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Managing Human and Environmental Health by Improving Soil Health

Termites – Silent Destroyers of Coconut Health

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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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Cover Picture: 16 year old coconut palm in the backyard of Shri. George Mathew in Maradu, Kochi, Kerala. The palm has recorded a productivity of 500 nuts per year

Message from the Editor

It is heartening to see the coconut sector on the path of slow recovery from the impact of the pandemic. The export of coconut products is also expected to increase during this year and coconut shell based activated carbon continues to be the highest exported product. Another interesting feature is the increased interest shown by start-ups and young entrepreneurs in coconut processing which is very promising for the coconut sector. Young entrepreneurs are not only into processing but also have recorded success in development of machinery for minimal processing of tender coconut, palm climbing etc.

It is very much essential to move forward with innovation, sensing the trends in consumer behaviour and their needs. Coconut is a crop which is still a major source of inspiration for innovation. Increased awareness among the consumers on the health and nutritional attributes of coconut products also increases their demand for convenience foods from coconut. As the world is moving on the path of environment friendly sustainable agriculture, coconut offers tremendous prospects since it is a crop of zero waste and its products are biodegradable. Other major coconut growing countries are moving ahead with innovations in various products incorporating insights by variants of the same product, categories, packaging, geography etc targeting customers in various age groups and categories. Innovative products like non dairy creamers, condensed coconut milk for iced coffee and roasted coffee beans with medium chain triglycerides are ideal for those with allergies and food sensitivities.

Entrepreneurs have to be sensitive to the changing consumption patterns and have to be innovating increasingly creative and unusual coconut products, satisfying a growing consumer appetite for coconut. We too have our own innovations, the recent introduction of a coconut paste, without added preservatives and flavours, in the convenience food category is a typical example. Let us move forward, thinking out of the box, creating innovative products produced from ethically sourced coconuts, thereby being partners in the development of a sustained and environment friendly coconut industry.

Editor

Termites –
Silent destroyers of coconut health

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Coconut, Cocos nucifera L., is popularly known as "Kalpavriksha" or tree of heaven mainly because every part of the tree yields benefits to the humankind. In India, it is cultivated in 2.17 million ha across 19 states and 3 Union Territories producing 21384 million nuts with an average productivity of 9815 nuts/ha (http://coconutboard.nic.in). Coconut is one of the important plantation crops in India which support millions of small and marginal farmers and can grow across diversified agro-climatic zones under both rainfed and irrigated conditions.

Over 750 insect species that attack coconut palm, termites are one such major soil insect pests. It is found in almost all the coconut growing tracts of our country. Generally termites are considered as serious pest in coconut nursery which causes 20% seedling loss in the laterite soil (Anonymous, 2006). However, they affect not only the seedlings but also the main plantations and the associated intercrops grown under coconut cropping system. Out of the 337 termite species known so far from India, about 35 species are reported to damage agricultural crops and buildings. The most dominant termite genera which attack coconut are Odontotermus which is

Termites are found in almost all the coconut growing tracts of India. Generally termites are considered as serious pest in coconut nursery which causes 20% seedling loss in the laterite soil. Termite affect not only the seedlings but also the main plantations and the associated intercrops grown under coconut cropping system

Figure 1: Termite affected coconut palms

a major mound builder followed by Coptomerus, Heterotermus, Microtermus, Microcerotermus which are subterranean habitants. Owing to changing climatic conditions, currently there is a growing concern on the termite ravage in coconut plantations in the coastal states of India.

Termites - Caste differentiation and colony division

Termites are fully social insects and they exhibit various morphological forms. They live all in colonies, with reproductives (kings, queens, and nymphs), soldiers and true workers. Termite morphological and anatomical adaptations are caste-specific, with structures evolving independently into reproductives (to allow dispersal, pair bonding and fecundity), workers (foraging and feeding, tending and feeding of immatures, nest construction) and soldiers (only defence). They live in small to larger colonies, sometimes a single colony containing a million or more individuals.

At certain times, larger colonies produce winged termites or "alates" that will eventually become king and queen termites. After a short flight where they find a suitable mate, they shed their wings and begin their family by excavating a small chamber in soft soil. They are called as primary reproductives, dark colored and the only caste with functional eyes. New king remains virtually unchanged in size whereas female expands its abdomen with increasing ovary development. A single queen can produce over 500 offsprings per year and it can stretch its abdomen by increasing body length of about 15 cm. Initially, the parental king and queen tend the young termites and often survive for a decade or longer. Once the queen's egg laying capacity increases, the older offspring begin to tend their younger siblings. Thereby colony continues to grow with increasing numbers of termites being produced each year.

However, if the king or queen dies, other individuals within the colony start developing functional reproductive organs to take their place. These individuals are called secondary reproductives. They are light in color, larger than workers but they never develop wings. Worker castes are functionally sterile and they care for the young, repair the nest, build foraging tunnels, locate food, feed and groom the other castes, and each other. Termite soldiers are the defenders of the colony and they fight against marauding ants and foreign termites with their hard mandibles. Soldiers are similar to the workers but they are blind, soft-bodied and wingless. Thus the success of termite colony establishment can be attributed to their cooperative behavior.

Scientific classification	
Kingdom	Animalia
Phylum	Arthropoda
Class	Insecta
Order	Blattodea
Infraorder	Isoptera
Super family	Blattoidea
Family	Termitidae
Genus	Odontotermus

Nature of damage

Termites pose serious threat to agriculture especially in tropical areas with higher relative humidity. Considerable crop yield losses were reported on perennial and annual crops due to termite attack in semi arid and sub - humid tropics. Their damage is greater in lateritic soils than in sandy soil. In general, termite damage is seen more in case of rain fed crops (20-25%) than the irrigated ones (10%). In rainfed crops, the plants experience moisture stress which predisposes them to termite infestations. In such cases, damage is more severe during droughts and dry season and sometimes it may exceed up to 30 - 40%.

It was observed that several tall palms in the ICAR – CPCRI research farm, Kasaragod and farmers garden were severely infested with termite attack during 2020. In severe conditions, earthern sheets were seen up to 3 - 4 feet height on the trunk of the affected palms. Deficit monsoon observed from 2015 – 2018 might have played as predisposing factors for the gradual buildup of termite infestation inside the moisture stressed coconut gardens which are now clearly visible. Termite attacks begin from the root level and then gradually spread to the upper portions. Workers and soldiers continue their activity under the earthen sheets and their damage is often negligible; occasionally it becomes serious. Although, termite does not usually kill the tree however it restricts the palm further growth due to its irreversible damage causes. However, if the damaged portion gets exposed to pathogenic microbes, palm death can also happen.

Figure 2: Earthern sheets on the Trunk

Figure 3: Runways spreading to the upper portion

Damage symptoms

A. Nursery seedlings

• Wilting is the first sign of termite attack in case of seedlings which occurs at the base of the collar region. The attacked plants show wilting before dying due to root damage which significantly affects the intake ability of water and nutrients.

• In some cases, Odontotermes spp fed directly on the roots thereby kills the plant.

B. Main field

• Earthern sheets on the trunk and runways on the bark can be seen on the grown up palms indicating that the tree had been severely infested with termites.

• In severe cases, the tissue under the bark could be completely eaten up by termites and reaching up to pith region and finally hollow stem can be noticed.

Some of the predisposing factors for termite invasion in coconut orchards are as follows: poor orchard sanitation, improper disposal of fallen leaves, nuts and debris, accumulation of crop debris (attractants for termite foragers), use of undecomposed farm yard manure, root and bark

Figure 4: Termites crawling over the fallen nut

Figure 5: Fallen nuts – source of termite attack

damage during intercultural operations and their exudates attracts termites, soil borne diseases/ nematodes invites secondary infestations of termite, finally any stress like drought or poorly drained soil etc., favours termite attack.

Integrated management practices for Termites

Termite control in coconut orchards is a herculean task and their elimination is neither advisable nor possible. Their nests are often located deep inside the ground and are difficult to reach. However, timely implementation of management practices may help us in alleviating termite problem in the perennial cropping system.

Management measures for nursery field

1. Adoption of field sanitation by disposal of organic matter in nursery soil and covering germinating nuts with a layer of river sand, drenching nursery with chlorpyriphos (0.05%) twice at 20-25 days intervals can help in avoiding termite attack.

2. Application of chlorpyrifos @ 3.8 g/nursery bed (7.5 m2) or fipronil granules @ 2.3 g/nursery bed before sowing seed nuts can also be taken up to avoid termite attack.

Management measures for main field

1. Orchard sanitation is the prerequisite action needed for preventing termite attack.

2. If the mulches around the tree basins are infested, mulches should be removed immediately.

3. Removal of crop debris and fallen nuts to reduce foods supplies to foraging termites; thereby termite attacks can be reduced.

4. Termite mounds/Termitoria in the coconut gardens should be destroyed. If possible, breeding queen should be searched out and killed to avoid occurrence of re-infestation.

5. Deep summer ploughing should be done in the coconut interspaces which expose termites to desiccation and natural predators.

6. Mechanically injured areas in the palms should be treated with copper oxy chloride @ 1% to avoid termite attack.

7. Frequent irrigation to be ensured to the palm base to reduce the termite attack especially in summer.

8. Application of calcium on the trunk can reduce the termite attack. Swabbing the base and trunk up to 2 m height with neem oil @ 5% can also reduces the termite damage.

9. Termite management primarily relies on the use of soil insecticides at the site of infestation. The most commonly used soil insecticide in India is Chloripyrifos. Affected palm tree base should be drenched with five liters of Chloripyrifos solution @ 2 ml in one litre of water. Other insecticides can be used in place of Chlorpyrifos are as follows: Imidacloprid 20% SL @ 1-2 ml litre; Fipronil 5 SC @ 4 - 5 ml/litre of water.

10. There are many ITKs adopted across regions for termite control; however their feasibility in use is locality specific and based on resources availability. Some of the ITKs followed in Kerala are: planting turmeric and arrowroot, aloevera etc in the coconut nursery may reduce termite damage. Application of crushed fenugreek and application of salt and ash in the coconut basin reduces the termite attack. Application of neem (Azadirachta indica) cake and salt in equal proportion in the basin also found to reduce termite numbers. ■

Managing Human and Environmental Health by improving Soil Health

Joshy V Cherian, Omega Ecotech Products, Coimbatore

Human beings are faced with serious health challenges today. The incidence of cancer is increasing at a rapid rate. Some of the studies have concluded that in about 25 to 30 years one death in every two death will be due to cancer. Cancer is seen even in infants these days. Various organ disorders like kidney failure, liver problem, heart attack etc has increased 10 times in the last 20 years. Chronic problems like Diabetics, Cholesterol etc. are very common, right from the juvenile phase.

