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## Message from the Chairman's Desk



Dear friends,

We are into the last month of the year with 2018 bidding good bye. A new year is on the threshold of birth. As I put pen to paper, I feel like a boat drawn on the beach listening to the dance – music of a joyous ride and am reminded of the famous dictum, “A new year is like a blank book and the pen is in your hands. It is your chance to write a beautiful story to yourself.” This is a time for each one of us to have thoughts of what has passed or was left behind and plan for what is to come, a time for new resolutions to be made and horizons to be conquered. December is also a month full of festivities, a month filled with love and humanity. It is a rare occasion where two festivities –Christmas and New Year - come together in succession and are celebrated by one and all, across the globe.

The history of the world is always narrated as tales of conflict between virtue and vice. Whenever the powers of evil take over goodness, history always reminds us that the ultimate victory will only be for goodness. The month of December is also a reminiscence of the ultimate victory of virtue - the birth of Jesus Christ. On a cold winter's night, full of darkness, our king was born. Songs of celebration were sung in heaven, warmth descended on the earth and darkness was turned to light. 'Peace on earth to the good hearted' is the message with which Jesus Christ was born in a stable. In the pitch dark sky of Bethlehem a shiny star was shone and a ray of love flickered, when the Messiah was born. This Christmas as we celebrate His birth, may light shine in our dark lives and may the ray of love flicker in us. At a time when the whole world has to stand together to fight the man made threats of global warming and climate change, when territorial acquisitions are on not only on land but also on seas, it is the message of peace and the feeling of oneness in mankind that alone will lead the world to prosperity.

The festival of Peace is followed with New Year celebrations. Every end marks a new beginning. Keep your spirits and determination unshaken and you shall always walk the glory road- with courage and faith, and armed with effort, victory will be yours. A new year brings in new hopes, dreams and aspirations. It is a time of togetherness wherein family members, relatives and friends meet together and exchange gifts. The flavor of food, the sound of children playing and the music makes the atmosphere lively and vibrant.

Christmas and New Year are excellent occasions for demonstration of culinary skills too. While celebrating Christmas, let us make coconut and its various products a part of the festivities. Let our banquet tables be rich with the goodness of coconut, coconut oil and various other coconut based products. Coconut is the main ingredient of Christmas dishes in many other countries where Kalpavriksha is not even grown. In countries like the United States, sweets made of coconut milk are the most sought after product during Christmas season. So Delicious, an American company which produces nearly 52 various items from coconut milk which is gluten free, fat free and soya free has embarked on this venture based on the realization that people of United States and Europe are switching away from gluten rich foods.

December is also the time when the winter peaks and snow falls. It is a time when coconut products are in high demand. Products like coconut oil, virgin coconut oil and copra help in maintaining the softness and smoothness of the skin. Lip balms based on VCO provide relief from chapped or dry lips and dry hair. Sale of edible copra in boat shapes is a regular sight during winter in North India. Moisturizers, hand creams, face creams etc containing virgin coconut oil are in good demand in the market during the season. Major pilgrim centers like Sabarimala are also having great demand for coconut oil and coconut during December.

All these remind us of the virtues and goodness of coconut which we very often forget. It is time for us to take the resolution to bring back the lost glory of coconut, beginning efforts thereof from our kitchen. I call upon the whole hearted cooperation of all in bringing back the lost glory of coconut.

Let us not forget the famous quote "Culture of the mind must be subservient to the heart." For dynasties will rise and fall, kingdoms will come and fade away. But God's love to the world will never fade or fail. To quote none other than Martin Luther:

"Glory to God in highest heaven,  
Who unto man His Son hath given;  
While angels sing with tender mirth,  
A glad new year to all the earth "

A Merry Christmas and Prosperous New year to one and all.

Dr. Raju Narayana Swamy IAS  
Chairman





# **Impact of the Gaja cyclone on coconut in Tamil Nadu and actionable strategies reviving livelihood**

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## **Introduction**

Natural disaster has become a common phenomenon in the East Coast region and the recent cyclone Gaja is yet another example that has taken more than 63 human lives, several hundreds of cattle and displaced many human beings in East Coast of Tamil Nadu. A scientific team from ICAR-CPCRI conducted a rapid assessment on the damage impact of cyclone Gaja on coconut palms in particular. The cyclone Gaja crossed landfall in Tamil Nadu during the late night hours of 15<sup>th</sup> November 2018 and early wee hours of 16<sup>th</sup> November 2018 causing worrisome impact to mankind and crops in the region. Wind speed exceeding 115 kmph had in fact caused huge crop and property loss. Coconut palm which could withstand Ockhi as well as the recent flood fury in Kerala was badly

damaged due to Gaja in all affected villages in the districts of Thanjavur, Thiruvarur, Pudukkottai, Nagapatinam, Dindigul and Tiruchirapalli. However, the impact of Gaja on coconut in Tiruchirappali and Dindigul districts is insignificant. In several affected villages more than 75% of the palms were damaged and uprooted leading to complete loss of palms in the region and severely affecting the livelihood of coconut farmers.

## **About the region**

East coast region of Tamil Nadu encompasses the Cauvery delta belt where coconut is one of the predominant crops cultivated currently. The crop provides ecological and livelihood security to millions

of people in the region. Soil is found to be mainly clay-loam and sandy alluvial in nature which makes water in stagnation even under slight drizzling due to limited percolation ability of soil. Tall is the common coconut variety in the region and few hybrids are also recorded in this locality during the snap survey.

### Coconut statistics

In the East Coast of Tamil Nadu coconut has been extensively cultivated in the Cauvery delta region during the past 40 years. A major shift in cropping pattern from rice to coconut farming is mainly attributed to deficit in labour available in these regions. Because of the available good water resource coupled with adequate crop care, coconut was found to be very economical to all the farmers in the region, which accelerated area wide expansion in no time.

**Table 1. Area and production of coconut in the Gaja affected regions of Tamil Nadu (2016-17)**

Name of the district	Coconut area (Ha)	Production (lakh nuts)	Productivity (Nuts/ha)
Thanjavur	36,136	6639	18372
Thiruvarur	4718	870	18440
Pudukkottai	9456	1121	11855
Nagapatinam	3823	654	17104
Tiruchirapalli	6070	465	7661
Average productivity/ha	14,686 nuts		
Average productivity/palm	84/palm		

Source: Coconut Development Board

In the predominant Gaja affected areas of Thanjavur, Thiruvarur, Pudukkottai and Nagapatinam, the average nut productivity is found to be very higher (84 nuts /palm/year). Among the Gaja affected regions, coconut is predominantly cultivated in Thanjavur district and the loss incurred to the crop is also very high in the region.

### General observations

The team visited different villages of the cyclone Gaja affected regions and then took stock of the hefty crop loss damage. The scene was unimaginable as the sturdy crop like coconut, an ecological service provider of the coastal region worldwide was also badly damaged.

a) In the affected gardens, coconut palms were either uprooted, broken at the bole region, trunk twisted and broken off if damaged by disease or any mechanical injury, extensive twisting of crown with irrecoverable damage, crown congestion with arrest of emergence of spear leaf, partially uprooted slanting palms.

b) Juvenile palms were also twisted and become slanted by partially uprooting and in many cases the crown was badly damaged

c) Affected fields were full of fallen tree trunks and deteriorating crowns and the scene is disheartening and heartbreaking.

d) Surviving palms are also badly damaged by the sheer force of cyclonic storm resulting in nut and button fall.

e) All the dicot trees enroute Gaja was jolted by the storm with complete detachment from soil resulting in complete drying of border trees and homestead trees such as Jack in Pudukkottai district

f) The worried and bleak faces of farmers including the farm women had in fact touched hearts of the scientific team expressing their helplessness and magnanimous support seeking livelihood revival.

g) Other crops such as oil palm, maize, sugarcane were also damaged in the region

### Impact of Gaja on Coconut

a) **Uprooting of palms:** Due to the heavy velocity (115 kmph) of the cyclonic storm Gaja, the palms along the windward side had been completely uprooted which cannot be revived. The uprooted palms are fallen on the ground.

b) **Trunk breakage:** In the affected gardens many of the palms were also broken at the trunk region which were constricted by moisture stress during earlier years or at weakened spots due to damage by pests and diseases such as rhinoceros beetle damage, basal stem rot disease, etc

c) **Breakage at bole region:** Palms that are exposed in the bole region with inappropriate earthing up, are broken off at the collar region and are completely detached from the root system.

d) **Terminal region blown off:** The terminal region of certain affected palms were blown away by the high velocity wind

e) **Semi-circular breakage of terminal region:** Due to the impact of the wind and the ability of the palm to withstand the partial pressure of swirling wind, a part of the crown region is broken off.





f) **Crown twisting of palms:** The crown had been twisted especially in the juvenile palms with reduced crown weight

In vast majority of the coconut palms, where the bole with roots was visible above the ground, the coconut palms were observed to have been broken at the base of the bole, resulting in toppling of the entire palm. In addition, breakage of the stem was observed in a few coconut palms, in the affected plantations. Closer observation of the broken trunks revealed that these palms had been affected earlier by pest and disease problems, resulting in scarring/damage of the stem and under wind-induced stress, the stems tended to break at these particular weak points, resulting in toppling of the crown. Since the coconut stem has no cambium, damaged tissues of the stem are not regenerated and in the presence of physical damage to the coconut trunk, such coconut palms cannot withstand the stress of high velocity cyclone winds. However, irrespective of the type of planting and soil conditions, a few coconut palms appear to have withstood and survived the havoc caused by high velocity winds and stand testimony to the ability of coconut palms to survive high intensity cyclones accompanied by high velocity winds. In such of the retained palms, varying levels of damage to the crown, ranging from bruising of the leaves, petiole breakage, spindle leaf breakage to severe tearing of leaves, various levels of defoliation were observed. This can be attributed to the phyllotaxy of the coconut leaves, facilitating passage of high wind velocity prevailing during cyclone through the canopy, and escaping complete detopping and death of the palms.

## Recommendations

### a) Removal of debris

The fallen crown and trunk region should be

immediately disposed off. The coconut leaves can be processed for composting and can also be used as mulch in the surviving palms. However, the crown portion after defoliation inclusive of trunk could be buried to avoid insect attraction.

### b) Caring the injured palms that are recoverable

The palms that are injured and distorted which are likely to recover immediately may be protected by application of Bordeaux paste 10% so that secondary pathogens and other pests do not gain entry. In addition, health of such injured palms may be improved by supplementation with 50% dose of recommended fertilizers along with need-based micronutrients. Crown twisted juvenile palms shall be made upright and applied with Bordeaux paste at injured site.

### c) Raising of short duration pulses/vegetables

In order to have a continuous flow of income which is presently affected by the palm loss, short duration pulses/vegetables should be cultivated at the earliest utilization the available water resources. The compost generated from palm leaves could also be used as manure.

### d) Decentralized farmer participatory seedling production initiative

The need for coconut seedlings in the affected region is very enormous and supply from external agencies is a haunting task and is practically not feasible to mobilize quality coconut seedlings from far off places immediately. In order to tide over this task, a decentralized farmer participatory seedling production initiative is suggested by identification of suitable mother palms that are wind tolerant, healthy and disease-free, high-yielding in the immediate vicinity. Collection of seed nuts from such identified mother palms should be started from December-January onwards so that good quality

planting materials are made available for planting in the coming season during September-October 2019. ICAR-CPCRI in collaboration with AICRP in Palms and Department of Agriculture, KVK can empower the identified farmer groups for raising coconut nursery.

