Index

Intercropping of spices in coconut garden - A success story from Maharashtra

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Coconut is a major horticultural crop in the Konkan region of Maharashtra, where the agro-climatic conditions are very much congenial for its cultivation. Government of Maharashtra has launched an ambitious Employment Guarantee Scheme (EGS) for fruit crop cultivation in 1990, which led to the expansion of the area under coconut cultivation to 22,750 ha (2015-2016), with productivity of 9,775 nuts/ha. In Maharashtra 95 per cent area under coconut is concentrated in Konkan region and most of the orchards are situated near the seashore, of which the majority are sole coconut orchards. In the state, coconut farmers are facing problems like fragmented holdings, scattered production, homestead nature of cultivation, lack of skilled manpower, incidence of pest and diseases, lack of adoption of scientific cultivation practices, lack of appropriate mechanization for harvesting and small scale processing and lack of awareness about improved technologies.

Coconut gardens offer excellent opportunities to exploit the interspace potential for maximizing returns per unit area. Coconut based cropping systems involving cultivation of compatible crops in the interspaces of coconut and integration with other enterprises like dairying offer considerable scope

Coconut gardens offer excellent opportunities to exploit the interspace potential for maximizing returns per unit area. Coconut based cropping systems involving cultivation of compatible crops in the interspaces of coconut and integration with other enterprises like dairying offer considerable scope for increasing production and productivity per unit area, time and inputs by more efficient utilization of resources like sunlight, soil, water and labour.

for increasing production and productivity per unit area, time and inputs by more efficient utilization of resources like sunlight, soil, water and labour. Under such a cropping system, all the management practices and component production systems should be able to maintain high productivity, profitability and sustainability of the existing coconut palms to maximize economic yield of the farm. Sustainability is the main objective of farming system, where the production process is optimized through efficient utilization of the inputs in safeguarding the environment.

Spices are important crops that can be grown as intercrop in coconut gardens in the West Coast region of Maharashtra state. Studies conducted by Regional Coconut Research Station, Bhatye, Dr. Balasaheb Sawant Konkan Krishi Vidyapeeth, Dapoli and other research institutions of the country have unambiguously proved the technical feasibility and economic viability of intercropping of spices compared to the monocropping of coconut. Many farmers also have adopted the technology and realized the profitability and sustainability in the coconut garden. The successful experience of a farmer in intercropping of spices in coconut garden is presented below.

Mr. Deepak Gopal Sawant is a 62 year old farmer who owns five acres of land in Burodi village who is from Dapoli tahsil of Ratnagiri district of Maharashtra has adopted the intercropping system in the farm. The farmer has a diploma in Agriculture Science from Dr. B.S. Konkan Krishi Vidyapeeth, Dapoli. After completion of his education, he joined the service as Agriculture Assistant in the same University and retired from the service. During the period of his service, he had planted Banavari variety in his five acres land during 2002 with the help of his family members, by adopting standard package of practices as recommended by the University. For planting coconut, seedlings were purchased from the nursery of All India Co-ordinated Research Project on Palms, Regional Coconut Research Station, Bhatye, Ratnagiri.

Visit of Project Coordinator along with scientists to the farm

The farmer with a bumber yield of nutmeg

Intercrops such as black pepper (Panniyur-1) was planted during 2008, the nutmeg (430 plants - var. Swad, Sugandha and Shreemanti) and Kokum (140 plants - Konkan Amruta) was planted all along the border during 2008. For all the crops the farmer adopted recommended package with regard to nutrient management and water management. For supplying the required nutrients, he applies organic manures viz. FYM/ poultry manure/goat manures along with the major and micronutrients. Irrigation is being given by adopting micro-sprinkler system. The recyclable biomass from the crops is being recycled in the garden itself in the form of mulching and converting it into vermicompost. Since his land is undulating type, he has also adopted soil and water harvesting measures, wherein the rain water is conserved within the garden.

The coconut is being harvested for tender nut purpose and sold at farm gate itself. On an average he harvest 90 to 100 tender nuts. The yield from nutmeg is around 500 to 600 fruits per tree, along with 750 g to 1.0 kg mace per tree. The black pepper yield range from 1.5 kg to 2.0 kg/ vine and kokum yield about 200-225 kg fruit/ tree. The economic benefit (average of 2 yrs) of the system indicates that, the variable cost of production involved to maintain one ha of the system was around Rs. 2,20,000/- to Rs. 2,30,000/- per year. Average net return realized from all the crops was to the tune of Rs. 5.75 lakhs to 6.55 lakhs/ha per year depending upon the market price of the crop. Thus from his experience it was realized that, cropping system with spices in coconut is highly profitable and remunerative over a period of time in the Konkan region of Maharashtra. ■

Virgin Coconut Oil gaining popularity as a functional food

R. Jnanadevan, Deputy Director, CDB, Kochi -11

Virgin Coconut Oil (VCO) produced by using coconut meat and coconut milk is gaining popularity as a healthy and nutritive food. The VCO contains biologically active components reported to enhance the health and wellness. Hence it has got enough popularity as a functional food and the public awareness is also increasing. It has a wider use as nutraceutical and cosmoceutical product. Those who get a chance to taste this healthy oil realizes its effect in increasing the general well being. Several people have started to include VCO in their regular diet. There are reports from their experience that VCO helps to increase the general well being. Over the last ten years the export of VCO has experienced a fast growth among the value added products from coconut. Philippines is the major player in export market. In India also the demand for VCO for domestic consumption and export is increasing due to the increased awareness and knowledge on the proven health benefits of this product. As per the data available with Coconut Development Board (2016-17) around 18,000 tonnes of VCO is produced in India. Out of which only 500 tonnes is exported and the remaining is consumed in the domestic market. It is expected that VCO will experience a dramatic growth in the market in future.

How VCO differs from ordinary coconut oil?

Virgin Coconut Oil is rapidly gaining popularity throughout the world in comparison with ordinary coconut oil. It is in fact different from ordinary coconut oil mainly in its physical form of source, method of extraction and its subsequent benefits. The main difference lies in the process of its extraction. Words like virgin and extra virgin used with this product is

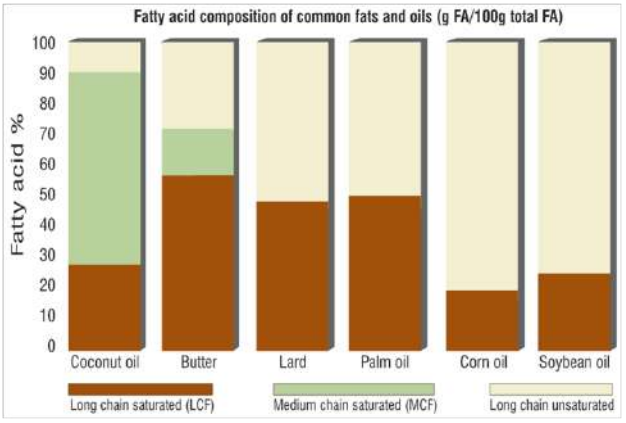
confusing the people. The word extra virgin is simply a marketing term, and it is not different from virgin coconut oil. One of the major differences between regular coconut oil and virgin coconut oil is the method of extraction. Regular coconut oil is made from copra, which is the dried coconut kernel. The copra is pressed and then the oil is extracted to make it suitable for consumption, whereas VCO is extracted from fresh coconut kernel by mechanical means, without the use of heat, without undergoing chemical refining.

VCO differs from regular coconut oil in its appearance. It is as clear as water but regular coconut oil is yellowish. It has a very good taste and smell as it is derived from fresh coconut. This preserves all the natural goodness including high content of Vitamin E and nutrients which are otherwise lost from ordinary coconut oil during process of extraction.

Virgin coconut oil has a very good taste and smell since it is derived from fresh coconuts and is subjected to very low heat and sunlight. Furthermore, virgin coconut oil is very effective as a moisturizing agent. Its antioxidant properties are far better than those of normal coconut oil. The shelf life of virgin coconut oil is very long(one year) which is much longer than any other edible oil and it does not go rancid easily.

Why VCO is called a functional food?

Functional foods are foods which contain an ingredient that gives health promoting properties over and above its usual nutritional value. Functional foods are food that claims to improve health or well-being by providing benefit beyond that of the traditional nutrients it contains. Nutraceutical product is a food that not only supplements the diet but also assists in treating or preventing disease so provides medicinal benefits. VCO is nowadays getting more popular among people as a functional food. VCO is considered as a functional food as well as a nutraceutical product because it provides nutrients good for health and reduce the risk of chronic diseases. VCO is the world's only natural low calorie (Bruce Fife, 2004) fat. It is reported that VCO is easily digested and has been used as a food and medicine. In Philippines it is sold through medical shop, i.e. the value chain for VCO started from the farmers to medical shops before it goes to consumers. Medical shops are also a participant of VCO value chain. VCO contains medium-chain fatty acids (MCFAs) that can improve health in many ways. One of the good choices of fat you can add to your diet is virgin coconut oil. VCO contains the highest percentage of medium chain fatty acids (MCFA) with carbon chain length of 8-12 carbon atoms. Medium chain standard fatty acids (MCFA) get easily digested in the human body and release energy. Hence these fatty acids are good for health. These fatty acids are immediately converted into energy rather than being stored in human body as fat. A comparison of common fats and oils are shown below.



Source: VCO Production Manual (FAO , February 2006)

Overall virgin coconut oil is a highly nutritious and contains a superior disease fighting fatty acid called lauric acid. It is also rich in fiber, vitamins, and minerals.VCO is very effective as a moisturizing agent. Its antioxidant properties are better than normal coconut oil. Fatty acid composition of VCO is given below.

Fatty acid		Range
Caproic acid	C 6:0	ND -1.0
Caprylic acid	C 8:0	– 10
Capric acid	C 10:0	5.0 – 10
Lauric acid	C 12:0	47.0 – 53.2
Myristic acid	C14:0	13.0 –21.9
Palmitic acid	C 16:0	7.5 – 11.0
Stearic acid	C 18:0	1.0 – 4.9
Oleic acid	C 18:1	5.0 – 10.0
Linoleic acid	C 18:2	1.0 – 2.5
Linolenic acid	C 18:3	ND – 0.2
Eicosanoic acid	C 20:0	ND – 0.2
Eicosanoic acid	C 20:1	ND – 0.2
ND – non detectable or ≤ 0.05%		
Source: CDB Institute of Technology		

Out of the total fatty acids in VCO, more than 64% is MCFAs with lauric acids (C12) ranging from 47% to 53% which vary with coconut variety. Studies conducted at Philippines Coconut Authority (PCA) revealed that hybrid varieties have higher lauric fatty acid content (about 50%) than local tall varieties.

