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Management of coconut garden during rainy season

● **Thamban C, Subramanian P and Jayasekhar.S**

ICAR-Central Plantation Crops Research Institute, Kasaragod

Planting of coconut seedlings

In well drained soils, seedlings can be transplanted with the onset of southwest monsoon in the west coast region. If the land is uneven and full of shrubs, the shrubs have to be cleared and land levelled before taking pits. In laterite soil with rocky substratum, deeper and wider pits, 1.5 m x 1.5 m x 1.0 m may be dug and filled up with loose soil, powdered cow dung and ash up to a depth of 60 cm before planting. In loamy soils with low water table, planting in pit size of 1 m x 1 m x 1 m filled with top soil to height of 50 cm is generally recommended. However, when the water table is high, planting at the surface or even on mounds may be necessary. Two layers of coconut husk (with concave surface facing up) can be arranged at the bottom of the pit before filling up. This will help in conserving the moisture. In case of laterite soil, addition of 2 kg of common salt will help in loosening the soil.

For realizing better yield from coconut, optimum plant density must be maintained 'in the field. A spacing of 7.5 m x 7.5 m is generally recommended for coconut. This will accommodate 177 palms per ha

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South west monsoon has set in and it is time to take up various crop management practices for coconut including planting of coconut seedlings, green manuring, application of first split dose of fertilizers, prophylactic/curative plant protection measures, etc.

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under the square system of planting. If the triangular system is adopted, an additional 20 to 25 palms can be planted. Hedge system can also be adopted giving a spacing of 5.0 to 5.5 m along the rows and 9 to 10 m between rows.

Generally underplanting is done in coconut gardens where the palms become unproductive and uneconomic to the farmer. Old palms are removed in stages over a period of 3 to 4 years. First peg mark the



area to be underplanted. To start with underplanting, remove the very poor yielders (less than 10 nuts per palm per year) and those trees which are very close to the peg marked point for underplanting. Other trees are to be removed at the rate of one third each year during 2nd, 3rd and 4th year after starting underplanting. If the existing garden is irregularly spaced, remove old palms within 1 m radial distance from the newly planted seedlings in the first year of underplanting, 2 m distance in second year, 3 m distance in third year and the rest in 4th year.

Care of young palms

In areas subjected to water logging, care should be taken to provide drainage facility in the coconut garden during rainy season. The pits should be cleared of weeds periodically. Soil washed down and covering the collar of the seedlings during the rainy days should also be removed.

Green manuring

Cultivation of green manure legumes having symbiotic association with efficient *Rhizobium* strains in coconut basins and interspaces during the monsoon period is a simple agrotechnique that can be adopted to generate significant quantity of biomass which can be incorporated to the palms at their maximum vegetative growth. If it is homestead type of coconut farming with other inter/mixed crops in the interspace, basin management with green manure legumes can be adopted. Under monocropping, interspace can also be utilised for sowing green manure legumes. At the onset of monsoon, seeds of green manure legumes are to be sown @ 100 g per basin for basin management and the seed rate will be 25 kg per ha of coconut garden if interspace also can be utilised for generating green manure. Green manure leguminous species

like cow pea, sunhemp, daincha, horse gram etc are suitable for this purpose. The field experiments on basin management with legumes in adult coconut plantations revealed the effectiveness of this technique to substitute fertilizer nitrogen for coconut upto 30 per cent.

Growing Glyricidia as green manure crop

Substantial quantity of nitrogen rich biomass can be produced through the cultivation of the fast growing perennial leguminous green leaf manure tree crop, *Glyricidia* in the coconut plantations. This can be very well grown along the borders of coconut plantation and can generate adequate amount of nitrogen rich green leaves. It can also be raised in littoral sandy soils where no other green manure can be established. The tree is propagated either through vegetative cuttings or seeds. One meter long stem cuttings or 3 to 4 month old seedlings raised in poly bags/raised beds can be used for planting. It is preferable that the planting season coincides with the monsoon (South West / North East monsoon) for better establishment. Spacing of 1 m x 1 m can be adopted. Two rows of *glyricidia* can be planted along the boundary of coconut garden in a zig zag manner. Plant stem cuttings or seedlings in an upright position in pits of 30 cm³. Height of the plants should always be maintained at 1 m by pruning.

