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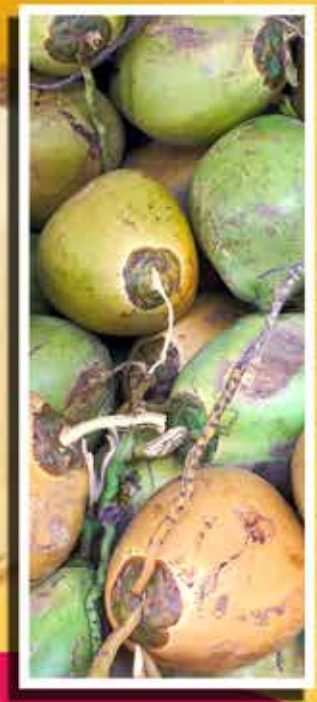

Preservation Protocol for
Trimmed Tender Coconut

Tropical tuber crops based cropping systems in coconut garden

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Articles, research papers and letters on different aspects of coconut cultivation and industry are invited for publication in this Journal. All accepted material will be paid for. The Board does not accept responsibility for views expressed by contributors in this Journal. All remittances and correspondence should be addressed to the Chairman, Coconut Development Board, Kochi - 682 011.

Coconut Development Board

The Coconut Development Board is a statutory body established by the Government of India for the integrated development of coconut cultivation and industry in the country. The Board which came into existence on 12th January, 1981, functions under the administrative control of the Ministry of Agriculture and Farmers Welfare, Government of India, with its headquarters at Kochi in Kerala State and Regional Offices at Bangalore, Chennai, Guwahati and Patna. There are five State Centres situated in the states of Orissa, West Bengal, Maharashtra and Andhra Pradesh and in the Union Territory of Andaman & Nicobar Islands. DSP Farms are located at Neriyamangalam (Kerala), Vegiwada (Andhra Pradesh), Kondagaon (Chhattisgarh), Madehpura (Bihar), Abhayapuri (Assam), Pitapalli (Orissa), Mandya (Karnataka), Palghar (Maharashtra), Dhali (Tamil Nadu), South Hichachara (Tripura) and Fulia (West Bengal) besides a Market Development cum Information Centre at Delhi. The Board has set up a Technology Development Centre at Vazhakulam near Aluva in Kerala.

Functions

❒ Adopting measures for the development of coconut industry. ❒ Recommending measures for improving marketing of coconut and its products. ❒ Imparting technical advice to those engaged in coconut cultivation and industry. ❒ Providing financial and other assistance for expansion of area under coconut. ❒ Encouraging adoption of modern technologies for processing of coconut and its products. ❒ Adopting measures to get incentive prices for coconut and its products. ❒ Recommending measures for regulating imports and exports of coconut and its products. ❒ Fixing grades, specifications and standards for coconut and its products. ❒ Financing suitable schemes to increase the production of coconut and to improve the quality and yield of coconut.

❒ Assisting, encouraging, promoting and financing agricultural, technological, industrial or economic research on coconut and its products. ❒ Financing suitable schemes where coconut is grown on large scale so as to increase the production of coconut and to improve its quality and yield and for this purpose evolving schemes for award of prizes or grant of incentives to growers of coconut and the manufacturers of its products and for providing marketing facilities for coconut and its products. ❒ Collecting statistics on production, processing and marketing of coconut and its products and publishing them. ❒ Undertaking publicity activities and publishing books and periodicals on coconut and its products.

The development programmes implemented by the Board under the project Integrated Development of Coconut Industry in India are- production and distribution of planting material, expansion of area under coconut, integrated farming for productivity improvement, technology demonstration, market promotion and Information and Information Technology. Under the Technology Mission on Coconut, the programmes implemented by the Board are development, demonstration and adoption of technologies for management of insect pest and disease affected coconut gardens, development and adoption of technologies for processing and product diversification and market research and promotion.

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Message from the Chairperson's desk

Dear Readers,

Coconut is called the Tree of Life and our coconut farmers have been nourishing this Kalpavriksha to provide food, fuel, fibre and wood for the community. Coconut farmers, majority of whom are small and marginal, not only toil to produce the healthy and nutritious food for us, but also in the process play a key role in the preservation of the environment and biodiversity around us. Coconut is the most suited crop for sustainable agriculture and it also contributes to the creation of more employment opportunities, particularly for youth and women with the development of the coconut industry and the establishment of coconut processing units.

Today farmers are facing issues of climate change like higher temperatures, erratic weather patterns like the recent Nisarga which affected the plantations in the west coast of the country especially Maharashtra, increased desertification and water scarcity already experienced by coconut growing tracts in Tamil Nadu and Karnataka, as well as the outbreak of pests and diseases that are spreading around more quickly than ever, the recent example being the invasive white fly species. It is important to work together with the farmers and adopt measures to combat the challenges faced and accelerate productivity and income from the small scale farms which will in turn help in ensuring livelihood security and social security.

I wish to call upon all stakeholders including the policy makers, scientists, farmers and entrepreneurs to come together and work towards making coconut, a remunerative and sustainable crop to the benefit of the small holder farmers.

G Jayalakshmi IAS

Chairperson

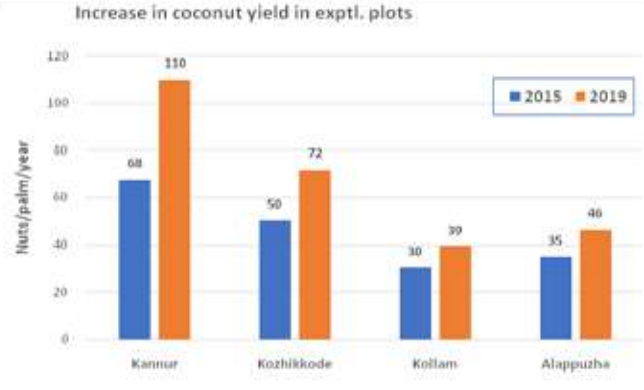
Enhancing coconut productivity in Kerala:
A simple solution to the complex problem

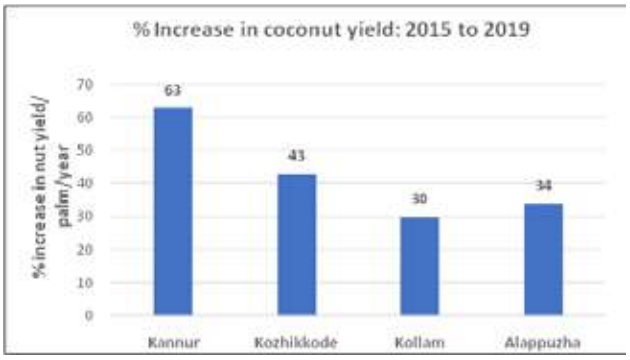
Nair, K.M., Anil Kumar, K.S., Thamban, C., Lalitha, M., Chandran, K.P., Jeena Mathew, Abdul Harris, Srinivasan, V., Maria Dainy, Shoji Joy Edison, Sajnanath, K., Rajeev, M.S., Vinod Mathew, S., Ajith Kumar, R., Rajasekharan, P., and Nagesh, S.S.

Kerala ranks first in area and production of coconut in the country, but scores poorly in productivity and is ranked sixth among the Indian states. Faced with the prospect of the palm following the fate of rice in the state, the Kerala State Planning Board requested the National Bureau of Soil Survey and Land Use Planning (ICAR) to undertake a research program for enhancing productivity of the palm, in consortium with relevant ICAR institutes working in the state (CPCRI, CTCRI, IISR, KVK's Kozhikode, Alapuzha, Ernakulam and Pathanamthitta and IIITMK). The consortium submitted a project proposal to the KSPB in 2014 with the primary objective of enhancing the palm productivity in major coconut-growing regions of the state through mitigation of soil related constraints to the palm. The project initiated in November 2014 was concluded in March 2020.

Analysis of variability in climate and soil qualities in the major coconut growing regions of the state pointed to the overriding influence of soil qualities over climate on coconut productivity. Based on purposive soil sampling and analysis , the research team zeroed in three major coconut growing regions of the state, viz., Northern laterites, Central laterites, and Coastal plain with the exclusion of Palakkad plain and Southern laterites with limited constraints to the palm, for experiments to alleviate soil related constraints and thereby enhancing the coconut yield significantly.

The major soil related constraints in the regions of focus were strong surface and subsoil acidity, toxicity of aluminium and deficiencies of major, secondary and micro-nutrients. To overcome the constraints



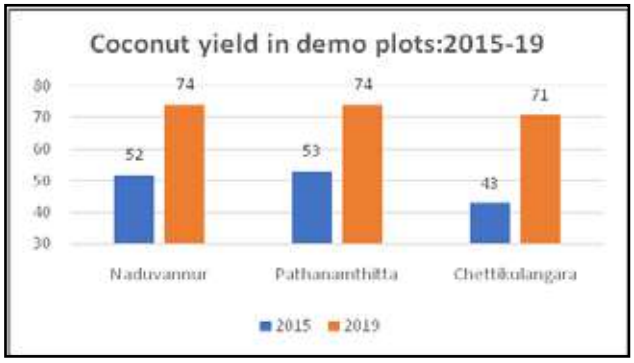


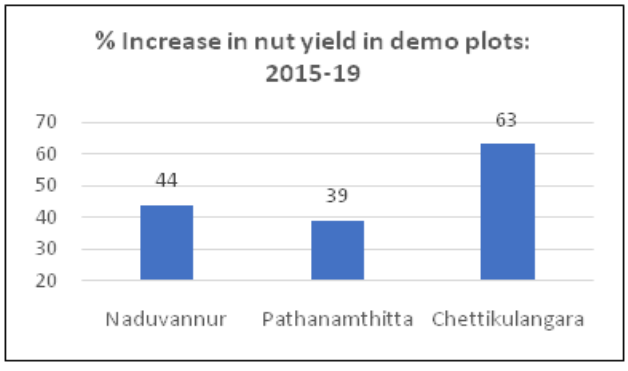
and reduce the cost of cultivation a new set of management practices, termed Best Management Practices (BMP) were formulated. The salient features of the BMP were discontinuing the annual preparation of basins around the palm, return of palm residues to the base in lieu of farm yard manure inputs, external input of liming materials to abate surface, subsoil acidity and aluminium toxicity, and inputs of fertilizers to meet the palm's requirement of not only the major nutrients but also secondary and micro-nutrients. The BMP was tested for its capacity to mitigate soil related constraints to the palm and significantly enhance harvested nut yield through statistically designed experiments and demonstrations in the farmer's fields, in the three regions.

The external input of liming materials and plant nutrients, within a short span of three years, mitigated the surface and subsoil acidity and aluminium toxicities and hiked the soil available nutrients to adequate level for the palm, with the exception of magnesium and boron in laterite soils of Central Kerala and sandy soils of coastal plain. The input of magnesium sulfate was found to be effective for amelioration of subsoil acidity. The rate of input of magnesium and boron were insufficient in central laterite and coastal sandy soils.The BMP followed could increase harvested coconut yield substantially into the fourth year in experiment and demonstration plots. The statistically significant increase in nut yield vindicated our hypothesis. Average increase in nut yield (2015 to 2019) at northern Kerala experimental sites (Pilathara and Naduvannur) was 48% and at Central Kerala sites 32% (Kalluvathukkal and Chettikulangara).

Average increase of nut yield in three demonstration sites in the same period was a whopping 49 % (Naduvannur 44 %; Pathanamthitta 39 %; and Chettikulangara 63 %). Paired test on annual coconut yields in most experiment and demonstration sites proved statistically significant when yield realised in the fourth year (2018-19) was compared with base year yield (2015-16).Average yield increase of 45 per cent (all experiments and demonstrations considered together) realised in the fourth year, after initial input of BMP, assume added significance since the ideal period for evaluating harvested nut yield for coconut palm starts from fifth year.