Studies on more health benefits of VCO are being revealed day by day. Several studies have been done and VCOs effectiveness and research to currently being done on the nutritional value of VCO. It is reported that VCO as a functional food provides health benefits or reduces chronic disease. MCFAs (C8 to C12) fats in VCO are similar to the fats in mother's milk that give babies the immunity to fight against diseases (Kabara, 2000). It possesses anti-inflammatory, anti microbial and anti-oxidant properties which work together to protect arteries and heart from cardio-vascular diseases. (Fife, 2004) VCO is digested easily without the need of bile and goes directly to the liver for conversion to energy. (Dayrit, 2003) Virgin Coconut Oil is loaded with Medium Chain Triglycerides (MCTs) which act as a neuro regenerative agent for Alzheimer's disease (Dr.Mary New Port). VCO also keep skin youthful, smooth & healthy looking. Using virgin coconut oil as a lotion will help improve your skin, hair, and nails due to its moisturizing and smoothening effects that also promote elasticity. It also protect our body from diseases. A study on "Health benefits of dietary intake of Virgin coconut oil on neural-immune network" was conducted by SRM University, Tamil Nadu with financial assistance from CDB. The major finding of this study provides the first proof of mechanism(s) of action(s) of physiological and molecular effects of VCO in brain and spleen. Study on "Effect of Virgin coconut oil as a dietary supplement on lipid profile and oxidative stress in dislipidemic individuals with Low High density lipoproteins [HDL]" by Amrita Institute of Medical Sciences and Research Centre, Kochi, Kerala. A Project on "Virgin Coconut Oil as a neuro regenerative agent for Alzheimer's disease – Computational analysis Pharmacogenomic study" by Amrita Viswa Vidyapeetham, Amritanagar, Coimbatore, Tamil Nadu with financial support from CDB are in progress.

Economics of VCO Production

VCO is one of the high value products from coconut. Return per coconut can be increased many folds by establishing VCO processing units. For production of one litre of normal coconut oil requires 10 coconuts where as for production one kg VCO requires 17 coconuts. The cost of ordinary coconut oil Rs.200/- to Rs.220/-per kg, where as the cost of VCO is Rs.1000/- per kg. Hence Income from coconut farm can be increased 3-4 times over traditional copra production, coconut oil or sale of fresh nuts. At present the average retail domestic price of coconut is @ Rs.20 per nut, 17 Coconut will generate an income of Rs.340/- However if 17 coconuts are processed into VCO, the income generated will be Rs.1000/- which is the current retail domestic price per kg for VCO traded in India. However for production of one litre of ordinary coconut from copra, 10 coconut is required and @ Rs.20/- per nuts with at cost of 10 coconut costs Rs.200/- The current retail market price of coconut oil is Rs.250/-. The margin or buying and selling price is very low in ordinary coconut oil compared to VCO. Under these conditions, processing of coconut to VCO instead of copra is a much profitable choice. Besides the export price of VCO is very high compared to ordinary coconut oil. The present international price of copra and coconut oil is less than the domestic price. This indicates that value addition is highest in VCO i.e. about 300% and it is one of the high valued products traded in the world market.

CDB under a sponsored research project of Central Food Technological Research Institute (CFTRI), Mysore in 2006 developed the technology for production of high quality VCO through wet processing called centrifugal method. VCO produced through this technology is on par with the quality standards of VCO at international level. The technology is available with CDB for transfer to interested entrepreneurs for starting commercial production units. Details of this process for extracting VCO and machineries required are available in the website of CDB.The health and nutritional attributes of virgin coconut oil (VCO) made it popular in domestic and global vegetable oil market. Considering the increasing demand of VCO in domestic and international market, more emphasis is given by CDB to increase its production and marketing. Venturing into more clinical studies to prove the goodness of VCO with international collaboration is another strategy adopted for its promotion. Export Promotion of VCO is also taken up by CDB. Separate ITC HS code for VCO is not yet allotted and at present it is exported from India with ITC HS code of other coconut products. This issue is being taken up by CDB with the Department of Foreign Trade, Ministry of Commerce Government of India. Coconut sector starting from the farmers, traders, processors and marketeers in the VCO value chain can expect to experience great prosperity. ■

Quality Virgin Coconut Oil
Doing the right thing at the right time

Deepthi Nair S, Assistant Director, Marketing, CDB, Kochi-11

Virgin Coconut Oil has emerged as the most promising coconut product of the current times with world demand increasing rapidly at geometric progressions. The nutraceutical benefits and its properties as a functional food have primarily led to this increased demand. The immense application of virgin coconut oil in the health and beauty care segments has also added to the demand. The advantage of VCO is that it could be produced at house hold, micro or village scale levels too which makes it possible for the micro, small and medium scale enterprises. But the major concern related to VCO is that it should be produced as per good manufacturing practices under well managed hygienic conditions to ensure quality as a food product suited for human consumption.

There are different processes for producing VCO but irrespective of the process, there are certain critical control points in VCO processing which will influence the quality of the final product. The common commercial methods of production of VCO include the fresh dry process which is the desiccated coconut route followed by the high pressure expeller method and the fresh wet process which is the coconut milk route followed by the centrifuge method.

Critical Control Points in VCO production

Nut selection

The selection of nuts hold great importance and play a major role in the quality of the final product. Fully mature nuts of 12-13 months maturity are most suited for VCO production since they have the highest oil content and the lowest moisture content. The nuts have to be thoroughly inspected to segregate and reject all immature, germinated or spoiled nuts. Nuts with cracks or a damaged soft eye should be discarded. It is to be ensured that the fully mature nut does not have a haustorium. With onset of haustorium development, the oil content of the kernel starts to decline and as the haustorium grows bigger, the quality deteriorates. The husk colour should have turned from green to brown.

Care should be taken to ensure that the nuts do not break during unloading. Also nuts should not be exposed to sunlight. This is because exposure of dehusked nuts to sunlight during weighing, unloading or delivery could lead to cracking of the shell that will cause spoilage. Studies have shown that there is possibility of nut cracking if the dehusked remain

in sun for more than an hour. Cracking of nuts will directly lead to initiation of spoilage.

It is always ideal to place the coconut processing facility within the production areas to ensure adequate supply of fresh nuts and reduce costs of logistics. The dehusked coconuts should be used for processing within a period of seven days from harvest.

Storage of nuts

Storage of nuts also holds much importance. As mentioned earlier dehusked nuts should not be exposed to sun and should be stored in clean storage areas with adequate ventilation. The storage pile should not be kept directly on the cement floor, but in elevated platform to facilitate flow of coconut water, in case breakages occur. Also store in such a way that the first in it is used for processing first. The maximum height of the storage pile for fresh nuts should not exceed 1.8 metres. Never store nuts in plastic sacks since lack of air circulation inside the sack would lead to moisture accumulation inside which can cause deterioration of the nuts.

Disposal of coconut water

Coconut water is an important by-product of VCO processing. It is extremely susceptible to fermentation and spoilage once opened. Coconut water is to be collected before deshelling if it is to be processed for production of packed coconut water or other value added products. If not it could be removed later after paring. Other options for the utilization of coconut water are production of value added products like coconut vinegar, nata de coco, electrolyte drinks etc. Large quantities of coconut water should not be disposed directly into drains or a sewage system or a river or sea without proper treatment. Coconut water is considered a major pollutant because of its high biochemical oxygen demand(BOD5) or biological oxygen demand.

In VCO processing, care should be taken to ensure that coconut water is not left on the floor since it will attract flies and will become a source of contamination. Since it easily gets fermented, it generates a foul smell. Undiluted coconut water becomes very acidic and could destroy the cement surface of the floors, if not properly tiled.

Selection of coconut kernel for processing

After splitting of nuts, quality control of fresh coconut kernel should be done to ensure that only fresh unspoiled coconut flesh is processed. The kernel should be firm in texture and white/opaque in colour. Coconut kernel with a soft texture, slimy surface or discoloration should be segregated and discarded. Also kernel from nuts with big haustorium or germination growth is soft and thin and has a rancid smell. Hence it must be discarded as it will destroy the quality of the whole batch.

Drying of coconut meat

In the fresh dry method through the desiccated coconut route, drying of coconut meat should be done within four hours of opening of the nut since delay in drying will cause bacterial contamination of the fresh meat which will in turn cause an unacceptable yellow oil. Quality VCO will be water clear. Maintenance of drying temperatures is also important. High temperature and improper drying techniques would result in unacceptable pale yellow with a burnt

Required characteristics and type of coconut oil for specific applications		
Specific Application	**Required characteristics**	**Type of coconut oil**
Nutraceutical and functional food	100% pure and processed under strict sanitary conditions; High Quality with FFA content of 0.1% and below and peroxide value of 1 and below.; does not have oily after taste when ingested	VCO from Fresh Wet Centrifuge process; Properly aged VCO from natural fermentation process
Base oil for hypoallergenic cosmetics	100% pure and processed under strict sanitary conditions; High Quality with FFA content of 0.1% and below	VCO from all types of production processes
Cold pressed bath soap	High Quality with FFA content of 0.1% and below	RBD coconut oil; VCO from all types of production processes
Moisturising body oil	High Quality with FFA content of 0.1% and below; no greasy feel (non-viscous) and easily absorbed by the skin; mild coconut scent	VCO from Fresh Wet Centrifuge process; VCO from coconut milk residue
Moisturising body butter and jelly	High Quality with FFA content of 0.1% and below	VCO from all types of production processes; RBD coconut oil
Hair conditioning oil, butter and wax	High Quality with FFA content of 0.1% and below	VCO from all types of production processes; RBD coconut oil
Aromatherapy and massage oils	High Quality with FFA content of 0.1% and below; no greasy feel (non-viscous) and easily absorbed by the skin; mild coconut scent	VCO from Fresh Wet Centrifuge process; VCO from coconut milk residue
(Source : Paper presented by Mrs. Divina Bawalan at 1st International Conference on Coconut Oil, March 2015, Bangkok, Thailand).		

odour. If the drying temperature is too low, bacterial contamination may occur resulting in unacceptable yellow coloured oil. Overloading the dryer can also result in yellow coloured oil due to deterioration of the kernel that is not reached by the heat.

Moisture in virgin coconut oil

Moisture content in VCO is one of the most crucial factors that affect the shelf life of the product. Removal of residual moisture is very critical in the wet extraction process. In the case of commercial production, vacuum drying is the most effective way though investment cost is high.

General sanitation in the plant

The hygiene and sanitation maintained in the plant is very crucial in the quality of the product. Strict adherence to the sanitary procedure will mean zero or fewer rejection/retention/complaints. Fresh coconut meat and coconut milk are low in acid, high in moisture and nutrients and hence highly susceptible to microbial contamination. Continuous cleaning and washing down of the processing area followed by end of the shift cleaning followed by regular disinfection will reduce the risk of VCO not meeting quality standards. All standard operating procedures for maintenance of sanitation should be strictly followed.

Removal of by-products

Coconut shells should be regularly removed to prevent contamination and foul odours. When VCO is produced from coconut milk, the residue generated after milk extraction should be transferred to the area where it is further processed.