Vermicomposting of coconut leaves

Rainy season is ideal for the production of vermicompost using coconut leaves. Fallen coconut leaves in coconut garden can be effectively converted into rich vermicompost using the earth worm, *Eudrilus* spp. Vermicompost preparation can be done in cement tanks or in trenches made in the coconut garden. The weathered coconut leaves collected



from the garden should be kept for two weeks after sprinkling with cowdung slurry. Cowdung should be used at the rate of one tenth of the weight of the leaves. Afterwards earth worms (*Eudrilus* sp.) are to be introduced at the rate of one kg for one tonne of the material. Vermicompost will be ready in about 75 to 90 days.

Application of bio fertilizers

Application of phosphate solubilising biofertilizers to coconut palms is highly beneficial when the available phosphorus content in the soil is low. CPCRI has released a product 'Keraprobio' which is a Plant Growth Promoting Rhizobacteria (PGPR) *Bacillus megaterium* which is also having the phosphate solubilising property. Kera probio can be applied @100 g/palm along with application of organic manures at the fag end of monsoon during August–September.

Fertilizer application

Soil related constraints, especially soil acidity and deficiency/imbalance of nutrients including major, secondary and micronutrients adversely affect coconut production. Hence, it is always advisable to test soil in the coconut garden periodically based on the results of which type and dosage of fertilizers and soil amendments should be decided. From an existing coconut garden soil sample should be taken from the basin of the palm 1 m away from the trunk. Under rainfed situation it is recommended to apply the chemical fertilizers in two splits. In the west coast region, apply one third quantity of recommended fertilizers as the first split after the receipt of summer showers during May and the remaining two-third quantity as second split dose during August-September after the cessation of heavy rains. First split dose ie one third of the recommended dose of fertilizers can be spread around the palms within a radius of 1.8 m in the coconut basin. For correcting soil acidity lime or dolomite can be applied. General recommendation is 1kg lime or dolomite per coconut tree which is to be applied two weeks before the application of chemical fertilizers.

Soil and water conservation measures

Proper soil and moisture conservation practices are essential for ensuring sustainable production especially when coconut is grown under rainfed condition with undulating terrain and sloppy conditions.

Husk burial

Burial of husk in trenches in between the rows of palms is also effective for moisture conservation in coconut gardens. Husk burial is to be done at the beginning of the monsoon in linear trenches of 1.5 to 2 m wide and about 0.3 to 0.5 m deep between rows of palms with concave side of husk facing upwards and each layer is to be covered with soil.

Mulching

Mulching is an important practice for moisture conservation. The coconut basins can be mulched with coir dust, coconut husks, green leaves, dried leaves, organic wastes, and dried coconut leaves. Mulching should be done before the end of north east monsoon and before the top soil dries up.

Catch pit filled with coconut husk

Catch pits can be constructed at all slopes to conserve soil and water. Though there are no standard dimensions for catch pits, catch pits of 1.5 m length x 0.5 m width x 0.5 m depth can be constructed. A bund is to be made at the downside using the excavated soil and pineapple suckers planted on it. This pit is also filled with coconut husk.