The major reasons attributed for these health problems are : hazardous residues in the food and water we consume, life style changes leading to severe stress in life and very poor quality of the food we consume that is food without proper nutrients. These types of food also disturb the body pH leading to various complications.

Environmental health is also facing serious challenges. The outcome of the ill health is climate change. Some of the impacts of climate change are increase in temperature, failure in monsoon, severe

Soil is one of the most important natural resources. Fertile soil is very important for sustainable agriculture. Soil fertility is influenced by four important factors viz. soil organic matter, soil inorganic matter, soil organism and soil microbes.

drought resulting in severe landslides and floods, which we have witnessed recently in Kashmir and Uttarkkand.

Another outcome of the environmental ill health is severe and fast depletion of our natural resources like soil, water, biodiversity etc.The reasons for the environmental challenges are, green house effect due to increase in green houses gases like Co2 , CH4 etc in the atmosphere and unscientific management of natural resources.

Soil: Soil is one of the most important natural resources. Fertile soil is very important for sustainable agriculture. Soil fertility is influenced by four important factors viz. soil organic matter, soil inorganic matter, soil organism and soil microbes.

Soil Organic Matter: It is a complex and varied mixture of organic substances. Globally around 2400 billion tons of carbon is stored in soil as organic matter. Altogether about twice as much carbon is stored in the soil than in the worlds vegetation (550 billion tons) and atmosphere (750 billion tons) combined. Soil is the largest carbon sink in the world.

Every year approximately 63 billion ton of carbon is released into the atmosphere from the soil. Approx. 59 billion tons of carbon is going back into the soil from atmosphere via plant residues. The imbalance of about four billion tons of carbon along with five billion tons of carbon released by burning of fossil fuels every year is added to the atmosphere. This addition of carbon dioxide is intensifying the green house effect. Soil health is primarily dependent on the level of soil organic matter.

Soil inorganic matter: Sand and clay particles, macro and macro nutrients are the inorganic matters in the soil.

Soil organisms: Earthworms, snails, insects, grubs, termites, nematodes etc. The population of the soil organism is dependent on the soil organic matter directly and indirectly. The chemical characters of the soil also influence the population of soil organisms. Earth worms are usually called the friends of farmers and termites are pulverizes of nature. They accelerate the decay of organic matter. Some of the soil organisms control various plant disease causing organisms and these organisms help in nutrient recycling.

Soil Microbes: All microorganisms are present in soil. For examples fungi, bacteria, actinomycetes algae etc.,The population of the soil microbes is directly dependent on soil organic matter, soil chemical and physical characters. Decomposers of

organic matter and nutrient recycling stabilize soil structure and synthesis various organic compounds which play a very important role in soil health. Some of them act as bio control agents and helps in the absorption of nutrients by plants breakdown of toxic compounds.

Present Status of Indian Soil in terms of Organic Fertility

*(a) Healthy Soil (Forest Soil)**

The Organic Matter level should be between 2 to 3%. Various other soil organisms are also abundantly available. Approximately 25 to 30 lakh earth worms per acre and approximately 15 to 20 tons of microbes are present per acre of soil **(Brandy,Nyle C ,1999, N.S Subba Rao, 4th edition*

*(b) Depleted Soil***

The organic matter level was recorderd below 0.5% in most places. Few soil organisms are available. Approximately 2 to 3 lakhs of earth worms were found per acre and approximately 3 to 5 tons of microbes were present per acre of soil. ***(Based on the studies conducted by Dr.Joshy V.Cherian and his team)*

Factors leading to the above conclusion were based upon the following reasons.: With the advent of Green Revolutions hybrid seeds were used and a demand for readily available plant materials was observed which lead to the increased use of chemical fertilizers. Over a period of time the addition of organic matter to soil was totally neglected.

Another reason for depletion of organic fertility is continuous and excessive use of chemicals for both nutrition and plant protection. These chemicals are harmful to the soil organic matter and living organisms. The soil testing conducted in almost all the labs in India gives information only about physical and chemical parameters of soil. Hardly any

lab provides information about the organic fertility status of the soil and no steps are taken to rectify the organic fertility of soil

Another major challenge modern societies are facing is accumulation of waste in all urban centers. In most of the urban centers the waste is dumped in dumping yards. In few places it is incinerated. It is estimated that in 30 to 40 years India will be world's largest Municipal Solid Waste (MSW) generating country.

The challenges due to the present unscientific management of Municipal Solid Waste are very many.

These dumping yards develop into ecological disasters by becoming breeding ground of insects,pests, reptiles, canines etc. posing serious threat also to the health of the locals. These dumps release large amount of very dangerous Green House gases for eg. Methane, N2O etc which contribute to the global warming The leachates from these dumps contaminate the ground water source. A considerable area of land is lost due this unscientific process. These yards catch fire very often releasing huge amounts of dioxins and other noxious gases into the local environment. The un-segregated municipal waste often has heavy metal contaminants. This method requires huge capital and operational infrastructure and cost. Any break in the chain of operations will cause severe inconvenience to the urban dwellers where the garbage gets accumulated. It affects the aesthetics of the city and is a disgrace. The movement of the garbage through the urban centres cause lot of inconveniences. It is an extremely menial job which amounts to social discrimination.

These huge challenges can be converted into a great opportunity. About 50 to 60 percentage of MSW is biodegradable organic material. By proper segregation at source we can separately collect all the different materials in MSW. All the plastic can be recycled reducing our consumption of precious petroleum products and thereby reducing our foreign exchange spent on import of petroleum. The metal and glass from MSW can also be recycled. The biodegradable organic material can be converted into excellent organic manure by a very efficient coir pith based aerobic composting medium.

Coir pith based aerobic composting medium

Coir pith composting medium is a highly efficient

solid state aerobic fermentation medium which can convert biodegradable material into high value compost without any foul odor in 23-30 days' time. It is a combination of clean processed coir pith and naturally occurring aerobic composting microbes. It is a patent pending product. Coir pith based composting medium has to be layered with biodegradable waste. The proportion of Coir pith based depends on the moisture level in the waste.

This technology is successfully followed in managing domestic waste in thousands of houses in many local bodies in Kerala along with an aerobic container. Market and commercial waste are being treated in various local bodies using this solution. Similarly the biodegradable waste of various agro industries in India are also being managed.

Advantages of using coir pith based aerobic composting medium

A hassle free, convenient method permits us to process the organic garbage, even in a domestic environment, in a short time. There is absolutely no foul smell. A biodegradable waste which is generating foul smell when introduced into the composting medium loose the foul smell immediately. There is no leachate during the process and no flies

are seen when the moisture is maintained at an optimum level. Frequent turning of the material is not required thereby reducing the inconvenience associated with turning. This process also eliminates the hazardous process of handling domestic waste by segregating the waste 'at source' and converting the same into compost (Compost). Composting can destroy pathogens or unwanted seeds. Unwanted living plants (or weeds) can be destroyed by covering with compost.Using Compost as a growing medium reduces water requirement to one fourth of the normal recommended dosage thereby effectively saving 75% of water consumption;

Additionally, this process will result in natural development of local earthworm population in the soil by providing adequate feed and a favorable environment. This will also substantially enhance population of microbial and other soil beneficial organisms. Compost thus produced can either be used in the kitchen / household garden or can be sold in the market for price. The speed of conversion of this process is very fast and the quality of the manure generated is very good.

Advantages of the manure when applied to the soil

The manure is capable of improving all the physical properties of soil including air water balance and protects the soil from sunlight and rain drops when available as a mulch. It provides various macro and micronutrients to the plants and enhances microbial population and microbial activity like Nitrogen fixation, solubilizing of various nutrients, production of humic substances etc. This manure can also enhance the buffering and water holding capacity and also water infiltration

Moderation of soil temperature both in day and night is maintained and also helps in reducing evaporation loss from soil. Less surface runoff is observed and soil erosion is restricted, less flooding by increased retention of water in soil.. It can also improve the soil structure so that it holds more nutrients and there by the soil becomes more fertile.

By repeated application of organic matter to the soil, the soil regains its health. When there is enough organic matter the microbial population will increase and the earthworm population and all other beneficial organisms in soil will proliferate. The organic matter when breaks down completely will release a lot of macro and micro nutrients. The organic matter also helps in building up the humus content of the soil.

All the above factors make the soil healthy. A healthy soil will support a healthy plant. A healthy plant is less susceptible to disease and pest problem. The harmful usage of chemicals have come down drastically. The minor incidence of pest and disease can also be controlled by bio inputs. The food and water we consume will have less harmful chemical residues. A plant growing in healthy soil will also produce fruits and vegetables which are rich in nutrients. A healthy soil will also help the plant face the challenges of climate change more efficiently. Thus the end user viz. the people and animals consuming these food and water will be healthy.

From an environmental angle the increase in organic matter in soil will ensure a healthy sustainable soil for generations.

The water availability will be better because the soil has much better water holding capacity. Because the soil is healthy it can support much larger life inside and above the soil thereby increasing the biodiversity. A healthy plant will fix more carbon dioxide throughout the year thereby reducing the pressure of carbon dioxide in the atmosphere which is responsible for the green house effect. Therefore

by correcting soil health we can manage both human and Environmental health.

SUDHLABH's composting digester

The composting set up comprises of a ventilated digester and composting medium, provided by Sudhlabh. This composting medium is a patent pending specially formulated coco peat based product developed and supplied by Dr.Joshy V Cherian.

The wet waste and composting medium in dry compacted form should be taken in a ratio of 1:1/8. Further the medium is hydrated, mixed with wet waste and deposited in the ventilated digester (dimensions provided at the end of the document). The final compost generated can be recycled by mixing it with fresh composting medium in 1:1 ratio.

Challenges

Criteria for setting up the digester were that it should be spread across the complex, it should have good air circulation so that the smell can be wafted away in the wind, good sunlight for better moisture management. It must be placed at least 10 feet away from home and 3 feet away from the compound wall so that the residents don't feel that they are near a composting area. It should have good drainage to clean the area thoroughly every day, strong concrete base so that 3000 kg unit doesn't sink in, good roof to avoid rain water, space to remove compost. It should also have work around space to clean and should not affect aesthetic value of the building.

The waste was mixed in a room and put into each digester. The digesters are filled one after the other which ensures enough time(40 to 45 days) before it is opened for compost harvesting.

A Municipal Waste Management Initiative

Kunnamkulam is a municipal town situated in Thrissur District of Kerala in India, spread across an area of 34.18 sq.km. The Municipality has an area of 34.18 sq.km and has 37 wards. The total population as per 2011 census is 54,071.

