been taken up and the release of parasites have shown good result in reducing the infestation of the caterpillar. Further, the demand for parasites from the farmers is also on the rise. The targeted parasite production is 25 lakhs per annum and about 2,17,02,358 parasites has been produced so far.

The Board has sanctioned projects to State Agriculture Horticulture departments for controlling the outbreak of black headed caterpillar in Tamilnadu and Karnataka. 38,310 infected trees in Erode district of Tamilnadu were rejuvenated through root feeding of Monocrotophos 10 ml / 10 ml water, and Parasite release @ Braconids 20Nos./ tree/ 5 times, Bethylids 10 nos./tree for 5 times and recommended fertilizer application under a sponsored project of the Board.

Under the project Development, implementation, training and popularization of IPM of coconut black headed caterpillar (*Opisina arenosella*) implemented by University of Agriculture Sciences, Bangalore the IPM package suitable for management of the pest in the agro climatic condition of Karnataka state was validated. The IPM package involved root feeding with azadiractin 5% @ 15 ml/palm or monocrotophos @ 10ml/palm along with the release of parasites *G.nephantidis* @ 15 parasitoids per palm, 2 releases and application of neem cake 1 kg, farm boon @ 2kg per palm in 2 applications were found effective in managing the pest population.

Another project for management of black headed

caterpillar (BHC) in Tumkur district on pilot basis has been sanctioned to Government of Karnataka and the project envisages covering an area of 5536 ha (830400 palms) by adoption of IPM package recommended by UAS, Bangalore.

Pest Control (India) Pvt. Ltd., Bangalore under the sponsored project evaluation of mass trapping technology for coconut black headed caterpillar (*Opisina arenosella*) by using indigenously developed sex pheromone lures and traps" conducted surveys in Tumkur, Hassan, Chikkamagalur, Ramanagara and Mandya districts of Karnataka and studies on trap type, colour and trap suspended height indicated that white colour trap is best. Cross vane trap was found attracting highest number of moths and traps installed at middle of crop canopy found more moth catches than any other heights.

A project was recently undertaken by the Department of Agriculture, Chennai for the control of BHC in Krishnagiri district covering Kaveripattinam Taluk (Nedungal, Bothapuram, Errahalli, Paiyur, Keelkuppam, Parror villages) covering 9370 infested palms and the pest attack was brought under control

### **Eriophyid mite**

The aggressive measures and timely intervention of the Board in association with ICAR, SAU's and the Department of Agriculture / Horticulture have considerably reduced the intensity of mite attack, which was reported as an epidemic out-break in early 2000. The Board had provided financial assistance of Rs 32.74 crores to the state governments of Kerala, Karnataka, Tamilnadu and Andhra Pradesh under TMOC for the management of eriophyid mite

Assistance has also been provided for development of technologies for the management of eriophyid mite, large scale demonstration of technologies as well as adoption of technologies for the management of mite.

The Project Directorate of Biological Control, Bangalore developed four new formulations of Mycohit based on the fungus *Hirsutella thompsonii* in addition to the dust formulation already developed with the financial support of the Board.

The Department of Horticulture, Karnataka under adoption of technology for control of mite in Karnataka conducted 100 Block demonstrations and 650 training and awareness programmes in 22 coconut growing districts of the state. The application of recommended dosages of nutrients and treatment with natural insecticides along with sufficient water application showed considerable improvement both in yield as well as in quality

44 demonstration trials have been conducted in farmers fields in Coimbatore and Pollachi blocks covering 1.5 acre(100 palms / farmer) for each demonstration as per recommendation of IPM package by Tamil Nadu Agricultural University, under the project Demonstration and evaluation of the integrated pest management package for coconut eriophyid mite in Coimbatore district.

The Department of Agriculture, Government of Maharashtra under the sponsored project of the Board control of eriophyid mite on coconut in maharashtra had taken up demonstrations covering 133.72 ha and pest incidence was reduced up to 25-30%.

The current strategy adopted for the management of the pests is the integrated nutrition management, pest management and water management. At present, the severity of the pest or crop damages have not been reported from any of the coconut growing states.

### Other Pests

The incidence of slug caterpillar was reportedly found recurring in east and west Godavari districts of Andhra Pradesh. The yield of palms is drastically reduced and crop loss is up to 95 %. A project for Studies on light traps for mass trapping and destruction of coconut slug caterpillar moths as an ecofriendly component of IPM was sanctioned to Andhra Pradesh Horticultural University, Tadepalligudem and analysis of various light traps with different intensities revealed that 200 W incandescent bulb is the best light intensity trap and trapped highest number of moth catches followed by 500 W incandescent bulb. Along with proposed light traps, 2 other traps i.e. U V light trap metallic and Acrylic were tested for their efficacy and found promising. The study found that peak time of attraction towards light source was from 19.00 hrs onwards and attained peak between 21.00 and 1.00 hrs and gradually decreased to nil at 3.00 hrs.