#### e) **Establishment of wind break system**

Wind break system by planting palmyrah and casurina should be invariably undertaken at all entry of points of cyclonic path in a social participatory mode taking ecology as well as environment safety as prime factors so as to reduce the impact of wind velocity in case of future natural fury by such cyclonic storm

#### f) **Scientific coconut rejuvenation**

While taking up new planting, deeper pits (1.0 m<sup>3</sup>) may be dug out for ensuring deep planting of coconut seedlings. After digging out pits of dimension 1 m x 1 m x 1 m, it shall be filled up with top soil to a height of 50 cm. The coconut seedlings are then planted in the centre of the pit by making small hole within the pits and the soil around the seedlings must be firmly pressed. Care should be taken so that the collar region of the seedlings is not filled up with soil in the planting process. Ensure slow filling of pits to facilitate vertical and horizontal penetration of roots for better anchorage and withstand wind pressure in future. After first year of planting, pits should be widened by scraping the soil around the pit with 1 m radius so that depth from surface of pit to the seedling collar region is 40 cm. In the second year, widening should be made to a radius of 1.5 m and the soil should be covered to fill the pit, leaving 30 cm from the top. Similarly third year after planting, basins should be widened to form a circular basin with a radius of 2m and to a depth of 20 cm. In regions having high water table, planting of seedlings on mounds ( at least 1 m height) formed by using the top soil excavated while making trenches is recommended.

#### g) **Wider spacing**

In cyclone prone areas, a wider spacing of at least 10 x 10 m is recommended for easy flow of wind during cyclonic storm by providing adequate leeway. This will encourage spaces for intercrops suitable for the region with crop pluralism strategy “an inch of land with a bunch of crops” making the system holistic, inclusive and providing continuous income and employment.

#### h) **Viable Crop insurance**

A viable crop insurance scheme has to be



implemented to ensure security in terms of any insurgency encountered. The existing insurance offered in this sector is very meager which needs enhancement to meet out any such disaster in future.

#### i) **Pest and disease management**

Besides complete crop loss encountered, the fallen palm trunks as well as the deteriorating palm crown would incite damage by rhinoceros beetle (*Oryctes rhinoceros*) and red palm weevil (*Rhynchophorus ferrugineus*), respectively. Aftermath of Gaja cyclonic storm, the two key pests infesting coconut palms viz., rhinoceros beetle and red palm weevil could invariably shoot up due to the available food source in the region mainly the fallen palm trunk and the deteriorating crown of palms. Close scrutiny and sustained surveillance is very critical to subdue the pest infestation in the affected region. ICAR-CPCRI has evolved effective management strategies to combat any pest outbreak in the region.

### **Rhinoceros beetle (*Oryctes rhinoceros*)**

Adult black beetle prefers the fallen coconut trunk in the affected region for egg laying as grubs feed on the decaying organic debris and coconut logs are one of the most favoured hosts. With enormous quantum of fallen palm trunk available in the cyclone affected region, a likely outbreak of rhinoceros beetle population is imminent. The decaying palm trunk would invariably attract the black beetles for oviposition in the region. Immature stages of the pest is thus a composter and adult beetles feed on the spear leaves.



### Management

1) Surviving tall as well as juvenile palms should be given prophylactic leaf axil treatment on top most three leaf axils with neem cake admixed with sand to keep away from the rhinoceros beetle incursion.

2) Injured palm trunks should be applied with coal tar or Bordeaux paste 10% to avoid secondary infection.

3) Juvenile palms can be shielded with fish net on the spear leaf region for avoiding the entry of black beetle into the leaf axils.

4) Application of Green muscardine fungus, *Metarhizium anisopliae* @ 5 x 10<sup>11</sup> / m<sup>3</sup> on the fallen palm trunks to induce epizootics in the developing grubs of rhinoceros beetle and this forms one of the eco-friendly approaches which can be successfully implemented through farmer-participatory community mode.

### Red palm weevil (*Rhynchophorus ferrugineus*)

The palm crowns that were irreversibly damaged in the cyclone mainly in the deteriorating phase at this point of time would attract egg laying by red palm weevil. Such crowns would therefore become a good breeding place for the weevils. This should be strictly monitored.

#### Management

1) Collection and destruction of palm crown by pouring kerosene to kill any live stages inside and enhance composting.

2) Taking a big pit and burying the deteriorating palm crown using a JCB so as to upkeep the farm hygiene and reducing palm odour cues.

3) Surviving palms with any injury or red palm weevil infested palms should be treated with indoxocarb @ 2.5 ml per litre to kill the immature stages of the pest immediately.

4) Encourage crop pluralism and stimulo-deterrent approach in rejuvenation with perfect geometry in homesteads

Basal stem rot disease (*Ganoderma sp.*)

Palm injury would also aggravate the incidences of basal stem rot disease which is very common in the region. Some precautions need to be made to prevent further spread of the disease in the region. These brownish patches on the stem may extend up to one metre from ground level and at times bark peeling 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

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 for the surviving palms in the cyclone affected region. ■



# 'Malai'-from the **NATURE back to NATURE -** an alternative to leather from mature coconut water

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**Using mature coconut water, which is often disposed as a waste product - Zuzana and Susmith create vegan leather- Malai for fashion and furnishings**

Vegan alternatives to leather is a novel concept and alternatives are coming up from the most unlikely sources like mushroom caps, pineapple, seaweed etc. Coconut water is the latest and novel addition to the list. Zuzana Gombosova from Slovakia and Susmith Suseelan from Kottayam, Kerala have been working on mature coconut water to create a sustainable material, named 'Malai', flexible, durable, biodegradable and water resistant alternative to leather which has naturally sparked interest at Design Festivals across the world.

Malai, is a safely biodegradable bio-composite material made from mature coconut water and natural fibres. 'Malai' refers to the creamy flesh of coconut and its water that sustains the bacteria that grows cellulose, the primary constituent of this material. One of the first of its kind in world, Malai aims to become a safer and sustainable substitute for animal leather, a product of the industry that brings high foreign exchange to India

Malai is developed by Malai Biomaterials Design Pvt Ltd, a material research and design studio based in Kerala with Zuzana Gombosova and Susmith Suseelan as Co-founders. The duo shares the process of developing Malai and the future applications of the material.

## The Beginning

Zuzana Gombosova initially started working with bacterial cellulose during her Master's degree in London. Her job as Material Researcher brought



**Malai reconciles a pure, simple philosophical approach to manufacturing with a sophisticated understanding of environmental science and technological process resulting in a product that is unique.**



her to Mumbai, India. She was keen to explore the possibility of growing bacterial cellulose in India in similar lines to the traditional 'Nata de Coco' in Phillipines where it is an important part of food industry. Susmith, is a Product Designer with background in Mechanical Engineering. A graduate from IISc Bangalore, he joined the in-house Design studio of a large manufacturing company in Mumbai, where he met Zuzana. Susmith who hails from 'the land of Coconuts' was also interested in bacterial cellulose and 'Nata De Coco'.

Zuzana and Susmith found that they shared more similar profound values, passion for craft and making as well as a concern for sustainability and the environment. Malai started as a result of their personal experiences of what it takes to produce a material. They wanted to produce healthy material that has more to offer and causes least damage to the environment. Both left their corporate jobs and focused more on material development. The first sample was developed after six months and almost 100 recipes later. The journey had the humblest beginnings with their personal savings.

### What Is Malai

Malai is a cellulose-cellulose biocomposite material which look, feel and functions similar to animal leather made primarily from coconut water and natural fibres. Malai is strong as leather and the durability of the material is better than artificial leather and is coloured using natural dyes such as indigo, madder or cutch. Seemingly a cross between leather and handmade paper, Malai can be cut, glued, stitched and embossed, and has since been used to create footwear, upholstery and accessories.

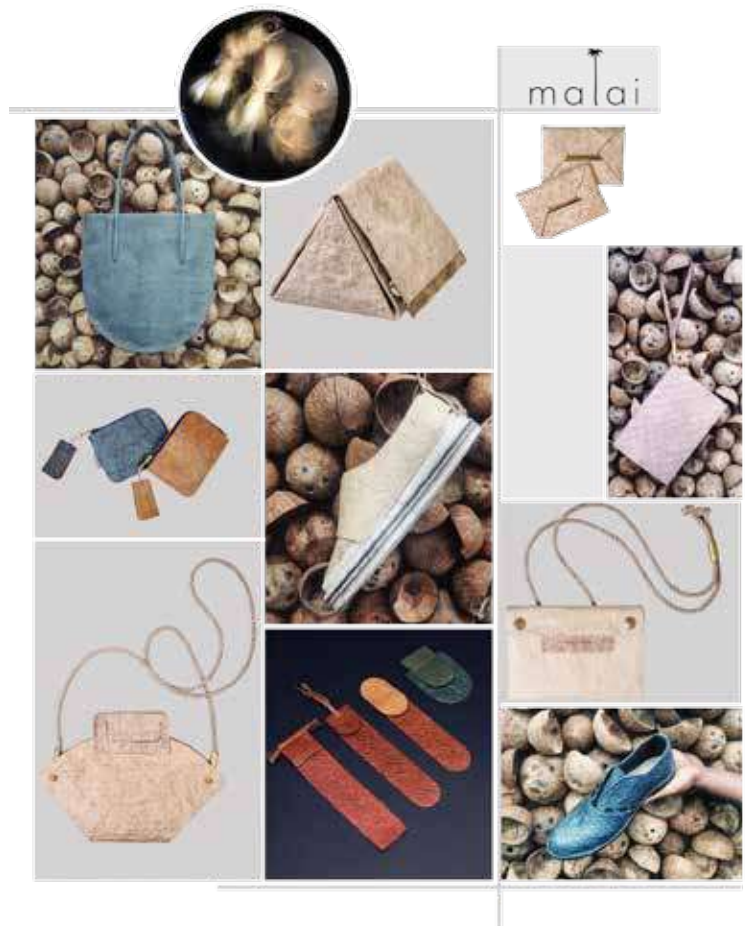
### How Is Malai Made

In the process of developing Malai, the duo discovered that using natural fibres along with bacterial cellulose can enhance the quality of the end product. The role of coconut water is to provide nutrients for bacteria while producing bacterial cellulose. This bacterial cellulose is a nano-material with a three-dimensional fibrous network and this glues together natural fibres via hydrogen bonding and physical entanglements forming the biocomposite. Starting from the raw materials, making of Malai takes 3-4 weeks depending on climatic conditions. They procure natural

fibres from banana farmers, who otherwise discard the stems after the fruit is harvested. They have listed and are exhibiting Malai in different material libraries that helped them get enquiry from manufacturers. The team constantly researches on various other aspects on how to improve the quality of the material and replace animal leather in all applications

### Future with Malai

Malai Biomaterials Design Pvt Ltd began liaising with independent Czech designers and companies to create and test products using Malai. One of the first ones to adopt Malai in their product line was 'Playbag' a company from Zlin, CZ (city of Bata) who made a wallet and hand bag. There has been a collaboration with Kazeto(CZ), traditionally known for paperboard products, especially suitcases. A biodegradable shoe, using Malai and Carfting, Plastics!, a bioplastics company, was designed by Berlin-based footwear designer Sophia Guggenberger. It was presented at Designblok Prague (a design show in the Czech Republic). TON, a traditional bent furniture brand,





### Making of Malai – the Process

Zuzana and Susmit work alongside Southern India's coconut farmers and processing units who find themselves with the much 'waste' coconut water after they've removed the harvest of white flesh from inside the mature coconuts. Normally this waste water would be released into the drainage system, but this in itself causes pollution of water and the soil to become acidified. This coconut water is sterilised resulting in an energy rich, entirely natural nutrient upon which our bacterial culture can feed. The nutrient and the culture is combined and then just let the bacteria do its thing. The fermentation period takes between twelve to fourteen days, at the end of which a sheet of cellulose 'jelly' is produced. They harvest the jelly which then undergoes a process of refinement. It is enriched with natural fibres, gums and resins to create a more durable and flexible material which may then be formed into flat sheets in a range of thicknesses and textures, or moulded seamlessly into 3D structures. A range colours can be achieved through the addition of natural dyes, if so desired. The final stages for creating Malai include leaving it to air-dry, and then softening it whilst applying gentle water-resistant treatment (without adding any plastic coatings or synthetic ingredients) ■

added Malai to one of their signature bar stool to create a striking seating option. "Two companies are currently testing Malai to create vegan watchstraps," says Zuzana, who participated at London Design Festival in September. Yoga bags and mats are next, given Malai's chemical-free nature. Associations with Indian designers are also on the cards. "Malai has a nutty smell and a leather grain but it is stiffer than leather. That could explain why it is often kneaded by hand to achieve drape and softness, a process fittingly termed the massage says Zuzana

The duo is open for collaboration with manufacturers and designers who are looking for sustainable materials for making bags, wallets, clutches, pouches, etc. At the moment, the studio is working on the next stage of development where it is being tested for footwear and furniture use.