Essential Composition and Quality Factors of Virgin Coconut Oil	
Parameter	Specification
Moisture (%)	Max 0.1
Volatile Matters at 120°C	Max 0.2
Free Fatty Acid (%)	Max 0.2
Peroxide Value meq/kg	Max 3
Relative Density	0.915-0.920
Refractive Index at 40°C	1.4480-1.4492
Insoluble impurities per cent by mass	Max 0.05
Saponification Value (Mg KOH/g oil)	250-260 min
Iodine Value (Wijs)	4.1-11
Unsaponifiable matter % by mass, max	0.2-0.5
Specific gravity at 30°C	0.915-0.920
Polenske Value	Min 13
Total Plate Count	<0.5
Colour	Clear Water
Odour and Taste	Natural Fresh co-conut scent, free of sediment, free from rancid odour and taste
(Source: APCC Quality Standards)	

VCO has a multitude of applications in nutraceutical, functional food and health and beauty care segments. The end market for the VCO should be in accordance with the quality of the VCO produced. And every stage of processing has a stamp on the final quality of the product. Hence at each stage, the right thing should be done at the right time

Wet coconut milk residue left unattended for more than four hours itself is a source of foul odours and microbial contamination. As indicated earlier, immediate flushing away of the coconut water is necessary whenever it is spilled on the floor.

Quality of VCO depends on the adoption of good practices during the preprocessing, processing and packaging stages. VCO has a multitude of applications in nutraceutical, functional food and health and beauty care segments. The end market for the VCO should be in accordance with the quality of the VCO produced. And every stage of processing has a stamp on the final quality of the product. Hence at each stage, the right thing should be done at the right time. ■

The status and future strategies for coconut cultivation in West Bengal

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Introduction

Coconut, "the tree of life" is ceremonially associated with worship of Gods and Goddess in different corners of the country. In addition coconut is a source of earning livelihood to the inhabitants of the coconut growing states in coastal areas. Besides, it is also having considerable importance in the national economy as a potential source of employment generation. As a result, now coconut cultivation is spreading at a faster rate from the traditional area to the nontraditional areas of the country.

Coconut situation in West Bengal

Coconut is grown in an area of 29,510 hectares with a production of 373.6 million nuts per year (2015-16). At present, based upon the area and production, West Bengal is considered as an important coconut growing state in the eastern region and ranks fifth in terms of area, production and productivity of coconut in the country.

In the state, coconut is mostly grown in homestead gardens. Only few organized plantations exist since independence, because the farmers of the state were not interested to engage their fertile lands with long duration crops like coconut compared to short durational remunerative crops like cereals, vegetables, flowers etc. As a result it was mainly concentrated in homestead land since ancient times scattered mostly in the southern parts of West Bengal. The main coconut growing areas of the state comes

under the districts of Nadia, North 24 Parganas and South 24 Parganas, Howrah, Hooghly, Murshidabad, Burdwan, Midnapur (East), Coochbehar, Jalpaiguri etc. More than 80% of coconuts are being utilized in the form of tender nut e.g. “dab” in the state. There is a whole sale market for tender coconut at College Street, Kolkata which is more than 100 years old. The tender nuts are being marketed here during early morning from 4.00am to 6.30am every day and then the nuts are transported to different parts of the country like Delhi, Mumbai, Patna etc. There are many small units of fiber extraction and different types of coconut fiber brushes are made which has great demand in the export market for its biodegradable nonpolluting nature of fiber.

Due to the old habitual consumption habit of coconut water as natural drink, at present about 80% of total coconut production of West Bengal is being utilized in the form of tender coconut as thirst quencher (tender nut water). The high intensity consumption of tender coconut water by the local population in West Bengal may be due to the realization of the medicinal and therapeutic uses by the consumers.

Status of coconut cultivation in Sunderban delta of West Bengal

The low lying areas of Sunderban are shaped into long high land stretch where coconut plantations are being done commercially and high value processed products can be prepared for enhancing the income of the farmers of the area. There is a great potential to make the coconut cultivation more remunerative through cultivation of different types of inter crops like vegetables, turmeric, ginger, black pepper, banana, pine apple, elephant foot yam etc. It will increase the income and employment generation as an important component of livelihood and nutritional security. Coconut also plays an important role as a climate resilient crop that protects the area from crop failure during the vulnerable weather aberration during high wind situation.

The crop flourish well in sandy soils along the sea coast. But it can also be grown well in various types of soil like lateritic soil, alluvial soil, clay soil, clay loam soil etc with proper drainage facility which allow unrestricted root growth and aeration. This type of soil and climatic conditions which is ideal for coconut cultivation exists in different parts of West Bengal. As a result based upon the soil and climatic conditions, the coconut growing regions of West Bengal can be divided into three parts; Coastal and Sunderban region which includes parts of the district of East Medinipur, parts of North 24 Parganas and South 24 Parganas, plain land area which includes the district of Nadia, Hooghly, West Medinipur, Burdwan and Howrah, terai region which includes the districts of Jalpaiguri, Coochbehar, Uttar Dinajpur, Dakshin Dinajpur and plain areas of Darjeeling in Northern part.

Opportunities:

Vast area available for coconut cultivation

Scope for employment generation

Scope for income generation through coconut based cropping system adoption

Food and fuel security to the marginal poor farmers and agricultural labors

Scope for establishment of small scale coir industry, charcoal industry and oil industry

Availability of huge biomass which will debar the inhabitants to destroy more specially the mangrove forests of sunderban area.

Reduces the air pollution through more biomass generation

Conservation of forests

Role of AICRP on Palms, Mondouri Centre in West Bengal

In coconut research, ICAR-Central Plantation Crops Research Institute, Kasaragod and All India Coordinated Research Project on Palms, HQ at ICAR-CPCRI, Kasaragod are playing a major role throughout the country. Similarly, in West Bengal the research activities on coconut through introduction of different location specific high yielding disease tolerant varieties (Tall and Dwarf), new technology development on integrated farming system approach in coconut garden for higher productivity, introduction

of High Density Multi-species Cropping System (HDMSCS), technological development for production of virgin coconut oil, sweet coconut inflorescence sap "Neera" and its value added products like jaggery, honey, sugar which are meeting the diverse needs of the coconut farmers were started since 1982 through establishment of All India Coordinated Research Project on palm at Mondouri, BCKV, West Bengal. Though the impact of this developmental activities were more prominent in four southern states like Kerala, Andhra Pradesh, Tamil Nadu and Karnataka because of higher area coverage and increased production due to large scale organized plantation. But the impact of these developmental activities has started to spread in other coconut growing states including WB also. As a result farmers of these states have started to give more importance on coconut cultivation.

For location specific research activities on coconut, a center of ICAR-All India Coordinated Research Project on Palms, (AICRP on Palms) was established at HRS, Mondouri, Bidhan Chandra Krishi Vishwavidyalaya, Mohanpur, Nadia W.B. in 1982. Since then, location specific recommendations were developed by the AICRP on Palms, Mondouri centre and disseminated to the coconut farmers through awareness program, FOCT program, publications etc.

Technologies generated under AICRP on Palms for the development of coconut farmers of W.B

A coconut variety Kalyani coconut-1 was released for West Bengal from Mondouri centre, BCKV.

The fertilizer recommendation for tall coconut a variety in West Bengal was 500:250:750g of N: P: K per palm per year was standardized under ICAR-AICRP on Palms experimental area.

> **Coconut flourish well in sandy soils along the sea coast. It can also be grown well in various types of soil like lateritic soil, alluvial soil, clay soil, clay loam soil etc with proper drainage facility which allow unrestricted root growth and aeration. This type of soil and climatic conditions which is ideal for coconut cultivation exists in different parts of West Bengal.**

The fertilizer recommendation for dwarf coconut varieties in West Bengal was standardized @1000:500:1250g of N: P: K per palm per year.

The following coconut based medicinal crop combinations like Coconut + Sarpagandha, Coconut + Aswagandha, Coconut+ Arrowroot were recommended for commercial adoption in West Bengal condition.

Under coconut based cropping system most remunerative flowering crop combination of Coconut + Gerbera recorded maximum B: C ratio and recommended for farmers of West Bengal

Ginger and Turmeric were also recommended as a most remunerative crop combination with coconut under West Bengal condition.

Banana and pineapple fruit crops recorded maximum income generation with coconut under West Bengal condition.

The nut yield and copra yield per palm per year in fertigation of 50% RDF was on par with fertigation of 75% RDF and soil application of 100% RDF. Hence fertigation of 50% RDF can be recommended for West Bengal.

Value addition of Coconut

Very recently ICAR-CPCRI, and BCKV, has started a work jointly on Cocosap "Neera" collection and its value addition at Balagarh, Hooghly, West Bengal. With the support of AICRP on Palms, Mondouri, BCKV, 1st technological MOU in Eastern India was signed in between the ICAR-CPCRI and farmer Mr. Kaushik Ghosh of West Bengal during 2016 on "Neera Production" and this work is gaining popularity very rapidly as the sap contains very low Glycemic Index along with a considerable amount of Na, K, and other minerals. The global demand for low GI sugars is increasing for diabetic patients and hence Neera and palm sugar can fill up this gap. With the support of AICRP on Palms, Mondouri, BCKV, 2nd technological MOU was also signed between the ICAR-CPCRI and M/S Felu Modak of West Bengal on value addition of Neera for preparation of Neera based milk sweets.

Rationale for tapping Neera (Kalparasa)

The inflorescence sap of coconut is the phloem sap which is used by the plant mainly for the growth of the palm and development of the fruit. In West Bengal condition generally coconut produces 10 to 11 inflorescences (spadix) in a year with scientific management e.g. on an average one per month. Each spadix can support 10-12 nuts either tender or mature coconuts. A tender nut requires 6 to 8 months while a mature nut requires almost a complete year for maturity. At a reasonably high water content of 400 ml per tender nut, the total water per spadix is just 4 to 4.8 liters. If the same unopened spadix is tapped for sap, it could produce average 30 to 35 liters of sap in a period of just 40 to 45 days which is rich in nutrients and photochemical as compared to tender coconut water. The sap thus collected can be sold as a health drink or can be processed into sugar, honey or syrup which has great demand in domestic and international market.

There is tremendous scope for marketing of Neera as fresh or its value added products like Neera jaggery, Neera sugar and milk based Neera sweets. Unlike many traditional sweetening agents, the products made from Neera is capable of providing the same sweetness without causing spikes in blood sugar levels. Therefore it is considered as a safe and healthy drink for diabetic patients. As a result now Neera and its value added products are getting popularity day by day in West Bengal among general people more specifically among the diabetic patients and global demands for low GI sugar is increasing.

ICAR-CPCRI has already recognized this work by publishing the same in their web site. Application for patent is also filed for the process of preparation of milk based Neera sweets.

Initially milk based Neera sweet preparation was started by M/S Felu Modak in Rishra, Hooghly, W.B. Now more than 50 sweet makers of West Bengal at different corners of the state are preparing milk based sweets for diabetic patients using either jaggery or neera sugar. There is a very good demand for fresh neera, jaggery and neera sugar in West Bengal.

Strategies for future development:

Introduction of high yielding location specific varieties

Commercialization through area expansion

Increasing availability of quality planting material

Adoption of scientific package of practices through training and on farm demonstration by the farmers for making coconut cultivation remunerative.

Dissemination of integrated nutrient managements recommendation,

Dissemination of cropping system management technologies to the farmers' for income and employment generation. This might be able to open a new path for the rural economic development of the state. In this concept more emphasis on research activities especially on techno economic aspect with special relation to size of the land holdings need to be given.