Challenges

Kerala state banned all landfill because of the frequent protests by the people living near the landfills. Based on the state government policy, the Kunnamkulam Municipality decided to compost the wet waste generated in the commercial space in the municipal area. The municipality strictly enforced segregation of waste and they constructed a building of 5000 sq.ft and installed a shredding machine. One ladies self help group was formed to compost the waste procured and delivered by the municipality.

The ladies self-help group composted the wet waste by mixing and shredding it with aerobic composting medium, a coco peat based specially formulated product developed and supplied by Omega EcoTech

Products India Pvt Ltd through IRTC (Integrated Rural Technology Centre). The shredded mixed waste is formed into windrow piles. The piles are periodically turned, mixed and bulked after two weeks. A month old compost is mixed with fresh waste and recycled. After the compost is fully mature it is sieved packed and sold as compost to nearby farmers.

Result

There is no landfill in Kunnamkulam municipality. All the wet waste generated in the commercial space is fully composted into good quality compost.The local farming community is using the compost for more sustainable farming. This has become a show case model for various municipalities and private entrepreneurships and many such initiatives are on the way. The municipality has also taken steps to compost the domestic waste in individual houses.

Waste Management in Apartments- a Case Study

Bangalore city is an important commercial city in South India and known as the silicon valley of India. The city is generating 5000 tons of waste daily. This waste was collected in a mixed format and dumped in nearby villages. Because of severe pollution and health hazards in the dump areas the local villagers protested and with the intervention of court the dumping was banned. Therefore the city administrators had to find ways to address the huge waste. The city was forced to regulate the waste management.

The Bangalore city corporation classified the large

apartments as bulk generators of waste and mandated them to segregate and manage waste by themselves. In order to initiate waste segregation, the Bangalore city corporation introduced "2 BINS AND 1 BAG" model in 2013.

The ideation, planning and implementation of a decentralized waste management model in Purva Fairmont apartment at Bangalore which is comprised of 324 houses is furnished below.

Approach

The residents of Purva Fairmont formed a committee and educated the residents about the needs and ways of segregation. Further they explored solutions to manage different categories of waste segregated such as Wet/ Organic waste, Dry waste, Reject waste, e-waste etc. Out of these, wet waste management seemed to be the most challenging. After collaborating with vendors and apartment volunteers, the committee studied the pros and cons of existing composting machines and techniques. They concluded with the following requirements for an effective wet waste management method which is sustainable composting model well suited for apartment complex. Affordability of the composting setup and ease of composting for the workers were taken into consideration. It was also decided that the compost generated should be of good quality.

Thereafter in 2013, the committee representatives met Mr. Vasuki from SudhLabh. They also visited SudhLabh's first trial run composting digester which was managed by a community of 80 odd apartments mostly of senior citizens.The major advantages of this model were its simple structure and set up, ease of composting and less effort by workers, easy maintenance, lesser construction and machine cost compared to existing facilities etc.

Capacity building and training was simpler. Electricity was independent and there is no complex machinery required. It was easy to correct the mistakes and change the process according to the conditions. There was lesser operational cost compared to existing machines with minimum smell and worms with minimum amount of the carbon source against the feedstock. We can recycle the compost generated by mixing it with fresh composting medium and above all, this process generates good quality compost.This inspired the committee to set up Shudhlab's digester in their apartment. Result

By the end of 2016, the apartment had fully functional five digesters which yielded good quality compost. Purva Fairmont processed 250kgs of Wet Organic waste and produced approximately 80 to 150 kgs of compost once in 2 days. After initial struggles, the residents turned to be very cooperative with the process. Few residents still complain but they are made comfortable and accommodative by continuous engagement. This composting process is good for the environment, this case gives an analysis of the contribution made by an apartment to preserve our mother Earth. Many more got inspired with this facility at Purva Fairmont apartment in HSR sector and have adopted the same. ■

Company Profile

Omega Ecotech Products India Private Limited came into existence in the year 1999 at Coimbatore, Tamil Nadu (India). The company is engaged in manufacturing, supplying and exporting a comprehensive gamut of Bio Fertilizers, Bio Fungicides, Bio Pesticides, Composts, Growth Promoters and Aerobic Composting media. The company is promoted by a team of Environmental and Agricultural scientists with rich experience in Biotechnology, Horticulture, Waste Land Development, Solid Waste Management and Organic Agriculture. The vision is to promote sustainable agriculture by producing compost by farmers and even in households using the composting media Bioclean.

BIOCLEAN

Bioclean is a highly efficient solid state aerobic fermentation media which can convert biodegradable material into high value compost without any foul odor in 23-30 days time.

It is a combination of clean processed coir pith and naturally occurring aerobic composting microbes. It is a patent pending product. Bioclean has to be layered with biodegradable waste. The proportion of bioclean depends on the moisture level in the waste. This technology is successfully used in managing domestic waste in thousands of houses in many local bodies in Kerala along with an aerobic container.

For more details, visit: www.omegaecotech.in ■

Red Palm Weevil Detector

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Red Palm Weevil [Rhynchophorus ferrugineus (Olivier)] is one of the most devastating enemies of coconut palms. The grubs of red palm weevil attack the stem, frond or central core (cabbage) of the palm. If the grubs attack the central core, the crown finally collapses and eventually the tree perishes. Usually 1-2% of palms are lost annually due to red palm weevil attack. The attack of red palm weevil can completely destroy a productive palm in one-two month's time, considering the fact that replanting a tree and bringing that to a productive yielding phase requires years of sustained effort and substantial expenses; it therefore augurs to take adequate timely curative measures to save a tree. Though effects of the attack are fatal, if infested palms are identified at an early phase, the trees can be saved and the infestation can be completely cured. Such cured palms would return to full production potential in a couple of months.

The symptoms of infestation are not quite explicit and visible to be easily observed in the early days of pest attack. Despite best efforts through continuous observations, the symptoms of the infestation may go undetected even by an experienced farmer until a stage when it has caused significant damage to the tree and the tree becomes unrecoverable. This calls for the need of an instrument that can detect the intrusion of the red palm weevil and diagnose its presence at the early stage of entry/infestation. ICAR-Central Plantation Crops Research Institute (CPCRI) had developed an earlier version of the detector during 90's which could not pin point the sound produced by the feeding grubs from that of other spectrum of noises produced in the environment.

This project thus envisaged the development of an affordable and user-friendly gadget to enable early diagnosis of Red Palm weevil infestation fine-tuning the detection of acoustic signals. The final embedded hardware is a combination of Artificial Intelligence (AI) and Signal Processing. ICAR-Central Plantation Crops Research Institute with the collaboration of the Startup M/s Resnova, Kochi and with funding from Coconut Development Board, Kochi developed this unique concept and the gadget for early detection of red palm weevil infestation in palms. In the feeding process by the grubs, the palm fibres are cut by the powerful mandibles resulting in the feeble sound, which is detectable by the sensor. The acoustics-sensor based detector could record the gnawing sound of the feeding grubs on palms up to 15 years old. The sensor can be fixed on the trunk about one metre from the ground level during the detection cum scanning process.

Acoustics based red palm weevil detector

The detection unit consists of a specially designed detector which is attached to the tree trunk; upon pressing the scan button the device scans the tree for two minutes. The collected signals undergo a series of filtration for removing unwanted noise signals both on the hardware and software sides. The processed signals are then evaluated by the AI models to check for patterns pertaining to grub activity. The result is then displayed on the screen of the device. The developed hardware was tested on the healthy and infested palms at ICAR-CPCRI, Regional Station Kayamkulam.

The device was able to provide an accuracy of more than 80 per cent during field trials. The device can be powered using a power bank of capacity 20,000 mAh and will work for 45 minutes in continuous operation. With further fine-tuning it would be an excellent product for early detection of red palm weevil infested palms in the field and turnaround the livelihood of coconut farmers for the successful management of the pest. It may take a year for the product to reach the farmers and the cost would be approximately ten thousand rupees. This is one of the disruptive innovative products leading towards digital India and Atmanirbhar Nariyal Krishi. ■

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Value Added Products from coconut

Being a zero wastage product, the product basket from coconut is enormous. Some of the value added products from coconut are Desiccated Coconut (DC), Virgin Coconut oil, Coconut chips, Coconut milk, Coconut milk powder, Coconut Vinegar, Coconut oil, Tender Coconut water, Ball copra, Neera and Neera products, Coconut ice cream, Coconut body lotion and so on. As part of the product promotion, commercial production units have been started in various parts of the country under Technology Mission on Coconut (TMoC).

CDB is providing financial assistance @25% of the project cost limited to Rs.50 lakh for entrepreneurs and 33.3% of the project cost limited to Rs. 50 lakh per project for SC/ST Women entrepreneurs for establishment of coconut processing units.

Virgin Coconut Oil

Coconut oil obtained from coconut milk is called virgin coconut oil (VCO). Traditional and modern methods are available for the manufacture of virgin coconut oil. In the traditional method, milk extracted from grated coconut kernel is boiled to get oil. Of late, the traditional method has been partially mechanized using a bridge press and mechanical grater. The modern method of extracting oil from fresh coconut kernel is known as wet processing.

The Virgin coconut oil is considered superior for use as edible oil, hair oil and baby oil because of its pleasing aroma and purity. It is applied on the body of babies to protect from skin diseases. Because of its low FFA content, this oil has a longer shelf life.

Composition of VCO as per APCC

Sl. No	Parameters	
1	Moisture (%)	Max 0.1
2	Matters Volatile at 120° C (%)	Max 0.2
3	Free Fatty Acid (%)	Max 0.2
4	Peroxide Value meq/kg	Max 3
5	Relative density	0.915 – 0.920
6	Refractive index at 40° C	1.4480 – 1.4492
7	Insoluble impurities per cent by mass	Max 0.05
8	Saponification Value	250 – 260 min
9	Iodine Value	4.1 -11
10	Unsaponifiable matter % by mass	max 0.2 - 0.5
11	Specific gravity at 30 ° C	0.915 – 0.920
12	Polenske Value	min 13
13	Total Plate Count	< 0.5
14	Color	Water clean
15	Odour and Taste	Natural fresh coconut scent, free of sediment, free from rancid odor and taste

Desiccated Coconut

Dehydrated coconut meat in the grated and shredded form is desiccated coconut (DC). A large number of units in India are manufacturing DC which is mainly absorbed by the confectionery and other food industries. DC is used as a substitute to grated coconut in various household preparations. DC is available in different grades based on the fineness of the material.