'At Malai Biomaterials Designs, we make sustainable materials and Malai is our flagship material. For a material to be sustainable the entire lifecycle has to be sustainable. We add value to waste streams like coconut water and banana fibres, our process of making Malai is efficient and clean, it is a perfect combination of aesthetics and functionality, the material can last as long as you wish to and end of life, the material safely composts and become soil: back to where it began. This is the sustainable future". concludes Susmith. ■

[www.made-from-malai.com](http://www.made-from-malai.com)



# Farmer Producer Organizations in Plantation Sector: Issues and Challenges

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## Introduction

A Producer Organisation (PO) is defined as a legal entity formed by primary producers. The major share of producer organizations across the globe involve members drawn from viz. farmers, milk producers, fishermen, artisans, etc. Producer organisations are voluntary membership organisations of agricultural producers. They can be organised and structured as associations, societies, cooperatives, farmers groups, unions, federations, or even firms. They exist to promote the interests of farmers and to work for their economic and social benefit. Most producer organisations provide services that directly or indirectly support agricultural production ( Rondot and Collion 2001, Bijman and Wollni 2008). A PO can be a producer company, a cooperative society or any other legal form which provides for sharing of benefits among the members. Farmer Producer companies form a sub-sect of producer companies, where the members are farmers. The legal sanctity of these organizations and their institutional acceptability vary widely across the nations. However, the evidences for beneficial nature of these farmer producer organizations are now widely accepted among policy makers and farmer members alike.

The name Farmer Producer Company is an accepted nomenclature in India denoting a producer organization usually involved in agricultural production, processing and marketing. The terms used to designate closely related institutions and

farmer collectives vary across the countries. Farmer Based Organizations (FBO), Community Based Organizations (CBO), Farmer Collectives (FC), Farmer Producer Companies (FPC) and Farmer Cooperatives (FC) are some of the names which are commonly used. Whatever be the nomenclature, essentially, the FPO carries out similar functions in most of the countries. The farmer producer organizations, as a new form of farmer collective combining the elements of cooperation and commercial companies, is being promoted aggressively as a means to address the challenges faced by small holder producers. The functional presence of producer organizations is considered to be critical for smallholders, to achieve competitiveness and ultimately improve their welfare (World Bank, 2008). In fact primary producer organisations or collectives are being viewed as the only institutions which can protect small farmers from ill-effects of globalization or make them participate successfully in modern competitive markets (Trebbin and Hassler, 2012).

## Evolution of Farmer Producer Organizations: Rationale

Aggregation and collectivisation is a tried and tested strategy which has benefitted many farming communities involved in cultivation of plantation crops across the world. It helps in bringing economies of scale, bringing down the input costs, better bargaining power and magnifies the voices of farmers as collective voice. It has also played a significant role in reducing the risk in agriculture and



strengthening the livelihoods of small and marginal farmers. By organizing themselves into farmer groups and FPOs, farmers have better capacity for and access to technical knowhow on crop planning and management, inputs (including seed production), credit, post-harvest management, value addition, marketing infrastructure and better market linkages.

The most common form of collectivisation that farmers have adopted across geographies involves some form of cooperative institutions and Self Help mechanisms and Joint Liability Groups. The Producer Companies or more specifically Farmer Producer Companies/Farmer Producer Organizations are of much recent vintage which evolved out of some shortcomings in the earlier institutional arrangements for collectivization. These farmer collectives were designed to address the constraints faced by small farmers and which arose from both the nature of agricultural production and the size of their holding. Some of the constraints which are of specific significance to small farmers involved in cultivation of plantation crops include

- Structural challenges which acts as a barrier between farmers and the market hindering their growth and market viability.
- Poor market infrastructure, non-availability of credit from formal sources, market information asymmetries, inefficiencies of factor markets and output market etc.
- Lower bargaining power and holding capacity arising from insignificant individual production volume and disaggregate nature of agricultural production.
- Higher input costs arising from purchase of inputs in retail market, low volume transactions, inability to forecast requirements and lack of technical expertise in input management and decision making.

Though the farmer collectives like cooperatives had many lofty ideals, over time these ideals got diluted and a sense of lethargy crept in. The cooperatives and other forms of traditional farmer collectives alike failed due to problems like political interference and poor management. The efforts to provide stability and support to these traditional institutions often resulted in excessive bureaucratic control in day to day functioning and resulted in a lack of clear focus and vision about their institutional raison d'être. The constant quest for creating an institutional structure that can withstand these challenges and constraints while maintaining the ethos of cooperation for farmers" collectivisation saw many experiments in collectivizing the farmers

and the Farmer Producer Companies or the Farmer Producer Organizations are one of the most promising of these innovative farmer collectives.

Though farmer cooperatives, which have a long history of existence, could be viewed as a crude form of farmer producer organization, its scope and functioning has significant drawbacks. Some of the major drawbacks of small farmer cooperatives/farmer collectives arise from capital constraints, corruption, free rider problems, political interference and lack of autonomy which adversely affected the performance of cooperatives in the country (Singh and Singh, 2013). As a considered policy intervention for strengthening and revitalizing farmer collective organizations, it now considered that a change in organizational and operational environment of farmer collectives/cooperatives more congruent with professionally run companies will be highly transformative in effect. The enhanced freedom, unshackling of collective power and stakeholder involvement in professionally run business operations was expected to make farmer collectives profitable business entities in a competitive market.

The concept behind Farmer Producer Organizations is that farmers, who are the producers of agricultural products, can form groups and register themselves under the Indian Companies Act. The aim is to enhance farmers" competitiveness and increase their advantage in emerging market opportunities.

### **Types of Farmer Producer Organizations**

Broadly Farmer Producer Organizations can be categorised into four broad categories (Thompson et al. 2009): viz, Market-oriented, Input-oriented, Extension-oriented and Policy and advocacy oriented.

These categories are useful for mapping the terrain, but most producer organisation are a mixture of some or all of these functions. The identity of a producer organisation will vary according to its origins and context, be shaped by economic change and policy trends, and may well shift during the lifetime of the organisation.

### **Evolution of FPOs in India**

Framing of a legislation that would enable incorporation of cooperatives as companies was one of the key policy initiatives under consideration during the early part of this millenium. The conversion of existing cooperatives into companies while ensuring the retention of the unique elements of cooperative business with a regulatory framework

similar to that of companies was envisaged through changes in the companies act (Gol, 2013). On the recommendations of an expert panel led by Y.K. Alagh, Government of India amended the extant Indian Companies Act, 1956, in 2002-03 to provide for “producer companies”. The amendments ensured the establishment provisions for creation of producer companies or more specifically Farmer Producer Companies in agriculture sector as a hybrid between cooperative societies and private limited companies. The policy initiative through the amendment of Companies Act, 1956 effected through “The Companies (Amendment) Act, 2002” saw the emergence of the new generation Farmer producer organizations, more identified with companies in functioning and scope than with the cooperatives.

In any agrarian economy dominated by the prevalence of small holder production system there exists a strong economic rationale and sound logic for a demand for such farmer producer organizations. The first farmer producer organization registered in India under the provisions of the new amendment was the Vanilla India Producer Co. in Kerala state which was set up in 2004. Over a short span of time, FPOs have emerged as an alternative institutional arrangement, across several crop sectors including plantation crops, to promote small holder aggregation and address production, processing and marketing constraints faced by them.

### Objectives of FPOs in plantation sector

A Farmer Producer Company can be formed by any 10 or more primary producers or by two or more producer institutions, or by a contribution of both. They can undertake activities related to production, harvesting, procurement, grading, pooling, marketing, processing, etc., of agricultural produce. Several well documented success stories of Farmer producer companies in the country, over the short span of its existence in plantation crop sector, have proven that the entire gamut of activities related to production, processing, value addition, marketing and trade are well within the ambit of its capability. Though an FPO in plantation sector essentially is similar to other FPOs in field crops and horticultural crops, there are some differences in terms of the priorities and focus of the FPOs working in different sectors. Here we take a brief look at the major priorities and functional role of FPOs in plantation crop sector.

- The major focus of FPOs in plantation crop sector

should be to organize farmers into a collective to improve their bargaining strength in the market. This is especially important in plantation crops because of the nature of price cycles in the output market and the nature of price instabilities.

- The plantation sector FPOs require frequent tactical decision making and the FPOs generally tend to get it done through experienced professional managers. They take decisions based on market price movements, supply scenario etc.
- They adopt all the good principles of cooperatives and the efficient business practices of companies and also seek to address the inadequacies of the cooperative structure.
- The Farmer Producer companies have strong democratic governance, each producer or member having equal voting rights irrespective of the number of shares held.
- The FPOs in plantation sector usually specialize in few products unlike FPOs in agriculture sector. The fewer the products, the greater is the need for forward integration in plantation crop sector. Therefore we have witnessed a trend favouring forward integration by adopting complex post harvest processing and creation of capacity in value added product development using the commodity in focus.

### Models of Farmer Producer Organizations

The primary agricultural production sector in India has experimented with several models of farmer collectives. The crops with significant contribution to plantation output are also the ones where, more number of farmer producer organizations is in operation. Here we examine the farmer producer organizations in, coconut and rubber, the two crops which together contribute 59.7 per cent of the gross value of output from agriculture in Kerala state, the leading producer of these commodities in India.

### FPOs in coconut sector

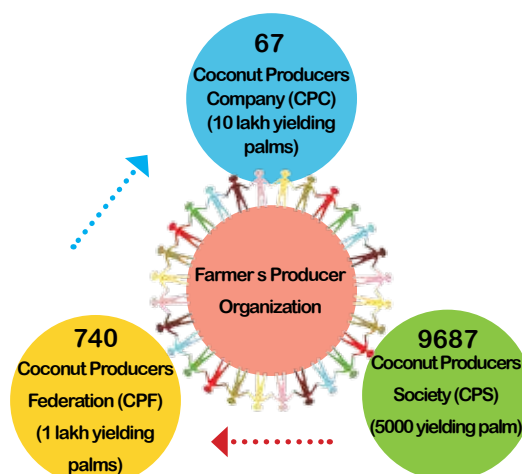
The coconut crop economy is one of the key components of the agricultural sector of the state of Kerala. The scope and potential of the new generation farmer producer organizations in agricultural sector was clearly demonstrated through the FPOs formed in the sector. It was the active institutional support and intervention of Coconut Development Board (CDB), a statutory body under the Ministry of Agriculture and Farmers Welfare that catalyzed the formation of FPOs among the largely unorganized

coconut farmers of the state. A three tier structure consisting of Coconut Producers Society (CPS), Coconut Producers Federation (CPF) and Coconut Producers Company (CPC) is operational in the state.