Establishment of progeny orchard for product planting materials

Establishment of small scale processing unit for preparation of value added products of coconut which will make coconut cultivation more remunerative. ■

Suryashoba
upholding the goodness of coconut

Sona John, Sub Editor, CDB, Kochi -11

'Suryashobha' is an established brand name in the manufacturing and marketing of 100 percent natural coconut milk powder. With 25 years of industrial experience, Mr.Suresh Kumar and his wife Mrs. Shobha Suresh, the proprietors of Suryashobha innovated this unique project through their long years of research and keen observation.

It was in 2010 this Thrissur based couple approached a public sector bank in the city to apply for a loan for setting up a coconut milk powder unit. The bank authorities were not willing to extend financial assistance as they were doubtful about the prospects of coconut milk powder unit in Kerala, a state with plenty of coconut trees. He was asked to come with some other prospective projects. The couple took it as a challenge and now the family owns the Suryashobha products with an investment of Rs. eight crore which is apparently the first of its kind in Kerala and the second in India

Initially Suresh Kumar started his unit on a very small scale. It took many years of research and keen observation and of course hard work to yield result. Suresh Kumar is the Managing Director of the Company, his wife Shoba Suresh is the proprietor and his son Sonu is looking after the marketing of Suryashobha products.

Suryashobha owns around 25 cents of land in industrial estate, Athani, Kerala. Initially the family had an engineering workshop for manufacturing grills and gates and also a paper cup manufacturing unit. The idea to start a milk powder unit came later and the family started working on it. Suresh approached Coconut Development Board for ascertaining the technical feasibility of starting a unit. On getting assistance from CDB during 2008 the work for setting up the unit was initiated.

> **Suryashobha is having a novel perspective to bring to the consumers healthy, good quality food products in its natural taste without any adulteration. Presently Suryashobha is using an Italian machine with the capacity to produce 200 tonne milk powder per month.**

With some of his gulf contacts Suresh Kumar was assured that there is good export demand for desiccated coconut powder. He had even identified some buyers before starting production. A group of 48 pravasi malayalees along with Suresh and his wife acquired land for setting up an integrated coconut processing unit at Akilad Beach, Chavakkad, Kerala. But after tsunami, the construction of building was not permitted within few kilometers of the beach and hence they had to drop that project.

Since then Suresh was planning a project. During that period there was no machines in India for producing coconut milk powder. Suresh designed a machine here in India itself based on the design of a similar machine from Denmark. The machine was having the capacity to process 750 kg coconut milk powder and 1500 kg desiccated coconut powder. The project is fully supported by Coconut Developed Board and the state of the art technology is the brain child of CFTRI Mysore.

During that period in 2010-12, Maggi was importing and marketing coconut milk powder in India. Suryashobha competed with Maggie with its good quality coconut milk powder and its natural sweetness.

The production unit is equipped with a competent team of well trained, self-motivated work force and guided by management and marketing professionals. The unit is a fully automatic system with disintegrator, milk extractor, tank with agitator, milk crusher, sterilization tank and a complete and fully automatic spray drier. A fully automatic line carton packing machine as per the product requirement is also installed in the unit.

Suryashobha is having a novel perspective to bring to the consumers healthy, good quality food products in its natural taste without any adulteration. Presently Suryashobha is using an Italian machine with the capacity to produce 200 tonne milk powder per month. Around 1000 tonne coconut is required for this. Suryashobha is the only unit in Kerala which uses Spray dried technology for producing tender coconut water powder. The company is also in its final stages of starting a coconut milk powder and a milk unit.

Suryashobha uses only best quality imported machines like spray dry machine, dehydrator for DC and a pulverizer with the capacity to crush 25000 nuts in one hour for producing desiccated coconut powder.

Once the raw material is brought inside the plant, there is absolutely no wastage of materials. Each and every edible part of the nut is used in its natural way to produce something or the other. Suryashobha's coconut milk powder, desiccated coconut powder, virgin coconut oil, tender coconut water powder, coconut sugar, coconut cream, coconut milk and coconut chips are the premium products of the product basket. Apart from these products, Suryashobha is producing around 25 other coconut based food products. The specialty is that these products are exclusively used for exports to USA, Europe, China and Gulf countries. In order to keep the freshness and best quality of the products, Suryashobha starts the manufacturing of the product only on receipt of export orders. Suryashobha exports 70% of its products and guarantees the same standard and quality product in the domestic market also.

Along with coconut based products Suryashobha is producing and exporting many other edible items. Since 25000 nuts are required daily for making the complete utilization of the installed capacity Suryashobha has ventured into the production of other quality food products and spice items.

Suryashobha is having to its credit a state of the art quality lab with FSSAI. Suryashobha is also having ISO 22000, organic and USFDA certifications.

The company procures raw material from in and around Thrissur and is having tie up with farmers for continuous supply of raw material. For extraction of milk, good matured nuts are required. The company procures good quality nuts at a higher price from the farmer.

The unit provides direct employment to 70 people and indirect employment to many others. While upholding the 'growth and let others grow along' motto, Suryashobha intends to benefit even the small scale coconut growers. The Suryashobha family wishes to have good investors and entrepreneurs to come to the coconut processing industry.

For further details contact:

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Antibacterial and Antifungal Activity of Crude Coconut Shell Oil

Coconut *(Cocos nucifera)* is a palm tree growing in the tropics. The nut contains white meat and sweet water which has anti-bacterial, antifungal, anti-viral anti-inflammatory, antioxidant activities. Antimicrobial activity of the water extract of coconut husk has already been demonstrated. However, studies regarding the polyphenol content of the coconut fruit wall are limited. Coconut shell can be grinded into powder and used as a filter for synthetic resins. It is also used as activated carbon and charcoal. Oil derived from coconut shells have been shown to have antimicrobial and anti-fungal activity.

Traditionally coconut shell oil has been used for the treatment of skin infections. It has been used for antitumor, antihelminthic, antimicrobial, anti-inflammatory antiseptic and antioxidant activity. A project was conducted by Sodha R., Gaonkar S, Kolte S. and Padmanabha P of Department of Chemistry, Kishinchand Chellaram College, Churchgate, Mumbai to extract oil from the coconut shell, purify it and test it for anti-bacterial and anti-fungal activity. The shell oil was first extracted by modified method then it was subjected to sequential solvent extraction with petroleum ether, chloroform and methanol. The anti-bacterial and anti-fungal activity was checked by ditch plate and agar cup diffusion method. The microbial activity was found to be more active in Petroleum Ether extract, hence an attempt was made to separate the components present in it by Flash Column Chromatography. The monitoring was done with TLC, and pure components were further studied for identification of Functional groups present in it using FTIR.

Coconut shells from south Mumbai were collected. They were cleaned and sun dried. Then the cleaned shells were polished with paper to make the surface of the shells smooth. Further the shells were ground manually to make small pieces which were used in extraction of the crude coconut oil. Petroleum ether, Chloroform and Methanol were used as solvents in the extraction and chromatographic procedures.

About 250gms of ground shells were heated in the earthen pot for a span of 3hrs giving a yield of 25cc of oil. The oil was fractionalized using the solvents. A 0.74m long silica column was used for separation of the extracts obtained by solvent extraction. 5.5gms of silica gel was taken and activated in hot air oven. Organic spotting was done for samples obtained from column chromatography to detect the presence of elements like nitrogen, chlorine, sulphur or any other halogens. The samples were further subjected to IR Spectroscopy and Gas Chromatography Mass Spectroscopy which has indicated the probable function group and molecular weight.

The samples were tested for their anti bacterial and antifungal activity. Petroleum ether extract is effective on *S. aureus* which is responsible for skin infections. It also gave satisfactory result for *E. coli* which is a part of normal intestinal flora though the shell oil gave comparatively lesser inhibition. Hence it can be concluded that the anti-bacterial and anti-fungal activity is shown collectively by several components of the fractionated coconut shell extract. We can use the petroleum ether extract of the crude coconut shell extract as an alternative. Further tests need to be done to separate and purify the compound that is responsible for the inhibitory effect.

Source: International Research Journal of Biological Sciences, Vol 4(11) ■

Use good quality planting material for potential yield

Jayashree A. Development Officer, CDB, Kochi -11

Coconut is a perennial crop having a longer life span. Hence the selection and use of planting material of high genetic quality assumes importance in coconut planting. The quality and excellence of the planting material is very important in deciding the future yield. Even when all scientific packages of practices are practiced the productivity may be low due to poor genetic quality of planting materials. Coconut is a crop of long gestation period providing long term yield for more than a human generation. It takes years to start yielding. Hence the original planting material must be rightly selected and should be best in quality. Seedlings must be brought from the selected seed nuts collected from high yielding elite mother palms. Otherwise productivity will be affected, even after proper fertilizer application and following scientific management practices. Criteria for selecting the seed nuts and seedlings as well as the varieties to be cultivated should be strictly followed.

The seed production in coconut is a very tedious process compared to other commercial crops like rubber and horticultural crops like mango, guava, orange, apple, grapes, litchi etc. Rapid multiplication processes like budding, grafting and layering are not feasible in the production of the planting material of coconut cultivation. The only method available for multiplication of coconut seedlings is through seednuts. Even in hybridization of coconut, the process is laborious and time consuming. Large multiplication of a single variety is also very slow. As such, the production and propagation of quality planting material is most difficult in coconut compared to all other crops.

Availability of the planting material is the most important input factor for getting optimum yield from any crop. The quality of seed is highly correlated with mother garden characters in a cross pollinated crop like coconut. Hence for production of quality seedlings, selection of good mother garden, mother palms and procurement of good seed nuts is of great are very important.

The demand for coconut seedlings in India for new planting and replanting is estimated at hundred lakh annually. The present production is around 35 lakh seedlings only and hence there exist a demand supply gap of 65 lakh seedling annually. Coconut Development Board has established Demonstration cum Seed Production Farms in ten states and around ten lakh best quality seedlings are being produced and distributed to farmers annually.Board is attempting to provide the farmer with the best quality seedlings through its DSP Farms which will provide the best results in yield.

Selection of seed garden

Seed gardens should be plantations with a record of consistently high yields. Gardens should have palms with a high proportion of heavy bearers but this must not be from very favourable conditions. Palms growing under very favourable conditions and receiving special care should be avoided as it will be difficult to assess their inherent yielding ability.Garden should be free from pest and disease incidence. Trees growing closer to households, cattle shed, compost pits etc.should be avoided.

Mother Palm Selection

For production of quality planting materials it is essential to have good quality mother palms of the desired varieties. In the absence of commercially viable vegetative propagation techniques only seed propagation is possible in coconut. Therefore mother palm selection is a key factor in planting material production of coconut.

Quality standards for mother palms

The mother palms should be between 15-45 years of age. The shape of crown should be spherical or semi-spherical. Petiole length and stalk of the bunches should be short and strong in nature and should have regular bearing habit with minimum annual yield of 80 nuts during the last 5 years. The tree should be regular and heavy bearer. A high yielding mother palm in its middle age will always have 25-30 fully opened leaves on its crown. The petioles should be short and stout and should be able to give effective support to the coconut bunches. The bunch stalks should also be short, strong and should not have the tendency of drooping down. Trees must have medium sized nuts with nearly round or spherical shapes. The dehusked nuts should have a weight of more than 600 g and the copra weight should be above 150g. Palms having long, thin and pendulous inflorescence stalks and palms producing long, narrow, small sized or barren nuts should be avoided. Palms showing alternate bearing tendency, palms shedding immature nuts in large numbers and palms grown under favorable environmental conditions e.g. trees near manure pits should not be taken.