Contour trench filled with coconut husk

This measure is to be taken up where the land slope is high. Trenches of 50 cm width x 50 cm depth and convenient length are to be made in between two rows of coconut palms. These trenches would then be filled with coconut husk. Coconut husks need to be filled in layers with the bottom layers facing up and top layer facing down. A bund of 20 cm height and suitable width (>50 cm) is made at the downstream using the excavated soil. Two layers of pineapple plants are to be planted on the bund with a spacing of 20 cm x 20 cm. Pineapple plants would



stabilize the bund and provide additional income to the farmer. The runoff water from the upper side would be collected in the trenches. Soil particles would also get collected in the trench along with the runoff water. Coconut husk retains the moisture and makes it available for plants during summer months

Half-moon bund around coconut basin reinforced with pineapple

This measure is to be taken up where there is mild slope (15-20%). Here a flat basin with a slight inward slope towards upstream is made by excavating soil from the upstream side and filling the excavated soil at the downstream side. After making the basin a bund of 30 cm height and >50 cm width is made at the downstream side of the coconut using the excavated soil. Two layers of pineapple plants would be planted with a spacing of 20 cm row to row and 20 cm plant to plant on the bund. The bund prevents runoff and water gets collected within the basin and percolates down. Pineapple would help to protect the bund and stabilize the same in addition to giving fruit yield.

Providing drainage

Proper drainage in the coconut garden is equally important as irrigation for better performance of coconut palms. Waterlogged conditions result in poor growth of palms. In ill drained garden, drainage facilities are to be provided during rainy season by digging deep and wide drains between the rows of palms and by raising the level of the ground around the individual palms.

Planting of perennials as mixed crops

Adoption of multiple cropping practices in coconut garden is suggested to ensure better utilization of basic resources and to enhance income and employment opportunities. After the palms attain a height of 5 to 6 metres (above 18 years) i.e., in older plantations, perennials like cocoa, pepper, cinnamon, clove and nutmeg can be grown as mixed crops. These crops can be planted at the onset of monsoon as per the details given below. These crops are to be adequately and separately manured in addition to the manures applied to the coconut palms. For facilitating multiple cropping in coconut gardens in the early growth phase itself it is advisable to have wider spacing of above 10 m x 10 m so as to provide ample opportunity to accommodate a number of perennial and annual crops in the interspaces.

Cultural requirements of crops for mixed cropping in coconut garden				
Crops	Propagation	Planting pits	Spacing	No. of plants per ha
Cocoa	Grafts	75 x 75 x 75 cm	3m x 3m (Single hedge)	450
Pepper	Rooted cuttings	50 x 50 x 50 cm	7.5m x 7.5m (At the base of the palm)	175
Clove	Seedlings	60 x 60 x 60 cm.	7.5m x 7.5m (At the centre of four palms)	148
Nutmeg	Grafts	60 x 60 x 60 cm	7.5m x 7.5m (Centre of four palms)	148

Planting of suitable fodder grass species like Hybrid Bajra Napier (Co3) also can be taken up in coconut gardens at the onset of monsoon as part of coconut based mixed farming.

Field /crop sanitation measures

Decaying organic debris, dead coconut stumps, logs and other such organic materials from the coconut garden are to be removed as a measure of field sanitation to reduce incidence of pest/disease incidence before the monsoon sets in. Similarly, crown cleaning also has to be done before the rainy season.

Crop protection during rainy season

Disease management

Diseases like bud rot and leaf rot affecting coconut are more prevalent during monsoon when the temperature is low and humidity is high. Hence, timely adoption of appropriate prophylactic/curative measures is very important to avoid spread of these diseases during rainy season.

Bud rot

It is important to give prophylactic treatment to all palms in bud rot disease endemic areas at the onset of monsoon. In localities where bud rot is regularly observed crown cleaning of all palms should be taken up and 1% Bordeaux mixture sprayed as a prophylactic measure. Palms should be regularly observed and curative measures have to be adopted as and when the initial symptoms are seen. The earliest symptom is the yellowing of one or two younger leaves surrounding the spindle. The spindle withers and droops down. The tender leaf base and soft tissues of the crown rot into a slimy mass of decayed material emitting a foul smell. The disease kills the palm if not controlled at the early stages. In early stages of the disease, when the spindle leaf starts withering, cut and remove all affected tissues

of the crown and apply Bordeaux paste and protect it from rain by providing a polythene covering till normal shoot emerges. Burn all disease affected tissues removed from the palm. Field sanitation and providing adequate drainage in the coconut garden help to reduce the spread of the disease.