Progress of Coconut Producers' Society, Federation and Company formation*				
S No	States	No. of CPS registered	No. of CPF registered	No. of CPC registered
1	Kerala	7220	464	29
2	Tamil Nadu	659	69	17
3	Karnataka	400	125	13
4	Andhra Pradesh	1115	82	8
5	West Bengal	214	0	0
6	Odisha	37	0	0
7	Assam	27	0	0
8	Gujarat	14	0	0
9	Maharashtra	1	0	0
	TOTAL	9687	740	67

\* (as on 18-Dec-2018) (Source: Coconut Development Board <http://coconutboard.nic.in/ProducerSocieties.aspx>)

The Coconut Producer Societies are small scale FPOs formed by association of 40-100 coconut growers in a contiguous area with a consolidated minimum of 4000- 5000 palms. The farmer member contributes equity in the organization and undertakes activities aimed at productivity improvement, cost reduction, collective marketing, processing and product diversification (CDB, 2007). The CPS, as knowledge based farmer centered collective, forms the basic unit of the FPO framework in the sector. The next hierarchical tier, the Coconut Producers Federations is formed by combining about 8-10 CPS. The FPO's formed are provided legal status through registration under Charitable Societies Act and are also registered with CDB. An aggregation of 8-10 CPFs would form a Coconut Producer Company. A CPC would have around ten lakh coconut palms under its management. . These companies, fully owned by the farmers, are registered under section 581B of Indian Companies Act of 1956. The coconut FPOs in the state has more than 7 lakh farmer members with equity rights with an average membership of 97 farmers in each CPS and an average area of 42.6 hectares under its operational control. The broad producer base and extent of area indicate the acceptability of these FPOs and its perceived utility.



## Support to FPOs through CDB Schemes

Coconut Development Board undertakes various promotional activities for the development of the coconut sector in the country. All the schemes are implemented through FPO's. The major programmes that are being implemented by the Board are, Setting up of Coconut Kiosks/points, Establishment of Coconut Nursery, Technology Mission on Coconut, Replanting and Rejuvenation of Coconut Gardens, Laying out of Demonstration Plots etc.

### ● *Setting up of sales outlets/ kiosks*

Financial assistance is extended for setting up of sales outlets/ kiosks for value added coconut products. The board will provide reimbursement of 50% of cost incurred on infrastructure and purchase of Assets, maximum of Rs. 1.5 Lakhs.

### ● *Establishment of Small Coconut Nursery*

Establishment of Small Coconut Nursery scheme is implemented on project basis to encourage FPO's in seedlings production by providing financial assistance for establishing coconut nurseries. Financial assistance is limited to 25 % of the project cost or Rs.2.00 lakhs.

### ● *Technology Mission on Coconut*

Under Technology Mission of Coconut, Financial assistance is provided for Setting up of modern copra dryer, Neera processing units, desiccated coconut powder, VCO, Coconut oil, coconut water etc.

### ● *Replanting and Rejuvenation of Coconut Gardens*

The main objective of the scheme is to enhance the productivity and production of coconut by



removal of disease advanced, unproductive, old and senile palms and rejuvenating the remaining palms.

● **Laying out of Demonstration Plots**

The objective of the LODP scheme is to increase the production and productivity of coconut from unit holding by proper and timely adoption of package of practices in a farmer participatory mode. This programme will facilitate the adoption of appropriate coconut based farming systems and promote farm level processing for value addition on a community basis.

**FPOs in rubber economy**

The collectivization of farmer producers started as early as 1986 in rubber crop in the form of voluntary associations of small growers registered under the Charitable Societies Act known as rubber producer societies (RPS) promoted by the Rubber Board. More than 75 per cent of the 2304 RPS are located in Kerala and they have gained wide acceptance among the small holder rubber growers in the state. They operate in small compact areas having a radius of 2 to 3 km with 50-200 small holder producer members. Though promoted by Rubber board, the RPS have operational freedom in undertaking transfer of technology, processing, marketing of produce and procurement of inputs. The RPS can be viewed as farmer producer organization as the key operational patterns were similar. The product aggregation and enhanced capacity of primary producer societies necessitated creation of federal producer organizations for scaling up activities and operating capital intensive commercial ventures. A total of 7 federated processing companies and 11 trading companies have also been established. (Rubber Board, 2016). Most of these are jointly owned Rubber Producers’ Societies with significant equity participation by the Rubber Board.

<b>Support to FPOs through CDB Schemes*</b>			
Sl No.	Scheme	Total No. of FPO 's	Total financial assistances Rs. (Lakhs)
1	Coconut Nursery	87	25.31
2	Coconut kiosks	153	188.48
3	Copra Dryers	32	157.16
4	Neera processing unit	10	350.73
5	Coconut oil	05	129.76
6	Coconut water	01	7.63
7	VCO	01	24.54
8	Desiccated coconut powder	01	25.00
9	Replanting and rejuvenation scheme (R&R)	6028	11283.57
10	Laying out of demonstration plot(LODP)	2254	15346.51
		TOTAL	27538.69

*\*As on 31<sup>st</sup> March 2018*

**Support to FPOs**

Governments can facilitate the development and strengthening of FPOs by creating a suitable legal and regulatory framework, developing policies that provide a framework for active and meaningful engagement and cooperation with FPOs, creating laws and policies that seek to establish a balance between several stakeholders with divergent interest, providing an enabling environment to access public incentive programmes and other resources, providing opportunities for FPOs to participate in policy development, supporting and facilitating capacity-building of FPOs, promoting equitable distribution



of access to government services and raising public awareness about the role and relevance of the FPOs in its domain. As a policy initiative to support farming community, FPOs bring a clutch of benefits for governments of the developing countries. It is in the interest of a benevolent government to develop a collaborative rather than an adversarial partnership with the FPO sector. A deliberate stance to support a policy environment conducive to establishment and growth of FPOs in plantation crop sector can bring rich dividends for governments.

- Encouraging the establishment and successful development of FPOs should be a priority for governments wishing to promote sustainable development of plantation crop sector since the stakeholder involvement through FPOs in nurturing the plantation economy will ensure incorporation of sustainability principles in all activities.

- The establishment of FPOs strengthens market forces and enhances better and fair access to markets for all stakeholders. The enhanced market efficiency, while enhancing government revenues, is helpful for optimizing resource allocation across crops and commodities

- The establishment of FPOs can reduce the need for government expenditure and involvement in provision of support services, especially extension services and other technical guidance services. This can free up government resources for other priority sectors in the country while making services available to plantation crop producers at a lower cost and with more effectiveness than is often possible by government.

Governments should encourage the development of FPOs as they can improve the process of policymaking by proposing supportive policies and providing coherent assessments of policy impacts from the perspectives of actual stakeholders.

### **Issues and challenges facing FPOs in plantation sector**

There is a broad consensus that concerted efforts need to be made to promote and nurture producer companies and further legislation need to be made to make these companies more attractive for investors. The rapid growth and development of FPO sector notwithstanding, this relatively new institutional mechanism has thrown up several issues. The restriction on trading of shares of FPOs which limits the exit options for investors, the exclusion on non-producers and the low level of institutional support

from commercial financial institutions are some of the persistent issues over the years. This shows that there is scope for improving the existing way of functioning and the need for policy makers to guard against complacency with respect to their approach to FPOs in policy matters.

#### ***Key issues and challenges include the following:***

- The low level of awareness about the functional and operational structure of FPOs among financial institutions makes them reluctant to provide term loans and working capital loans to producer companies. Therefore creation of awareness among financial institutions needs to be accorded priority. Though agricultural income is exempted from income tax, the same benefit is not available to Farmer Producer Companies. Equal tax treatment on par with agriculture need to be extended to FPOs in plantation sector also.

- Many FPOs failed in their objectives due to lack of administrative capacity resulting in poor management of books which leads to issues with accountability and transparency. These factors also stand in the way of their accessing finance from banks. Only a few FPOs in plantation sector have explored the options for getting premium pricing through certification strategies and providing traceability of its produce. This results both from a lack of capacity and lack of awareness. This situation needs to be addressed.

- The role of professional extension services is underutilized during the initial stages of formation of FPOs. These services can be used in locating farming community, awareness creation, community mobilisation, organising community meetings through local leaders, social capital formation, facilitating formation of core group, capacity building of farmers etc.

- Many FPOs are dependent on grant-in-aids and subsidies provided through various government and non-governmental sources. This undermines an assessment of their actual commercial viability and makes them fragile as an institution. The FPOs need to be trained to become self sufficient and weaned off external support within a short span of time.

- Most of the FPOs in operation focus on increasing the output volumes alone with a hazy focus on profitability. The FPOs should focus on productivity enhancement per unit of land and reorient their present focus on production to a focus on market oriented production. The focus on productivity and profitability can be embedded in

crop planning, rotation and shifting patterns of crops and development of value chains to reduce the transaction cost.

- The establishment of FPOs resulted in product diversification and scaling up of processing facilities. For example, the emergence of FPOs in coconut sector has resulted in ensuring availability of more than 30 product types in the consumer market strengthening the product value chain and benefitting consumers through wider product range.

- Many self help groups, especially the women self help groups have successfully adopted the FPO model for venturing into commercial activity, thus bringing together an organizational mix of cooperation, self help and commercial attributes. For example, a conglomerate of women SHGs representing more than 7000 families below poverty line has launched a FPO with an annual turnover of more than Rs 30 million. The establishment of several such FPOs indicate the availability of entrepreneurial skills and capacity for risk bearing amongst collectives of primary producers.

- The FPOs were formed along natural clusters of farming groups with focus on specific crop which created better understanding and close interdependence among members.

- The availability of an institutional facilitator (Coconut Development Board and Rubber Board) for initiating formation of FPOs and handholding the nascent collectives through the developmental stages helped in establishment of FPOs in these crops.

- The farmer producer organizations have promoted participation of small holder producers in the process of value creation and thereby ensuring a share of value addition to the small holders.

- The diversity in forms and activities of farmer producer organizations in these crops promoted healthy competition and sufficient market opportunities for harnessing benefits from value addition.

- Federated structure of the FPOs in coconut and rubber has helped in increasing the grass root level participation while broadening the participation and increasing the capacity for equity capital accumulation.

- The farmer producers are members of multiple societies and have shown the discipline required for successful collectivization and good business acumen to leverage their strengths and benefit from public institutional support.

## Constraints and the way forward

Collectivization of producers, especially small and marginal farmers into farmer producer organisations has emerged as one of the most effective means of addressing the challenges faced by agriculture sector. But the growth and establishment of FPOs, both in terms of number and extent of activities, has not been uniform across the crops in Kerala. The spices farming sector, which contribute more than 10 per cent to the value of output, has not seen the emergence of FPOs commensurate with its potential for value addition. The possible missing link which led to this situation might be the absence of institutional handholding services which were available in case of crops like coconut and rubber. Broadening the base of farmer collectivization is urgently required by giving more emphasis for sectors like spices, vegetables and fruits. This could be done by identifying public institutions as developmental partners in each target sector. The cooperative sector of the state offers a huge latent potential for mobilizing farmer producers on the lines of FPOs through facilitation of smooth transition from cooperative legal framework to FPO mode. The state which has a high intensity of farmer collectives in cooperative sector should give special focus on this aspect of FPO development.