Maturity of Seed Nuts

The mature nuts are harvested when at least one nut in the oldest bunch starts becoming dry. In Tall varieties, it takes 11-12 months to become a matured seed nut whereas in dwarfs, nuts will mature in 10-11 months after the emergence of the inflorescence. Such nuts produce a resonant and ringing sound when hit with the harvesting knife or tapped by finger indicating that the husk is dry. Immature nuts will produce a dull sound. Harvest the bunches intended for seed nut by lowering them to the ground using a rope to avoid injury to seed nuts when palms are tall and ground is hard. The seed nuts should be medium sized, round or oblong in shape.

QUALITY STANDARDS FOR SEEDNUTS	
Germination	> 80%
Purity	> 98%
Fruit weight	>400 gm (dwarf)
	> 600 gm (tall)
Nut water	present
Maturity	11-12 months (tall) &
	10-11 months (dwarf)
Pest and disease incidence	nil

Collection of seed nuts

The time of seed nut collection may vary from region to region according to the seasonal conditions. It is always better to collect nuts that had undergone development during rainy season for seed nut purpose.

The proper time for the harvest of seednuts depends to a large extent on seasonal conditions of the locality. January to May is considered to be optimum on the West Coast because the nuts harvested during this season are generally bigger in size with a higher copra content than during other months and give maximum germination. The nuts can be planted in the nursery during the last week of May or in the first week of June with the onset of South West Monsoon whereas in East coast region seednuts can be sown in October- November.

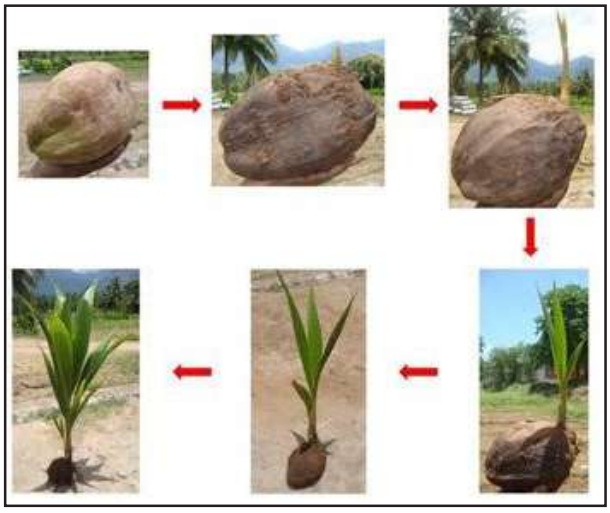
The season of harvest may have to be adjusted to suit local conditions so that the seed nuts can be sown in the nursery after about two month's storage. The shape and size should be proper and any type of damage of the nut during harvesting is to be avoided. The seed nuts should be fully mature, i.e., about twelve months old. Mature nuts will produce a clear metallic sound on tapping, which can be identified by experience. Immature nuts will produce dull sound. The presence of water has to be judged by shaking the nuts. Fully matured nuts will have dry husks with a distinct browning of the inner fiber.

Method of harvesting

The nuts are to be lowered by ropes only to get an undamaged embryo. However in cases where mother palms are not very tall and the soil is loose and friable, the seednuts can be harvested by cutting the bunches and allowing them to fall on the ground.

Storage of Seed Nuts

Storing of nuts is another important step for quality seedling production. The seed nuts after harvest are not immediately planted in the nursery. Usually the seed nuts are stored in shade for about a month till the husk becomes dry to facilitate speedy and maximum germination. To get better quality seedlings, the seed nuts of tall and hybrid are to be air cured for one month followed by sand curing for two months. For dwarf varieties, the air curing should be lesser than one month followed by sand curing for two months. In general seed nuts of tall variety are stored up to two months after harvest and dwarfs are sown within 15 days. For storing, arrange the seed nuts with the stalk-end up over an 8 cm layer of sand in a shed and cover with sand to prevent drying of nut water. Up to five layers of nuts can be arranged one over the other. The nuts can also be stored in plots, provided the soil is sandy and the ground is sufficiently shaded. In case of nuts harvested in May, heap them in partial shade, till husk is well dried and then sow them in the nursery. Nuts without the splashing sound indicate that the nut water has become dry and hence it should not be used for sowing. During summer, sprinkle water to prevent the drying of nut water.



Growth from seed to seedling

Nursery management

Nursery Area

Select nursery area in a well drained plot with coarse texture soil near water source for irrigation. Nursery can be raised in the open space with artificial shade or in the adult coconut garden.

Seed Nut Sowing

Sow seed nuts in a long and narrow bed at a spacing of 30 x 30 cm either horizontally or vertically in deep trenches with 20-25 cm depth. Five rows of nuts

Sowing of seednuts

may be sown in each bed accommodating 50 nuts per row depending upon the slope of the land. Raised beds may be prepared in places where drainage may be impeded during heavy rains. An 80 cm spacing in between the beds will enable the nursery operations from the sides without disturbing the beds.

Inter cultural operations in Nursery

Irrigate the nursery beds once in three days. Keep the nursery free of weeds. To manage the weed problem in coconut nursery, growing sun hemp twice followed by hand weeding at 6th month is found to be very effective besides yielding green manure for manuring the adult coconut palms. Provide shade to the nursery by raising Sesbania or Leucaena on the sides of beds during summer. Too much shade makes the seedling grow lean and lanky. The seed nuts start germination in 6-8 weeks after planting and the germination continues upto six months. Select seedlings that germinate before five months after planting. Remove those nuts which do not germinate five months after sowing. Survey for pest and diseases regularly. Precaution need to be taken by treating the soil for termite and root grub.

Time of Sowing

The proper time for planting nuts in the nursery vary from tract to tract depending upon the monsoon. By planting at the commencement of the rainy season it will be possible to avoid heavy and frequent watering required for good germination. May-June is the most appropriate time for planting seed nuts in the nursery.

However in West Coast region, seed nuts can be collected during the period from January to April and can be sown in June in the nursery whereas in East Coast region seed nuts are sown during October-November.

Pretreatment of seed nuts

At the time of planting seednuts, it is necessary to examine the nuts individually and discard those nuts in which the nut water has dried up or kernel has rotten during the course of storage. If the soil is dry and rains are delayed, soaking of seednuts in water prior to planting may be beneficial. Soaking of seed nuts in water for 15 days has been found to result in quicker and better germination. If the period is prolonged, germination and quality of seedlings gets affected.

Method of Sowing in Nursery bed

The seednuts may be sown in trenches of 20 cm deep and 40 cm apart in the nursery beds either vertically or horizontally with a spacing of 30 cm between the nuts (centre to centre). Though a higher percentage of germination is obtained with the horizontal planting, no difference manifest in the performance of the seedlings as compared to vertical planting. When seedlings are to be transported over long distances, vertically planted seedlings are easier to handle and can be compactly packed.

In the horizontal sowing, nuts may be sown with the widest of the three segments at the bottom and in vertical planting the stalk-end up. The depth of sowing may be adjusted so that the husk is just visible at the surface.

Method of raising seedlings in polybags

In order to avoid the transplanting shock the seedlings can be raised in polybags. For this, initially

Polybag nursery

the nuts are sown vertically in the nursery closely and when they start germinating, once in every fifteen days the sprouted nuts are collected and placed in polybags of 500 guage measuring 60 cm x 45 cm filled with potting mixture and 8-10 holes at the bottom. The potting mixture is to be in 2:1:1 ratio of the top soil, sand and farm yard manure. The sprouts are thus collected for a period of five months from the date of sowing. These polybags are kept at a distance of 0.50 to 1 m from bag to bag.

The advantage of poly bag seedlings is that there will not be transplanting shock and the seedlings are more vigorous. Seedlings establish quickly and start flowering early.Polybag seedlings can be stocked on availability and can be planted in the main field during conducive weather conditions.

Care and management of the nursery

Watering the nursery beds is very important to ensure quick germination and proper growth of seedlings. The frequency of watering should be adjusted depending upon rainfall and other weather conditions, age of the seedlings and soil conditions. Watering may be done on every alternate days during the summer months.

In small nurseries, pot watering or irrigation using hose pipes can be adopted. Irrigation by sprinkler or perfosprayer is also ideal.

Mulching and shading will be very beneficial immediately after the monsoon ends, particularly when the nursery is located in the open areas.

During dry and hot weather, the nursery beds should be mulched and shaded with dry coconut leaves or any other suitable material. Coconut leaf mulch has been reported to promote early and better germination, good growth of seedlings and high percentage of good seedlings. Polybags may be kept under partial shade. The nursery beds must be weeded periodically.

A careful watch must be kept on the incidence of pests and diseases in the nursery. Control measures need to be adopted if symptoms of termite attack are noticed.

Selection of Seedlings

Selection of seedling is a very important step in ensuring high yield. Under favourable environmental conditions and proper management, seed nuts of West Coast Tall palms will commence germination within 8 to 10 weeks after planting and 80-85 % of the seed nuts shall be germinated within 5 months.

Select 9 to 12 months old seedlings. Seedlings, which have germinated earlier, having good girth at collar and early splitting of leaflets should be selected for planting.

QUALITY STANDARDS OF SEEDLINGS	
Age of seedlings	10 - 12 months
Number of leaves	6 and above with short petiole
Girth at collar	>8 cm for dwarf and > 10 cm for tall
Height	> 80 cm for dwarf and > 100 cm for tall and hybrids

Select quality seedlings with a minimum of six leaves and girth of 10 cm at collar. The rest of the nuts, even if they remain viable, will have to germinate under increasingly unfavourable conditions which will result in poor growth. Such nuts should be discarded. Eliminate the seedlings which are deformed or having stunted growth. If rigorous standards of selection are adopted, 60 to 65 % quality seedling in a nursery can be obtained from the total nuts sown. The recovery

percentage may be lower if seednuts happen to be from poor mother palms or if nursery management like irrigation and plant protection has been neglected. All the seedlings raised in polybags are suitable for planting since selections are being made at the sprouting stage itself.

Uprooting of Seedlings

After selection, the seedlings should be removed from the nursery only just before they are required for transplanting in the field. These seedlings should not be pulled out by force, but their roots should be neatly cut and the seedlings with the nuts gently removed. Pruning of roots is not harmful in younger seedlings (7 to 12 months old) but may cause some delay in establishment and retard the growth of older ones. The seedlings pulled out of the nursery should be planted as early as possible, preferably before 10 days.

Under favourable enviornmental conditions, the nuts of the tall variety of the coconut will commence to germinate 11 to 12 weeks after planting. The percentage of germination reaches the maximum between the 17th and 18th week and then commences to decline. Nuts which do not germinate within six months from the date of planting are removed from the nursery. Selection of seedlings in the nursery is based on characters which are believed and in some instances actually proved to be associated with good yield in the adult palms such as early germination, rapidity of growth, early splitting of leaves into leaflets, vigour, sturdiness and freedom from pests and diseases.