In order to popularize the biological control of major pests and diseases of coconut using bio agents, Horticultural Research Station, Ambajipeta has taken up a project mass multiplication of parasitoids, predators, bio-agents and large scale demonstration of biological control of major insect pest and diseases of coconut in Andhra Pradesh and large scale demonstrations are being carried out in selected villages.

Further, Board has financed a research project to Andhra Pradesh Horticultural University for identifying the effective package against post harvest diseases in coconut and studies showed that a combination of chemical preservatives Menadione (400 ppm) and Benzoic acid (750 ppm) showed complete inhibition of all major mycoflora associated with copra rots. The demonstration of developed packages in farmer's field is in progress in the second phase of the TMOC funded project titled development of effective and safe chemical module against post harvest diseases of coconut and demonstration of developed module in farmer's conditions,

The details of completed project are given as table 1 and details of ongoing projects are available at <http://www.coconutboard.gov.in/tmoc-ongoing-projects.pdf>

As a result of the technologies developed and demonstration programmes for pest and disease management undertaken by various agencies through the Technology Mission on Coconut of CDB, many of the serious issues affecting coconut gardens could be brought under threshold level through out the country. In order to make scientific research in coconut sector more effective, focused and intensive, concerted efforts from farmer's collectives, Research Institutes under ICAR, State Agricultural Universities and State Agriculture / Horticulture departments are indispensable. Continuous research and well built extension network in various fields of coconut can bring in the way out to major threats faced by the industry and make it a more profitable and sustainable crop.

**Table 1. Completed research projects of Technology Mission on Coconut**

Sl. No.	Name of the Project	Year of sanction	Implementing Agency
<b>Development, demonstration and adoption of technology for management of insect pests and disease affected coconut gardens</b>			
1	Development of mycoacaricide for the control of mite	2001-02	PDBC, Bangalore
2	Adoption of technology for the control of mite in Karnataka	2001-02	Department of Horticulture, Karnataka
3	Large Scale Production of anti-serum for confirmation of root wilt resistant palms	2002-03	CPCRI, Kayamkulam.
4	Project for containing root wilt diseases in Border districts of Kerala	2002-03	Department of Agriculture, Govt. of Kerala.
5	Increasing Productivity and income in root-wilt affected areas - a farmer participatory demonstration	2002-03	CPCRI, Kayamkulam.
6	Development, Implementation, Training and popularization of IPM of coconut black headed caterpillar ( <i>Opisina arenosella</i> )	2002-03	University of Agriculture Sciences, Bangalore.
7	Mass production of biological agents, demonstration and adoption of technology for management of Coconut leaf eating caterpillar	2002-03	Coconut Research Station, TNAU, Aliyarnagar
8	Project for enhancement of production and productivity of coconut by laying out demonstration plot	2002-03	Dept. of Horticulture, Govt. of Karnataka.
9	Project for control of the out break of Black headed Caterpillar in Erode District of Tamil Nadu	2003-04	Commissioner of Agriculture, Chepauk, Chennai
10	Project for demonstration of the Integrated Management of Rhinoceros beetle and Red Palm weevil in coconut	2003-04	Commissioner of Agriculture, Cheapuk, Chennai
11	Sustainable management of proven technology on control of insect pest and diseases in coconut and establishment of 'Demonstration cum seed production technology'	2002-03	Kerala Agricultural University, Vellanikkara.
12	Management of eriophyid mite infestation in Andhra Pradesh	2004-05	Department of Horticulture, AP.
13	Holistic approach for management of coconut waste and Biocides to mitigate pests and diseases of coconut	2002-03	RRL, Bhubaneshwar.
14	Control of Bud rot disease of coconut in Kozhikode district	2003-04	Director of Agriculture, Govt. of Kerala.
15	Modernization of the existing Parasite Breeding Laboratory at DSP Farm, Mandya	2002-03	CDB with the guidance of PDBC, Bangalore.
16	Demonstration and evaluation of the integrated pest management package for coconut eriophyid mite in Coimbatore district, Tamil Nadu	2003-04	Centre for Plant Protection Studies, Tamil Nadu Agricultural University, Coimbatore
17	Biological Pest control in coconut-(Biological control of leaf eating caterpillar in Karnataka)	2003-04	Dept. Horticulture, Govt. of Karnataka
18	Mass Production and Demonstration of Bio-control agents for the management of Stem Bleeding disease, Rhinoceros beetle and Black headed caterpillar of Coconut	2004-05	CPCRI, Kasaragod
19	Integrated pest and disease management of coconut in heavily root (wilt) disease affected districts of Kerala State to develop model coconut farms	2004-05	CPCRI, Regional Station, Kayamkulam
20	Project for Control of Eriophyid Mite on Coconut in Maharashtra	2004-05	Department of Agriculture, Government of Maharashtra.
21	Project for Control of Eriophyid Mite in Coconut in Orchards of Orissa	2004-05	Agricultural Department, Govt. of Orissa.
22	Demonstration of technology for mass trapping Red Palm Weevil and Rhinoceros beetle of Coconut using Aggregation pheromone lures and traps	2005-06	Bio-Control Research Laboratories, Div. PCI Pvt. Ltd, Bangalore
23	Production of root (wilt) resistant / tolerant coconut seedlings for root (wilt) disease prevalent tracts	2004-05	CPCRI, RS, Kayamkulam
24	Development of sex pheromone lures and devising suitable trapping system for management of the coconut black headed caterpillar, <i>Opisina arenosella</i>	2005-06	Bio-Control Research Laboratories, Div. PCI Pvt. Ltd, Bangalore
25	Increasing productivity and income from coconut through Integrated Disease Management Technology in Basal from stem rot affected area - a farmer participatory demonstration-training programme	2005-06	CRS, Veppankulam