Analysis of socio-economic profile of coconut farmers unequivocally pointed to the waning interest





in the crop, in line with overall decline of agriculture in the state.Reasons are many; income from other sources outweighing crop production, small size of holdings returning paltry profits, unfair markets, widespread incidence of pests and diseases lacking effective control and so on. Many of the external inputs in BMP are currently not readily available with local fertilizer dealers: lime, dolomite, zinc sulphate, copper sulphate, borax and sodium molybdate. The means of overcoming farmer apathy and bottlenecks on supply side is to make available prepacked inputs for coconut palms at the farm gate, two times in a year, or make it available with all fertilizer dealers in the state, adequately labelled with details of contents and advisory on usage. The program should be assiduously preceded and followed by effective extension strategy to popularise the BMP among coconut farmers

Evaluation of the changes in soil qualities and their reflection on coconut yield enabled modification of BMP evolved before the experiment. AEU-wise revised BMP evolved for Coastal sandy plain (AEU 1 & 2), Onattukara sandy plain (AEU 3), Central laterites (AEU 9& 12), and Northern laterites (AEU10, 11& 13) with divisions for first three years and thereafter follows.

The agronomic management part of BMP for coconut palms remain same for all the regions.

No basins for coconut palm and tillage of inter space unless required for intercrops and no external inputs of organic manure (cow dung or farmyard manure) are required, only the palm residues need to be returned to base of palm.

End note: Discontinuing the practices of basins around the palm and farmyard manure/cow dung inputs together can provide enough cash for liming material and plant nutrient inputs!

1. For Northern Laterite soils (AEU 10, 11& 13): First three years for adult palm			
Packet No	Content of each packet	No. of packets	Time of application
1	Urea 250 g	2	One each of packets numbered 1 to 3 should be applied in April/May after receipt of enough rainfall to moisten the soil. The remaining 1-3 numbered packets are to be applied in September (after cessation of south-west monsoon, but before onset of north-east monsoon).
2	Factamphos 500 g MOP – 1kg	2	
3	Sodium Chloride – 1kg MgSO4- 500g	2	
4	Lime- 1 kg Dolomite – 1 kg	1	15 days after application of packets 1-3 in April/May
5	Borax- 100 g Zinc sulphate – 50 g Copper sulphate- 50 g Mo salt- 5 g	2	One packet 10 days after lime in April/May. One packet to be applied in September (after cessation of south-west monsoon, but before onset of north-east monsoon).
2. For Northern Laterite soils (AEU 10, 11&13): Fourth year onwards for adult palm			
Packet No	Content of each packet	No. of packets	Time of application
1	Urea 250 g	2	One each of packets numbered 1 to 3 should be applied in April/May after receipt of enough rainfall to moisten the soil. The remaining 1-3 numbered packets are to be applied in September (after cessation of south-west monsoon, but before onset of north-east monsoon).
2	Factamphos 100 g MOP – 500 g	2	
3	Sodium Chloride –500 g MgSO4- 250 g		
4	Lime- 1 kg	1	15 days after application of packets 1-3 in April/May
5	Borax- 50 g Zinc sulphate – 25 g Copper sulphate- 25 g Mo salt- 10 g	2	Packet 5 to be applied in September (after cessation of south-west monsoon, but before onset of north-east monsoon).
3. For Central Laterite soils (AEU 9& 12): First three years for adult palm			
Packet No	Content of each packet	No. of packets	Time of application
1	Urea 250 g	2	One each of packets numbered 1 to 3 should be applied in April/May after receipt of enough rainfall to moisten the soil. The remaining 1-3 numbered packets are to be applied in September (after cessation of south-west monsoon, but before onset of north-east monsoon).
2	MOP – 1kg	2	
3	Sodium Chloride – 1 kg MgSO4- 1 kg	2	
4	Lime- 1 kg Dolomite – 1 kg	1	15 days after application of packets 1-3 in April/May
5	Borax- 100 g Zinc sulphate – 50 g Copper sulphate- 50 g Mo salt- 5 g	2	One packet 10 days after lime in April/May.One packet 10 days after Urea and other fertilizers (packets numbered 1 to 3) in Oct/Nov.
4. For Central Laterite soils (AEU 9&12): Fourth year onwards for adult palm			
Packet No	Content of each packet	No. of packets	Time of application
1	Urea 250 g	2	One each of packets numbered 1 to 3 should be applied in April/May after receipt of enough rainfall to moisten the soil. The remaining 1-3 numbered packets are to be applied in September (after cessation of south-west monsoon, but before onset of north-east monsoon).
2	MOP – 500 g Factamphos 100 g	2	
3	Sodium Chloride –500 g MgSO4- 500 g	2	
4	Lime- 1 kg	1	15 days after application of packets 1-3 in April/May
5	Borax- 100 g Zinc sulphate – 25 g Copper sulphate- 25 g Mo salt- 10 g	1	Packet no 5 to be applied in September (after cessation of south-west monsoon, but before onset of north-east monsoon).

5. For Onattukara sandy plain (AEU 3): First three years for adult palm			
Packet No	Content of each packet	No. of packets	Time of application
1	Urea 250 g	2	One each of packets numbered 1 to 3 should be applied in April/May after receipt of enough rainfall to moisten the soil. The remaining 1-3 numbered packets are to be applied in September (after cessation of south-west monsoon, but before onset of north-east monsoon).
2	MOP – 1kg	2	
3	MgSO4- 1 kg Sodium chloride 500 g	2	
4	Lime- 1 kg	1	15 days after application of packets 1-2 in April/May
4	Borax- 100 g Zinc sulphate – 50 g Copper sulphate- 50 g Mo salt- 5 g	2	One packet 10 days after lime in April/May.Second one in September (after cessation of south-west monsoon, but before onset of north-east monsoon)
6. For Onattukara sandy plain (AEU 3): Fourth year onwards for adult palm			
Packet No	Content of each packet	No. of packets	Time of application
1	Urea 250 g	2	One each of packets numbered 1 to 3 should be applied in April/May after receipt of enough rainfall to moisten the soil. The remaining 1-3 numbered packets are to be applied in September (after cessation of south-west monsoon, but before onset of north-east monsoon).
2	MOP – 500 g	2	
3	MgSO4- 500 g Sodium chloride 500 g	2	
4	Lime- 1 kg	1	15 days after application of packets 1-2 in April/May
5	Borax- 100 g Zinc sulphate – 25 g Copper sulphate- 25 g Mo salt- 10 g	1	Packet no 5 to be applied in September (after cessation of south-west monsoon, but before onset of north-east monsoon).
7. For Coastal sandy plain (AEU 1&2): First three years for adult palm			
Packet No	Content of each packet	No. of packets	Time of application
1	Urea 250 g	2	One each of packets numbered 1 to 3 should be applied in April/May after receipt of enough rainfall to moisten the soil. The remaining 1-3 numbered packets are to be applied in September (after cessation of south-west monsoon, but before onset of north-east monsoon).
2	MOP – 1kg	2	
3	MgSO4- 1 kg	2	
4	Lime- 1 kg	1	15 days after application of packets 1-2 in April/May
5	Borax- 100 g Zinc sulphate – 50 g Copper sulphate- 50 g Mo salt- 5 g	2	One packet 10 days after lime in April/May.Second one in September (after cessation of south-west monsoon, but before onset of north-east monsoon)
8. For Coastal sandy plain (AEU 1 & 2): Fourth year onwards for adult palm			
Packet No	Content of each packet	No. of packets	Time of application
1	Urea 250 g	2	One each of packets numbered 1 to 3 should be applied in April/May after receipt of enough rainfall to moisten the soil. The remaining 1-3 numbered packets are to be applied in September (after cessation of south-west monsoon, but before onset of north-east monsoon).
2	MOP – 500 g Factamphos 100 g	2	
3	MgSO4- 250 g	2	
4	Lime- 500 g	1	15 days after application of packets 1-2 in April/May
5	Borax- 100 g Zinc sulphate – 25 g Copper sulphate- 25 g Mo salt- 10 g	1	Packet no 5 to be applied in September (after cessation of south-west monsoon, but before onset of north-east monsoon).

Authors: 1,5,6 CPCRI Kasarkod., 2,3 NBSS and LUP Bangalor., 4 Indian Spice Research Institute Kozhikode., 7 KVK Alappuzha., 8 KVK Pathanamthitta., 9 KVK Ernakulam., 10 KVK Kozhikode., 11 State Planning Board Thiruvananthapuram
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Tropical tuber crops based cropping systems in coconut gardens for enhancing productivity and farm income

A case of farmer participatory research cum demonstration

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Introduction

Coconut or 'Kalpavriksha', the tree of life with lot of virtues, is an important plantation crop that assumes the status of a high value commercial crop in India. Though, Kerala occupies the largest area (54%) under coconut, majority of the coconut holdings are small, which neither provides gainful employment opportunities to the family throughout the year nor generates sufficient income to meet the family requirement. The coconut farmers are also exposed to economic risks and uncertainties due to high degree of price fluctuations. The domestic price of coconut in India has also been showing a declining trend. The phyllotaxy and the unique plant architecture of the coconut tree offer ample scope for utilizing the greater portion (75%) of the unutilized area between the trees for intercropping.

Tropical tuber crops such as cassava, elephant foot yam and greater yam are ethnic starchy vegetables with good production potential, cooking quality and taste besides medicinal and nutritive values. Hence these are important as traditional food in the diets of the people of Kerala. It is estimated that tuber crops provide about 6% of the dietary energy, apart from being good sources of β carotene, antioxidants, dietary fibre and minerals. They have higher biological efficiency, can tolerate drought and shade, withstand flooding and salinity to some extent and are adapted to marginal environments, low input situations and adverse soil and climatic conditions. These crops are less water and input demanding and relatively free from pests and diseases. Hence these crops are known as 'climate resilient' or 'future crops'. They also have immense industrial uses, in the production of starch, sago, alcohol, liquid glucose, vitamin C and as raw material for poultry and animal feed besides medicinal properties.

Scope and importance of coconut + tuber crops systems

Cultivation of tropical tuber crops in the interspaces of coconut palms will enhance farmers' income and enable employment opportunities and the compatibility / flexibility of tuber crops in coconut gardens have been documented by ICAR-CTCRI. In particular, the food production can be substantially enhanced by integrating tuberous vegetables in the existing perennial tree-based cropping systems, since tuber crops are adapted to the same ecological conditions as plantation crops.

Besides, tuber crops also thrive well under partially shaded conditions unlike most other conventional vegetables like tomato, brinjal, okra etc., and cereals and perform well in a wide range of soil and climatic conditions. In such a system, the main crop provides the cash income, tuberous intercrops serve as high energy secondary staple to the farm family and feed for farm animals, behave as insurance crop against risk and natural calamities, enhance the resource use efficiency, ensure food security, augment net income and enhance employment opportunities.

The problems in coconut like no gainful employment, low income, pests and diseases, nutrient disorders, price fluctuations etc. need to be addressed for the development of coconut garden and sustainable livelihood of the coconut growers. The problems can be addressed very well and taken care of by the intervention of sustainable nutrient management technologies in tuber crops, a group of feasible under-storey crops in coconut gardens. Intercropping tuber crops in coconut gardens and adoption of sustainable soil health practices in tuber crops would enable higher yield (10-25%), higher profit (20-30%) and gainful employment (220-250 man days ha-1) due to their higher biological efficiency and higher and stable price in the market (Rs. 40-50 per kg of tubers). With this background, thirty farmer participatory demonstrations have been planned in three districts of Kerala viz., Thiruvananthapuram, Kollam and Pathanamthitta with the objective of building resilience and generating higher productivity and profitability in coconut gardens through frontier nutrient management technologies in tuber crops.

Technologies for nutrient management in tuber crops

ICAR-CTCRI has developed sustainable nutrient management technologies such as customized fertilizers suitable to various agro-ecological units (AEUs) based on site specific nutrient management (SSNM) and organic farming technologies in major as well as minor tuber crops. These technologies are adopted to increase the system productivity and profitability as well as ensure food-cum-nutritional security and sustainable livelihoods in the coconut-based homesteads of southern India.