Leaf rot

Leaf rot disease commonly occurs on coconut palms already affected by root (wilt) disease. Infection by this disease is the major reason for the low productivity of root (wilt) affected palms. As a prophylactic treatment against leaf rot disease mix 2 ml Hexaconazole 5 EC in 300 ml water and pour into the well around the base of the spindle leaf or apply talc based formulation of *Pseudomonas fluorescens* or *Bacillus subtilis* singly or in consortium @ 50 g in 500 ml/ palm at the onset of monsoon.

As the damage due to rhinoceros beetle infestation increases the chance of bud rot/leaf rot incidence, prophylactic leaf axil filling with 1:1 mixture of neem cake and sand @ 500g / palm before the onset of monsoon (May last week to June first week) is to be taken up on priority basis.

Pest management

For the effective management of pests like rhinoceros beetle, red palm weevil, root grubs and eriophyid mite suitable prophylactic/curative measures are to be adopted in rainy season to avoid crop loss in coconut. Besides, close scrutiny and sustained monitoring in synergy with farm and palm hygiene is the key for success in pest suppression.

Rhinoceros beetle and red palm weevil

For the management of rhinoceros beetle and red palm weevil infestation, prophylactic leaf axil filling with any of the following material before the onset of monsoon (May last week to June first week) is recommended.

- 1: 40 mixture of chloranthraniliprole granule (Fertera 0.4 % WG) and sand @ 250 g / palm (one round/year during May-June) or
- Leaf axil filling with 1:1 mixture of neem cake or marroti or pongamia and sand @ 500g / palm or
- Leaf axil filling with naphthalene ball @ 12 g / palm and placing sand above it. (Repeat at 45 days interval)

As curative treatment in red palm weevil infested palms, spot application with indoxacarb (Avaunt 15.8 EC) @ 2.5ml / litre or imidacloprid (Confidor 200 SL, 17.8 ai) @ 1 ml/ litre is found effective in suppressing



the pest as well as recovery of palms.

Root grubs

For the control of root grub infestation in coconut, blanket application of bifenthrin @ 2 kg ai/ ha (i.e., Talstar 10 EC @ 20 litre / ha) is to be adopted during the last-phase of the South-West monsoon i.e., second week of August. Soil application of *Steinernema carpocapsae* @ 1.5 billion / ha during October is recommended for the bio-suppression of root grubs.

Coconut eriophyid mite

In coconut palms with eriophyid mite incidence, spraying of neemazal (10000 ppm) @ 4 ml/ litre on young buttons after pollination or spraying of palm oil (20 %) sulphur (5%) emulsion during August is recommended.

Conclusion

Timely adoption of crop management practices especially soil health management and prophylactic/curative plant protection measures is very important to ensure sustainable coconut production. Diseases like bud rot and leaf rot affecting coconut are more prevalent during monsoon. Hence, timely adoption of prophylactic/curative measures is very important to avoid spread of these diseases during rainy season. Similarly, appropriate prophylactic/curative measures are to be adopted in rainy season for the effective management of pests like rhinoceros beetle, red palm weevil, root grubs and eriophyid mite to avoid crop loss in coconut. Adoption of integrated disease management practices by few individual farmers alone can not control the incidence of the fungal disease. Hence, efforts are to be made to facilitate group action among the coconut farmers at grass root level to get desired results for the adoption of IDM practices against bud rot in coconut. Hence, farmer producer organisations like Coconut Producer Societies and Coconut Producer Federations can play important role in organising coconut farmers for effectively adopting prophylactic/curative plant protection measures and other crop management practices during rainy season. ■

Integrated Management of Basal Stem Rot Disease and Black Headed Caterpillar of coconut in Karnataka

● Manjumath Hubballi,

Asst Prof. (Pathology), HREC, AICRP on Palms centre, Arsikere, UHS, Bagalkot, Karnataka