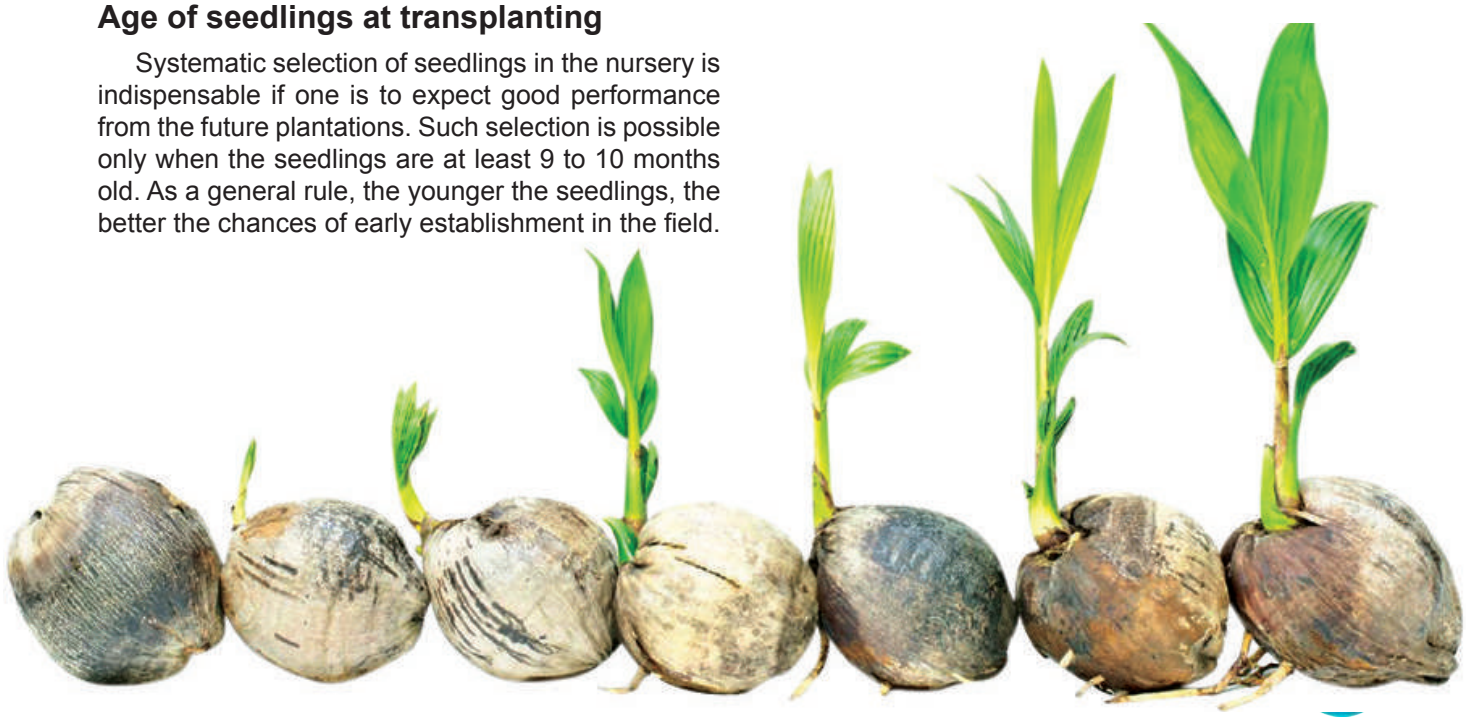
Age of seedlings at transplanting

Systematic selection of seedlings in the nursery is indispensable if one is to expect good performance from the future plantations. Such selection is possible only when the seedlings are at least 9 to 10 months old. As a general rule, the younger the seedlings, the better the chances of early establishment in the field. At the younger stage enough reserve food material would be available in the nut for being utilized by the growing seedlings. At about seven to nine months the seedlings will have 45 to 50 per cent of the kernel still left in the nut.

Consequently, the transplants can tide over the initial shock and the detrimental effects of root injury with less reliance on soil for nutrition. In the case of aged seedlings with lesser food reserve the transplantation shock and root injury will be considerable and will lead to delayed establishment in the field. Under ordinary conditions, seedlings of 9 to 18 months old can be considered the best for planting in most places. At this stage, the seedlings would have developed three to five fully opened leaves and a few roots with adequate availability of stored food in the nut. These seedlings do not wither quickly and being light in weight, are also easy and cheap to transport over long distances.

Transplantation and care of the young seedlings

The area proposed for the plantation should be cleared and planting holes marked out at the appropriate places. The initial preparation of the land will depend upon the topography, soil type and the groundwater level. If the ground water level is high and the soil subject to water logging, the preparation of raised mounds or bunds may become necessary. The site should be fenced properly to prevent cattle trespassing.



Planting

Different standards of spacing are adopted for the coconut crop in the major producing countries, with local variations within countries.

The choice of a spacing standard for the coconut depends upon whether the crop is grown as monoculture or in association with other crops,whether perennial or seasonal in character. In monoculture, spacing is adjusted in such a way as the fronds of the adjacent palms do not overlap when fully grown with the result that maximum sunshine is available for the palms to grow properly.

When other crops are also planted in association with the coconuts, the spacing should be wide enough to enable sufficient light to reach the lower storey.

Different spacing advocated were(1) triangular planting at a distance of 10 m giving 115 palms per ha or approximately 47 palms per acre,(2) a spacing of 9.1 m on the triangle giving 138 palms per ha. and (3) a spacing at 75 palms per acre or 187 palms per ha. In India, the general recommendation for pure stand coconut is 7.5 to 9.0 m on the square or triangle for the ordinary tall variety. Another useful development in coconut spacing is the hedge planting method.

Methods of Planting

Among the different methods of planting advocated for coconut, the square and triangular methods are the most common and widely adopted. In monoculture, the triangular method is advisable as it will accommodate about 15 per cent more palms in a unit area at a given spacing. When intercrops are grown the hedge method is more desirable, because it facilitates penetration of more sunlight besides offering comparatively little room competition.

The planting pits and the technique of planting

The planting holes or pits are usually prepared two to three months prior to transplantation. The usual practice is to burn organic refuses in the pit and char the sides to prevent termite attack. A planting hole of 1.3 m cube is found necessary in hard laterite soils. In light soils where the water table goes down very deep during summer, planting holes of 1 m cube are recommended , where as shallow planting holes are adopted in areas where the water table is comparatively high. The seedlings are planted in small holes dug at the centre of the pits in such a way that the top of the husk of the seed nut is just visible outside. The soil around the seedlings should be firmly pressed , but should not be allowed to cover the collar of the seedlings nor get into the leaf axils.

Time of planting

The planting season depends upon the climatic conditions. The proper time in India will be with the advent of the monsoons ie from May to June and from October to November. Planting before the monsoon with adequate provision for shading and watering has been found to facilitate early and better establishment of seedlings.

Care of young palms

It is only by bestowing proper care and attention during the early stages the palms can be made to bear early and well. The seedlings should be protected from stray cattle till they attain sufficient height. The surface water should be diverted and the pits should be cleared of rain water as often as possible. During summer the seedlings should be shaded properly. It is equally important to keep down the weed growth around the seedling. A circle of about 1 to 2 m in radius should always be kept free of weeds and the area mulched with the dried weeds or any other organic mulches. Mulching conserves soil moisture and also regulates soil temperature. As the palm grows, the size of the circle can be increased or the entire garden can be ploughed or dug up. At the end of the first year, the gaps caused by loss of seedlings should be filled up. Similarly all the unhealthy and defective seedlings should be removed and replanted by good, fresh planting. The process may have to be continued up to five years after transplantation. Since the newly transplanted seedlings take more than five years to flower, some income can be obtained by cultivating suitable intercrops during this period. Termites, rhinoceros beetle mealy bug, red palm weevil, leaf rot and rodent are the common pests and diseases found to affect the young seedlings. The seedling should be inspected frequently and prompt control measures need to be taken if affected by any of the pests or diseases. ■

Tender Coconut Cutlet

INGREDIENTS

Tender coconut	1/2 kg
Potato	3 (boiled & mashed)
Onion	1 big sized (Finely chopped)
Ginger	1 tablespoon (Chopped)
Green chilly	2-3 (Chopped)
Turmeric powder	1 teaspoon
Red chilly powder	1 teaspoon
Pepper powder	1 teaspoon
Garam Masala	1 teaspoon
Bread crumbs	1 cup
Beaten Eggs	2
Salt	As needed
Oil	For frying

METHOD OF PREPARATION

• Pressure cook the potatoes and peel and mash it. Keep it aside. • Cut the tender coconut in to small pieces and apply the red chilly powder and turmeric powder on the pieces and keep aside for 10-15 minutes. • Mean while in a medium sized pan, pour oil and heat it. Add the chopped onions, ginger, green chillies and saute till it turns soft. • Mince the tender coconut and add it to the pan along with the pepper powder and garam masala. Saute it for 10- 15 minutes. • Turn off the flame and allow the mixture to cool for 10 minutes. • Once it is cooled, add the mashed potatoes and mix well. (The mixture should be shaped when rolled into balls). • Roll out small portions of the mixture into medium sized ball and flatten it between the palms to give it a shape. • Dip each cutlet in beaten egg and roll them in bread crumbs. Make sure that all sides are nicely coated. • In another pan heat the oil and fry the cutlet in medium flame till it is golden brown. • Serve with tomato ketchup.

Tender Coconut & Chocolate Brownie

INGREDIENTS

Butter: 125gm

Dark chocolate chopped: 1/4 cup

Caster Sugar : 1/4 cup

Egg: 2

Vanilla essence : 1 tsp

Shredded tender coconut : 1/2 cup

Flour : 1/2 cup

Baking powder : 1/2 tsp

METHOD OF PREPARATION

Pre-heat oven to 180°. Grease20-cm square baking tin. Melt butter. When melted stir in chocolate .Mix well. In a bowel stir in caster sugar and add eggs one by one. Beat well after adding each egg and vanilla essence. Fold in to butter and chocolate mixture. Sift baking powder and flour together into a bowl and then fold the previous mixture add coconut. Bake for 30 minutes.

Perpared by Royjoseph Pothen,
Executive chef , Flora Airport Hotel, Kochi

CDB participated in Dubai Global Convention, 2018

Coconut Development Board participated in Dubai Global Convention held in Dubai during 17-19 April 2018. Coconut Development Board was represented by Dr. B N S Murthy, Chairman and Shri. E Aravazhi, Deputy Director.

Around 500 delegates, experts and participants from UAE, India, USA, UK, Bahrain, Japan, UAE, Ghana and Singapore participated in the Convention. The Ministry of Foreign Trade and Industry, Govt. of UAE & the Consulate General of India in Dubai were the official partners of the Convention. The Convention was held in partnership with Abu Dhabi Foreign Investment Office (ADIO), Sharjah Investment and Development Authority – Shurooq. Indian Business and Professional Council (IBPC) also partnered for the Convention. The Institute of Chartered Accountants of India, UAE (Dubai) and the Institute of Company Secretaries of India were the Institutional Partners of the Convention. The UAE-India Business Council (UIBC) was the Industry Partner.