Composition of Desiccated Coconut

Sl. No	Item	Quantity
1	Moisture	1.3-2.5%
2	Protein	6.0-6.6%
3	Oil	68-72%
4	Carbohydrate	18-20%
5	Crude fibre	4-6%

Source - Tropical Foods, Chemistry and Nutrition, Volume 2, George E Inglett*

Coconut Milk

Coconut Milk is the oil-protein-water emulsion obtained by squeezing fresh grated coconut kernel. The undiluted and diluted forms are called coconut milk and the concentrated form is coconut cream. Coconut milk is obtained by extraction of fresh coconut wet gratings with or without water. This is an instant product, which can either be used directly/diluted with water to make various preparations such as fish & meat dishes, curries, sweets, deserts, puddings, cocktails, cakes, cookies, coconut jam, ice creams etc. It can also be used in the manufacture of bakery products and for coconut milk flavouring food stuffs. Preserved forms of coconut milk such as canned cream or milk and dehydrated whole milk are now available in many coconut growing countries. Commercial production of these products has been promoted in the Philippines, Thailand, Indonesia, Western Samoa, Sri Lanka and Malaysia and to some extent in India. Indonesia is the leading exporter of coconut milk followed by Sri Lanka, Thailand and Philippines.

Coconut Skimmed Milk

Coconut fresh kernel is a rich source of plant protein and is an invaluable material for the preparation of milk substitutes. Coconut skimmed milk is a solution of the soluble components of coconut after the cream is separated in a cream separator. Skimmed milk is a good source of quality protein suitable for the preparation of many useful food products or as supplemental protein source, especially in regions deficient in animal proteins. Freshly prepared coconut milk from pared kernel is filtered through a 120 mesh vibrating screen and the pH of the filtered milk is raised from 6.3 to 7.0 with the additions of sodium hydroxide. The milk is then pasteurized at about 60^{o}C for one hour and subsequently centrifuged in a cream separator to yield the aqueous phase or the protein rich skimmed milk.

Spray Dried Coconut Milk Powder

Spray drying is the best method for the preservation of coconut milk. Spray dried coconut milk powder is reconstituted into coconut milk by adding water which can be used to make various food preparations. The product offers additional advantages such as less storage space, bulk packaging at reduced cost and longer shelf life. Technology for the manufacture of spray dried coconut milk powder is available with Coconut Development Board.

Coconut Cream

Processed and packed coconut cream is a ready-to-use product which can either be used directly or diluted with water in various edible preparations. Coconut cream when partially defatted is called coconut milk. Coconut cream/ milk is used as an ingredient in household recipes and as a component of processed foods. Coconut milk is also used as coconut cream, a mixer in alcoholic drinks. Coconut milk/cream is available in pouches, bottles and tetra packs. Technology for the manufacture of coconut cream is available with Coconut Development Board.

Smart Phone - Smart Irrigation

Shwetha. R, Technical Officer, CDB, Kochi -11

Coconut palms (*Cocos nucifera*) are one of the most beautiful and useful trees with a classical appearance of tall slim trunks crowned with elegant green leaves that certainly enhance the beauty of a place. Being the livelihoods of millions of people in the developing world, through production and employment generation by associated industries, it is the most widespread and economically useful palm of the wet tropics.

The coconut palms are found throughout tropical and subtropical regions and Southern part of India's climate is more suitable for its cultivation. However for the palms to yield the best production, timely irrigation and demand-based water supply is very important. The palms require an evenly distributed rainfall of 1500-2000 mm and in areas where the water is scarce, drip irrigation is highly recommended.

In order to guarantee a sustained productivity and supplemented economic growth in the times of climatic challenges, vulnerability of soil degradation, diminishing labour force, the scenario cries out for innovation in agriculture. The economic survey of the Indian government alludes the emphasis to extract ''more crop per drop" which stress the need for contemporary technologies for obtaining maximum productivity from a single drop of water. Hence the time has come in which calls in not just an irrigation system but installation of a "smart" irrigation system.

We live in the 21st century wherein everything can be controlled and operated automatically, but there are still a few important sectors where automation hasn't been adopted in full throttle and irrigation in agriculture is one such example. Presently farmers use manually controlling measures to irrigate the land from time to time which mostly consumes more quantity of water. The modern drip irrigation system signifies the advantage of saving large quantity of water by delivering the water to the root zone or on to the soil surface through a network of valves, pipes, tubing and emitters. Hence drip irrigation is also termed as localized irrigation or micro irrigation

The "smart" irrigation system is a new technology which irrigates the palms automatically. This technology uses an android based automatic irrigation system capable of controlling irrigation electrical appliances using android application. This

uses Wi-Fi to communicate with Mobile phones. Soil moisture and temperature sensors are inserted to the farm to monitor and changes the current status of field on mobile phone. Android automatic system displays the values of the sensors continuously in an android application and on a web page and the user/ farmer can control the motor pump ON/OFF from any place, while receiving an SMS alert. Irrigation scheduling could be monitored using the Android Application.

The "smart" irrigation system involves the soil moisture sensor and temperature sensor connected to a controller and the values from these sensors are sent to an android application. The variations in temperature and soil moisture are monitored and irrigation could be controlled by the system. The soil moisture sensor senses the level of moisture content present in the irrigation field and the

temperature sensor to detect the temperature of the field. Connections from the soil moisture and temperature sensor are interfaced to the system unit which receives inputs from these sensors installed in the field and generates signal for operating the water pump. The values of the soil moisture and temperature sensor will be sent to the mobile and the farmer can switch ON/OFF the motor through his mobile. A farmer on seeing the soil moisture value going below the threshold level or if the temperature exceeds the threshold level can turn on the motor through the android application installed in the mobile. This can be kept on until the levels of moisture and temperature are optimized and then turned off.

The Solar powered Smart Irrigation System with advance in Electronic and Electric Engineering is another innovation in this platform. Electricity is conserved by using cost effective solar power and grid power which can be the answer for all energy needs. It is a suitable alternative for farmers in the present state of energy crisis. It optimizes the usage of water by reducing wastage and also reduces the labour intervention for farmers.

This smart technology wipes out the over use of water in irrigation thereby reducing the water wastage especially when irrigated in large coconut farms. One of the main advantages it offers is the convenience to the farmer as the farmer can switch on/ off the system even without being physically present in the field. The system runs by itself thus saving great deal of time. The entire palms can be precisely irrigated by a single person eliminating the labour problems where the lack of labour issues is present. The irrigation can be adjusted as per the varietal need of the palms and ensure that maximum crop productivity is obtained. The weed growth in the field is reduced to an extent as this system will not irrigate unnecessarily area of the farm.

Besides the saving in monetary value of water usage, the importance for the preservation of this natural resource justifies the adoption of smart irrigation technology by coconut growers. ■

Are coconut home gardens playing significant role in national coconut production?

An analysis of the coconut sector in Sri Lanka

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The contribution of coconuts to livelihoods and the economy of Sri Lanka is quite significant. Coconuts have contributed Rs. 108.9 Bn (US$ 609.77 Mn) in for- eign exchange in 2019, which accounted for 1% of the GDP. This sector employs approximately 135,000 people in the production and industry sectors and provides livelihood for over 700,000 people.

The coconut palm was once a major plantation crop in the humid tropics, including Sri Lanka, but is now mainly and widely cultivated by the smallholders. At least 96% of the total world coconut production comes from smallholdings. The total extent of coconut in Sri Lanka at present is 443,538 ha. According to census and statistics published by the Central Bank (2014), the smallholding sector in Sri Lanka occupies 83.7% of coconut cultivating lands signi- fying the important role played by the smallholder sector in national coconut production. The small- holding sector is defined as coconut holdings of size below 20 acres (8.1 hectares). This includes home gardens where coconut palms are scattered.

Of the total districts cultivating coconuts, three dis- tricts namely Kurunagala, Puttalam and Gampaha lead in coconut cultivation, accounting for more than 70% of coconut lands in the country (Figure 1). These are the districts that contribute most to the national coconut production (Figure 2).

The Table 1 shows the extent (ac) under coconut, by district and sectors in 2014 and the Table 2 shows

Table 1. Extent (ac) under Coconut by Districts and Sectors- 2014 (source: Central Bank Report 2014)

District	2014			
	Total extent (Ac)	Small Holding Sector (Ac)	% Small Holding Sector	Estate Sector (Ac)
Puttalam	186,053	141,062	75.8	44,991
Kurunegala	419,312	329,556	78.6	89,756
Gampaha	133,551	115,957	86.8	17,595
Sri Lanka	1,095,983	917,345	83.7	178,638

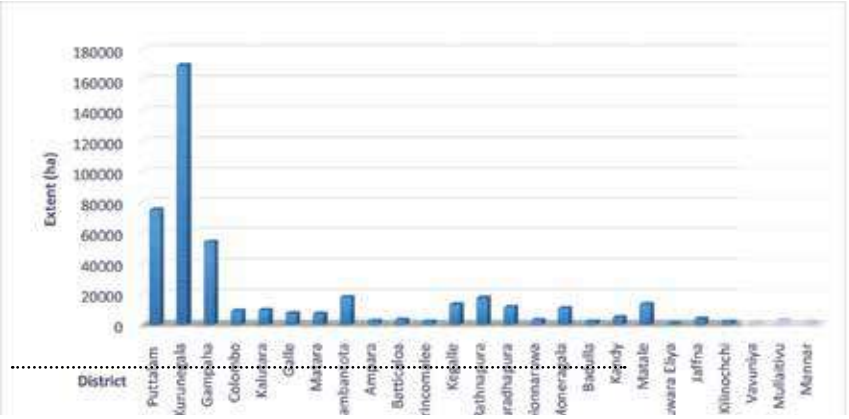


Figure 1. Coconut extent in ha in district wise *(Source: Census & Statistics, 2014)*

the number of scattered coconut trees and their estimated extent in acres in smallholding sector by district and sector wise. For the estimation of extents under scattered trees, the number of trees per acre was taken as 64. The scattered trees in the smallholding sector are mostly confined to home gardens and accounts for 64.6% out of total of 83.7% smallholding sector in extent. Of this 64.6% of home gardens, 41.13% is in three major coco- nut growing districts; Puttalam, Kurunagala and Gampaha, majority being in the Kurunagala district. The rest 23.47% home gardens are in all the other coconut growing districts.

The balance 19.1% (83.7%-64.6% = 19.1%) smallholding sector seemed to be the organized smallholders with systematically planted coconut. The increase in home gardens in Sri Lanka is noticeable during past many years, undoubtedly as a result of the high rate of coconut land fragmentation for land sales as well as for property sharing among children. From this data analysis, it is evident that in coconut home gardens, in other words the scattered trees, play a significant role in the coconut production in Sri Lanka.