Sl. No.	Name of the Project	Year of sanction	Implementing Agency
26	Multi locational Technology Demonstration on Coconut Mite Control in Coconut Growing States	2006-07	Regional Research Laboratory (CSIR), Bhubaneswar
27	Control of Red Palm weevil in Tamil Nadu during the year 2007-08	2006-07	Department of Agriculture, Chepauk, Chennai.
28	Project for management of Black headed Cater Pillar on coconut in Kasaragod District	2006-07	Department of Agriculture, Kerala
29	Survey and Identification of root wilt disease free palms and evolution of resistant genotypes in coconut through selection and hybridization	2003-04	Kerala Agricultural University, Regional Research Station, Kayamkulam
30	Control of Leaf blight disease incidence of coconut in Anamalai block of Coimbatore district	2008-09	Dept. of Agriculture, Govt. of Tamilnadu
31	Integrated Coconut Development Scheme	2006-07	District Panchayat, Kozhikode
32	Development of management technologies for post harvest diseases in coconut	2007-08	Agricultural Research Station, Acharya NG Ranga University Ambajipeta.
33	Integrated Management of Bud Rot Disease of Coconut in Endemic Area	2007-08	CPCRI, Kasaragod, Kerala.
34	Demonstration of recommended IPM/INM technologies for the management of Eriophyid mite in the affected areas of Gujarat	2007-08	Director of Research, Junagadh Agricultural University, Junagadh, Gujarat
35	Control of Black Headed Caterpillar outbreak in Erode district of Tamil Nadu	2007-08	Department of Agriculture, Tamil Nadu
36	Soil and plant health management through organic recycling in coconut based production system	2008-09	Central Plantation Crops Research Institute (CPCRI), Kaymkulam
37	Organic group farming project for coconut based farming system in Vechoor	2008-09	Manarcadu Social Service Society, Manarcadu, Kottayam
38	Management of Black Headed Caterpillar (BHC) menace on Coconut in Karnataka	2009-10	Director of Horticulture, Govt. of Karnataka, Bangalore
39	Field demonstration of integrated disease management technology for management of leaf rot disease including bio agents	2009-10	CPCRI, Kasaragod
40	Monitoring and surveillance of infestation of pest and disease of coconut in Andaman Nicobar Islands	2009-10	Director, Central Agricultural Research Institute (ICAR), Port Blair, A & N Islands
41	Development of nutrient management strategy for improving the health of the palm to build resistance to pests	2009-10	Orissa University of Agriculture and Technology, Bhubaneshwar, Orissa
42	A study on the quality of coconut in Andhra Pradesh in terms of output of copra, oil, coconut water, shell and husk	2009-10	Andhra Pradesh Horticultural University Tadepalligudem, West Godavari District, Andhra Pradesh
43	Survey for the occurrence and severity of root (wilt) disease of coconut in Dakshina Kannada District of Karnataka.	2009-10	University of Agricultural Sciences, GKVK, Bangalore
44	Survey on incidence and severity of Ganoderma wilt of coconut with respect to agronomic practices in dry tracts of southern Karnataka	2009-10	UAS, GKVK, Bangalore
45	Studies on light traps for mass trapping and destruction of coconut slug caterpillar moths as an ecofriendly component of IPM	2009-10	Andhra Pradesh Horticultural University, Tadepalli Gudem
46	Production of Disease free Elite planting material for improving the productivity of coconut in Bay islands	2009-10	Central Agricultural Research Institute (ICAR), Port Blair, A & N Islands
47	Evaluation of Mass Trapping Technology for coconut black headed caterpillar ( <i>Opisina arenosella</i> ) by using indigenously developed Sex Pheromone Lures and Traps.	2010-11	Bio-control Research Laboratories, Division of Pest Control (India) Pvt. Ltd., Arakere, Bengal
48	Control of Black headed caterpillar in Krishnagiri district	2012-13	Department of Agriculture, Chepauk, Chennai