Policy incentives to support FPOs must target facilitating improved access to investments, technology inputs and markets. The external commercial environment can be made friendlier through targeted policy measures favouring FPOs. The relaxing of licensing rules on trading, procurement, marketing operations etc. can enlarge the scope of operations and facilitate diversification of operations.

The network of FPOs in two major crops of the state, coconut and rubber shows the importance of handholding institutional services in development of FPOs. By focusing on crops with high potential for value addition like spices, leveraging network of self help groups and addressing constraints like access to training services, credit and technology can further strengthen the FPO sector in the vstate.

With a strong network of cooperative institutions and diverse agricultural production sector, there is considerable scope for development of the FPO mode of farmer collectivization in Kerala. The organizational, financial and commercial sustainability of FPOs in the state can be further

enhanced by leveraging the strengths and addressing the constraints through pragmatic policies.

The experiences of evolution and impact of FPOs in small holder's crops like coconut and rubber in Kerala state in India discussed above clearly indicate the importance of facilitating FPOs in the sustainable development of plantation sector. Global Forum for Rural Advisory Services (GFRAS. 2015.) has made recommendations for enhancing the effectiveness of FPOs which are very relevant for the FPOs in plantation sector as well. GFRAS suggests that FPOs

should increase their capacities in good governance, organisational management, and Federal -level coordination. Besides they need to develop mechanisms for delivering financially sustainable rural advisory services, promote a better understanding among farmers of the role of producer organisations in demand-driven rural advisory services, intensify their partnerships with other actors in the agricultural innovation system, increase their capacity to provide rural advisory services, especially concerning demand-orientation, brokerage, flexibility, and communication. ■

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## Pepper – a safe companion in coconut gardens

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“Pepper prices touches 40 lakh per ton”, the news hungry media flashed the hike in pepper prices all over India and some went to the extent to write “Pepper price jumps while rubber dips”, giving a dig once most coveted crop of the day.

Pepper had its best boom in the late forties and early fifties during the post world war period. According to elder farmers in the hilly tracks of Kerala, they suddenly became cash-rich and started to buy lands. The hilly hamlets started to get plenty of cars and automobiles and they also built modern terraced buildings.

Stories on the movement of promising bridegrooms from urban centres to the hilly “pepper-rich families in search of brides” is still narrated by the elders with its unending charm. Some pepper farmers in the hilly terrains took the opportunities to send their children to the then greater centres of learning like Trivandrum, Ernakulam and even

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**Pepper magic in home therapy is gaining more popularity and it is transferred from generations to generations like devotional songs. Growing of pepper in flats are becoming popular. It is a pretty sight to observe that they are using pepper not only in dried forms, some even prepare pickles also.**

”



to Chennai for higher education. Even now, these stories are described by grandmas with a lot of glitter to the younger generation.

It also helped for a large scale spread of pepper culture in the homesteads in mid and coastal tracts of Kerala, since pepper is grown as a companion crop of several perennial trees like coconut, Mango, jack etc. Without any additional space, farmers could generate a handsome income. Pepper thus became a very popular homestead crop all over the state. Pepper from time immemorial is given privilege to adore as a divine herb giving home-made medicines. It is added to several veg and non-veg preparations for providing rich aroma and enhancing digestive capacity. It is added to jaggery and coffee to prepare a sweet decoction to prevent the throat-aches, cough and cold. Though it was difficult for them to explain curative action, still it is popularly used in all homes in most of the rural areas. Dry pepper is preserved even now in every home of Kerala as a home medicine to guard against fever and digestive disorders.

Another very interesting fact was the emergence of new marketing system in rural areas during December – January, the peak harvesting period of pepper. Small group of traders visit homes to bargain for collecting pepper, since the homestead farming was the domain of women. After visiting the pepper crop, they offer a price and settle the harvesting right. These groups will not only do the plucking, but also pay the price on the spot, without spoiling the vine, so that the next year also they will get the same contract. The spot payment, coupled with vine-care, these groups were doing a service for the rural people and they too were earning well. The biggest difficulty experienced by the farmers now is the total eclipse of this group and no substitute system has replaced. During the period, the encouragement given by the research and development agencies for growing pepper as a crop got wide acceptance as the companion crop for coconut. It was very widely accepted also, but now the lack of labour for climbing the trees has virtually spoiled the system. Solutions must be found for facing the situations like harvesting of pepper, spot procurement and the difficulties for marketing. Otherwise the process of movement of produce to the primary, secondary and tertiary market will suffer, upsetting the market reputation already created.

While growing on fruit trees, with good foliage, shade-loving varieties should be encouraged. While basins are made for coconut trees, pepper roots



must not be injured. Basins for manuring coconut must be made six feet away from the trunk of the palm. These tips if followed, will help the homestead cultivation of pepper.

The trade circles are pointing out that domestic consumption is going up. The huge demand observed during the farm fairs for quality pepper is the sight to be seen. The domestic promotion in a consumer-friendly manner could even face fall in export prices of pepper. The trade, but fears, once the new opening up of trade policies are put into effect, other pepper producing countries may use India as a potential market, bringing bad luck to domestic traders and farmers through price-cut competition.

Pepper magic in home therapy is gaining more popularity and it is transferred from generations to generations like devotional songs. Growing of pepper in flats are becoming popular. It is a pretty sight to observe that they are using pepper not only in dried forms, some even prepare pickles also. The use of pepper is gaining more and more acceptance and if more research is done on its medicinal qualities, its popularity will attain new heights. The present problems are so painful, as the old saying, “Njaval tree is full of fruits, but the crow is suffering from beak-ache”. The pepper vines are ready to produce more thrills, yet framers are facing several obstacles which must get quick relief. The practice of limiting the heights of pepper vine, enabling the family to harvest must be encouraged. “Better late than never”. Remember: Pepper prices cross rupees Four lakh per ton. It is the time for action.

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# Bioinoculant preparation simplified for farmers : 'produce and use' on-farm system

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**A** minimal and economically viable method for mass-multiplication of plant-beneficial bacterial and fungal inoculants (bioinoculants) has been standardized for the benefit of the farmers. The method utilizes locally available wastes such as rice gruel and mature coconut water synergistically blended with biochar, as a medium for on-farm production of contaminant-free bioinoculants. The method produces aqueous bioinoculant formulation that can be easily applied as seed treatment, seedling dip, soil drenching and foliar spray and is suitable for immediate field application. Decentralized on-farm bioinoculant production by farmers paves way for enhanced adoption of bioinoculant technology by farmers, helping them to improve their farm soil health and fertility and ultimately crop production capacity.

Microorganisms are becoming an important basis for sustainable and environmental-friendly agriculture. Several plant beneficial microorganisms such as nitrogen fixers, phosphate, potash, zinc and silicate solubilizers, plant growth promoting rhizobacteria, arbuscular mycorrhizae and microbial control agents of insect pests, diseases and weeds offer immense potential to increase the sustainability of agricultural system. To make available such plant beneficial microorganisms for farmers use, 'bioinoculant technology' has been in the forefront. This technology is based on mixing proven plant beneficial microbes with solid or aqueous carrier. The carriers used for harbouring the live microbes must be: easily available, inexpensive, non-toxic

to inoculants and plants, have sufficient moisture absorbing potential and good pH buffering capacity. The plant-beneficial bacteria or fungi are usually mixed with powder carriers such as peat, lignite, talc or appropriate aqueous medium containing ethylene glycol, xylene, methanol or the regular synthetic media broths.

To produce carrier based bioinoculant broadly following steps are involved viz. multiplication of proven bacterial or fungal isolates in known medium to a high population level, mixing the cells of the isolates in sterilized solid or aqueous carrier material, and packaging and marketing them to the farmers.

The carrier based inoculants are applied by the farmers in four ways: seed treatment, seedling dip, soil application and foliar spray. Production of bioinoculant formulations in India during 2012-13 was 65527 Mt as compared to 25005 Mt in 2008-09 (Indian Fertilizer Scenario 2014, Dept. of Fertilizers, GOI). The drive for safe and environment friendly agriculture will only see the need to significantly boost bioinoculant production in the coming years. This situation provides ample opportunities for developing bioinoculant production process that uses locally available liquid wastes of organic nature to be used as substrate for the mass-multiplication of the plant-beneficial bacteria and fungi.

Bioinoculant formulations currently available in market mostly depend upon peat, talc, lignite, and such others as carriers of the live inoculants. These carrier materials are normally mined from earth and then processed for use. Their availability is

not ubiquitous and unlimited requiring them to be transported to distant places for the bioinoculant preparation. Aqueous carriers such as ethylene glycol, xylene, methanol or regular growth media broths used are predominantly synthetic in nature and generally expensive. Under certain conditions the organic solvents are toxic to the inoculants and plants too. They also are hampered by limited pH buffering capacity during the multiplication of the inoculant organism. Therefore, a large carbon-footprint is left by the current bioinoculant production industry which adds to the escalating weather perturbations. Moreover, the technology also has to grapple with the issues of contamination and lower population of viable inoculant bacteria or fungi present in the carriers than the prescribed levels at the time of application by the farmers. With emphasis on safe and environmental-friendly farming increasing each passing day, the need for producing large volumes of bioinoculants is only imperative.

A method for on-farm production of plant-beneficial bacterial and fungal inoculants is described here using aqueous by-products that otherwise go as waste, i.e., rice gruel and mature coconut water. This production system will be useful in places where large areas are under coconut cultivation and rice is the staple food for the population and therefore ensuring constant supply of rice gruel and mature coconut water. This method is expected to reduce the carbon-footprint and have a contaminant-free and decentralized bioinoculant production.

### Description of the process

Pressure cooker, heater or gas stove with LPG cylinder, candle or bunsen burner, rice gruel which is by-product from parboiled rice cooked in traditional Indian method, mature coconut water which is obtained from mature coconut in homes using coconut for preparing daily food, powdered biochar or charcoal commonly available in farm households and bioinoculants, bacteria or fungi, in 5-10 ml plastic syringe or ink-filler are the materials required for the process.

### The method

Mix filtered rice gruel and mature coconut water in equal proportions. Add appropriate volume of the fresh rice gruel + coconut water mixed in 1:1 ratio into the pressure cooker. Biochar or any other charcoal is added to the liquid medium @ 1g/L.

Close the lid of pressure cooker and sterilize the contents by heating on stove. After 3 whistle sounds,

lower the flame and continue for 20 min. after which switch off the stove. Remove the pressure cooker from heat after sterilization and allow the contents to cool without opening the lid. Now add the starter bioinoculant culture into the pressure cooker. Slowly swirl the cooker so that the microbial inoculum mixes well. Keep the cooker under room temperature conditions in a clean and dry area. Mix the contents well twice in 4 to 5 hr interval by swirling the cooker. Then leave the cooker undisturbed for the rest of the incubation period. The incubation period for bacterial mass-multiplication is 24-72 hrs and for fungi is 6-7 days. After incubation, the mass-multiplied microbial inoculants will be ready for application. A minimum of  $n \times 10^7$  to  $10^9$  colony forming units of the inoculants will be present in per ml of rice gruel-coconut water medium prepared in this way. It will be devoid of any contaminant bacteria or fungi. The aqueous bioinoculant can now be used for seed treatment, seedling root dip, soil application or foliar spray.