Of the major diseases, Basal Stem Rot (BSR) incited by *Ganoderma spp.* is a serious disease affecting coconut. The disease has been called with variety of names viz., Ganoderma wilt, Basal Stem Rot, Anabe Roga and Thanjavur wilt. This disease was reported way back in 1906 by Buttler in India. Later, during 1952 the disease appeared in Thanjavur district of Tamil Nadu and hence, the name Thanjavur wilt. The disease is prevalent in most of the growing areas of Southern India. The disease is considered as lethal disease, as it completely kills the palm in advanced stages. The surveys conducted in major growing areas of Karnataka indicated, that on an average 10-15 per cent of palms are infected with BSR. The worst case of the disease is that, it remains asymptomatic till bleeding patches occur on stem. In general this disease is observed in all growing packets of Karnataka. However, Hassan, Tumkur and Chickmagalur districts have severe incidence of this disease. The leaf eating black headed caterpillar, *Opisina arenosella* is a serious pest of coconut palm causing significant yield loss in all the coconut growing tracts of India. It infests coconut of all age groups and is a prolific feeder of coconut leaves. On the adult palms, the infestation starts on the outer whorls of leaves and due to the feeding damage, the photosynthetic efficiency especially of the lower fronds will be impaired and in severe cases, whole plantation presents a burnt up appearance due to the drying of leaves. In case of severe outbreaks the attacked leaves droop, bunches buckle and the immature nuts are shed heavily, in extreme cases feeding by the caterpillar on the green nut surface is also observed.



Demonstration of root feeding of Hexaconazole



Basal stem rot is a major disease of coconut in Tumkur and Hassan districts of Karnataka coupled with incidence of Black headed caterpillar. In order to manage the disease attack, the Coconut Development Board sanctioned a project entitled Demonstration of Integrated Management Practices for Basal Stem Rot Disease and Black Headed Caterpillar in Coconut growing regions of Karnataka and the same is in operation at Horticulture Research

and Extension Station under All India Coordinated Research Project on Palms, Arsikere centre. Under the guidance of Dr. H.P. Maheswarappa Project Coordinator (Palms), in order to make aware of the management techniques available at the AICRP centre, one day training programme was organised on 18th June 2018 at Shashivala village in Arsikere Taluk of Hassan District in Karnataka. Dr. Y. K. Kotekal, Director of Extension, University of Horticulture Sciences, Bagalkot inaugurated the training programme and addressed farmers regarding pest and diseases of coconut and also challenges faced by coconut growers. Dr. Manjunath Hubballi, Scientist and Principal Investigator of the project gave training on coconut diseases and in particular basal stem rot disease and its integrated management. Further, he demonstrated the root feeding of Hexaconazole 2 ml per 100 ml of water to the farmers. Dr. Chandrashekar, G. S. Scientist and Co-PI of the project highlighted the importance of Black Headed Caterpillar in coconut plantation and its management. The field demonstration on release



Demonstration of release of parasitoids

of parasitoids viz., *Bracon bravicornis* and *Goniozus nephantidis*, which were mass produced at biological control laboratory, Horticulture Research Station, Arsikere for the management of black Headed caterpillar in coconut was conducted. More than 200 farmers participated in the programme and had interaction with scientists. ■

The Symptomology of BSR

BSR produces multiple symptoms on roots, stem and on crown region of the palm and identification of the disease is often confused with stem bleeding disease. Disease symptoms progress slowly, but usually every infected plant eventually dies. Disease develops from the roots and the first visual symptoms are visible on stem as reddish brown exudation. *Peries et al.* (1975) presented a detailed description of the symptomatology of the disease. Nambiar and Rethinam (1986) made some distinguishing characteristics that help in disease diagnosis as both Ganoderma wilt and stem bleeding diseases in coconut produces similar type of symptom such as exudation of reddish brown fluid from the stem. According to *Thirumalaiswamy et al.* (1992), palms in Thanjavur wilt, sometimes succumb without expressing external symptoms. Palms aged 10 years and older were more susceptible to the disease than younger palms.