Customized fertilizers based on SSNM: Technologies for SSNM have been developed in cassava, elephant foot yam and yams based on intensive research at ICAR-CTCRI for the last 15 years. This has resulted in the development of customized fertilizers for cassava and elephant foot yam, which enhanced the yield by 24% over farmers' fertilizer practice, besides maintaining soil quality. Customized fertilizers consisting of macro and micronutrients based on soil test values are used for managing the nutrient requirements in tuber crops to attain specific yield goals.

Organic farming package

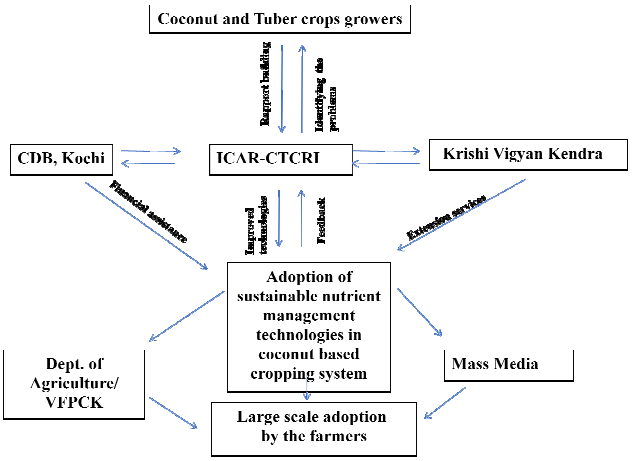
About 15 years of research on organic farming of tropical tuber crops at ICAR-CTCRI indicated that organic farming resulted in 10-20% higher yield, 20-40% profit, besides improvement in tuber quality and soil health. Organic production technologies have been developed in cassava, elephant foot yam, yams, taro, Chinese potato and arrowroot. Organic farming technology consisting of organically produced planting materials, organic manures, green manuring, bio-fertilizers, bio-control agents, biopesticides etc. are used for managing the nutrient requirements of tuber crops.

Partners in Farmers' Participatory Research

Farmers' participatory research involves the

following partners in achieving the stable, sustainable and productive technology transfer for enhancing the productivity and farm income. The conceptual framework of the project is given in Fig 1.

Fig. 1



- Coconut and tuber crops growers
- Coconut Development Board, Kochi
- ICAR-Central Tuber Crops Research Institute, Sreekariyam, Thiruvananthapuram
- Department of Agriculture, Govt. of Kerala
- Krishi Vigyan Kendra
- Vegetable and Fruit Promotion Council, Kerala (VFPCK)
- Media- Press, Journals, Video

Farmers who had interest in taking up scientific interventions were selected based on the principles of participatory research and also based on the scoring procedure developed by the scientists of ICAR-CTCRI in consultation with the officials of Coconut Development Board, Krishi Bhavans and Krishi Vigyan Kendras. Farmers who had coconut gardens with 50 cents each were selected for demonstrating technologies viz., customized fertilizers (SSNM) and organic farming (OF) in cassava, greater yam and elephant foot yam. Data on socio–economic background, available resources, farming details, farming practices, knowledge on coconut and tuber crops farming, constraints in farming etc. were collected in detail with the active participation of the farmers. Soil samples were collected prior to the start of the demonstrations and were analyzed for chemical properties. Demonstrations on SSNM and organic farming (Table 1) were carried out as per approved technical programme and already standardized technologies. Funds for establishing 30 demonstration plots in three districts were sponsored by Coconut Development Board, Kochi.

Implementation of the farmer participatory demonstration

Farmer participatory demonstrations were established with the active participation of the farmers under the guidance and supervision of scientists and staff members of ICAR-CTCRI. Planting materials of improved varieties of tuber crops, critical inputs viz., customized fertilizers and organic inputs were supplied to the farmers. A total of thirty demonstrations were established in Thiruvananthapuram, Kollam and Pathanamthitta districts in Kerala for proving the technical feasibility and economic viability of the nutrient management technologies in coconut + tuber crops intercropping system.

The ICAR-CTCRI, Thiruvananthapuram, had also initiated a collaborative programme with Jail Department, Government of Kerala and Coconut Development Board (CDB), Government of India and established a 'Tuber Crops Museum' at Open Jail and Correctional Home located at Nettukaltheri, Thiruvananthapuram, Kerala. The programme started during March 2018 by providing planting materials, technical support and established an organic yam plot in coconut garden. The harvest of the organic yam crop as well as establishment of a Tuber Crops Museum was inaugurated on 7th March 2019 by Mrs. R. Sreelekha I.P.S., Director General of Prisons, Kerala (Fig. 3). Dr. Archana Mukherjee, Director, ICAR-CTCRI graced the occasion and delivered the keynote speech. The ICAR-CTCRI has provided organic inputs as well as quality planting materials of 23 different varieties of tropical tuber crops for the establishment of the Tuber Crops Museum. This includes improved

Table 1. Farmer participatory demonstrations on nutrient management technologies in tuber crops based cropping system in coconut

District and panchayats	Month and year of start	Intercrop	Technology	No. of demonstrations
Thiruvananthapuram (Chenkal & Ottasekharamangalam panchayats, Neyyattinkara municipality and Thiruvananthapuram corporation)	May -June 2018	Cassava	SSNM	3
			Organic farming	3
		Greater yam	SSNM	2
			Organic farming	2
Kollam (Chavara and Panmana panchayats)	May-June 2019	Elephant foot yam	SSNM	3
			Organic farming	3
		Greater yam	SSNM	2
			Organic farming	2
Pathanamthitta (Koipuram, Mallapally, Aranmula and Kottanad panchayats)	May-June 2020	Cassava	SSNM	3
			Organic farming	3
		Greater yam	SSNM	2
			Organic farming	2
Total				30

varieties of cassava, sweet potato, elephant foot yam and white yam.

Expected Output

These demonstration plots will serve as model plots for farmers and other stakeholders. Productivity and farm income from coconut and tuber crops will be enhanced by the adoption of nutrient management technologies and cropping system models. Upscaling of demonstrations will pave way for achieving sustainability of coconut and tuber crops sector in Kerala.

Follow up

All the thirty demonstrations in three districts are being monitored for collecting the details on yield and economics of coconut and tuber crops for assessing the system productivity and profitability. Field days during harvest of tuber crops will be organized involving farmers and other stakeholders to recognize the success of the technologies and also to promote improved technologies of tuber crops in coconut gardens. On-farm demonstrations on customized fertilizers and organic farming technologies in tuber crops will help in increasing the productivity and profitability of coconut as well as upliftment of tuber crop growers. These trials and demonstrations will serve as model plots for other farmers to adopt improved technologies

Fig. 3)

in coconut farming, which warrant the efforts from all stakeholders viz., ICAR-CTCRI, CDB, Kochi, Department of Agriculture, Krishi Vigyan Kendra, farmers, input agencies, marketing traders etc. Productivity and profitability of coconut gardens through soil health management in tropical tuber crops are being documented and will be published in the form of success stories, technical bulletins and research papers. The validated technologies will be given to KVKs, Department of Agriculture and other line departments for popularization and scaling up of the technologies in larger areas for doubling farmers' income on a sustainable basis.

Acknowledgement

The authors are grateful to the Coconut Development Board, Kochi, Ministry of Agriculture and Farmers' Welfare, Govt. of India for sponsoring the project. ■

Biological Control of Coconut Black Headed Caterpillar

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The coconut palm, Cocos nucifera L. belonging to family Arecaceae is known as "Tree of Life" or "Kalpavriksha" which provides livelihood to billions of people across the world. Opisina arenosellaWalker is one among the major pests infesting coconut, which causes severe damage to the foliage, deprive the palm of its photosynthetic area and thus, directly affects the yield. The black headed caterpillar is one of the serious and endemic pests of coconut in India. Caterpillars of this pest remain in a gallery of frassy material and they feed on leaf chlorophyll. They cause drying of leaves/leaflets leaving only the upper epidermis intact or in case of older infestation, only midrib of the leaflet remains. When palms are severely damaged, the attacked leaves droop, bunches buckle and the immature nuts shed heavily. Intensive and successive foliar applications of broad spectrum chemical insecticides for controlling larval stages leads to environmental pollution and disturbance in the natural balance in addition to insecticide resistance development.

The use of biological control agent is one approach to reduce the undesirable ecological and health problems associated with overuse of chemical insecticides in agro ecosystems. Biological control is a naturally occurring phenomenon and the biocontrol agents act on the crop pests and maintain them at certain densities. However, this may not be sufficient in certain situations and pests break out and cause economic damage. Then we have to supplement the activity of the naturally occurring biocontrol agents viz., parasitoids, with introduction of appropriate agents. There are two aspects, one is conservation of parasitoids and enhancement of their activities to keep the pests under check. The second approach is use of biocontrol agents by way of mass culturing and release of selective natural enemies. This can be done in two ways, inoculative release wherein the released biocontrol agent establishes and multiply generation after generation and persist for longer periods. In the other we use them as a 'biological insecticide' and bring about control of the pest in a shorter period and do not expect the agent to survive and multiply. Either it is conservation and enhancement or mass culture and release, a thorough knowledge of the crop ecosystem and the pests occurring is essential for successful implementation of the biocontrol programmes.

During the Year - 2017-18 (September to April), the incidence of black headed caterpillar was noticed in the range of 31.25 to 53.37% on the coconut palms grown in villages of Palalli, Arasaguppe, Ankegowdanakoppalu, Hadanuru, Hulukatte, Nagathihally, Nonavinakere, Kaidalu, Kibbanahalli and Kyathanahalli with the higher damage intensity of 5-7 damaged fronds per palm with clear drying symptom was noticed in an area upto to 250 acres. The percent infestation by coconut black headed caterpillar was noticed in 5 major coconut growing villages namely, Palalli (34%), Arasaguppe (41%), Ankegowdanakoppalu (32%), Hadanuru (44%), and Kyathanahalli (53%) in Tumkur district of Karnataka state. Considering the harm caused to the ecosystems by the spray of harmful chemical insecticides, the ICAR - All India Coordinated Research Project on Palms centre, Horticulture Research and Extension Centre, Arsikere, University of Horticultural Sciences, Bagalkot, Karnataka conducted the



Parasitoid production at AICRP on Palms, HREC Arsikere

Coconut black headed caterpillar infested palms			
Parasitoids release:			
Sl No.	**Name of the village in Tumkur district**	**Number of parasitoids released**	
		Goniozus nephantidis	**Bracon brevi-cornis**
1	Palalli	24400	18321
2	Kyathanahalli	19500	15621
3	Ankegowdana-koppalu	21365	23568
4	Hadanuru	28147	22314
5	Arasaguppe	23458	15489
	Total	**116870**	**95313**

training programme and meetings with an aim to create awareness among the farmers on the pest stages, damage symptoms and the management by parasitoid release techniques.

The farmers of Palalli, Arasaguppe, Ankegowdanakoppalu, Hadanuru and Kyathanahalli villages in Tumkur district were supplied with a total of 1,16,870 Nos. of Goniozus nephantidis and 95,313 Nos. of Bracon brevicornis for the inoculative (augmentative) release on the black headed caterpillar affected palms. As medium level of infestation was observed, a total of 4-5 release of stage specific parasitoids were made at the rate of 20 Nos. of *G. nephantidis* and 30Nos. of *B. brevicornis* per palm in the infested area.