His Highness Sheikh Nahyan bin Mubarak Al Nahyan, Hon'ble Cabinet Member & Minister for Tolerance, Govt of UAE was the Chief Guest of the inaugural session. His Excellency Abdulla Al Saleh, Under secretary- Foreign Trade & Industry, Ministry of Economy, UAE delivered the inaugural address. Dr. Tayeb Kamali, Director General, Education and Training Development, Ministry of Interior, UAE was the Guest of Honour. H E Navdeep Singh Suri, IFS, Ambassador of India to United Arab Emirates was the Special Guest of Honour. Mr. Vipul IFS, Consul General of India in Dubai delivered the Special Address. Ashok Chawla IAS, Chairman, National Stock Exchange of India and former Secretary, Ministry of Finance, Govt. of India, Vijay Karia, Chairman & Managing Director, Ravin Group of Companies, India, His Excellency Ahmed Sultan Bin Sulayem, Executive Chairman, Dubai Multi Commodities Centre (DMCC), Abdulla Bin Damithan, Chief Commercial Officer, DP World, UAE and Dr. B. R. Shetty, Founder and Chairman, NMC Healthcare, UAE delivered special addresses.

> **Dubai Global Convention is a good platform conceptualized to bring together opportunities for learning and sharing between the member and associated companies and organizations, covering transformational leadership for disruptive innovation and business excellence.**

The Institute of Directors (IOD), India also organized the 28th World Congress on 'Business Excellence and Innovation' in Dubai alongwith the Dubai Global Convention. It was the 6th Annual Convention in Dubai. The theme of the Convention was Transformative Leadership for Fostering Creativity, Innovation and Business Excellence'. Around 500 delegates, experts and participants from UAE, India and abroad took part in the programme.

Along with Coconut Development Board, Coir Board and many other prominent leading Indian companies took part in the programme.

Some of the prominent and leading UAE companies that participated included JAFZA (DP World), Khalifa Industrial Zone Abu Dhabi (KIZAD), Dubai Multi Commodity Centre (DMCC), Emirates Airlines, Al Habtoor Group, Sharjah Investment & Development Authority – Shurooq, Protiviti, Shapoorji Pallonji, UAE, BRS Ventures, GEMS Education, Aster Healthcare, Al Dobowi Group, ITNL International, Crowe Horwath etc

The Plenary Session II was a Special Presentation on KIZAD, 'Abu Dhabi Ports: The Emirate's first Industrial Free Zone', by Edwin Lammers, VP - Commercial, Khalifa Industrial Zone (KIZAD), Abu Dhabi Ports, UAE. The Plenary Session (III) was on the sub-theme "Boards to lead Business Excellence: Staying Ahead of the Curve". It was chaired by Dr. B. R. Shetty, Founder & Chairman, BRS Ventures, NMC Healthcare, UAE Exchange & Travelex, UAE.

The Plenary Session IV was on sub-theme "Sustaining Business Excellence in a Volatile, Uncertain, Complex and Ambiguous (VUCA) economic environment". The session was chaired by Arindam De, Country Head and Managing Director, Protiviti Middle East Member Firm, UAE.

The Plenary Session (VI, b) was on the sub-theme "Achieving Growth and Transformation through Quality & Business Excellence Frameworks". It was a case study presentation by the winners of theGolden Peacock Awards. The session was chaired by Dr. Mukesh Batra, Founder & Chairman Emeritus, Dr Batra's™ Group. He briefed the history of his group and how they had grown from small beginnings to massive success today.

In the session on Indo-UAE Business Meet, Dr. B. N. S Murthy, Chairman, Coconut Development Board, Ministry of Agriculture & Farmer's Welfare, Govt. of India presented the history of coconut development in India and its positive benefits. He invited the participants to the Board's stall at the venue. He made a presentation of SWOT analysis of Indian coconut sector and the bright prospects of coconut exports to the UAE.

The second day's deliberations commenced with the Plenary Session on the theme Competitive Strategy in Pursuit of World Class Excellence chaired by Ms. Samira Shaloh, Co- Founder, Brain Quest, UAE.

The Plenary Session was the Golden Peacock Awards presentation ceremony. His Highness Sheikh Nahyan bin Mubarak Al Nahyan Hon'ble Cabinet Member and Minister of Tolerance, Govt. of UAE conferred the famed 'Golden Peacock Awards for Business Excellence' and 'Innovative Product/ Service-2018', to the winners amongst business and Industry from India and abroad. His Hinghness, in his keynote address highlighted that India and UAE are historic trading partners. He cited the example of late HRH Sheikh Zayed who is rightly regarded as the founder of modern UAE. HRH's vision integrated the various units and Emirates of UAE. His model

was based on Connectivity, Innovation and Business Excellence. He stressed the importance of tolerance, which resulted in mutual benefit through shared ideas. Referring to the theme of the IOD Convention, he said, the company / boards should encourage three key policy initiatives which can lead to Business Excellence-Creativity, Innovation and Tolerance.

His Excellency Sultan Al Habtoor, President, Al Habtoor Motors and Vice President, Al Habtoor Group conferred the Golden Peacock Awards on the winners amongst Indian and Global business and industry for Quality and Training-2018 along with H.E. Mr Vipul IFS, Consul General of India in Dubai.

The Plenary Session on the sub-theme Reshaping Business Excellence through Technology was moderated by Abhishek Sen Gupta, Head of Videos, Khaleej Times. After the conclusion of second day sessions, an MoU was signed with Brain Quest, UAE headed by Ms. Samira Shaloh and the CEO, on behalf of IOD, India. The last Session was on the sub-theme Achieving Growth and transformation through Innovation.

Nimish Makvana, Director-UAE Chapter, IOD, India & Past Chairman, ICAI –Dubai and Partner, Crowe Horwath - UAE delivered the vote of thanks on behalf of IOD to all the sponsors, institutional partners, speakers, and the participants from the UAE and other countries during the valedictory session. On the final day of the Convention, a study tour of KIZAD was organized by the IOD in collaboration with the authorities of Abu Dhabi Ports.

A view of CDB stall in Dubai Global Convention. Dr. B N S Murthy, Chairman, Shri. E Aravazhi, Dy. Director, CDB and Shri. Niyas Khan, Country Manager, KLF are seen

An exhibition was also held as part of the programme wherein Coconut Development Board displayed various coconut based value added products. M/s. KL Group, India had their display cum sales counter in Board's stall. Reliable export enquiries were received for various coconut based products especially virgin coconut oil. ■

CDB participated in National Seminar on Road Map of Vegetable Oil Production

CDB, State Centre, Vijayawada participated in the exhibition organized by the DAC & FW, Oilseeds Division, MOA & ICAR-IIOR, Rajendranagar, Hyderabad during April 28-29, 2018 in connection with the National Seminar on Road Map of Vegetable Oil Production by 2022. Shri.Gajendra Singh Shekhawat, Hon'ble Minister of State for Agriculture & Farmers Welfare inaugurated the Exhibition on 28th April 2018. Dr Ashok Dalwai ,Special Secretary & CEO, National Rainfed Area Authority, Dr.S.K Malhotra, Agricultural Commissioner, Dr A.K Singh, DDG, ICAR, Dr.A Vishnu Vardhan Reddy, Director, IIOR and Senior Scientists of various organizations visited the exhibition. Dr BNS Murthy, Horticulture Commissioner & Chairman, CDB welcomed the Hon'ble Minister to the Board's Stall.

Various organizations related to oilseeds production, State Agricultural University, Telangana and private organizations participated in the exhibition. CDB displayed various value added products of coconut including handicrafts. Posters & publications related to coconut and various programmes of CDB were displayed in the stall.

Study team from Tamilnadu visited SCMS

In order to have a first hand knowledge of the neera processing technology, a 14 member team of officials of Government of Tamilnadu visited SCMS, Kochi. The team visited the neera plant of SCMS, the first neera plant in private sector in India established with the financial assistance of Coconut Development Board. The team also explored the prospects of neera by products like neera sugar, honey, squash, biscuit, wine etc.

The team is planning to utilize the neera technology of SCMS which has a shelf life of more than three months. Prof. Pramod P Thevanoor, Vice Chairman, SCMS presided over the workshop on neera production which followed wherein Dr. C Mohankumar, Director, SCMS Bio Sciences and Bio Technology Institute briefed on the various steps in neera production. Office bearers of CPCs from Thanjavoor and Puthukottai and officials of CDB took part in the programme.

Entrepreneurs Awareness Programme

An 'Entrepreneurs Awareness Programme' was conducted by BJP Industries Cell in Kochi on May 5th 2018 to give information and exposure to entrepreneurs on the processing of high-value added coconut products, its market scope and sourcing of appropriate processing machineries and equipment from reputable companies with an objective to adopt low-cost and best technologies. The program provided trainings from various central governmental organizations such as Marine Products Export Development Authority (MPEDA), Khadi and Village Industries Commission (KVIC), Coir Board & Coconut Development Board.

During the session on value addition of coconuts and its market scope, Kum. Sharon Mariam Jacob, Food processing Engineer, CDB, Kochi briefed on the Technology Mission on Coconut (TMOC) Scheme, value addition of coconuts, scope and market opportunities of various coconut based foods and various training programmes conducted by the Board. The aim of the session was to give a broad spectrum of different food and non-food products that can be derived from coconut. The training session also provided details of training programs on various coconut based food products conducted at Coconut Development Board Institute of Technology (CIT), Keenpuram, South Vazhakulam P.O., Aluva – 683105.

Through the training programme, entrepreneurs were provided information on the scope of various value added products of coconuts.

Monthly operations in the coconut gardens- June

Andaman and Nicobar Islands

Open basins around palms of a radius of 2m from the base of the palm. Apply 25 to 50 kg of cattle manure or compost and 10-20 kg of ash per tree and cover the basins with soil. Remove the weeds in the nursery.

Andhra Pradesh : Continue manure application if not done during June. Plant seedlings in the main field. As a prophylactic measure against the infestation of rhinoceros beetle, fill the youngest three leaf axils with a mixture of 250g powdered marotti/ neem cake with equal volume of sand or place naphthalene balls(12g/ palm) and cover them with sand thrice a year. If the attack of the mite is noticed, spray neem oil - garlic – soap emulsion 2 percent (20 ml neem oil +20 g garlic emulsion + 5 g soap in 1litre water) or commercial botanical pesticides containing azadirachtin 0.004 per cent @ 4ml per litre on bunches, especially on the perianth region of buttons and affected nuts or root feed neem formulations containing azadirachtin 5 per cent @ 7.5 ml with equal quantity of water.

Assam : Do not allow rain water to accumulate in the pits of transplanted seedlings. Clean the crowns of the palms. If stem bleeding disease is noticed, (1) remove the affected tissues of the stem and apply 5 percent calixin on the wound. When this is dry apply warm coal tar (2) root feed the affected palm with 5 ml calixin in 100 ml water per palm at quarterly intervals (3) apply 5 kg neem cake per palm per year along with the organic manure during the post monsoon period (4) regulate field regime by providing proper drainage during rains and irrigating the palms during summer. If bud rot disease is noticed, remove and clean the infected tissues and apply Bordeaux paste on the affected portion. The treated portion should be given a protective covering to prevent washing out of the paste during rains. Spray the neighbouring plants with 1 percent bordeaux mixture. Adopt plant protection measures when the weather is clear. Remove the weeds from the nursery.