### Advantages of the method

The simplicity of this method empowers small and marginal farmers to mass-multiply plant-beneficial bacteria or fungi themselves on their farm. Locally available substrates are used as medium for bioinoculant mass multiplication. Contamination-free bioinoculants containing BIS stipulated population of bacteria or fungi can be obtained.

This method adheres to BIS standards for aqueous bioinoculant preparation like, the pH of the rice-gruel-biochar medium ranges between 5.4-5.8. This range falls within the BIS stipulated range of pH 5-8 for aqueous media. The medium offers excellent suspensibility for the multiplication of the plant-beneficial microorganisms. The BIS stipulated minimum population of  $10^7$  to  $10^8$  cfu/ml of media for plant-beneficial bacteria or fungi is easily maintained by this method. No external bacterial or fungal contamination is observed in this method if the procedure is followed carefully. The method produces aqueous bioinoculant with adequate viable cells for seed treatment as well as field application. The method also circumvents the necessity for storage of the bioinoculants as they can be produced and used immediately. The method, if practiced by individual farmers or group of farmers, can greatly reduce the carbon-foot print for bioinoculant mass-multiplication because of the decentralized approach.

It offers scope for further innovation at farmers'



1. Sterilized coconut water-rice gruel medium with micronized biochar
2. *Bacillus megaterium* multiplied by this method in rice gruel+coconut water medium in a pressure cooker
3. Luxuriant growth of PGPR *Bacillus megaterium* in rice gruel+coconut water medium indicated by the turbidity (right). Medium without culture (left).
4. PGPR *Bacillus megaterium* multiplied in rice gruel+coconut water medium (right) in comparison to that multiplied in commonly used nutrient broth (left)
5. Colony forming units of more than 10<sup>7</sup> of PGPR *Bacillus megaterium* could be obtained in rice gruel+coconut water medium by this method, no external contaminant is seen other than the pure culture.
6. Bioinoculant *Pseudomonas putida* multiplied by this method showed higher level of fluorescence (right)
7. This method yielded colony forming units of more than 10<sup>9</sup> of PGPR *Bacillus licheniformis* without any external contamination

level itself as they can identify other appropriate locally available substrates for bioinoculant mass-multiplication.

### Some important precautions

Once the bioinoculant is used, the cooker should be immediately cleaned with boiling water. The nozzle, weight and rubber gasket must be cleaned with more precaution. The clean dry cooker can be used for next round of mass-multiplication. A separate cooker for bacterial inoculants and fungal inoculants will help in preventing cross contamination. Care should be taken to keep the syringe and ink-filler out of reach of children. The cooker must NOT be used for preparation of food.

### Summary

The method described here relates to

contamination free mass-multiplication of plant-beneficial bacteria and fungi in a synergistic mixture of rice gruel and mature coconut water (1:1 ratio) combined with minute quantities of biochar for immediate field application. The rice gruel-coconut water - biochar medium described here supports growth of all types of plant-beneficial bacterial inoculants, fungal antagonists and microbial entomopathogens. The bioinoculants thus multiplied can be easily applied as seed treatment, seedling dip, soil drenching and foliar spray. Owing to its minimal technical requirements, the bioinoculant can be produced at any time needed for the farmers, provided the starter inoculant cultures are made available. Reliable certified agencies can supply starter bioinoculants in plastic syringe or ink-filler, which is an important external requirement in this method. ■





## Black Pepper - a promising intercrop in coconut gardens of Assam

J.C. Nath, S. Sumitha and H.P. Maheswarappa

AICRP on Palms (HRS), Kahikuchi, Guwahati, Assam

**B**lack pepper (*Piper nigrum* L.), known as ‘King of spices’ and ‘Black gold’ is one of the important foreign exchange earner for the country. India accounts for around 90% of the area under cultivation and production but our productivity is low. Black pepper (*Piper nigrum* L.), known as ‘King of spices’ and ‘Black gold’ is one of the important foreign exchange earner for the country. India accounts for around 90% of the area under cultivation and production but our productivity is low.

Mono-cropping coconut provide very low income for upland farmers even with an optimum planting density. However, there is a large area of land beneath the canopy of coconut plantations available for the farmer to use. From the land utilization point of view, coconut utilizes only 25 per cent of the soil mass while 75 per cent of the area is not utilised effectively. The unutilised coconut land can be efficiently utilized for inter-cropping. These advantages include an increase in productivity due to coconut yield and inter-crops and efficient land and labour utilization at farms. When seasonal crops are grown in coconut farms, it is called inter-cropping. With perennials it is called mixed cropping. When different crops are grown with coconut, it is known as multi-cropping.

Black pepper is a perennial climbing vine grown

for its berries and is extensively used as spice. It is valued for its characteristic pungency and flavour as an ingredient in food preparations and also as a condiment. It is therefore rightly considered as the “king of spices” and universally acclaimed as Black gold is one of the important foreign exchange earner for the country and where, pepper is grown as a profitable mixed crop in almost all the coconut and areca nut garden. Pepper has traditionally been a South Indian spice, growing in the region for centuries. Now, however, new geographies are rising to challenge the south’s near monopoly in its cultivation. Spices in the North Eastern states have been grown using nature friendly for year as the region is blessed with tropical rain forests and rich soil, which are favorable for organic farming.

All India Coordinated research project on palms centre at Kahikuchi, Assam has started the screening of black pepper varieties for their performance as intercrop in coconut garden during 2009. Five pepper varieties viz., IISR Thevam, IISR Shakti, IISR Malabar Excel, Sreekara and Panniyur -1 were selected for the trail (Table 1).

### Planting and after care of black pepper

Black pepper vines produce three types of shoot, namely (1) Primary climbing shoot with long internodes having adventitious roots at nodes which

Variety	Mean yield dry (kg/ha)	Features
Panniyur -1	1242	High yielding, not suited to heavily shaded areas
IISR Shakthi	2677	Suited to all black pepper tracts
IISR Shakthi	2253	Tolerant to Phytophthora foot rot
IISR Thevam	2481	Tolerant to Phytophthora foot rot; suited to high altitudes and plains
IISR Malabar Excel	1440	Suited to high altitudes; rich in oleoresin

cling to the supports/ standards; (2) Runner shoots which originate from the base of the vine and creep

are carefully separated from the tree and buried in the soil around the base of the coconut tree to ensure that the growing tip of the vine is kept above the soil. This practice induces more leader shoots covering the entire standard and production of laterals from the base of the standard.

Apply recommended dose of fertilizer and organic manures NPK at 50:50:150 g/vine and application of 2-3 kg of vermicompost or FYM or compost. Only one-third of this dosage should be applied during the first year which is increased to two-thirds in the second year. The full dose is given from the third year onwards. Care should be taken not to disturb the root system of the plant and apply the manure on the outer side of the root system and cover with soil. Irrigation during summer months is required and can be given in the form of drip irrigation or sprinkler irrigation.

Pepper varieties	No of laterals (one m column height)	No of spikes (in one m column height)	Spike length (cm)	No of berries/spike	Dry yield (kg/vine)
IISR Thevam	25.1	87.4	10.9	55.1	0.98
IISR Shakthi	26.0	83.6	11.6	49.2	0.88
IISR Malabar Excel	23.7	82.0	11.5	56.7	0.92
Sreekara	29.8	91.2	8.7	43.8	0.89
Panniyur -1	27.6	109.1	14.4	64.1	1.25

on the ground, have long internodes which strike roots at each node and (3) Fruit bearing lateral shoots. Cuttings are raised mainly from runner shoots, though terminal shoots can also be used. The rooted cutting need to be planted one meter away from the bole of coconut in North – East direction. Before planting, one 50x50x50 cm dimension pit has to be taken and should be kept open for 15 days . The pits are filled with a mixture of top soil, farmyard manure @ 5 kg/pit and 150 g rock phosphate. Neem cake @ 1 kg, Trichoderma harzianum @ 50 g also may also be mixed with the mixture at the time of planting. With the onset of monsoon, 2-3 rooted cuttings of black pepper are planted individually in the pits.

Lowering of the vines is a practice followed in many pepper growing regions. In this method, the vines are allowed to trail on support trees up to 20-25 feet and to allow the climber to climb the coconut palms for harvest on nuts. Subsequently, the vines

### Harvesting

Black pepper takes about 7-8 months after flowering to reach full maturity. In India the crop is harvested during December –January in plains and January-April in the high ranges of Western Ghats. Among the pepper varieties, Panniyur-1 recorded significantly higher number of spikes, spike length, number of berries per spike and dry yield compared to other varieties. It is important to harvest pepper at the proper stage of maturity in order to achieve a dried product of good colour and appearance. Harvest starts when one or two berries turn yellow. The spikes are nipped of by hand and collected in bags.

Being a perennial crop, high yielding varieties or hybrids require several years of field observation. This is quite expected as the period of evaluation was very short (eight years) and further evaluation in the years to come will definitely bring out suitable varieties for Assam condition. ■



# San Ramon, high copra yielding coconut variety of western ghats of Tamil Nadu

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AICRP on Palms, Coconut Research Station, Aliyarnagar , Tamil Nadu Agricultural University

Collection, conservation and utilization of plant genetic resources and their distribution are indispensable components of crop breeding programmes. Conservation of genetic diversity is crucial, because of the genetic erosion brought about through an array of causes including introduction of new coconut varieties, shift in farming systems and changing economic conditions. Being a perennial crop with a persistent capacity for sexual reproduction, coconut gene pools serve as a repository for conservation and development of new varieties. Global interests also heavily focus on the identification, collection and conservation of germplasm to safeguard the genetic diversity of the coconut palms grown in India. Field gene banks are the only viable option for ex-situ conservation of coconut largely due to recalcitrant nature of the coconut seed. With this background, under the All India Co-ordinated Research Project on Palms centre, Coconut Research Station, Aliyarnagar (Tamil Nadu Agricultural University) initiated an evaluation study of coconut germplasms during 1988. A total of 43 germplasms were planted in non-replicated trial in three sets.

Based on the evaluation studies of the germplasms, varieties have been recommended and released for cultivation based on the special traits of the cultivar. Long term study indicated that, among the germplasms, San Ramon is found to have higher copra content and tender nut quantity. The germplasm at the age of 29 years had grown to a height of 12.9 m with a girth of 108 cm and have the potential to produce 12 leaves per year. The nut is a very big size (3658 g weight) and dehusked nut weighs about 1856 g. The special character of this variety is higher copra content with 377 g/nut. In the foot hills of western ghats region of Tamil Nadu, data on nut yield for 9 years (2008 to 2016) indicated that,



on an average it produces 71 nuts per palm per year and with respect to copra out turn, it produces 26 kg/palm and it works out to 4.6 t/ha of coconut garden. The tender nut water quantity is 700 ml per nut with TSS of 6.1 oBrix, total sugar content of 5g/100ml, reducing sugar content of 3.5g/100 ml, amino acid content of 2.1 mg/100 ml, sodium content of 24 ppm and potassium content of 2648 ppm.

The higher copra content of the variety drew the road map for the scientists to recommend the variety in the name of Kalpa Shatabdi from ICAR-CPCRI Kasaragod for cultivation across the farmers' holdings in the foot hills of Western Ghats of Tamil Nadu. Further, in order to produce and supply quality seedlings to farmers in the near future, mother block of the variety has been planted at Aliyarnagar centre.