Parasitoid release techniques

▶ *Parasitoid establishment and pest management*

One of the farmers, Shri Devarajappa from

Parasitoid release techniques

Arasaguppe village, where approximately 34 acres orchard was infested by black headed caterpillar released the stage specific parasitoids, B. brevicornis (15489No's) and G. nephantidis (23458No's) four times. This in turn resulted in sharp reduction in the pest population. The parasitoid recovery studies were also undertaken randomly in the pest affected areas to determine the establishment and build up of these natural enemies in the pest attacked gardens. Data on parasitoid establishment after third and six months of bio agents release revealed that the natural enemies established well in the affected gardens and bio-agents successfully paralysed O. arenosella caterpillars. The pest population showed

Coconut black headed caterpillar infested palms

Recovered garden

Establishment of parasitoid on black headed caterpillar

a quick decline after the parasitoid release. The larval population of O.arenosella decreased by 22.18 to 59.14 % after three months of release and up to 95.14 to percentage after six months of release of parasitoids. Similarly, the pupal population also decreased by 13.56 to 74.15 % after three months and the process led to decrease in the pupal population by cent percentage.

After six months of parasitoid release, the suppression of the pest was clearly visible, emerged cocoons of G. nephantidis and B. brevicornis were noticed in the orchard and there was no black headed caterpillar population in the newly emerged leaves. Due to the avoidance of chemicals, the natural occurrence of few other parasitoids viz., *Apanteles sp., Xanthopimpla sp, and Brachymeria sp., predators viz., Cardiastethus exigus, Parena nigrolenata* and grasshoppers were observed in the field.

The released parasitoids were able to self-perpetuate successfully and managed the pest population in all the black headed caterpillar-affected gardens in the villages of Tumkur district. The larval parasitoids *G. nephantidis and B.brevicornis* were found to be more efficient in reducing black headed caterpillar population with higher per cent parasitization compared to other parasitoids. The process of biological control is a cost-effective and environment-friendly method that does not introduce pollutants into the environment and is the best alternative to the chemical or the mechanical control methods. The post release response showed the happiness among the farmers about the role of bio-agents in suppressing the pest without application of chemical pesticides.

The impact of biological control was clearly apparent in the pest infested villages after six months. The inoculative release of parasitoids effectively regulated the larval stage of pest and came down substantially in all the black headed caterpillar affected gardens. The self perpetuating parasitoids prevented the further spread and the outbreak to other villages. The cost involved in bio-control was very less compared to cost of chemical insecticides. In the present days success of biological control as an alternate system of management of notorious insects like black headed caterpillar, which gives momentum to sustainable agriculture. ■

Bio control management options for invasive whiteflies on coconut

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The coconut crop is mainly confined to the four southern states, accounting 90% of the area under coconut, among which Andhra Pradesh shares about 1.11 lakhs ha. area with a production of 1567.60 million nuts. An invasive rugose spiraling whitefly (RSW), *Aleurodicus rugioperculatus* Martin (*Hemiptera: Aleyro¬didae*) has entered India and reported on coconut palm (*Cocos nucifera L.*) for the first time during August-September, 2016 at Pollachi taluk, Coimbatore district in Tamil Nadu and Palakad taluk in Kerala . In Andhra Pradesh it was first reported at Kadiyam in the nursery gardens during late December 2016 probably entering Andhra Pradesh through infested coconut seedlings obtained from Kerala and on Oil palm too from Kalavalpalli village in West Godavari district in February 2017 .

As per the Department of Horticulture , Government of Andhra Pradesh statistics in February 2019 in Andhra Pradesh East and West Godavari districts had a severe (more than 30 spirals/leaflet) incidence of this pest and an area of 1535 ha of coconut and 2461 ha of Oil palm plantations (Total 3997 ha) in East Godavari district, an area of 4428 ha of coconut and 9092 ha of Oil palm plantations (Total 13518 ha) in West Godavari district were found to be more affected as compared to other coconut growing districts. Contiguous areas of coconut and oil palm particularly in West Godavari district might had been the reason for increased area of infestation by white fly in this district as compared to East Godavari district where coconut and oil palm plantation areas are clearly demarcated. In other coastal districts viz., Srikakulam an area of 2185 ha of coconut and 129 ha of oil palm plantations (Total 2314 ha) in Vizianagaram an area of

Name of the district	Number of villages affected	Area affected with Rugose spiralling whitefly		
		Coconut (ha.)	Oil Palm (ha.)	Grand Total area (ha.)
West Godavari	63	4428.20	9092.60	13520.80
East Godavari	155	1535.80	2461.50	3997.30
Krishna	1	2.80	0.00	2.80
Srikakulam	36	2185.25	129.00	2314.25
Vizianagaram	36	1336.0	45.00	1381.00
Visakhapatnam	28	738.20	16.00	754.20
Total	**319**	**10226.25**	**11744.10**	**21970.35**

Source : Department of Horticulture., Govt of AP

Bondars nest fly infestation

1336 ha of coconut and 45 ha of oil palm plantations (Total 1381 ha) and in Visakhapatnam an area of 738 ha of coconut and 16 ha of oil palm plantations (Total 754 ha) were found affected in February 2019 and the recent surveys and inputs from Department of Horticulture indicated in January 2020 indicated an increase in the area affected by rugose white fly in all these districts . The favourable period for this pest is from September to March months and a low population with extended pupal periods was observed in unfavourable conditions from April to August in 2019 under Andhra Pradesh conditions.

Extent of area infested by Rugose spiralling whitefly in Andhra Pradesh(February 2019)

The data collected on RSW population as per standard week at HRS., Ambajipeta in 2020 revealed the establishment and re-emergence of the invasive rugose spiralling whitefly on coconut in the month of June 2020 . Unlike in 2019 where the establishment and re-emergence was observed in the month of August low incidence is being observed in the second fortnight of June 2020 itself. Unlike the regular adult rugose spiralling whitefly which has a body length of about 2 mm with a pair of irregular light brown bands across the wings, the whitefly which is surviving in off season is less than 0.5 mm in body length without these bands. Unlike regular egg spirals which have 30 to 40 number of eggs the offseason population of whitefly is laying eggs numbering 5 to 10 in non conspicuous spirals. The incidence is particularly observed on dwarf varieties ie., Gangabondam, Chowghat Orange Dwarf (COD), Malayan Yellow Dwarf (MYD) and on hybrid Godavari Ganga as compared to local East coast tall.

Further, three years after the appearance of the rugose spiralling whitefly on coconut in Andhra Pradesh, Bondars nest fly species (BNW), Paraleyrodes bondari Peracchi was observed from Chagalu and Kalavalapalli villages of West Godavari feeding on the lower surface of coconut palm leaflets. This whitefly is very small (< 1.0 mm) and has conspicuous X-shaped oblique grey bands on the wings. Nymphs and adults are present nesting chambers of woolly wax resembling bird's nest . The adult whitefly lays stalked eggs and the nymphs are flat with fibreglass like projections from the dorsum. BNW incidence was noted in lower leaf of Godavari Ganga hybrid coconut varieties with nest colonies exceeding 10 per leaflet.

Impact of various biological control strategies on Rugose white fly :

1. Field evaluation of Isaria fumosorosea (NBAIR Pfu-5) against rugose spiraling white-fly Field experiments were conducted in association with NBAIR- ICAR Bangalore in Madavaraidupalem

Demonstration on Spraying of entomopathogen Isaria

Visit to RSW infested coconut planation in West Godavari district

in East Godavari and Kalavalapalli village in West Godavari district, Andhra Pradesh (two gardens) during November- March , 2018-19 to field evaluate the efficacy of I. fumosorosea against rugose spiraling whitefly on coconut (Godavari Ganga hybrid). The results revealed that I. fumosorosea Pfu-5 reduced the egg hatching (62-78%), caused mortality on early nymphal instars (52-68%) and late nymphal instars (48-63%). However, during high temperatures (at a temperatures of >350C) there is a comparatively lower suppression of eggs (18.6%), nymphs and pupae (20.3%)

Field experiment conducted in 2019-20 at HRS., Ambajipeta in December in Gangabondam variety (dwarf) revealed that I. fumosorosea Pfu-5 reduced the egg hatching (37-50 %), caused mortality on nymphal instars (35-40%) and sprayings carried out at higher temperatures showed very low impact on egg and nymphal stages of white fly .

Good results with I. fumosorosea Pfu-5 can be obtained if sprayings are carried out at 10 to 15 days interval with high jet sprayers when there are no high temperatures . Further spraying operations should be initiated very early in the season as and when RSW population is observed as it can have more impact and can reduce and arrest the RSW population build up.

▶ *2. Field establishment studies of predator Dichochrya astur on rugose spiralling white fly*

Green lacewing (Chrysoperla zastrowi), is believed to be a natural predator of the whitefly but failed to establish successfully after release in the infested coconut and oil palm plantations in Andhra Pradesh . However another neuropteran predator D. astur was found to feed and establish on RSW eggs naturally under field conditions providing scope for biological control of RSW utilizing this predator if mass multiplication and large scale production is attempted . Further this predator was also reported to be more frequently encountered on A. disperses on guava in South India

Natural abundance and feeding of D. astur, on rugose white fly was observed in many RSW infested coconut gardens in Andhra Pradesh and hence, keeping in view of this predator potential and demand from farmers a project entitled "Bio-control based management of rugose spiralling whitefly, *A. rugioperculatus* on coconut in Andhra Pradesh" was submitted to CDB , Kochi with a view to standardize and mass produce this predator. With the funds provided under the project the mass production of predator D.astur is being standardized along with increased production of its surrogate host *Corcyra cephalonica* and supply the predator egg strips to the needful plantation farmers.

Initial studies on successful field establishment of predator D. astur

A field experiment was conducted in 4 year old hybrid Godavari Ganga plantation in the month of December 2019 at Sri Bezawada Srinivas farm at Chikkala village, Chagallu mandal in West Godavari District ; initially no *D. astur* population was observed in the garden and low to medium infestation (9- 15 spirals/leaflet) of white fly was recorded. A total 500 numbers of D. astur eggs and were clipped in five palms @ 100 per palm in 10 leaflets randomly on 17-12-2019 and 20 days after clipping 6 per cent grub and 2 per cent egg and 1 percent pupal stage natural recovery of predator *D. astur* was observed. The white fly population dwindled to low with less than 3 spirals/leaflet in the palms due to successful establishment of predator.

Another experiment on efficacy of this predator under high infestation levels was conducted in HRS., Ambajipeta in 6 year old cross combination where all leaflets in the 8 leaves were completely infested

Clipping of D.astur eggs in field

and merging of spirals (more than 30 spirals) was observed due to high population build up of RSW . About 100 eggs of predator *D. astur* were clipped to the leaf randomly on the leaf lets and all the infested leafs were clipped (800 eggs per palm) and 80 per cent of the RSW eggs were fed by the predator on the palm . Further an extended grub period *D. astur* of 32 days was observed in the field as compared to 14 days in lab when fed on corcyra eggs . As *D. astur* is an egg predator and does not feed on other stages of RSW spraying of bio pesticide I. fumosorosea Pfu-5 / or spraying of water with high jet sprayers should be done before clipping of predator eggs for successful management of RSW when incidence is high (More than 30 spirals per leaflet) by this beneficial

Further, this predator was also found to effectively feed on eggs of Bondars nest fly species (BNW), *P. bondari* which provides increased scope of utilising this predator in coconut plantations where combined infestation of all invasive white flies is present.