It appears that much attention and extension work has not been concentrated on to this category may be due to the prioritization of the other categories such as the estate sector and the organized smallholding sector. In this home garden category, by experience, the writer is certain of that coconut is grown as part of the home gardens primarily for consumption and not with a major income gen- erating intension as in the case of tea small home gardens. If there is surplus coconut, they are sold to the village coconut buyer finally ending up in the coconut industries. Therefore, management of those scattered coconut trees in home gardens is minimal. Coconut extension service does not seem to reach much of this category and thus coconut is surviving in many home gardens without the application of fertilizer and conservation of soil moisture.

The coconut industry in Sri Lanka has, at present, reached a transitionary stage, since an increasing demand for both processed coconut products and fresh nuts has generated in the international market. The world demand for high-priced coconut high-value products is increasing at an exponential rate (Figure 3). This shows that the market for coconut high-value products is huge and growers and manufactures have the opportunity to increase their incomes and bring higher foreign exchange from coconut to the country. However, the current annual national production of coconuts in Sri Lanka varies at a low level between 2,450 and 3,000 million nuts. For example, during the period 2015 to 2019, coconut yields depended heavily on climatic factors, particularly on the amount and distribution of rainfall as coconut is a rain-fed crop.

A deficit in soil moisture adversely affects the growth of different parts of the coconut tree in

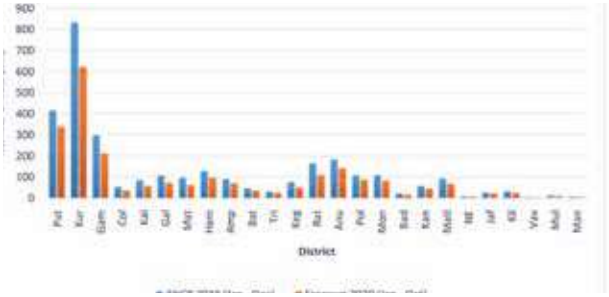


Figure 2. National coconut production district-wise (Mn nuts) (Source: CRI)

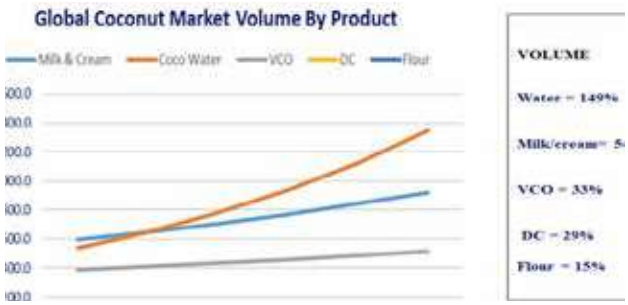


Figure 3. Demand for coconut high-value products (Source: International Coconut Community)

Table 2. Number of scattered coconut trees and estimated extent in acres (ac) in smallholding sector under coconut by district wise- 2014 (Transformed data from Central Bank Report 2014)

District	Number of scattered trees		Total No. of scattered trees % Small Holding Sector	Estimated Extent in scat- tered trees Estate Sector (Ac)	Estimated extent as % (district wise and national wise	% against total extent of coconut land (Cumulative)
	Holdings ¼ Acre and below	Holdings above ¼ Acre				
Puttalam	323,133	6,606,858	6,929,991	108,281	9.87	
Kurunegala	470,471	15,666,011	16,136,482	252,132	23	32.87
Gampaha	793,374	5,002,692	5,796,066	90,563	8.26	41.13
Sri Lanka	5,377,927	39,938,192	45,316,119	708,064	64.6	64.6
(Country total coconut extent- 1,095,993ac)						

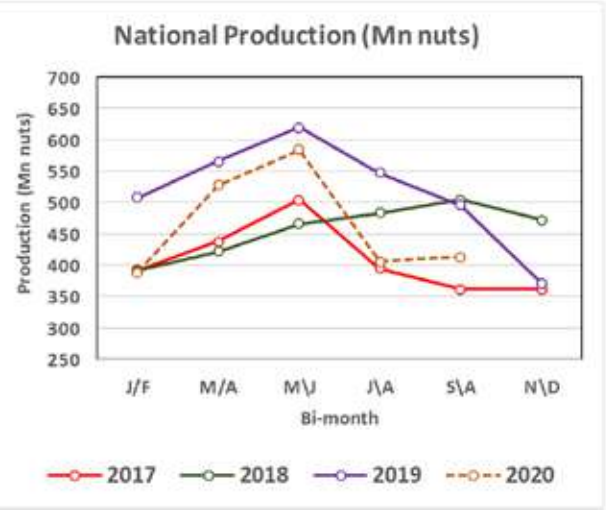
varying degrees, also adversely affecting productivity to a considerable extent. Soil moisture availability influences inflorescence initiation, female flower development, abortion of spadices, delay in opening of spathes, shedding of button nuts and immature nut fall and furthermore reduction in size of developing nuts and cracking of coconut shells resulting in undeveloped kernel. for example, due to the severe drought in the year 2016, the coconut production was declined by 396 Mn nuts in 2017 when comparing with the previous year 2016 (Table 3).

During the lean production years, mainly attributed to droughts, the coconut industry suffers heavily because of a shortage of nuts and as a result, high farmgate nut prices, making their processed products less competitive in the international market. During the same time, the consumers also suffer from high price of nuts in the open local market. Since about 70% of the total coconut production in Sri Lanka is locally consumed, unlike in Indonesia and the Philippines, the price of coconut is positively associated with national coconut production in Sri Lanka (Figure 4).

The actual industry and local consumption need

of coconut as fresh nuts and oil, has been estimated to be about 3,795 million (Figure 5) to cater to the ever-increasing demand for coconut in the local and international markets. According to statistics, the local coconut oil industry has the capacity to produce about 80,000 Mt of coconut oil per year, but due to a shortage of nuts, the result of low national coconut production, average coconut oil production has been limited to about 40,000-45,000 Mt per year.

These are shortage of about 35,000 to 40,000 Mt of coconut oil within the country. Imported Palm



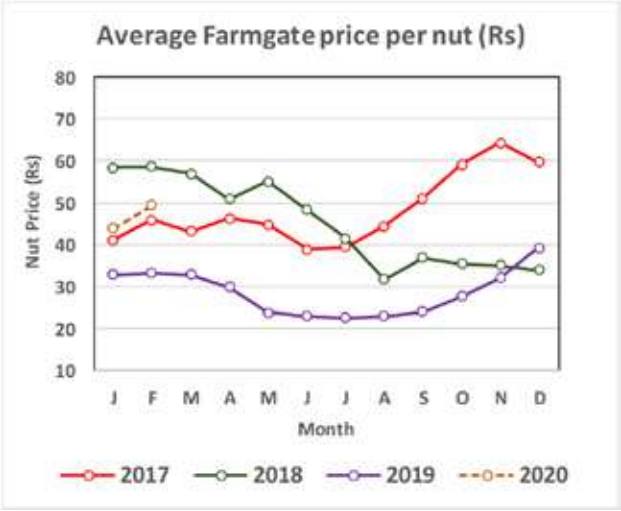


Figure 4. Fluctuations in national coconut production and farm-gate coconut price (Source: CRI)

Table 3. Bimonthly and annual national coconut production in Mn nuts from 2015 to 2019 (Source: CRI)

	2015	2016	2017	2018	2019
January/ February	414.2	439.1	391.5	390.9	508.0
March/April	394.0	513.2	438.1	421.4	565.8
May/June	613.4	586.8	503.4	465.6	619.1
July/August	609.8	539.2	394.7	482.8	547.6
September/ October	536.8	436.9	361.7	504.4	495.2
November/ December	458.7	330.1	360.7	471.7	370.8
Total	3027	2846	2450	2737	3107

Oil and other edible oils are used as substitutes for coconut oil for direct consumption and for other industries such as soap, margarine and confectionary industries.

According to statistics, around 180,000 to 250,000 Mt of edible oils have been imported to the country annually over the past three years (Table 4) both for consumption as well as for industrial usage.

Hence there is a need to increase coconut produc- tion and more essentially, lessen the year to year yield variation in the country by increasing the production from the existing coconut cultivations as a short/medium term measure as well as by new planting as a long-term strategy.

To sustain the yield of an existing bearing coconut tree, it is necessary to have a campaign to promote recommended agricultural practices such as nutrient management in the form of either use of organic or inorganic fertilizer in correct quantities, the correct method of application at the correct time as well as by providing or conserving required moisture during rain free periods. In that respect, home gardens can play a dynamic role, as at present the estate sector and medium scale planting sector are already, to a certain extent, apply the necessary management practices since their lands are run as income generating units. Two diagnostic surveys carried out by CRI have also identified that even during the period of operation of the government fertilizer subsidy scheme, only less than 30% of the coconut lands have been fertilized.

It is the home gardens that were not applying fertilizer due to various reasons, most probably due to not being aware of the need of fertilizer to sustain coconut yields from the coconut tree.

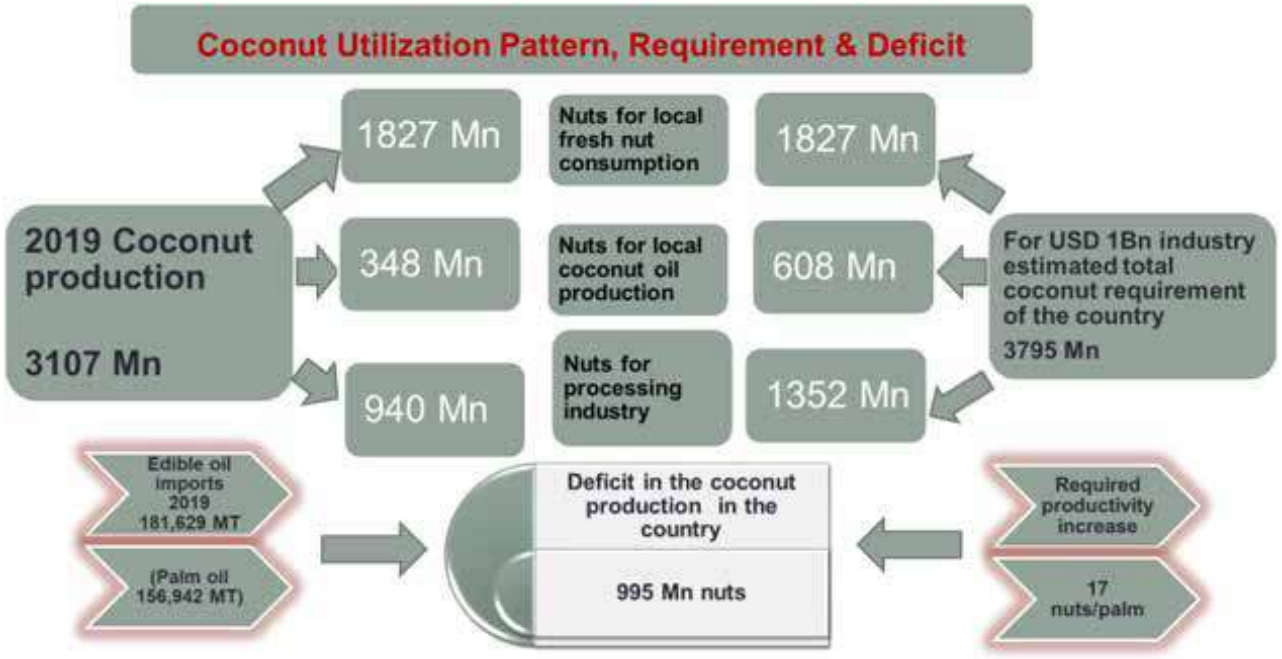


Table 4. Coconut oil production and other edible oil imports (MT) (Source: CDA)