Roots: The pathogen first infects the root system and during the very early stage of infection no external disease symptoms are clearly visible. Initially a few roots get infected and rot. Extensive

rotting and discoloration of root system is a characteristic symptom of the disease and the rotting proceeds towards the bole thus, cortical tissues disintegrate and the stele turns brown. The roots are watery with a distinct alcoholic smell. The production of new roots decreases in the infected palm. In severely infected palms, more than 70 % root rotting was observed (Rethinam 1984, Bhaskaran 1986, Srinivasulu and Rao 2007).

Stem: From the roots, the infection slowly progresses up the stem leading to internal disintegration of cortical and stele tissues. Exudation of reddish brown viscous fluid from the basal portions of the stem is the first visible symptom of the disease in the affected palm. By that time, the rotting would have progressed from the bole to the basal portion of stem. Karthikeyan et al. (2006a) reported that the disease caused 15 to 25% damage to roots and bole below the ground level by the time external symptoms are visible. The internal tissues of the affected stem turn brown in color and rotting in the stem can be seen up to the height of the bleeding. Bleeding on the stem begins at the base and may extend up

to 15 feet in severe cases (Vijayan and Natarajan 1972, Bhaskaran *et al.* 1989). Occasionally, some infected palms do not show bleeding symptoms (Thirumalaiswamy *et al.* 1992). The bark from the base of the stem peels off. Infestation of scolytid beetle, *Xyloborus perforans* and the weevil, *Diocalandra stigmaticollis* are found infesting the stem in severely infected palms. Sporophores of the fungus, *G. lucidum* appear at the base of the affected palms prior to wilting or just after the death of the palm (Bhaskaran *et al.* 1982, Vijayan *et al.* 1973, Rethinam 1984, Bhaskaran 1986, Srinivasulu and Rao 2007).

Crown: The leaflets exhibit wilting symptoms and outer one or two whorls of leaves turn yellow. Later, they exhibit light to moderate browning followed by drooping and drying. As the disease advances, the remaining leaves also droop down in quick succession and the spindle alone remains. Vijayan and Natarajan (1972) reported that the first external symptoms are flaccidity and folding of leaflets, chlorosis and bronzing of lower whorl of leaves. Under prolonged infection, the outer

leaves falloff one by one, leaving only the spindle with a few unhealthy leaves around. The spindle leaves which emerge subsequently are reduced in size and do not unfold properly. Later stem shrivels and dries up. In some cases leaves breakoff near the base along the midrib. Soft rot of bud may also set in some cases emitting bad smell. In advanced stages, all the leaves drop off leaving very thin decapitated stem (Vijayan and Natarajan 1972, Bhaskaran *et al.* 1982, Bhaskaran 1986). As the disease progresses, number of flowers, number of buttons reduces and normal development is arrested leading to button shedding. The leaves droop down resulting in hanging down of the subtended bunches. Most of the palms bear profusely, just prior to and at the time of initiation of symptoms

(Snehalatharani, A & H.P, Maheswarappa & Venkat, Devappa & Malhotra, Suresh. (2016). *Status of coconut basal stem rot disease in India – A review. Indian Journal of Agricultural Sciences.* 86. 1519-1529.) ■

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Polyphenolic extract from coconut kernel shows potent anti cancer activity in human cancer cells.

● Nevin K.G

Assistant Professor, School of Bioscience, MG University, Kottayam

Colon cancer is a serious health problem with very high mortality rates, affecting both men and women worldwide. The modern diet with high red meat consumption and excessive alcohol use along with sedentary lifestyle has led to an increasing mortality rate for colon cancer. Presently, there are several synthetic drugs available for the control of colon cancer. However, while synthetic anticancer drugs prolong survival, they often have adverse health effects and nonspecificity. Based on this fact, several dietary phytochemicals have been investigated for colon cancer therapy. Studies on diet-based antioxidants have advanced at a full pace due to their capability of quenching reactive oxygen species (ROS) and prevent our body from various deadly diseases including cancer. These compounds are capable of inhibiting critical cell cycle molecules and inhibit proliferation and/or inducing apoptotic death in cancer cells. Polyphenols, nontoxic secondary metabolites, have been shown to possess anticancer properties. There is little convincing epidemiological evidence that intake of polyphenols/flavonoids is inversely related to the incidence