Production and supply of Dichochrysa astur eggs to plantation farmers in 2019-20 under CDM TMOC project

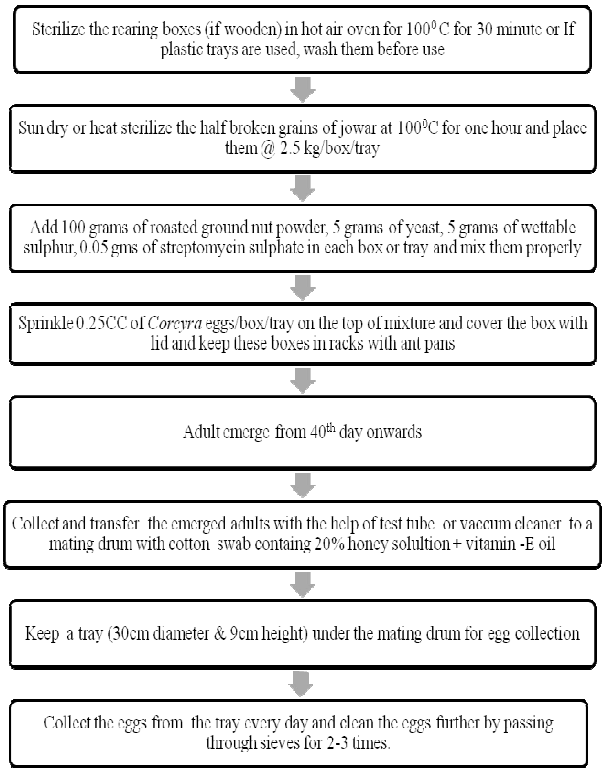
Month	No. of D. astur eggs supplied to farmers
April 2019	1,85,000
May 2019	-
June 2019	3000
July 2019	5000
August 2019	21,000
September 2019	-
October 2019	8000
November 2019	64000
December 2019	2,14,500
January 2020	7,87,000
February 2020	4,42,000
March 2020	4,11,000
Total	21,40,500

3. Field establishment studies of parasitoid *Encarsia guadeloupae* against Rugose spiralling white fly in AP :

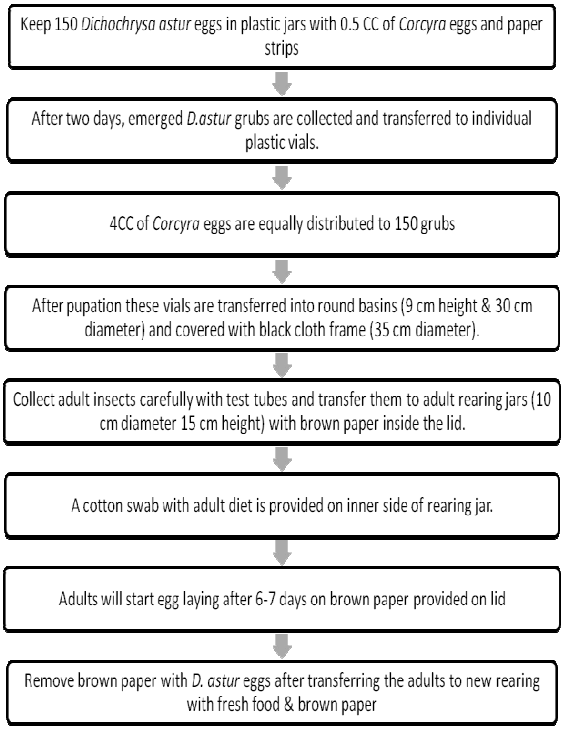
No initial presence *E. guadeloupae* and its parasitisation was observed in the rugose white fly infested gardens and nurseries up to December 2017 in A.P. Hence, in December 2017 and January 2018 three parasitoid consignments were obtained from Coconut Research station, Aliyarnagar, TNAU and clipped in coconut plantations in Kalavalapalli and Chikkala villages in West Godavari district. The data on parasitisation of rugose whitefly by *E. guadeloupae* was recorded to ascertain establishment of parasitoid in the released gardens. During January 2018, 20.01±1.69 per cent parasitized pupae were observed per 10 palms. Later the per cent parasitisation was increased to 72.06±3.15 during February which later decreased to nil during April till August 2018 .

No parasitisation by *E. guadeloupae* was observed in April and May months inspite of availability of white fly stages probably due to high temperatures and hence once again consignments of Encarsia were obtained From CPCRI , Kasaragod and NBAIR , Bangalore was observed. The per cent parasitisation of 29.34±3.56, 42.38±5.48, 69.49±4.94 and 68.83±3.61 was observed during months of September, October, November and December 2018 respectively.

Flow chart on Mass production of surrogate host *Corcyra cephalonica*



Flow chart for low cost large scale mass production of RSW Predator *D. astur*



Similarly in the year 2019 after summer no natural establishment of this parasitoid was observed and 3000 parasitized pupae consignments of the parasitoid were obtained From TNAU , Coimbatore and NBAIR , Bangalore and released in Chikkala village, Chagallu mandal in West Godavari district and HRS., Ambajipeta in September–October 2019 . The establishment of E. guadeloupae was promising in Chikkala village where no spraying operation of any kind was resorted , while in HRS., Ambajipeta where various spraying operations were taken up the establishment of the parasitoid though present is not comparable to that in Chikkala village indicating detrimental effect of any spraying operations on *E. guadeloupae* and are in tune with the studies carried out by CPCRI Kasargod on conservation biological control strategy where no sprayings (pesticides) can enhance the population build up of parasitoids in the natural ecosystem from initial 10-15% to as high as 70-80% in a period of five to eight months.

Per cent parasitized whitefly pupae observed after parasitoid release on coconut in Kalavalapalli village (2018-19)

Month/Year	**Per cent parasitized whitefly pupae observed (For 10 palms at random)**
	Coconut (5 years old)
January 2018	20.01±1.69
February 2018	72.06±3.15
March 2018	52.81±3.07
April 2018	Nil
May 2018	Nil
June 2018	Nil
July 2018	Nil
August 2018	Nil
September 2018**	29.34±3.56
October 2018	42.38±5.48
November 2018	69.49±4.97
December 2018	68.83±3.61
January 2019	71.35±4.31
February 2019	65.44±2.63
March 2019	28.68±1.78

(Re-Release)*From CPCRI , Kasaragod and NBAIR , Bangalore in September 2018

Independence Day observed in CDB

Shri. Saradindu Das, Chief Coconut Development Officer hoisitng the National Flag at CDB Head Quarter premises on 15th August 2020. Officers and staff of the Board are also seen.

Further with the combined incidence of rugose spiralling whitefly and bondar nest fly there is always a chance of infestation by bondars nest fly in new areas if clipping of parasitized pupae of RSW with *E. guadeloupae* is resorted too. There fore due care should be taken on while redistributing *E. guadeloupae* parasitized RSW pupae and invariably lab reared or supervised and controlled production of *E. guadeloupae* parasitized pupae should only be redistributed.

Management strategies recommended for RSW in Andhra Pradesh

1. Avoid transportation of coconut seedling or any other ornamental plants from pest infested areas to new uninfested areas

2. Release of *D. astur* @ 100 to 150 eggs / palm during low incidence and up to 300 eggs/ palm during medium incidence for at least 10 per cent of infested palms particularly in those plantation where spraying is not feasible

3. Re-distribution of *E. guadeloupae* in RSW infested areas taking due care

4. Avoiding Pesticides spray

5. Spraying Azadirachtin @ 1% @ 1 ml per litre along with detergent powder @ 10 gms two / three sprays at 15 -20 days interval.

6. Foliar application of entomopathogenic fungi *I. fumosorosea* @ 1x108 spores/ml (5 gm /litre along with sticker 2 ml/litre)

7. Intermittent Jet water spray at fortnightly intervals

8. Installation of yellow sticky traps on palm trunk to attract adult white flies and regular smearing with castor oil at 7 to 10 days interval

9. Community based approach for management ■

Preservation Protocol for Trimmed Tender Coconut

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Consumers generally prefer highly nutritious drinks in the form of 'ready to serve' and as a soft drink in bottles or as tetra packed beverages. Tender coconut is a noble gift of nature and the recent health awareness among the consumers has revitalized its importance as a drink of choice. Minimal processing technique for tender coconuts is being developed in response to huge demand from North America and Europe, and thus provides an opportunity for the Asia – Pacific nations to boost the income of coconut growers, farmer producer companies and tender coconut processing industries.

The tender coconut comprise an exocarp (skin), mesocarp (composed of a fibrous husk), and an endocarp (shell) that encloses the kernel (flesh) and juice. Raju et al. (2002) reported that the average weight of tender coconut is 1.5 kg of which husk

> **Across regions, across lifestyles, across borders, Ttender coconut is the one taste that binds all. A pure, healthy, natural drink that helps us get healthy and stay healthy.**

weight constitutes about 65% of the total weight. Even though the tender coconut husk acts as an insulator for coconut water, it is bulkier and increases the cost of transportation and packaging. The bulky nature of tender coconut can be reduced by trimming out the husk to leave it as two-third of the original weight. A minimum of 20–35% of the coconut weight can be reduced by performing trimming operation (Pandiselvam et al., 2019). Trimmed tender nuts are prepared by trimming/shaving of the husk to the maximum possible level, without damaging the shell. This not only ensures considerable reduction in the ratio of weight/volume of the nut but also results in an attractive look (diamond/pentagonal shape). Nevertheless, browning and mold development in the nuts following the trimming process requires to be controlled with careful use of chemical solution without contaminating the kernel and the water. This article discusses the various preservation protocol/ methodologies of the trimmed tender coconut that are available to ward off the chemical and microbial contamination.

Preservation protocol:

The following procedures are generally followed to preserve the trimmed tender coconut.

1. Harvesting

For shaping/trimming the nuts, it is important to ensure that the maturity of tender coconut is greater than or equal to 6 months. Mohpraman and Siriphanich (2012) found that the sodium metabisulfite (SMS) residues were higher in the edible portions of the trimmed younger coconut (less than 6 months old) treated with SMS solution than in matured nuts. Also, care must be taken while harvesting the tender coconuts to prevent them falling to the ground. Presence of cracks on the surface of tender coconut husk will enhance the enzymatic activity. Also, there is a possibility of development of cracks on the tender coconut during handling and storage due to high pressure of the water inside.

2. Surface sterilization

Tender coconuts have a high microbial load on its surface, especially those left on the ground after harvesting and transported over long distances. FAO (2007) recommends that the whole tender coconuts are washed in potable water to remove dirt and soil. Sanitizing the nut in a dilute bleach solution further reduces the number of microorganisms and postharvest diseases on the surface of the tender coconut.

3. Trimming

Shaping of the tender coconut has been done by using either semi-automatic mechanical trimming machine (approximate cost: Rs. 1.2 lakhs) or fully automatic air compressor based trimming machine (approximate cost: Rs. 2.5 lakhs). The capacity of the fully automatic trimming machines varies from 4-6 nuts/min, whereas semiautomatic machine has the capacity of about 1 to 2 nuts/min. In some places, lathe machine has been used for trimming the tender coconut. But the capacity of the lathe based trimming was only 21 nuts/h, which is lower than manual trimming (40 nuts/h) (Jarimopas and Ruttanadat, 2007). ICAR- Central Plantation Crops Research Institute (CPCRI), Kasaragod, has developed the linear actuator-based vertical trimming machine for tender coconut processing. The license for the fabrication of the ICAR-CPCRI developed trimming machine was transferred to one machine manufacturer and the interested machine fabricators/entrepreneurs can approach ICAR-CPCRI for license. The cutting energy required to trim the different genotypes of tender coconuts has been analyzed and reported (Pandiselvam et al., 2020). The trimmed tender coconut has a flat bottom, cylindrical body, and conical top. Care must be taken to avoid over-trimming around the eyes, as the tender nut has internal water pressure causing the eyes to burst. Mohpraman and Siriphanich (2012) recommended that the trimming process should allow at least 1 cm thickness of the husk left on the stem end of the fruit over the soft eye. Otherwise, the chemicals used as anti-browning solution may penetrate the edible portion/water via the soft eye.

4. Dipping in chemical solution

The trimmed tender coconuts must be treated with anti-browning solution to control the activity of enzymes such as Polyphenol Oxidase (PPO) and Peroxidase (POD).

- CPCRI Technology- ICAR-CPCRI developed a technology for preservation of trimmed tender coconuts and the technology has been commercialized to two entrepreneurs. Application of combination of organic acids, chelating agents and resorcinols were found to be more effective in preventing the browning of trimmed tender coconuts.

- KAU Technology- Trimmed tender coconuts are treated with the solutions of 0.5% potassium metabisulphite (KMS) and 0.5% citric acid for three minutes (Raju et al., 2002).
- In Thailand – The trimmed tender nuts are dipped in 1 to 3% sodium metabisulphite (SMS) solution for 2 to 5 min and then wrapped in plastic film to prevent the enzymatic browning (Tongdee et al. 1991).