	2013	2014	2015	2016	2017	2018	2019
Coconut oil	45,208	45,268	52,790	49,567	12,784	10,913	44,648
Other edible oil	156,657	162,766	164,102	108,192	229,632	232,802	181,629

Table 5. Nutrient removed (loss) from the soil (Kg/ha/year) by harvesting coconuts (Source: CRI)

Component of the nuts	N	P	K	Mg
Kernel	46.07	6.38	24.25	3.67
Husk	24.52	2.67	146.56	5.72
Nut water	0.73	0.3	7.59	0.28
Shell	4.21	0.28	7.16	0.46
Total	75.53	9.63	185.56	10.13

N: Nitrogen, P: Phosphorus, K: Potassium, Mg: Magnesium

As the income gained by selling spare nuts from the home gardens are not considered as very important income for the family by the home garden owners, a different and effective extension approach needs to be introduced to them to motivate them to manage coconut in their home gardens. Thus, it is proposed that coconut extension programs should be more expanded towards the home gardens which are not managed well with regular application of fertilizer and soil moisture conservation methods, although those units appear to represent one of the major fractions of coconut cultivation.

Fertilizer may not be easily accessible to home gardens and not being available in small pack- aging, may also be some of the reasons for not applying fertilizer in home gardens. Currently fer- tilizer is only available as a minimum of 50 kg size bag. This is where the intervention of the coconut extension services should come in and play a big role by educating the owners of home gardens and making necessary agriculture services easily accessible to them.

The basic approach of the management of coconut is the effective management of water and nutrient. Mulching the manure circle (2m around the palm) of the coconut palm is a simple, low cost but effective recommended soil moisture conservation practice in many coconut growing countries for stable coconut yield during rain free period by mainly preventing loss of soil moisture by evaporation. In Sri Lanka during a prolong drought in 2016, it was very clearly observed that the coconut farms with coconut trees properly mulched and added with husk pits were the least affected by the drought. In order to conserve soil moisture around coconut trees in home gardens without any additional cost, mulch- ing the trees with various types of organic materials freely available in-home gardens can be effectively used. Materials such as coconut fronds, coconut spathes, coconut bunch stalks, coconut husks, tree lopping, banana chunks, home garden sweepings (dried fallen leaves), organic household waste and weed trash can be used for mulching in home gardens. These are usually collected and burnt in many home gardens to keep the home garden land- scape clean and nice looking. Fallen coconut fronds should be cut into a few pieces and placed loosely in layers around two-meter circle from the coconut tree base, leaving one foot from the base. Similarly, coconut husk can be arranged around the tree. Coconut husk is rich in K nutrient, so they provide K nutrient to the soil as an additional service. In home gardens, a combination of those materials can be used for this purpose.

Mulching with organic materials not only prevents loss of moisture from the soil, but also reduces soil tem- perature, incorporate organic matter to improve the soil physical characters after decomposition which again helps to improve soil moisture retention and nutrient holding capacity, add nutrients by decomposing the organic materials, improve activities of earthworms and favorable soil microorganisms creating a better environment around the tree to facilitate proper root growth and avoid weed growth. The first mulch and upgrading the mulch should be done when the soil is wet preferably before the end of rainy season for effective conservation of soil moisture, but progression of the mulch can be done at any time.

Mulching is basically a practice to conserve soil moisture although it has lots of other benefits as described above. However, mulching alone cannot improve entirely the productivity of a coconut tree to its potential yield. It requires balance N, P, K nutrients mainly and Mg in addition in Sri Lankan condition. Hence recommended coconut fertilizer mixtures either in the form of organic or inorganic at their right dose at right time needs to be added to a coconut tree annually to supplement the nutrient loss from coconut palm (Table 5). In addition, 1 Kg of Dolomite is recommended to be applied along with fertilizer to supply Mg in Sri Lanka. Application of fertilizer needs to be done when the soil is moist preferably immediately after the intense rains in the rainy season.

Extension workers need to take this message; the need and importance of adding fertilizer and mulch to each coconut palm as per the recommendation in the home gardens and elsewhere to achieve higher and stable nut yield. Increased coconut yield will help the coconut industrialists to achieve higher foreign exchange income from the coconut sector. An increase in the productivity of coconuts in the home gardens, which appears as one of the major fractions of coconut cultivation, not only it will help narrow down the coconut shortage in the country, but also improve the income of households. *Reproduced from: Cocoinfo International Vol. No. 27, No.1 2020.* ■

CDB to collaborate with Lakshadweep Administration for strengthening coconut processing sector

With the objective to plan activities for strengthening coconut processing sector in U.T. of Lakshadweep, a meeting was held with the officers of Union Territory (UT) of Lakshadweep at Coconut Development Board, Kochi on 1st February 2021 under the Chairmanship of Shri. Damodar AT, IFS, Secretary of Departments of Environment & Forest, Animal Husbandry, and Labour Employment & Training, U.T.of Lakshadweep.

Shri. R Madhu, Secretary, Coconut Development Board welcomed the officers. Shri. Damodar AT, IFS, spoke on the need for close cooperation between CDB and Union Administration of Lakshadweep for the integrated development of coconut sector in Lakshadweep Islands. Since various products of Lakshadweep are certified as organic, Lakshadweep is aiming for the marketing of niche and premium products with specific organic branding.

Shri. Pramod P Kurian, Assistant Director (Dev.) made a presentation on coconut scenario in the U.T of Lakshadweep, schemes of Coconut Development Board and value addition in coconut.

Detailed discussions were held and it was decided that in order to promote Virgin Coconut Oil (VCO) production sector in Lakshadweep, a precise model exclusively for 'Lakshadweep Organic' VCO may be drafted by the Board. For the socio economic upliftment of the farmers through productivity improvement, cost reduction, efficient collective marketing and processing and product diversification, Farmer Producer Organisations (FPOs) may be formed in Lakshadweep in consultation with CDB. For maximizing the coconut utilization in the U.T.of Lakshadweep, byproduct processing sector shall also be strengthened. Processed products like Coconut Vinegar, Testa oil, Defatted Desiccated coconut etc. shall also be included in the DPR for VCO production unit. It is observed that the Lakshadweep is having potential for Neera and Organic Neera Sugar production, which shall be explored. Information on state of the art technologies for harvesting , coconut climbing machines etc. may be provided by the Board.

Dr. Mohammed Koya K, Scientist in Charge, ICAR-KVK, Lakshadweep, Shri. Ubaidulla K.P. , Officer, Marketing & PRO, LDCL and Shri. Aboosalih P, Factory Co-ordinator LDCL, Shri. K.S. Sebastian, Assistant Director (Mkg.), CDB, Shri. Sabareenathan P, Finance Officer, CDB, Smt. Deepthi R and Smt. Shanithamol Z, Technical Officers, CDB also attended the meeting.

Shri. R Madhu, Secretary, CDB hoisting the National flag during the Republic Day celebration at CDB, HQ premises.

Farmers' Field day Training Programmes on Coconut Cultivation Technology

CDB, RO, Guwahati

Coconut Development Board, Regional Office, Guwahati organized a Farmer's Field day programme on scientific coconut cultivation technology on 4th February 2021 at Gohpur in collaboration with Sub Divisional Agricultural Office, Gohpur, Biswanath. Shri Gopal Das, Argri. Inspector, Sub divisional agricultural office, Gohpur, Biswanath welcomed the guests and 20 farmers participated in the programme.

Shri Kaustabha Kt. Pandit, SDAO,Gohpur, Biswanath explained about scientific coconut cultivation technologies, water management and soil conservation methods and also explained about processing and value addition of coconut, coconut disease and pest management. Shri Mridul Talukdar, H.A, CDB, RO, Guwahati explained about the activities of the Coconut Development Board and also explained CDB's scheme, activities, training programmes etc.

During interaction with farmers, suitable answers were given to the queries on coconut plantation, plant protection etc.After the training programme field visit was done in one of the best farm and Shri Kaustabha Kt. Pandit, SDAO, Gohpur briefed on coconut plantation and explained them how to maintain the coconut palm and how to protect the coconut palms from affecting disease during the field visit programme.

Coconut Development Board, Regional Office, Guwahati organized another Farmer's Field day programme on scientific coconut cultivation technology on 12th February 2021 at Chengdoi village in collaboration with Krishi Vigyan Kendra, Nalbari. Shri Homeswar Mazumdar, SMS (Horticulture), KVK Nalbari welcomed the guest and participants in the programme.

In her speech, Dr. Manoshi Chakrabarty, Head i/c of KVK, Nalbari explained the importance of coconut cultivation and value addition. She spoke on the economic values of coconut and its products and appealed the farmers to follow scientific coconut cultivation.

Smt. Panchi Rajkhowa, FA, CDB, RO-Guwahati briefed on Board's activities, training programmes and schemes for the development of coconut in North-Eastern states.

Shri Homeswar Mazumdar, SMS (Horticulture), KVK, Nalbari spoke on Scientific Coconut Cultivation technologies including nursery management, management of diseases and pests, soil conservation methods. The farmers' queries on coconut cultivation, schemes etc. were suitably replied by the experts.

As part of field day programme, the team visited Smt. Padmawati Boro's field, Chendgdoi, Nalbari 2nd best National farmer award winner of Assam and demonstrated fertilizer application of coconut palm in her field.

The programme was concluded with vote of thanks by Shri Kamal Baishya, DEO, Coconut Development Board, RO-Guwahati, 20 farmers attended the programme.