Bihar / Madhya Pradesh/ Chhattisgarh : Provide proper drainage; do not allow rain water to accumulate for a long time in the pits. Transplant selected good quality seedlings in the already prepared and half filled pits. Drench the basins of transplanted seedlings with 0.05percent chlorpyriphos twice at 20 to 25 days interval against the attack of termites. Apply 2 kg bone meal or single superphosphate in the pit before planting. Open the basins around the palm of a radius of 2m upto a depth of 15-20 cm, and apply manures and fertilizers and cover with soil. During this month apply 30-50 kg farmyard manure/ compost per palm in the basin before the application of fertilizers. In irrigated and well maintained gardens apply the fertilizers @ 275g of urea, 500g single super phosphate and 500g muriate of potash. In rain fed gardens apply the first dose (1/3 of the recommended dose) of fertilizers i.e. 250g urea, 350g single superphosphate and 400 g muriate of potash, per adult palm and cover with soil. The gaps caused by the death of seedlings (previous year's planting) should be filled up, preferably with polybag seedlings. Similarly, remove all unhealthy and defective seedlings and replant with healthy seedlings. Check the palms for bud rot. If bud rot is

found, remove the affected parts and apply bordeaux paste. Spray the neighbouring palms/ seedlings with 1 per cent bordeaux mixture.

Karnataka : Open circular basins around the palm, of a radius of 2m. Take appropriate control measures if attacks of rhinoceros beetle and red palm weevil are noticed. Keep the garden free of weeds. Give a prophylactic spray with 1 per cent bordeaux mixture if not given during the last month. Seedlings can be planted during this month. If the attack of the mite is noticed, spray neem oil - garlic – soap emulsion 2 percent (20 ml neem oil + 20g garlic emulsion + 5g soap in 1 litre water) or commercial botanical pesticides containing azadirachtin 0.004 per cent @ 4ml per litre on bunches, especially on the perianth region of buttons and affected nuts or root feed neem formulations containing azadirachtin 5 per cent @ 7.5 ml with equal quantity of water.

Kerala/Lakshadweep : Open basins around the palms, of a radius of 2 m and fill them with green manure cuttings or green leaves @ 25kg per palm or bulky organic manures like cowdung, compost, etc.@ 50kg per adult palm and close the basins partially, if not done in June. Clean the pits in which seedlings have been planted. Search the crowns of trees for rhinoceros beetle, red palm weevil and also for bud rot disease. Take steps to check them. Clean the crown of the palm.

If the attack of the mite is noticed, spray neem oil - garlic - soap emulsion 2 percent (20 ml neem oil + 20g garlic emulsion + 5g soap in 1 litre water) or commercial botanical pesticides containing azadirachtin 0.004 per cent @ 4ml per litre on bunches, especially on the perianth region of buttons and affected nuts or root feed neem formulations containing azadirachtin 5 per cent @ 7.5 ml with equal quantity of water. Remove the weeds from the nursery.

Maharashtra/ Goa/ Gujarat: Bury husk in trenches between palms with concave side up. A prophylactic spray with 1 per cent bordeaux mixture may be given against fungal diseases.

Orissa: As a prophylactic measure against the infestation of rhinoceros beetle, fill the youngest three leaf axils with a mixture of 250g powdered marotti/ neem cake with equal volume of sand or place naphthalene balls(12g/palm) and cover them with sand thrice a year. Hook out the rhinoceros beetles. Manure vegetables and other crops. Give a prophylactic spray with 1 per cent bordeaux mixture against fungal diseases.

Tamil Nadu/ Puducherry : Open basins around the palms. Keep the garden free of weeds. Give the palms a prophylactic spray with one per cent bordeaux mixture to prevent bud rot and other fungal diseases. Apply the first dose of fertilizers i.e. 300g urea, 500g single superphosphate and 500 g muriate of potash per adult palm if not applied during last month. Search for rhinoceros beetle on the crowns of the palms with the beetle hook and kill the beetles. As a prophylactic measure against the infestation of rhinoceros beetle, fill the youngest three leaf axils with a mixture of 250g powdered marotti/ neem cake with equal volume of sand or place naphthalene balls (12g/ palm) and cover them with sand thrice a year. Planting of seedlings in the main field can be done during this month. Search palms affected by Thanjavur wilt and take appropriate management practices. If the attack of the mite is noticed, spray neem oil - garlic – soap emulsion 2 percent (20 ml neem oil + 20g garlic emulsion + 5g soap in 1 litre water) or commercial botanical pesticides containing azadirachtin 0.004 per cent @ 4ml per litre on bunches, especially on the perianth region of buttons and affected nuts or root feed neem formulations containing azadirachtin 5 per cent @ 7.5 ml with equal quantity of water.

Tripura: Basin around the palm should be cleaned by removing the weeds. Green manure crops sown in May if any, should be ploughed and incorporated during the month. As a prophylactic measure against the infestation of rhinoceros beetle, fill the youngest three leaf axils with a mixture of 250g powdered marotti/ neem cake with equal volume of sand or place naphthalene balls(12g/ palm) and cover them with sand thrice a year. Collected seed nuts may be sown in seed beds without delay by taking advantage of the rain.

West Bengal: Apply green manure at the rate of 25 kg per palm. Keep the garden free of weeds. Start planting of seedlings in the main field. A prophylactic spray of 1 percent bordeaux mixture against fungal diseases may be given. ■

Market review – April 2018

Domestic price

Coconut Oil

During April 2018 the price of coconut oil opened at Rs.19200 per quintal at Kochi and Alappuzha market and Rs.20000 per quintal at Kozhikode market. During the month, price of coconut oil at all three markets expressed an upward trend. By the fag end of the month prices at all three markets slumped.

The price of coconut oil closed at Rs.19900 per quintal at Kochi and Rs.20000 per quintal Alappuzha market and Rs.20950 per quintal at Kozhikode market with a net gain of Rs.700 at Kochi market and Rs.800 at Alappuzha market and Rs.950 per quintal at Kozhikode market.

The price of coconut oil at Kangayam market in Tamilnadu, which opened at Rs.17667 per quintal, expressed a mixed trend and closed at Rs.17800 per quintal with a net gain of Rs.133 per quintal.

Table1: Weekly price of coconut oil at major markets Rs/Quintal)

	Kochi	Alappuzha	Kozhikode	Kangayam
01.04.2018	19200	19200	20000	17667
08.04.2018	19700	19700	20800	18333
15.04.2018	19700	19700	20700	18000
22.04.2018	20300	20300	21200	18667
30.04.2018	19900	20000	20950	17800

Milling copra

During the month, the price of milling copra opened at Rs.12650 per quintal at Kochi, Rs.12350 per quintal at Alappuzha market and Rs.13200 per quintal at Kozhikode market. During the month, price of milling copra at all three markets expressed an upward trend. By the fag end of the month prices at all three markets declined.

The prices closed at Rs.13265 at Kochi and Rs.13050 at Alappuzha market and Rs.13550 at Kozhikode markets with a net gain of Rs.615 per quintal at Kochi and Rs. 700 per quintal at Alappuzha market and Rs.350 per quintal at Kozhikode market.

At Kangayam market in Tamilnadu, the prices opened at Rs. 12100 per quintal and closed at Rs.12400 per quintal with a net gain of Rs.300 per quintal.

Table2: Weekly price of Milling Copra at major markets (Rs/Quintal)

	Kochi	Alappuzha (Rasi Copra)	Kozhikode	Kan-gayam
01.04.2018	12650	12350	13200	12100
08.04.2018	13140	12700	13550	12500
15.04.2018	13140	12700	13550	12600
22.04.2018	13520	13200	13800	12600
30.04.2018	13265	13050	13550	12400

Edible copra

The price of Rajapur copra at Kozhikode

market which opened at Rs.16200 per quintal expressed an overall upward trend during the month and closed at Rs.18200 per quintal with a net gain of Rs.2000 per quintal.

Table3 :Weekly price of edible copra at Kozhikode market (Rs/Quintal)	
01.04.2018	16200
08.04.2018	16700
15.04.2018	17300
22.04.2018	17500
30.04.2018	18200

Ball copra

The price of ball copra at Tiptur market which opened at Rs.13000 per quintal expressed an upward trend during the month and closed at Rs.14500 per quintal with a gain of Rs.1500 per quintal.

Table 4 : Weekly price of Ball copra at major markets in Karnataka (Rs/Quintal)	
	Tiptur
01.04.2018	13000
08.04.2018	13800
15.04.2018	13800
22.04.2018	14000
30.04.2018	14500

Dry coconut

At Kozhikode market, the price of dry coconut ruled at Rs.9550 per quintal throughout the month.

Table5 : Weekly price of Dry Coconut at Kozhikode market (Rs/Quintal)	
01.04.2018	9550
08.04.2018	9550
15.04.2018	9550
22.04.2018	9550
30.04.2018	9550

Coconut

At Nedumangad market the price of partially dehusked coconut opened at Rs.21000 and closed at Rs. 19000 per thousand nuts with a net loss of Rs.2000 per thousand nuts. At Pollachi market in Tamil Nadu, the price of coconut opened and closed at Rs.16000 per thousand nuts. At Bangalore APMC, the price of partially dehusked coconut opened at Rs. 27500 and closed at Rs. 29000 with a gain of Rs.1500 per thousand nuts during the month. At Mangalore APMC market the price of partially dehusked coconut of grade-I quality ruled at Rs.23000 throughout the month.

Table 6: Weekly price of coconut at major markets (Rs /1000 coconuts)				
	Neduman-gad	Pollachi	Banglore	Mangalore (Grade-1)
01.04.2018	21000	16000	27500	23000
08.04.2018	21000	17000	29000	23000
15.04.2018	21000	16000	29000	23000
22.04.2018	21000	16000	29000	23000
30.04.2018	19000	16000	29000	23000

International price

Coconut oil

The international and domestic price of coconut oil in Philippines expressed a downward trend whereas the price of coconut oil in Indonesia and India expressed a mixed trend during the month. The price of coconut oil quoted at different international/ domestic markets is given below.

Table 8: 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*
07.04.2018	1168	1115	1147	2783
14.04.2018	1154	1109	1107	2691
21.04.2018	1127	1075	1079	2793
28.04.2018	1113	1059	1093	2711

* Kangayam

Copra

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

Table 9: Weekly price of copra in major copra producing countries

	Domestic Price(US$/MT)			
	Philippines	Indonesia	Srilanka	India*
07.04.2018	645	628	1427	1980
14.04.2018	682	610	1427	1919
21.04.2018	677	556	1427	1927
28.04.2018	670	512	1599	1889

* Kangayam

Coconut

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

Table 11: Weekly price of dehusked coconut with water

Date	Domestic Price (US$/MT)			
	Philippines	Indonesia	Srilanka	India*
07.04.2018	173	189	330	586
14.04.2018	174	189	329	564
21.04.2018	176	188	329	564
28.04.2018	175	187	338	541

*Pollachi market