Mohpraman and Siriphanich (2012) recommended the SMS concentration of ≤5% for ≤5 min dipping. Increase in the SMS concentration and dipping time resulted in penetration of SMS in the nut's interior via air channels in the husk and through the soft eye.

5. Surface drying

It is recommended to follow the shade drying immediately after dipping the nuts in anti-browning solutions to avoid the superficial mold growth on the surface of the trimmed wet coconuts.

6. Shrink wrapping

The trimmed nuts are packed in either 0.025 mm thick LDPP or 0.023 mm thick LDPE covers having 40 ventilation holes (*Raju et al., 2002*). In Thailand, the trimmed nuts are wrapped with polyvinylchloride (PVC) film (Mohpraman and Siriphanich, 2012).

7. Storage

Trimmed tender coconut treated with 2% SMS has been stored for 3 to 4 weeks under refrigerated storage (3 to 6°C with 90 to 95% RH) and can be stored for 2 to 7 days at ambient temperature (Paull and Ketsa, 2015). The concentration of 0.5 to 1.0% SMS will extend the shelf life of trimmed nut up to 2 days under ambient temperature (Paull and Ketsa, 2015). The nuts treated with 0.5% KMS and 0.5% citric acid can be stored for 26 days under refrigerator condition (5±7 °C). The CPCRI developed solution will enhance the shelf life of trimmed tender coconut 4 to 6 weeks under refrigerator condition. In general, the refrigerated condition would be safe for the storage of trimmed nuts.

8. Transportation

The trimmed nuts are packed in single-piece cartons containing 6 to 16 each (*Paull and Ketsa, 2015*) and transported to the desired places. Also, the product can be packed in plastic crates and insulated chill boxes for transporting and storage. ■

References

Jarimopas, B., & Ruttanadat, N. (2007). Development of a young coconut fruit trimming machine. Journal of Food Engineering, 79(3), 752-757. 2. Mohpraman, K., & Siriphanich, J. (2012). Safe use of sodium metabisulfite in young coconuts. Postharvest Biology and Technology, 65, 76-78.

3. Pandiselvam, R., Manikantan, M. R., Subhashree, N., Mathew, A. C., Balasubramanian, D., Shameena Beegum, P. P., … Hebbar, K. B. (2019). Correlation and principal component analysis of physical properties of tender coconut (Cocos nucifera L.) in relation to the development of trimming machine. Journal of Food Process Engineering, 42, e13217. https://doi.org/10.1111/jfpe.13217

4. Pandiselvam, R., Manikantan, M. R., Balasubramanian, D., Beegum, P. S., Mathew, A. C., Ramesh, S. V., ... & Niral, V. (2020). Mechanical properties of tender coconut (Cocos nucifera L.): Implications for the design of processing machineries. Journal of Food Process Engineering, 43(2), e13349. https://doi.org/10.1111/jfpe.13349

5. Paull, R. E., & Ketsa, S. (2015). Coconut: postharvest quality-maintenance guidelines. College of Tropical Agriculture and Human Resources (CTAHR). University of Hawai'i at Manoa. F_N-45.

6. Raju, V.K., Thangaraj, T., & Carvalho, M.G.R. 2002. Standardisation of minimal processing technology for marketing tender coconut as a chilled natural beverages. Proceedings of Placrosym XV, 668-677

7. Tongdee, S.C. 1991. Postharvest handling of tender coconut. ASEAN Food Journal, 6:74–75.

Occurrence of leaf blight – a new concern to coconut plantations in Andhra Pradesh

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Coconut (*Cocos nucifera Linn.*) is an important plantation crop in India. It is cultivated for oil and raw materials used in the coir industry. Coconut farming and allied activities provide livelihood security to millions of people in India. The every part of a coconut tree has its own use or applications. It is generally called "Tree of Heaven", "Tree of Abundance", "Tree of Life" and "kalpavriksha". Andhra Pradesh is one of the most important coconut growing states in India.

In the present scenario of climatic change this valuable palm is devastated by several fungal, bacterial, viral, viroid and phytoplasmal diseases that not only deteriorate the quality of nuts but also reduced the vigour and yield of palms. A wide range of fungi attack different parts of coconut namely, crown, stem and root. Among the 173 fungal species reported on coconut, only a few cause serious disease problems and provide challenges for management and are difficult to control effectively and the major devastating diseases prevalent on coconut in Andhra Pradesh are Basal stem end rot caused by Ganoderma lucidum, Stem bleeding disease caused by Thievolopsis paradoxa, bud rot caused by Phytophthora palmivora, Grey Leaf Spot caused by Pestalotiopsis palmarum and lately Leaf blight caused by Lasiodiplodia theobromae.

Among the various fungal diseases affecting coconut palm, *L. theobromae* (Botryosphaeriaceae: Botryosphaeriales: Dothideomycetes: Ascomycota) is cosmopolitan in distribution; however, this species is more commonly found in tropical and subtropical regions. This fungus is unique and destructive to crops because it can live endophytically in asymptomatic plant material and avoid detection by quarantine. Moreover, Lasiodiplodia species can ramify profusely when the host is under stress, causing significant yield losses. The probable mode of entry of this disease into Andhra Pradesh might be due to transport of nursery seedlings already infected with leaf blight from other parts of the country.

S. No.	Name of the Village	Mandal/District	GPS coordinates	Percent disease incidence (PDI)
1	Jangareddy gudem	Jangareddygudem/West Godavari	Latitude17.12, Longitude 81.29	25.8
2	Adurru	Mamidikuduru/East Godavari	Latitude 17.15, Longitude 81.74	25.5
3	Chakalirevupalem	Ravutalapadu/East Godavari	Latitude 17.00, Longitude 82.26	15.6
4	Antervedipalem	Sakhenetipalli mandal/East Godavari	Latitude 16.40, Longitude 81.77	10.2
5	Kothalanka	Mummidivaram/ East Godavari	Latitude 16.63, Longitude 82.13	4.2
6	HRS, Ambajipeta farm	Ambajipeta/East Godavari	Latitude 16.60, Longitude 81.95	0.5
7	Dwarapudi	Mandapeta/East Godavari	Latitude 16.95 Longitude 81.93	1.0
8	Mukkamala	Ambajipeta / East Godavari	Latitude 16.64 Longitude 81.96	3.0
9	Pulletikurru	Ambajipeta / East Godavari	Latitude 16.63 Longitude 81.94	2.5
10	Rajupalem	Mammadivaram/East Godavari	Latitude 16.66 Longitude 82.10	1.5

Symptoms of leaf blight

● The pathogen causing severe damage in adult palms (above 30 years old) and mild damage in young palms.

● Heavily infected coconut palms exhibited delayed flowering when compared to healthy palms and the incidence is severe in older/matured fronds and the younger fronds were mostly free from the disease.

● The affected leaflets showed minute yellow dots initially and start drying from the tip towards middle rachis. Drying spread to entire leaf let and shows a charred or burnt appearance from distance.

● In the fronds, irregular necrotic spots with dark brown margins appeared on leaf lets of older fronds and turn dark brown in colour on maturation with black powdery mass.

● Under severe conditions, symptoms of dark grey to brown lesions with wavy or undulated margins appear on nuts from the apex.

● The affected nut will be desiccated, shrunken, deformed and drops prematurely. The pathogen penetrates into the kernel through mesocarp, resulted in decaying of endosperm

Preliminary Roving survey taken up at different villages of Andhra Pradesh

The disease incidence was first observed in Jangareddygudem village of West Godavari district during September 2018. And intensive roving survey revealed the disease prevalence in the following places.

The variety grown is East Coast Tall and soils in the surveyed gardens majority were black soils. The trees are aged between 5 to 40 years in the infected gardens and symptoms were mostly in initial stages thereby providing scope for management.

Management measures for leaf blight

● Remove and destroy old infected leaves having the inoculums from the healthy coconut palms, which acts as primary source of inoculum to further spread of the disease

● Spraying of Hexaconazole 2 ml per litre of water on infected palms

● Basal application of Pseudomonas fluorescence @ 200 g along with 50 kg FYM per year.

Creating awareness to the farmers of coconut in coordination with Department of Horticulture, Farmer Produce Organizations and Coconut Development Board is essential to control the spread of the disease. ■

Turning waste to wealth

Success story of 'Samruthy' Coir-pith Composting Unit -

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Mr. Sebastian Philip, Mr. Baby Mathew and Mr. Saju Joseph of Chooral, Kannur District, Kerala run a coconut coir fibre extraction unit that generates on an average 3-4 tonnes of coir-pith waste every month. Their extraction unit was commissioned about 16 years back and has been working round the year since then. Huge mounds of coir-pith had accumulated in their unit premises and it became a major disposal problem. They even had to excavate large pits to accommodate this ever growing mound of coir-pith waste.

The coir-pith mound was growing out of proportion and taking up much of their available land area near their factory. The group started enquiring for means to dispose this waste in an environmental-friendly manner. Then they learned about the composting technologies available to recycle this lignin-rich waste to compost. They became aware of the popular technology of composting coir-pith using urea and oyster mushroom fungus Pleurotus sajor-caju. They also came to know about the co- composting procedure of coir-pith developed at ICAR-CPCRI, to produce organic manure, where the use of urea was not involved. This technology attracted them as the compost produced was entirely using organic inputs.

Mr. Sebastian and group then visited CPCRI, Kasaragod during December 2017 to learn more about this urea-free composting technology. They got first-hand information about the coir-pith composting procedure from Drs. Murali Gopal and Alka Gupta, who were part of the team led by Dr. George V. Thomas (former director of CPCRI) which developed this technology. They were given demonstration of the composting procedure in the CPCRI composting unit. The procedure required mixing of coir pith with good quality poultry manure along with lime (calcium oxide) and rock phosphate (available as Rajphos or Mussoorie-Phos in local fertilizer stores) in the ratio 900:100:5:5 and spreading evenly in an area of 4x2x1 m (lx bx h) dimensions after proper mixing with sufficient addition of water. The whole coir pith heap is kept sufficiently moist by sprinkling water regularly and covered with gunny bag. Turning is required once in 15 days till 45-60 days when the

Huge mound of coir-pith waste dumped alongside the coir-fibre extraction unit

coir pith will become dark brown to black colour indicating the completion of composting process. Addition of fermented cow dung slurry during the first and/or second turning of composting materials is beneficial for the process. The final product can then be shade dried and packed.

Convinced with this technology, they then approached Dr. P. Chowdappa, the then Director of the Institute and inked an Memorandum of Agreement (MoA) with ICAR-CPCRI during Feb. 2018, facilitated by Dr. K. Muralidharan, Head, Div. of Social Sciences and Nodal Officer, ITMU, and promptly initiated the composting process in their place at Chooral, Payyanur.

The group made the infrastructure ready and received step-by-step guidance by the technology-developers and by the end of June 2018, their first batch of coir-pith compost was ready and launched with brand name 'Samruthy' Coir-pith compost. Random samples of ready compost were collected by us for quality check and found satisfactory. Currently their capacity is to generate 25 tonnes of compost in one round taking three months time. They plan to expand their production capacity. They found the mixing process to be labour-intensive for which they are also collaborating with ICAR-CPCRI and private firm to develop a simple mechanical mixing equipment to help reduce the labour cost and time. This innovation, once developed, will significantly improve coir-pith composting technology and can soon become more popular.

The 'Samruthy' coir-pith compost produced by the group, using this process, is highly porous, dark coloured, odour-free product, with pH in the range of 6.1 to 6.4 and having up to 500% water holding capacity. Its C:N ratio is 21 to 22 and organic carbon content 28-30%. The total N, P and K content ranges between 1.3 to 1.4, 0.9 to 1.2 and 1.3 to 1.6 %, respectively. It is also a good source of plant micronutrients such as Fe, Cu, Zn and Mn and microbiologically rich in free-living nitrogen-fixing and phosphate solubilizing bacteria.