CDB, SC, Odisha

Coconut Development Board, State Centre, Odisha organized a Farmers' Field Day Training on Cultivation Technology on Coconut and Implementation of Laying of Demonstration Plot scheme on 10th February 2021 with 20 farmers of two Coconut Producers Societies- Budhijagulai CPS & Jai Bajrangabali CPS by maintaining proper social distancing and adhering to the safety measures keeping in view of the COVID-19 pandemic situation.

Dr. Rajat Kumar Pal, Deputy Director, State Centre, Odisha spoke on scientific coconut cultivation technology in brief, certain element deficiency symptoms and its effects predominantly of Boron, dosage of application of fertilizers, manure and compost as well as pest and disease control and its management. He also clarified the doubts and queries of farmers who were facing issues with

regard to coconut cultivation specifically about the management practices for the havoc created by the recent incidence of Rugose Spiralling Whitefly on coconut palms. The farmers who attended the training gained much useful insights which added to their overall knowledge about coconut cultivation.

Regional Level Webinar on Coconut Cultivation Technology

Coconut Development Board, State Centre, Odisha organized Regional Level Webinar on Cultivation Technology on Coconut on 9th February 2021 with farmers of Rayagada district who were connected through video conferencing mode from five different locations of Gunupur.

Dr.Rajat Kumar Pal, Deputy Director, State Centre, Odisha welcomed the Chief Guest, Dr. Sarat Chandra Sahoo, Prof. OUAT, Bhubaneswar. KVK Rayagada, Head, Shri Binod Jena briefed on coconut cultivation practices, palm varieties, sowing methods and irrigation which farmers found quite useful for further improvement and progress for coconut cultivation.

Dr. Sarat Chandra Sahoo, Professor & OIC,AICRP on Palms, OUAT, Bhubaneswar elaborated about the coconut cultivation technology in brief – precisely regarding the different varieties of coconut-Tall, Dwarf and Hybrid, selection of good quality mother palm, sowing method, land preparation, suitable climate, certain element deficiency symptom and its effect predominantly of Boron, dosage of application of fertilizers, manure and compost as well as pest and disease control and its management specifically for cultivation of Coconut in Odisha region. He also clarified the doubts and queries of farmers who were facing issues during coconut cultivation specifically on the management practices for the havoc created

by the recent incidence of Rugose Spiralling Whitefly on coconut palms.

The participant farmers gained useful insights and information regarding coconut cultivation technology during the interactive session of Regional Level Webinar in association with KVK,Rayagada. The programme ended with vote of thanks by Kum. Minati Majhi, CDB, State Centre, Odisha.

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Cultivation practices for coconut -March

Collection and storage of seed nuts

Continue seed nut collection from the identified mother palms. Seed nuts should be carefully harvested and properly stored to prevent drying of nut water. Wherever the ground surface is hard, harvested bunch should be lowered to the ground using a rope.

Nursery management

Continue irrigation for the seedlings in the nursery.

Weeding has to be done wherever necessary. If termite infestation is noted in the nursery drenching with chlorpyriphos (2ml chlorpyriphos in one litre of water) should be done. Spiralling white fly infestation is observed in coconut nurseries in many localities. Spraying of water on the lower surface of leaves of seedlings can be done against spiralling white fly attack.

Fertilizer application

In irrigated coconut gardens, apply one fourth of the recommended dose of chemical fertilizers to the coconut palms.

Irrigation

Irrigation has to be continued in coconut gardens. If basin irrigation method is adopted, provide irrigation once in four days @ 200 litres per palm. Drip irrigation is the ideal method of irrigation for coconut. The number of dripping points should be six for sandy soils and four for other soil types.

Moisture conservation

Scarcity of water for irrigation during the peak summer days will be a major problem in most of the

coconut growing areas. Hence, it is imperative that coconut growers judiciously use water for irrigation. Drip irrigation has to be adopted to save water. Mulching and other soil and moisture conservation practices should be adopted if not done earlier. In water scarce areas, wherever feasible, life saving/ protective irrigation has to be provided to coconut palms. Mulched materials are to be removed in the basin before giving such life saving/protective irrigation and immediately after providing irrigation the basin should be covered again with the mulching materials.

Shading

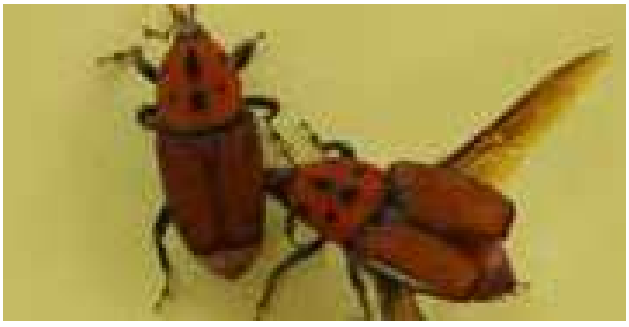
Shade has to be provided for the newly planted seedlings, if not already provided.

Management of pests and diseases

The month of March remains dry throughout, however, some summer showers at random could reduce the heat intensity and accelerate some humidity favouring outbreak of pests. The sucking pests such as whiteflies as well as coconut eriophyid mite could increase during the period. The slug caterpillar endemic regions should be strictly monitored and precautions should be carried out to prevent expansive spread by destroying pest-laden older leaves. Rugose spiralling whiteflies will find weather conditions very conducive and therefore suitable health management approaches such as nutrition and watering is very critical to upkeep proper health so as to put forward extra foliage to counter pest attack. Coconut seedlings in nurseries should be strictly monitored for rugose spiralling whitefly and nesting whiteflies. The odour plumes of deteriorating palm residues in the cyclone affected areas of Andhra Pradesh and Tamil Nadu could orient the red palm weevil for egg laying in the standalone palms for which strict monitoring is warranted. Crop residue burning on the palm basin should be avoided or it may soften trunk issues paving entry of stem bleeding and basal stem rot pathogens. March is thus known for strict monitoring days for maintaining good palm health and evading pest attack.

Red palm weevil *(Rhynchophorus ferrugineus)*

Incidences of rhinoceros beetle, would subsequently induce the invasive potential of the killer native pest, viz., the red palm weevil, which needs an injury for the weevils to orient towards the palm cue and lay eggs. Yellowing of leaves in mid whorl region, oozing of brown fluid, presence of bore holes, choking of spindle region and gnawing sound of grubs heard along the trunk are some early symptoms for timely diagnosis of pest damage. Farmers fail to detect the pest damage at an early stage due to concealed habitat of the pest. Dwarf genotypes and palms aged between 5-15 years are relatively more susceptible. All life stages of the pest were noticed inside the infested palms. Being a fatal enemy of palms, 1% action threshold has been fixed.



Adults weevils

Crown entry

Toppling of palm

▶ *Management*

- Avoiding palm injury is very critical to disorient the gravid weevils away from the field and therefore

leave out at least one metre from palm trunk when petioles are cut.

- Complete destruction of pest affected palms / crown toppled palms immediately
- Crop geometry and correct spacing is very crucial to reduce pest attack.
- Timely and targeted spot application of imidacloprid 0.002% (1 ml per litre of water) or indoxocarb 0.04% (2.5 ml per litre of water) on infested palms would kill the feeding grubs and induces recovery of palms by putting forth new spear leaf.
- Crop-habitat diversification (Ecological Bio-engineering) through coconut based cropping system strategy inciting defenders and pollinators would diffuse the palm-linked volatile cues and encouraged pest suppression. Diversified cropping system reduced pest incidence than mono-cropping.

Coconut eriophyid mite, *Aceria guerreronis*

Coconut eriophyid mite is the invasive pest reported from our country during 1998 and has been on the rise during post-winter season. It belongs to the spider family with two pairs of legs, sub-microscopic (200-250 microns size), lays about 100-150 eggs and the life cycle completed in 7-10 days. Mites infests the developng nuts immediately after pollination and are confined within the floral bracts (tepals) and feeds on the meristematic tissues beneath the perianth. Appearance of elongated white streak below the perianth is the first visible symptom. Within few days, yellow halo appears round the perianth, which turns as warts and finally develops as cracks, cuts and gummosis. Shedding of buttons, immature nuts, malformation of nuts are other indications of mite damage.

Mite damaged nuts

Mite colony

Progression of mite damage

▶ *Management*

a) Removal and destruction of dried spathes, inflorescence parts and fallen nuts to subdue the pest population

b) Spraying 2% neem-garlic emulsion or azadirachtin 10000 ppm @0.004% or root feeding with neem formulation containing azadirachtin 10000 ppm at 10 ml with equal volume of water three times during March-April, October-November and December –January is recommended.

c) Application of talc-based preparation of acaropathogen, Hirsutella thompsonii@ 20 g / litre/ palm containing 1.6 x 108cfu three times in synergy with neem formulation.

d) Kalpaharitha (a selection from Kulasekharam Tall) was found field tolerant to mite damage.

e) Application of recommended dose of fertilizers, recycling of biomass, raising of green manure crops in palm basin and incorporation during flowering, summer irrigation including soil and water conservation measures improve the palm health and reduce the pest attack.

Rugose Spiralling Whitefly (*Aleurodicus rugioperculatus)*

This period could also witness the establishment of the invasive rugose spiralling whitefly (Aleurodicus rugioperculatus) in new areas as well as re-emergence in already reported areas. The pest population is increasing very high due to favourable weather factors of high day temperature and fall in relative humidity. Presence of whitefly colonies on the under surface of palm leaflets and appearance of black coloured sooty mould deposits on the upper surface of palm leaflets are characteristic visual symptoms of pest attack. In severe cases, advancement in senescence and drying of old leaflets was observed. Leaflets, petioles and nuts were also attacked by the whitefly pest and a wide array of host plants including banana, bird of paradise, Heliconia sp. were also reported. Continuous feeding by whiteflies cause health deterioration in palms for which agronomic care is very critical.

▶ *Management*

- In juvenile palms, spraying of water with jet speed could dislodge the whitefly and reduce the feeding as well as breeding potential of the pest.
- Ensure good nutrition based on soil-test recommendations and adequate watering to improve the health of juvenile and adult palms. Agronomic health management of palms is very crucial including

planting of intercrops wherever possible to diversify volatile cues and improve microclimate disfavouring flare up of whitefly.

- No insecticide should be used as this causes resurgence of the pest and complete kill of the natural aphelinid parasitoid, *Encarsia guadeloupae.* A pesticide holiday approach is advocated for the build up of the parasitoid.
- Installation of yellow sticky traps and conservatory biological control using *E. guadeloupae* could reduce the pest incidence by 70% and enhance parasitism by 80%.
- Habitat preservation of the sooty mould scavenger beetle, *Leiochrinus nilgirianus* could eat away all the sooty moulds deposited on palm leaflets and cleanse them reviving the photosynthetic efficiency of palms.
- A close scrutiny should be made for the presence of other whiteflies including the nesting whiteflies on coconut system.