Performance of Kalpa Shatabdi at AICRP (Palms) centre, Aliyarnagar			
Nut yield an copra out turn		Tender nut quality	
Nut yield / palm / year	71	Volume of tender nut water (ml)	700
Whole nut weight (g)	3658	TSS (o Brix)	6.1
De-husked nut weight (g)	1856	Total sugars (g/100 ml)	5.0
Copra content (g/nut)	377	Reducing sugars (g/100 ml)	3.5
Copra yield (kg/palm/year)	26	Amino aciv d (mg/100 ml)	2.1
Copra out turn (t/ha/year)	4.6	Sodium (ppm)	24
Oil content (%)	67.4	Potassium (ppm)	2648



## Growing bonsai, now made easy

Arjun N V, College of Agriculture, Kerala Agricultural University, Vellayani, Trivandrum



**H**ome Gardens with Bonsai plants is found to fine tune the beauty concepts of modern interior designing. The miniature version of the enormously sized trees is definitely a treat for the eyes. Growing Bonsai is considered to be a tough task. But with few simple steps you can as well design a dwarf tree; interest will be more when the tree is coconut!.

For making a coconut bonsai an unpeeled dried coconut with husk is selected. Select those nuts which on shaking shows presence of water inside. Place these nuts in a container of water. Keep this in a warm place for 35 days. Change water every 5 days. After 35 days, remove water

and leave the nut in a dry place for 2-3 days for draining the water.

The nuts are taken and the husk is peeled carefully. On peeling we can see the coconut sprout. Take a pot or a suitable container and fill the container with well drained soil till half. Add same coco peat or coco coir. Now carefully place the sprouted nut such that the sprout and half of the nut is above the portion covered with coco coir. Water the pot.

Few days later we can see new roots developed. And further after 14 days we can witness leaf germination with increased number of roots. When the leaves grow upto 8 -10 cm with long roots the planting is ready to repot. The coir and soil attached to the nuts and roots is washed thoroughly and cleaned.

Take an attractive container pot and fill with stones in ½ inch thickness. Make a soil mix of garden soil (60%), sand (30%), compost, cocopeat / coco husk (each 10%) . The plantling is placed into this soil with the nut partially above the soil and cover it with white stones. Cover the below stem portion to prevent root drying. Keep in shade for 10 days. Pour water in every 4 days. The coconut Bonsai is ready to be in the home garden.



## 54<sup>th</sup> APCC Session/Ministerial meeting in Malaysia



The 54<sup>th</sup> APCC Session/Ministerial Meeting of APCC was held in Kuala Lumpur, Malaysia during 24-28 September 2018 hosted by the Ministry for Agriculture and Agro Based Industry, Government of Malaysia.

Hon. Dato' Salahuddin Ayub, Malaysian Minister for Agriculture & Agro Based Industry, Plenipotentiary delegates from the APCC member countries Hon. Atarake Nataara, Minister of Commerce, Industry and Cooperatives from the Government of Kiribati, Hon. Viam Pillay, Assistant Minister of Agriculture, from the Government of Fiji, Hon. Benny Allen M.P Minister for Agriculture and Livestock from the Government of Papua New Guinea, Hon. Fa'aso'otauloa Pati Taulapapa, Associate Minister for Agriculture and Fisheries from the Government of Samoa attended the session. Senior Government Officials of APCC member countries and observers from the Centre for Agriculture and Bioscience International (CABI) and the Melanesian Spearhead Group Secretariat (MSG) also participated in the meeting. Hon. Salahuddin Ayub, Minister for Agriculture and Agro Based Industries, Government of Malaysia inaugurated the Session in the presence of the Ministers, dignitaries and plenipotentiary delegates from the member countries.

APCC Plaque of appreciation were presented to Hon Minister for Agriculture and Agro Based Industries, Government of Malaysia and to the awardees from the coconut sector and industry in Malaysia during the inaugural session. The Session discussed on upgrading and renaming APCC to International Coconut Community and on the updates by APCC Scientific Advisory Committee on the Health aspects of coconut.

Country paper presentation by member countries gave a brief update on the policies and programs for coconut development undertaken by National Governments including the legislations to promote the development of the sector. The delegates presented the status of coconut production, processing and export in their countries and updates on coconut replanting, new planting and rehabilitation programs. The status of the research and development activities, policies and programs implemented in the country to enhance farm productivity and increase the farmers income were also shared by the delegates. The constraints faced by the sector and the suggested road map for the way forward for coconut sector were briefed by the delegates. The country papers helped in understanding the developmental activities undertaken by the countries and to replicate the models for customised implementation in other countries. It also helped in exchange of ideas and technology and paved the way for possible collaboration between member countries. The major producing countries like India, Indonesia, Philippines and Sri Lanka provided insights for other member countries on the way ahead to ensure sustained developmental activities in coconut sector.

The Session endorsed the recommendations of the 48<sup>th</sup> APCC COCOTECH Conference and approved that the upcoming 49<sup>th</sup> 'International COCOTECH Conference' will be held on the theme 'Promoting Smart Farming and Eco-Friendly Technologies for Sustainable Coconut Development'.

The delegates were taken for a field visit to coconut plantations at Sungai Yu, Keluarga Jaya Resources, Tanjung Karang and Coconut Processing Facilities at Kapar coconut Industry.

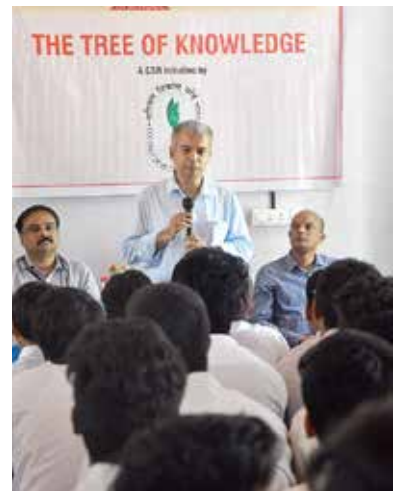
## The Hindu In School to reach more schools through CDB



In order to cultivate the reading habits among students, Coconut Development Board in association with The Hindu is distributing free copies of The Hindu In School to thirty two government schools in Ernakulam district during this academic year. The programme is undertaken by the Board as part of the Corporate Social Responsibility initiative.

"Books are treasure not with gold, silver or precious stones but with riches much more valuable that include knowledge, noble cause and high ideas", Dr. Raju Narayana Swamy IAS, Chairman, Coconut Development Board said after the formal launch of the distribution of free copies of The Hindu In School at Government High School, Edappally, Kochi on 28<sup>th</sup> November 2018.

Smt. Shija Parappurath, Head Mistress, Smt. Sreelakshmi S, Faculty, English Department & Shri. Suresh George, Senior Deputy General Manager, The Hindu spoke during the occassion. Smt. Mini Mathew, Publicity Officer, CDB, Shri. Suresh Pillai, Asst. General Manager, The Hindu and students attended the programme.



## Awareness programme in Official Language

An awareness programme in Official Language Hindi on Income Tax provisions was organised at the Head Quarters of the Board on 19<sup>th</sup> December 2018 to promote the use of Official Language in the Board. Shri R. Madhu, Secretary presided over the function. Shri. Harish Kumar, Income Tax Officer and Shri. Lalit Kumar, Income Tax Inspector, Office of the Chief Commissioner of Income Tax, Kochi were the resource speakers. Shri. Lalit Kumar, Income Tax Inspector made a presentation and briefed about the various provisions of income tax relevant to salaried class. An interaction session was also held in which Shri. Harish Kumar, Income Tax officer resolved all the queries raised by the Officials. Smt. Beena S., Assistant Director(OL) welcomed the gathering and Smt.Sangeetha T.S., Sr.Translator proposed vote of thanks.





## Kanyakumari CPC got Neera License

Kanyakumari Coconut Producer Company Nagercoil, Kanyakumari District, Tamil Nadu got neera license for tapping, processing and marketing of coconut neera. The license is valid from 19<sup>th</sup> December to 31<sup>st</sup> March 2019. 12 trained neera technicians including two neera master trainers can be employed by the company to tap neera.



*Krishi Kalyan Abhiyan field day programme at Chahataghat, Jalalgarh block, Purnia district, Bihar on 11<sup>th</sup> December 2018.*

## Agrovision

Coconut Development Board, State Centre, Thane participated in 10<sup>th</sup> edition Agrovision Exhibition - 2018 from 23<sup>rd</sup> to 26<sup>th</sup> November 2018, held at Reshimbag, Nagpur, Maharashtra organized by Agrovision Foundation, New Delhi.

Shri.Radha Mohan Singh, Hon'ble Union Agriculture Minister, Govt of India inaugurated the programme in the presence of Shri.Yogi Adityanath, Hon'ble Chief Minister, Uttar Pradesh, Shri.Devendra Fadanvis, Hon'ble Chief Minister, Govt. of Maharashtra, Shri. Nitin Gadkari, Hon'ble Union Transport Minister, Govt. of India, Shri.Sudhir Manguntiwari, Hon'ble Finance Minister, Govt. of Maharashtra, Shri.Chandrakant Patil, Hon'ble Minister of Revenue, Relief & Rehabilitation, PWD, Govt of Maharashtra, Shri.Chandrashekhar Bawankule, Hon'ble Minister for Energy, New and Renewable Energy, Govt of Maharashtra and VIPs from Central Govt. and State Govt. and other officials. More than 170 exhibitors, viz, the best companies among manufacturing machines, equipments, input suppliers and semi processed product in the food industry exhibited their products in the show.



*Board's stall in Agrovision*

Coconut Development Board, participated in Agrovision with the objective of promoting entrepreneurs and retailers of coconut products from Vidarbha region. Board arranged display of various value added coconut products like packed tender coconut water, coconut oil, coconut milk powder, virgin coconut oil and well informative charts, posters etc. Publications of the Board in various languages leaflets and brochures were also distributed to the visitors. VIPs, officials of various National companies and NGOs, business communities from all age groups visited CDB stall.



## Retirement

Shri. C Sreekumar, employee of CDB retired from the services of Coconut Development Board on 30<sup>th</sup> November 2018 on superannuation. He joined the Board in 1985 and has served the Board for more than 33 years.



# Cultivation practices for coconut -January

## Collection and storage of seed nuts

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

Irrigation has to be continued. Weeding has to be done wherever necessary. If termite infestation is noted in the nursery drenching with chlorpyrifos (2ml chlorpyrifos in one litre of water) should be done. Spraying of water on the lower surface of leaves of seedlings can be done against spiralling white fly attack.

## Shading

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



## 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. Depending on the evaporation rate, quantity of water to be provided through drip irrigation system in different coconut growing tracts can be decided. In Kerala 30-35 litres and in Tamil Nadu and Karnataka 35-45 litres of water is sufficient per palm per day through drip irrigation system during January.



## Management of coconut gardens in cyclone affected areas

Extensive damage to coconut palms has occurred due to the cyclone *Gaja* in Tamil Nadu and *Titli* in Andhra Pradesh. Field sanitation is to be maintained by proper disposal of fallen coconut leaves and coconut stem. Burning of coconut leaves and coconut stem should be avoided. Leaves can be collected and can be used for either mulching or composting. Coconut stem shall be removed from the field and wherever possible logs can be buried in the field itself by taking deep trenches ( more than 2 meter deep with convenient width and length wherever feasible). Irrigation has to be provided for the surviving palms and additional dose of fertilizer with 1 kg potash and 500 g urea to be provided per palm. Mulching has to be provided in the palm basin.