The 'Samruthy' coir-pith compost produced by this group is being sold and used by horticultural units for vegetable and flower seedling production and also for plantation crops such as coconut, arecanut, rubber, banana and spices crop such as black pepper and cardamom. It can be applied to coconut, arecanut, cocoa, rubber and oil palm @ 20-25 kg/tree/year; about 2-4 tonnes/ha for vegetables and ornamental crops; and 2-2.5 tonnes for paddy. The addition of coir pith compost improves the physical properties and water holding capacity of soils. It increases the organic matter and carbon content of poor humid tropical soils. It also helps in better root formation and enhances crop growth and yield. Agri-horti nurseries can use it as an ideal medium for raising pot-tray seedlings.

Through the ICAR-CPCRI technology, the group was able to effectively create 'wealth' from the huge quantities of coir-pith 'waste' available with them. They produced more than 120 tonnes of good

Dr. Alka Gupta, Principal Scientist-Microbiology guiding Mr. Sebastian & group for coir-pith compost production (left); coir pith heaps getting composted (right)

quality urea-free coir-pith compost within a short span of two years. There is an encouraging demand for this compost from the growers with positive feedback. Their product filled a gap in organic input requirement of the plantation and horticulture sector farmers of the district and nearby areas. The 'Samruthy' unit has now become a model site for those interested in producing urea-free coir-pith compost using ICAR-CPCRI technology. This venture by Mr. Sebastian and his Group highlights the successful conversion of 'waste' to 'wealth' with technical support from scientists of ICAR-CPCRI, Kasaragod.

Persons interested in the technology can contact Director, ICAR- CPCRI at 04994-232894 (directorcpcri@gmail.com) and those interested in obtaining 'Samruthy Jaivavalam' can contact Mr. Sebastian K. Philip of Kalapurackal, Chooral, Mathil P.O., Payyanur, Kannur-670307 at his mobile number - 7511112861.

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Rebuttal of International Coconut Community

On the alleged negative impact of coconut's production systems on biodiversity and the unjustifiable propaganda regarding the use of monkeys to harvest coconuts.

Jelfina C. Alouw
Executive Director, International Coconut Community

The International Coconut Community strongly objects to the proposal to boycott coconut products due to the alleged negative impact of its production systems on biodiversity and the unjustifiable propaganda regarding the use of monkeys to harvest coconuts.

The International Coconut Community (ICC1), a UN ESCAP intergovernmental organization representing 20 coconut producing countries, refutes to the articles published by Erik Meijaard regarding the claim that producing coconut oil is more harmful to biodiversity than producing palm oil.

Our objection is based on the following ten points:

1. Erik Meijaard and co-authors recently published the paper entitled: "Coconut oil, conservation and the conscientious consumer" (Meijaard et al. 2020). In this paper, Meijaard et al. admitted that their measure of threats of coconut oil to biodiversity: i) is incomplete, ii) focuses on what has happened in the past, iii) allocates all impacts to commercial coconut oil production alone cannot readily be applied to individual producers, and v) relies on incomplete information about crop distribution, where informed consumer choices require measures and standards that are equally applicable worldwide. They admit that: "It remains challenging to identify and weigh which species and environments have been or will be threatened by production of which products, and in which contexts, but such measures are needed." Nevertheless, they make a sweeping claim that 20.28 (but recently corrected down to 18.32) species are threatened per million liters of coconut oil produced, compared with 3.79 species threatened per million liters of palm oil produced. Globally, the annual production of coconut oil is around 4.95 million T, whilst the palm oil industry produces a massive 76.06 million T per annum. Using their own claim and questionable extrapolation, oil palm production would appear to threaten 288 species and coconut only 91 species. This indicates that taken over the whole area and volume of oil production, oil palm is more than three times as threatening as coconut. Furthermore, the vast majority of the species allegedly threatened by coconut production live in small island nations that together produce only 8% of the global output of coconut oil, says Meine van Noordwijk, a senior research fellow at the World Agroforestry Center3.

2. ICC argues that the extrapolation done by Meijaard and co-authors is questionable, as ecosystem, habitat and production system interactions are highly complex. Coconut production systems are generally more biodiverse than palm oil production systems and lend themselves to more flexible approaches to biodiversity conservation, agroecological intensification, and sustainable production.

3. This paper is limited in that it used only commercially traded coconut oil as the basis for its conclusion. The paper ignored the fact that a significant amount of the coconut harvest is used locally in food, drink and other household products. The coconut is very much a part of the culinary tradition of people in the tropics. In addition to the use of coconut for food, it is also used for building material and various household and farm implements. These major uses of the coconut were not considered in this paper.

4. In this paper, the authors declared "no competing interests." However, Mr. Meijaard is Director of Hutan dan Habitat Alam Indonesia, a company which has investment interests in Borneo where much of the conversion of forests into oil-palm plantations is happening.

5. Separately, Mr. Meijaard wrote an article in a newspaper with an inflammatory title: "Why coconut oil may be worse than palm oil for the environment" (Meijaard, 2020). It is intriguing that while he also cited threats from coffee and chocolate, he chose to headline the threat from coconut oil to shield palm oil, which is under intense attack for its harmful environmental effects. Apparently, Mr. Meijaard considers this as a zero-sum competition between coconut oil and palm oil, when there should be none.

6. On another issue, the use of monkeys to harvest

coconut has also come under scrutiny. This practice is found in only certain countries and parts of small regions. The use of monkeys illustrates a favorable partnership between animals and humans to promote economic growth. Monkeys are treated well as they are fed for every excellent job they perform and are accorded gentle treatment and education by owners just like their pets. In fact, monkeys are useful means of picking coconuts due to the training they receive. For the welfare of the animal's respective countries have their own legislation like in Thailand The Cruelty Prevention and Welfare of Animal Act B.E. 2557 (2014) under which who proscribes any act of cruelty to animal without justification would be punished under the Act. However, more recently the scenario has changed. Many farmers are now using palm-climbing machines for harvesting of coconuts. Different counties have their own cultural practices with animals. For example, in Europe pigs are traditionally used to search for truffles. The use of monkeys and pigs in two different cultures are both respectable where the animals are treated humanely. PETA's concern over animal cruelty is understandable, but its campaign for countries to ban coconut products manufactured is not justifiable. It is rather affecting the entire coconut community. One should respect racial and cultural diversity and the rights of poor smallholder farmers to aspire to developing sustainable livelihoods.

7. The coconut is a smallholder crop (92% are small farms), with farmers growing 1-2 hectares per family. Thus, unlike other large-scale plantation crops, there is no need to destroy forests that kill indigenous crops and animals to establish coconuts.

8. Unlike other large plantation monocrops within environmentally fragile production ecosystems, coconut is frequently grown in association with other crops as intercrops such as fruit crops and nitrogen-fixing agroforest tree species, and with poultry (free-range poultry) and livestock integration (goats, cattle). Such biodiversity-enriched coconut farming systems reduce canopy-level temperatures and create a favorable microclimate in which other crops microorganisms and other species can flourish.

9. Large other plantations use expensive and often environmentally destructive chemical fertilizers. Large-scale land conversion affects biodiversity. Such land conversion causes destruction of habitat and loss of biodiversity (Tilman et al. 2001; Sodhi and Brooks. 2006). In comparison, coconut farmers rely on natural organic farming to produce coconuts. Currently, ICC is promoting the production of organically grown coconuts using science-based, doable, affordable and sustainable technologies. Thus, coconuts protect the environment, whilst maintaining yields and helping farmers produce organically grown coconuts that can be sold at premium prices.

10. Unlike other plantation crops where poor farmers are only used as laborers and paid low wages, coconut farmers can earn more income from intercropping and livestock integration, and from establishing small or medium enterprises (SMEs) to produce and market high-value coconut products.

The International Coconut Community was established to uplift the lives of the coconut farmer. The ICC values biodiversity because it sustainably enriches the environment and linked habitats and production systems and offers important benefits for coconut production systems in this instance, as well as those stakeholders, including smallholders and farmers who are associated with these production systems.

Meijaard et al. highlighted the need for reliable measures of the extent of impact on biodiversity within production systems. In response to this, ICC proposes that both coconut and palm oil industries consider conducting parallel studies applying a proven robust measure. Developed by the Alliance of Bioversity and CIAT, the Agrobiodiversity Index4 can be used to identify good practices, and manage risks and opportunities to increase use and conservation of agrobiodiversity for sustainable coconut and palm oil systems. ■

References: 1. Meijaard, Erik; Jesse. F. Abrams; Diego Juffe-Bignoli; Maria Voigt; Douglas Sheil (2020). Coconut oil, conservation and the conscientious consumer. Current Biology 30, R737–R758. 2. Meijaard, Erik (2020). Why coconut oil may be worse than palm oil for the environment. Independent. July 9, 2020. https://www.independent.co.uk/news/long_reads/science-and-technology/coconut-oil-worse-palm-oil-deforestation-environment-ecology-a9605761.html 3. Rochmyaningsih, Dyna (2020), Claim that coconut oil is worse for biodiversity than palm oil sparks furious debate, Science, Jul. 17, 2020 https://www.sciencemag.org/news/2020/07/claim-coconut-oil-worse-biodiversity-palm-oil-sparks-furious-debate 4. Sodhi, N. S., & Brook, B. W. (2006). Southeast Asian Biodiversity in Crisis. Cambridge, 5113 UK: Cambridge University Press. 5. Tilman D., Fargione J., Wolff B., D'aAntonio C., Dobson A., Howarth R., Schindler D., 5190 Schlesinger W.H., Simberloff D., and Swakhamer (2001) Forecasting agriculturally 5191 driven global environmental change. Science 292: 281- 284.

Cultivation practices in Coconut Garden - September

Planting

In low lying areas, planting of coconut seedlings can be undertaken in small sized pits or on mounts raised to one metre above water table. Prevent accumulation of rain water in the seedling pits by ensuring adequate drainage. In regions like Tamil Nadu field preparation should be done for new planting.

Manuring

Circular basins of 1.8m in radius and 25 cm depth may be dug and green leaf or compost or farm yard manure at the rate 50 kg per palm may be spread in the basin. Two third of the recommended dose of chemical fertilizers may be spread over the green leaf or compost and covered. Application of 500 g N, 320 g P_2O_5 and 1200 g K_2O per palm per year is generally recommended for adult plantations. To supply two-third of the above nutrients it is necessary to apply about 0.72 kg urea, 1 kg rock phosphate (in acidic soil) or 1.33 kg Super Phosphate (in other soils) and 1.33 kg of Muriate of potash (MOP). Under irrigated conditions, one fourth of the recommended dose of chemical fertilizers can be applied during September.

It is always recommended to apply chemical fertilizers based on the soil test results rather than going by the general recommendations.

Wherever Boron deficiency is noticed 100 g Borax may be applied in the basin. For coconut palms showing yellowing of leaves due to Magnesium deficiency, 0.5 kg of magnesium sulphate can be applied in the basins along with other fertilizers.

The above schedule of manuring is suitable for all the major coconut growing regions which are mostly benefitted by South-West monsoon during the season. In localities of Tamil Nadu, which are mostly benefitted by North- East monsoon the first dose (one third of recommended dose) of chemical fertilizers can be given during September. Under such situations, lime or dolomite or gypsum @ 1kg/ palm need to be applied two weeks before the first dose of chemical fertilizers are applied.

Green manuring

Wherever green manure crops are grown, plough in the green manure crop (after attaining 50 per cent flowering) and incorporate into the soil.

Intercultural operations

Ploughing/digging of interspace is to be undertaken to keep the plantation free of weeds. Care should be taken to avoid injury to coconut palm while ploughing.

Nursery management

Weeding should be done in the nursery. Five month old ungerminated nuts and dead sprouts should be removed from the nursery. In localities of Tamil Nadu, which are mostly benefitted by North-East monsoon, land preparation can be taken up for sowing seednuts.