Nesting whiteflies *(Paraleyrodes bondari and Paraleyrodesminei)*

In addition to the rugose spiralling whitefly, two more nesting whiteflies (Paraleyrodes bondari and Paraleyrodes minei) are found associated with palm leaflets. Nesting whiteflies are smaller in size (1.1 mm) than rugose spiralling whitefly (2.5 mm). The nymphs are flatter with fibreglass like strands emerging form dorsum whereas the nymphs of rugose spiralling whitefly are convex in shape. Adult nesting whiteflies construct bird's nest like brooding chamber and sustains in the chamber. P. bondari had X-shaped oblique black marking on wings with two minute projections on rod shaped male genitalia whereas P.minei is devoid of black markings on wings and possesses cock-head like genitalia. Nesting whiteflies compete with rugose spiralling whitefly and reduce the aggressiveness of rugose spiralling whitefly in many cases.

▶ *Management*

- In juvenile palms, spraying of water with jet speed could dislodge the whitefly and reduce the feeding as well as breeding potential of the pest.
- Ensure good nutrition and adequate watering to improve the health of juvenile and adult palms
- Effective nitidulid predators belonging to Cybocephalus sp. were observed on the palm system and pesticide holiday is advised for conservation biological control.

Slug caterpillars *(Darna nararia)*

Emergence of slug caterpillar, Darna nararia is East Godavari district, Andhra Pradesh and Tumkur, Karnataka could happen as this period is quite conducive for the population build up especially on coconut palms planted along the river beds and brackish water zones. Several hundreds of caterpillars would congregate and feed from under surface of palm leaflets, causing glistening spots and in synergy with grey leaf blight disease complete scorching of leaflets could be observed. In severe cases, complete defoliation was realized and only midribs will be spared. High temperature and cool weather could be one of the triggering factors.

Slug caterpillar infested field

Mature caterpillars on palm leaflet

Management

- Complete destruction of affected palm leaflets with caterpillar at early stages of infestation should be made immediately so that the pest build up is suppressed. Care should be taken as the caterpillars cause extreme itching when contacted with human

skin due to the presence of poisonous scoli.

- Establishment of light traps and spraying *Bacillus thuringiensis* 5 g/litre was found effective along with inundative biological control using the eulophid larval parasitoid, Pediobius imbrues.

Stem bleeding *(Thielaviopsis (Ceratocystis) paradoxa)*

This disease is mostly confined in the acid soils of Kerala and becomes quite explicit during the period. Conspicuous exudation of reddish-brown gummy fluid is visible on the trunk which turns black on drying. It could be observed initially as small bleeding patch along the longitudinal crack, which later coalesce and form extensive lesion. The tissues underneath show tremendous discoloration and decay subsequently. In advanced stage of infection, outer whorls of leaves turns yellow, dry and shed prematurely affecting the overall health of the palm. Invasion by scolytid beetles such as Diocalandra and Xyleborus would further weaken the stem.

Management

- Avoid burning of trash and palm residues near the trunk to avoid trunk/root injury
- Adequate irrigation and adoption of soil and water conservation measures is advised.
- Application of 5 kg of neem cake enriched with Trichoderma harzianum and soil test based nutrition.
- Application of paste of Trichoderma harzianum talc formulation on the bleeding patches on the trunk was also found effective in preventing the spread of stem bleeding.

Basal stem rot disease *(Ganoderma spp.)*

It is a destructive disease observed in all coconut growing regions and found very severe in soils with higher pH and moisture stress condition. The pathogen invades the root system during early stages of infection that are not visibly noticed. The disease is very severe in areas of Thanjavur, Tamil Nadu, parts of East Godavari, Andhra Pradesh and Arsikara, Karanataka. The outer whorl of leaves turn yellowish, then gradually become brown and droop from their point of attachment and hang vertically downwards to form a skirt around the trunk apex. In course of time, the apex of the trunk shows tapering with the advancement of the disease, and bleeding symptoms may appear on the bole region. At the base of the stem a characteristic reddish brown discoloration develops, accompanied by the exudation of a brown viscous gummy substance. These brownish patches

Basal stem rot disease

Bracket fungus

may extend up to one metre from ground level and at times bark pealing was also observed. Sometimes fruiting bodies (basidiocarp) of the pathogen develop from the affected trunk.

Management

- Avoid burning of trash and palm residues near the trunk to avoid trunk/root injury
- Removal of dead palms and palms in advanced stage of the disease as well as destruction of the boles and root bits of the diseased palms to remove disease inoculums.
- Isolation of neighboring healthy palms, by digging isolation trenches (60 cm deep and 30 cm wide) around the affected palm (1.2 m away from the base of the trunk).
- Application of neem cake (5 kg) fortified with Trichoderma harzianum (CPTD 28) talc formulation (50 g) per palm per year at six monthly intervals reduced the disease intensity.
- Root feeding of hexaconazole @ 2% (100 ml solution per palm) and soil drenching with 0.2 % hexaconazole or with 40 l of 1% Bordeaux mixture in the coconut basin are recommended

Hence, sustained monitoring and prophylactic treatments would suppress the damage potential of pest and disease and suitable health management strategies need to be adopted at the appropriate time. Timely pest management strategies has to be implemented in March to upkeep sound palm health for ensuring sustained production and keep away from pest and disease infections.

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

Market Review – January 2021

Domestic Price

Coconut Oil

During the month of January 2021 the price of coconut oil opened at Rs. 20100 per quintal at Kochi and Rs. 20100 per quintal at Alappuzha market and Rs. 22000 per quintal at Kozhikode market. The price of coconut oil at Kochi,Alappuzha and Kozhikode market expressed a slight downward trend.

The price of coconut oil closed at Rs. 19800 per quintal at Kochi and Rs. 19700 per quintal at Alappuzha market and Rs. 21800 per quintal at Kozhikode market with a net loss of Rs.300 at Kochi and Rs.400 at Alappuzha and Rs.200 per quintal at Kozhikode market.

The prices of coconut oil at Kangayam market in Tamilnadu, which opened at Rs. 18333 per quintal and it expressed a mixed trend during the month and closed at Rs. 18000 with a net loss of Rs. 333 per quintal.

Weekly price of coconut oil at major markets Rs/Quintal)				
	Kochi	Alappuzha	Kozhikode	Kangayam
01.01.2021	20100	20100	22000	18333
09.01.2021	19900	19900	22000	18133
16.01.2021	19750	19750	21800	NR
23.01.2021	19800	19850	21800	17933
30.01.2021	19800	19700	21800	18000

Milling copra

During the month, the price of milling copra opened at Rs.13150 per quintal at Kochi and Rs.13150 per quintal at Alappuzha market and Rs. 13850 per quintal at Kozhikode market.

The prices of milling copra closed at Rs. 13000 per quintal at Kochi and Rs. 12850 per quintal at Alappuzha market and Rs. 13750 per quintal at Kozhikode market with a net loss of Rs.150 at Kochi and Rs.300 at Alappuzha and Rs.100 per quintal at Kozhikode market.

*NR-Not reported *NQ-Not quoted

At Kangayam market in Tamilnadu, the prices opened at Rs. 11900 per quintal and closed at the same price.

Weekly price of Milling Copra at major markets (Rs/Quintal)				
	Kochi	Alappuzha (Rasi Copra)	Kozhikode	Kan-gayam
01.01.2021	13150	13150	13850	11900
09.01.2021	13050	12950	13700	11800
16.01.2021	12950	12900	13650	NR
23.01.2021	13000	12900	13700	11900
30.01.2021	13000	12850	13750	11900

Edible copra

The price of Rajpur copra at Kozhikode market opened at Rs. 16500 and closed at Rs.15200 per quintal with a net loss of Rs.1300 per quintal.

Weekly price of edible copra at Kozhikode market (Rs/Quintal)	
01.01.2021	16500
09.01.2021	16000
16.01.2021	15800
23.01.2021	15700
30.01.2021	15200

Ball copra

The price of ball copra at Tiptur market opened at Rs. 14679 per quintal and closed at Rs.14000 per quintal with a net loss of Rs.679 per quintal.

Weekly price of Ball copra at major markets in Karnataka (Rs/Quintal)	
01.01.2021	14679
09.01.2021	14400
16.01.2021	14785
23.01.2021	14000
30.01.2021	14000

Dry coconut

At Kozhikode market, the price of dry coconut opened at Rs.12250 per quintal and expressed a downward trend during the month. The prices closed at Rs.11750 per quintal with a net loss of Rs.500 per quintal during the month.

Weekly price of Dry Coconut at Kozhikode market (Rs/Quintal)	
01.01.2021	12250
09.01.2021	12350
16.01.2021	12150
23.01.2021	11950
30.01.2021	11750

Coconut

At Nedumangad market in Kerala, the price of coconut opened at Rs.20000 per thousand nuts and closed at Rs. 21000 during the month with a net gain of Rs. 1000 per thousand nuts.

At Bangalore market, the price of coconut opened at Rs.22500 per thousand nuts and closed at Rs. 25000 per thousand nuts.

Weekly price of coconut at major markets (Rs /1000 coconuts)				
	Nedumangad	Pollachi	Manglore	Banglore
01.01.2021	20000	NR	29000	22500
09.01.2021	20000	17000	NR	NR
16.01.2021	20000	NR	NR	27500
23.01.2021	21000	17000	NR	NR
30.01.2021	21000	NR	NR	25000

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*
02.01.2021	199	215	NR	521
09.01.2021	201	227	NR	521
16.01.2021	240	227	NR	NR
23.01.2021	244	234	NR	536
30.01.2021	245	231	NR	NR
*Pollachi market				

Coconut Oil

International price of coconut oil expressed a mixed trend during the month. However domestic price of Indonesia expressed a downward trend and Sri Lanka expressed an upward trend 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	Indo-nesia	Sri lanka	India*
02.01.2021	1488	NR	1400	2581	2518
09.01.2021	1511	NR	1410	2684	2491
16.01.2021	1500	NR	1388	2684	NR
23.01.2021	1378	NR	1286	2702	2463
30.01.2021	1381	NR	1368	2715	2472
* Kangayam					

Copra

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

Weekly International price of copra in major copra producing countries				
Date	Domestic Price (US$/MT)			
	Philippines	Indonesia	Srilanka	India* * Kangayam
02.01.2021	937	867	1514	1635
09.01.2021	951	873	1530	1621
16.01.2021	957	854	1415	NR
23.01.2021	898	771	1518	1637
30.01.2021	871	803	1555	1635

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