**Pest-infested field****Black headed caterpillar****Goniozus nephantidis**

## Management of pests and diseases

January month is the critical winter month with cool night and hot day and the humidity comes down. Pest vigilance in this period should be strengthened as this period opens out dry day time with cool night favouring population build up of sucking pests and dry pathogens. Breeding pits of coconut rhinoceros beetle get dried favouring egg laying and development of grubs. The establishment of moth pests, viz., black headed caterpillar and slug caterpillar is aptly virulent and successful in this month in all endemic zones of Kerala, Tamil Nadu, Andhra Pradesh and Karnataka.

### Pests

#### Black headed caterpillar, *Opisina arenosella*

The coconut black headed caterpillar, *Opisina arenosella*, is a major pest distributed in almost all coconut growing tracts across the country especially along the water bodies during winter. The infested portions get dried and form conspicuous grey patches on the upper surface of the lower fronds. Severe pest damage results in complete drying of middle to inner whorl of fronds leaving a burnt appearance. Presence of black headed caterpillars, webbing of leaflets and occurrence of dried faecal matter on the leaflets are the characteristic features of pest incidence. In the absence of natural enemies in the new area of emergence, the outbreak becomes faster and expands at high speed. Damage results in tremendous reduction in photosynthetic area, decline in rate of production of spikes, increased premature nut fall and retarded growth. Extensive feeding of caterpillars causes a crop loss of 45.4% in terms of nut yield in addition to rendering the fronds unsuitable for thatching and other purposes. Farmers need not panic and this is one of the classical examples of successful augmentative biological control suppressed by natural enemies.

#### Management

- a) Regular monitoring of palm fronds for pest occurrence in endemic zones.
- b) Removal and destruction of 2-3 older and dried leaves harbouring various stages of the pest. The leaflets could be burnt to reduce the caterpillar/pupal population.
- c) Domestic quarantine should be strengthened by not transporting coconut fronds from pest-infested zone to pest free zone.
- d) Augmentative release of the larval parasitoids viz., *Goniozus nephantidis* (20 parasitoids per palm) and *Bracon brevicornis* (30 parasitoids per palm) if the pest stages is at third-instar larvae and above. The pre-pupal parasitoid (*Elasmus nephantidis*) and pupal parasitoid (*Brachymeria nosatoi*) are equally effective in pest suppression and are released at the rates of 49% and 32%, respectively for every 100 prepupae and pupae estimated.
- e) Before releasing, the parasitoids are adequately fed with honey and exposed to host odours (gallery volatiles) for enhancing host searching ability.
- f) Ensure adequate irrigation and recommended application of nutrients for improvement of palm health.

#### Nut borer, *Cyclodes omma*

Incidence of nut borer was observed in certain coconut gardens in Pollachi (Tamil Nadu). This is a sporadic pest normally found in dwarf genotypes and also in hybrids. Succulency due to excessive nutrition by nitrogenous fertilizers is also one of the factors responsible for pest outbreak. Caterpillars bore into buttons after pollination as well as immature nuts and feed on the internal contents during night hours, resulting in button shedding. Palms subjected to assisted pollination are more susceptible to pest attack. The pupal stages are observed on the debris of palm crown.

#### Management

- a) Crown cleaning and removal of immature stages

of the pest

- b) Judicious and need based application of nitrogenous fertilizers to avoid succulency
- c) Application of the entomopathogen, *Bacillus thuringiensis* @ 20 g per litre or neem oil 0.5% (5 ml per litre with 10 g soap powder) using hand sprayers would reduce pest incidence.

#### Cocout 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.

#### 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 three times during March-April, October-November and December –January is recommended. Prophylactic application before the increase in summer temperature should be resorted to.
- c) Application of talc-based preparation of acaropathogen, *Hirsutella thompsonii* @ 20 g / litre/ palm containing 1.6 x 10<sup>8</sup>cfu 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.

In the cyclone Gaja affected regions of Tamil Nadu

and Titli affected regions of Andhra Pradesh, pest scouting for rhincoeros beetle and red palm weevil should be undertaken and all prophylatic strategies suggested should be undertaken.

#### Diseases

##### Leaf blight of coconut (*Lasiodiplodia theobromae*)

Leaf blight is an emerging disease in Coimbatore, Erode, Dindigul, Tirunelveli and Kanyakumari districts of Tamil Nadu. The pathogen causes damage in leaf and nuts. Affected leaflets start drying from the tip downwards and exhibit a charred or burnt appearance. The leaves in lower 3 to 4 whorls are affected. Leaf blight causes apical necrosis of lower leaves with an inverted “V” shape, and symptoms similar to those induced by drought (water deficit) and other stresses. The leaflets have extensive necrotic lesions with defined edges and without transition areas between the necrotic and healthy tissues. The pathogen can internally colonize the rachis, inducing internal necrosis that moves upward towards the stem (systemic invasion). The necrotic tissues develop exposed cracks that release gums under the leaf rachis and at petiole insertion. On coconuts, small black sunken region appear near the perianth of immature nuts. When nearly mature /mature nuts were infected, the infection spread internally into mesocarp without any external symptoms. The affected nuts are desiccated, shrunk, deformed and drop prematurely causing 10% to 25 % loss in nut yield.

#### Management

- a) Improving the palm health by application of 5 kg of neem cake enriched with *Trichoderma harzianum* and soil test based nutrition.
- b) Adequate irrigation and adoption of soil and water conservation measures is advised.
- c) Root feeding of *hexaconazole* @ 2% (100 ml solution per palm) thrice a year.

The dynamics of insect pests and diseases in coconut system vis-à-vis weather change pattern is so critical in population build up. Timely prophylactic measures to safeguard palms and enhancing palm health through need-based nutrition is very essential to withstand the pressure exerted by pests and diseases in outbreak situation.

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# Market review – November 2018

## Domestic price

### Coconut Oil

During November 2018 the price of coconut oil opened at Rs.14700 per quintal at Kochi and Alappuzha market and Rs.15400 per quintal at Kozhikode market. During the month, price of coconut oil at all three markets expressed a declining trend during the first fortnight of the month and thereafter expressed an upward trend..

The price of coconut oil closed at Rs.15200 per quintal at Kochi and Alappuzha market and Rs.15800 per quintal at Kozhikode market with a net gain of Rs.500 per quintal at Kochi and Alappuzha market and Rs.400 per quintal at Kozhikode market.

The price of coconut oil at Kangayam market in Tamilnadu, which opened at Rs.12333 per quintal, expressed a mixed trend and closed at Rs.13200 per quintal with a net gain of Rs.867 per quintal.

Weekly price of coconut oil at major markets Rs/Quintal)				
	Kochi	Alappuzha	Kozhikode	Kangayam
01.11.2018	14700	14700	15400	12333
11.11.2018	14700	14700	15400	12867
18.11.2018	14350	14200	15100	12533
25.11.2018	15000	14700	15600	13333
30.11.2018	15200	15200	15800	13200

### Milling copra

During the month, the price of milling copra opened at Rs.9200 per quintal at Kochi, Rs.9100 per quintal at Alappuzha market and Rs.9350 per quintal at Kozhikode market. The price of milling copra at all three markets expressed a slight declining trend during the first fortnight of the month and thereafter expressed an upward trend.

The prices closed at Rs.9600 at Kochi market, Rs.9500 at Alappuzha and Rs.10000 at Kozhikode markets with a net gain of Rs.400 per quintal at Kochi and Alappuzha market and Rs.650 per quintal at Kozhikode market.

At Kangayam market in Tamilnadu, the prices opened at Rs. 8500 per quintal and closed at Rs.9200 per quintal with a net gain of Rs.700 per quintal.

Weekly price of Milling Copra at major markets (Rs/Quintal)				
	Kochi	Alappuzha (Rasi Copra)	Kozhikode	Kangayam
01.11.2018	9200	9100	9350	8500
11.11.2018	9200	9100	9450	8450
18.11.2018	9000	8900	9300	8500
25.11.2018	9500	9250	9800	9000
30.11.2018	9600	9500	10000	9200

### Edible copra

The price of Rajapur copra at Kozhikode market which opened at Rs. 18800 per quintal expressed a fluctuating trend during the month and closed at Rs.17600 per quintal with a net loss of Rs.1200 per quintal.

Weekly price of edible copra at Kozhikode market (Rs/Quintal)	
01.11.2018	18800
11.11.2018	17800
18.11.2018	18000
25.11.2018	18000
30.11.2018	17600

### Ball copra

The price of ball copra at Tiptur market which opened at Rs.16600 per quintal expressed an overall downward trend during the month and closed at Rs.15000 per quintal with a net loss of Rs.1600 per quintal.

Weekly price of Ball copra at major markets in Karnataka (Rs/Quintal)	
	Tiptur
01.11.2018	16600
11.11.2018	16000
18.11.2018	15500
25.11.2018	15000
30.11.2018	15000



**Dry coconut**

At Kozhikode market, the price of dry coconut opened at Rs.9350 per quintal expressed a slight declining trend during the month and closed at Rs.9250 per quintal with a net loss of Rs.250 per quintal

Weekly price of Dry Coconut at Kozhikode market (Rs/Quintal)	
01.11.2018	9350
11.11.2018	9350
18.11.2018	9250
25.11.2018	9250
30.11.2018	9250

**Coconut**

At Nedumangad market the price of partially dehusked coconut opened at Rs.16000 per thousand nuts and closed at Rs.15000 per thousand nuts with a net loss of Rs.1000 per thousand nuts. At Pollachi market in Tamil Nadu, the price of coconut opened at Rs.11000 per thousand nuts and closed at Rs.13000 per thousand nuts. At Bangalore APMC, the price of partially dehusked coconut opened at Rs. 18500 and closed at Rs.1650 per thousand nuts. At Mangalore APMC market the price of partially dehusked coconut of grade-I quality opened at Rs.20000 per thousand nuts and ruled at same price throughout the month.

Weekly price of coconut at major markets (Rs /1000 coconuts)				
	Neduman-gad	Pollachi	Banglore	Mangalore (Grade-1)
01.11.2018	16000	11000	18500	20000
11.11.2018	16000	11000	18500	20000
18.11.2018	15000	11000	18500	20000
25.11.2018	15000	12000	18500	20000
30.11.2018	15000	13000	16500	20000

**International price**

**Coconut oil**

The international price of coconut oil and domestic price of coconut oil in Philippines, Indonesia expressed a downward trend during the first fortnight of the month and thereafter expressed an upward trend. Whereas the domestic price of coconut oil in India expressed an mixed trend during the

period. The price of coconut oil quoted at different international/ domestic markets is 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)	Philippines	Indonesia	India*
3/11/2018	770	770	778	1714
10/11/2018	726	720	725	1788
17/11/2018	709	710	711	1741
24/11/2018	823	800	807	1853

\* Kangayam

**Copra**

The domestic price of copra at Srilanka expressed a downward trend during the month whereas price of copra in Philippines, Indonesia and India expressed a mixed trend. The price of copra quoted at different domestic markets is given below.

Weekly International price of copra in major copra producing countries				
Date	Domestic Price (US\$/MT)			
	Philippines	Indonesia	Srilanka	India*
3/11/2018	464	368	1034	1181
10/11/2018	449	351	1029	1174
17/11/2018	412	341	1029	1181
24/11/2018	439	392	1000	1251

\* Kangayam

**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*
3/11/2018	123	117	176	340
10/11/2018	118	114	171	347
17/11/2018	118	115	171	340
24/11/2018	119	116	164	361

\*Pollachi market