Crown cleaning

Wherever crown cleaning has not undertaken during August the same may be done during this month.

Mulching

Mulching of palm basins can be undertaken during the second fortnight of September to conserve moisture

Plant protection

▶ *Integrated Pest Management*

▶ *Rhinoceros beetle*

Adopt mechanical method of control by extracting beetles with beetle hooks, without causing further injury to the growing point of the palm. The top most leaf axils may be filled with powdered neem cake/ marotti cake (*Hydrocarpus sp/ pongamia*) @ 250 g + fine sand (250g) per palm as a prophylactic measure. Fill the innermost three leaf axils with 4 g each of naphthalene balls covered with sand (12 g/palm) for juvenile palms. Placement of two perforated sachets containing *chlorantraniliprole a.i.* 0.4% (5 g) or fipronil (3 g) or one botanical cake (2 g) developed by ICAR-CPCRI and incorporation of the biomass of weed plant *Clerodendron infortunatum Linn.* in the cow dung/compost pit can also be done. The breeding sites may be treated with green muscardine fungus (*Metarhizium anisopliae*)

▶ *Red Palm Weevil*

Avoid causing injury to the palms, as they would attract the weevil to lay eggs. Mechanical injury if any, caused should be treated with coal tar. While cutting fronds, petiole to a length of 120 cm is to be left on the trunk to prevent the entry of weevils into the trunk. Removal and burning of palm at advanced stage of infestation would aid in destruction of various stages of the pest harboured in the trunk. Prophylactic leaf axil filling suggested for rhinoceros beetle is very essential as this pest pave way for red palm weevil.

If damage occurs in the crown, the damaged tissue has to be removed and insecticide suspension, *imidacloprid* (0.02%) @1 ml/L of water may be poured in. In case of entry of weevil through the trunk, the hole in trunk may be plugged with cement/tar and the top most hole is made slanting with the aid of an auger and the insecticide solution is poured through this hole with funnel.

▶ *Eriophyid mite*

Spraying on the terminal five pollinated coconut bunches with neem oil garlic soap mixture @ 2 per cent concentration (neem oil 200 ml, soap 50 g and garlic 200 g mixed in 10 litres of water) or spraying neem formulations containing 1 per cent azadirachtin @ 4 ml per litre of water or spraying palm oil (200 ml) and sulphur (5g) emulsion in 800 ml of water and root feeding azadirachtin 10,000ppm @ 10 ml + 10 ml water is effective. Along with the recommended dose of manures and fertilizers, 5 kg neem cake should also be applied.

▶ *Coreid bug*

Spray neem oil-soap emulsion (0.5%) on the pollinated bunches. The emulsion can be prepared by adding 5 ml neem oil and 8 g bar soap in one litre water.

▶ *Rugose Spiralling Whitefly*

No chemical insecticide should be sprayed on leaves. Apply 1% starch solution on leaflets to flake out the sooty moulds.

In severe cases, spray neem oil 0.5% and no

insecticide is recommended. Install yellow sticky traps on the palm trunk to trap adult whiteflies. Encourage build up of parasitoids (*Encarsia guadeloupae*) and re-introduce parasitized pupae to emerging zones of whitefly outbreak.

In situ habitat conservation of the sooty mould scavenger beetle, Leiochrinus. nilgirianus

Integrated Disease Management

▶ *Bud rot*

Remove the infected tissues of the spindle completely. Two or three healthy leaves adjacent to the spindle may have to be removed, if necessary, for easy removal of all rotten portions and thorough cleaning. After removing the affected tissues apply 10% Bordeaux paste and cover the wound with a polythene sheet to prevent entry of rain water. The protective covering has to be retained till normal shoot emerges. Destroy the infected tissues removed by burning or deep burying in the soil. Spray 1% Bordeaux mixture to the surrounding palms

▶ *Stem bleeding*

Avoid burning of trashes near the tree trunk. Avoid injury to the tree trunk. The affected tissues should be completely removed using a chisel and smear the wound with 5% hexaconazole (5 ml in 100 ml of water) and drench the basins @ 25 lit. of 0.1% solution

Smearing paste of talc based formulation of *Trichoderma harzianum* on the bleeding patches on the stem can be done (The paste can be prepared by adding 50 g of Trichoderma formulation in 25 ml of water)

Soil application of *Trichoderma harzianum* enriched neem cake @ 5kg per palm and adopt recommended irrigation/moisture conservation practices.

▶ *Leaf rot*

Remove rotten portion of the spindle leaf and 2-3 successive leaves and pour fungicide solution containing 2 ml hexaconazole 5 EC in 300 ml water/ palm or talc based formulation of *Pseudomonas fluorescens* or *Bacillus subtilis* @ 50 g in 500 ml water/palm into the well around the base of the spindle leaf

Undertake prophylactic measures to prevent rhinoceros beetle attack

▶ *Basal Stem Rot/Ganoderma wilt*

Remove dead palms, palms in advanced stages of the disease and destruct the bole and root bits of these palms. Isolation of diseased palms from healthy palms by digging isolation trenches of 2 feet depth and one feet width around the basin can also be done. Avoid flood irrigation or ploughing in infected gardens to prevent spread of the inoculum.

Addition of 50 kg of farmyard manure or green leaves per palm per year and application of Trichoderma harzianum enriched neem cake@ 5 kg per palm and irrigating the palm once in 4 days and mulching around the basin is also useful.

Raise banana as intercrop wherever irrigation is possible Root feeding of hexaconazole @ 2% (100 ml solution per palm) or soil drenching with 0.2% hexaconazole / 1 % Bordeaux mixture @ 40 litre solution per palm can also be done.

Field sanitation

Special care should be taken to remove the organic debris/fallen trees etc in the coconut gardens in Kerala state affected by the recent heavy rainfall/ flood situation. ■

(Prepared by: Thamban, C. and Subramanian, P., ICAR-CPCRI Kasaragod and Joseph Rajkumar ICAR-CPCRI Regional Station, Kayamkulam)

Market Review – July 2020

Domestic Price

Coconut Oil

During the month of July 2020 the price of coconut oil opened at Rs. 15900 per quintal at Kochi and Alappuzha market and Rs. 16200 per quintal at Kozhikode market. The price of coconut oil at these three markets expressed an overall upward trend.

The price of coconut oil closed at Rs. 16300 per quintal at Kochi and Alappuzha market and Rs. 17200 per quintal at Kozhikode market with a net gain of Rs.400 at Kochi and Alappuzha and Rs.1000 per quintal at Kozhikode market.

The prices of coconut oil at Kangayam market in Tamilnadu, which opened at Rs. 13000 per quintal, closed at Rs.13667 with a net gain of Rs. 667 per quintal.

Weekly price of coconut oil at major markets Rs/Quintal)				
	Kochi	Alappuzha	Kozhikode	Kangayam
04.07.2020	15900	15900	16200	13000
11.07.2020	16000	16000	16400	13133
18.07.2020	16000	16000	16500	13133
25.07.2020	16200	16200	16900	13333
30.07.2020	16300	16300	17200	13667

Milling copra

During the month, the price of milling copra opened at Rs.10000 per quintal at Kochi, Rs.9950 per quintal at Alappuzha and Kozhikode market. The price of Copra at Kochi Alappuzha and Kozhikode market expressed an upward trend during the month.

The prices closed at Rs.10400 per quintal at Kochi market and Rs.10350 per quintal at Alappuzha market Rs. 10800 per quintal at Kozhikode market with a net gain of Rs.400, Rs.400 and Rs.850 per quintal respectively.

At Kangayam market in Tamilnadu, the prices opened at Rs. 9000 per quintal and closed at Rs.9400 per quintal with a net gain of Rs.400 per quintal.

Weekly price of Milling Copra at major markets (Rs/Quintal)				
	Kochi	Alappuzha (Rasi Copra)	Kozhikode	Kan-gayam
04.07.2020	10000	9950	9950	9000
11.07.2020	10100	10050	10100	9200
18.07.2020	10100	10050	10200	9100
25.07.2020	10300	10250	10650	9200
30.07.2020	10400	10350	10800	9400

Edible copra

The price of Rajpur copra at Kozhikode market opened at Rs. 10300 per quintal expressed an upward trend during the month and closed at Rs.12000 per quintal with a net gain of Rs.1700 per quintal.

Weekly price of edible copra at Kozhikode market (Rs/Quintal)	
04.07.2020	10300
11.07.2020	10300
18.07.2020	11000
25.07.2020	12000
30.07.2020	12000

Ball copra

The price of ball copra at Tiptur market which opened at Rs.9000 per quintal expressed an upward trend and closed at Rs.9400 per quintal with a net gain of Rs.400 per quintal during the month.

Weekly price of Ball copra at major markets in Karnataka (Rs/Quintal)	
04.07.2020	9000
11.07.2020	8800
18.07.2020	9000
25.07.2020	9400
30.07.2020	9400

Dry coconut

At Kozhikode market, the price of dry coconut opened at Rs.10400 per quintal and expressed an overall downward trend during the month. The prices closed at Rs.10150 per quintal with a net loss of Rs.250 per quintal during the month.

**NR-Not reported*

Weekly price of Dry Coconut at Kozhikode market (Rs/Quintal)	
04.07.2020	10400
11.07.2020	10650
18.07.2020	10600
25.07.2020	10350
30.07.2020	10150

Coconut

At Nedumangad market in Kerala, the price of coconut opened and closed at the same price of Rs. 15000 per thousand nuts.

At Pollachi market in Tamil Nadu, the price of coconut opened at Rs.12000 per thousand nuts and closed at Rs. 13000 during the month with a net gain of Rs 1000 per thousand nuts.

At Bengaluru market, the price of partially dehusked coconut opened at Rs.17000 per thousand nuts and closed at Rs. 15000 during the month with a net loss of Rs 2000 per thousand nuts.

The price of partially dehusked coconut was not reported during the month at Mangalore market.

Weekly price of coconut at major markets (Rs /1000 coconuts)				
	Neduman-gad	Pollachi	Banglore	Mangalore (Grade -1)
04.07.2020	15000	12000	17000	NR
11.07.2020	15000	12000	16500	NR
18.07.2020	15000	12000	16500	NR
25.07.2020	15000	13000	16000	NR
30.07.2020	15000	13000	15000	NR

International price

Coconut

The price of coconut quoted at different domestic markets in Philippines, Indonesia, Srilanka and India are given below.

Weekly price of dehusked coconut with water				
Date	Domestic Price (US$/MT)			
	Philippines	Indonesia	Srilanka	India*
04.07.2020	174	144	278	354
11.07.2020	175	145	262	367
18.07.2020	175	149	270	374
25.07.2020	172	151	289	381
				*Pollachi market

Coconut Oil

The domestic price of coconut oil in Sri Lanka expressed a downward trend during the month. Whereas domestic price of coconut oil in Philippines and Indonesia expressed a mixed trend during the month. The international price of coconut oil opened and closed at USD 889 per MT during the month.

The price of coconut oil quoted at different international/ domestic markets are given below.

Weekly price of coconut oil in major coconut oil producing countries					
	International Price(US$/MT)	Domestic Price(US$/MT)			
	Philippines/ Indonesia (CIF Europe)	Philip-pines	Indone-sia	Sri lanka	India*
04.07.2020	889	838	830	2447	1737
11.07.2020	881	835	835	2531	1755
18.07.2020	886	833	832	2449	1755
25.07.2020	889	837	833	2395	1782
					* Kangayam

Copra

The domestic price of copra in Indonesia and Philippines expressed an overall upward trend and Sri Lanka expressed a mixed trend during the month. The price of copra quoted at different domestic markets are given below.

Weekly International price of copra in major copra producing countries				
Date	Domestic Price (US$/MT)			
	Philippines	Indonesia	Srilanka	India* * Kangayam
04.07.2020	587	542	1371	1202
11.07.2020	592	546	1346	1229
18.07.2020	594	555	1265	1216
25.07.2020	595	568	1346	1229

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