of cancer. In contrast, numerous cell culture and animal models indicate potent anticarcinogenic activity by certain polyphenols, mediated through a range of mechanisms including antioxidant activity, enzyme modulation, gene expression, apoptosis, upregulation of gap junction communication, and P-glycoprotein activation. These compounds act as key modulators of signaling pathways and are therefore considered ideal chemopreventive agents.

Coconut and its products have been an important part of the diet among Indian population for time immemorial. There are various reports regarding the beneficial effect of the oil isolated from coconut by wet as well as dry process. Unfortunately, the use of coconut oil for culinary purpose has initiated a burning debate over its health benefits. Although the debate is centered on the oil consumption, not many studies are conducted on the biological effects of the minor components present in coconut kernel. It was previously reported that the virgin coconut oil (VCO) contains polyphenolic compounds having significant antioxidant effect with an important role in the cardiovascular health. Although the



cardiovascular benefits of these polyphenols are documented, their anticancer properties are poorly understood. A study was undertaken by the School of Biosciences of, M G University, Kottayam with the financial assistance of Coconut Development Board to evaluate the antiproliferative effect of the polyphenols/flavonoids isolated from coconut kernel on human colon cancer cell line.



are especially abundant in fruits and vegetables. The beneficial health effects of flavonoids have been attributed to their free radical scavenging properties. In addition to their antioxidant properties, flavonoids have antiviral, antiallergic, anti-inflammatory, and antitumor activities. There are insufficient and conflicting evidence regarding flavonoid intake and the prevention

Dwarf x Tall variety was collected from Shornur Panchayat Krishi Bhavan Office, Palakkad, Kerala, India. Kernel from coconut was removed and defatted with petroleum ether (60–80) using a Soxhlet apparatus. The residue obtained after defatting was dried, weighed, and exhaustively extracted using 80% methanol. Methanolic extract thus obtained was dried in rotary evaporator, weighed, and used for further experiments.

Phytochemical analysis showed that fraction from coconut kernel (CKf) contained a significant amount of total polyphenols than total flavonoids. The results of the study further confirm the presence of polyphenol and flavonoid structures in coconut kernel. Preliminary phytochemical analysis and UV-VIS and FTIR spectrum showed the presence of significant amount of phenolic and flavonoid compounds.

Evaluation of CKf for potential anticancer activity on HT-29 cells was carried out by studying the growth inhibitory effects using the MTT assay for 24 and 72 h. It was found that CKf strongly inhibited the growth of HT-29 cells in a dose-dependent manner. The effect of CKf on cell viability on normal rat cardiomyocytes (H9c2) cell lines and human monocytes were tested and showed absolutely no toxicity (unpublished data). The study revealed that CKf elicited significant cytotoxic effect in HT-29 colon cancer cells in a time- and concentration-dependent manner.

The present study evaluated the antiproliferative potential of the polyphenol-containing extract from coconut kernel on human colon cancer cell lines (HT-29). Preliminary phytochemical analysis showed that CKf contains polyphenolic compounds. Phenols and flavonoids are polyphenolic compounds that are distributed widely in the plant kingdom; they

of colorectal neoplasms. Moreover, it is difficult to determine the flavonoid intake. Therefore, more studies are needed to clarify the association between flavonoids and colorectal neoplasms. While most of the researches on the identification of phenolic/flavonoid compounds in several diet and dietary components are extensively studied, similar studies on coconut kernel polyphenols are surprisingly very few. Although the antioxidant properties of the total polyphenols isolated from VCO were basically studied, this is the first report on the antiproliferative activity of polyphenol-rich extract from coconut kernel against colon cancer cells.

Colorectal cancers are common cancers and leading causes of cancer deaths worldwide. Colorectal cancer is widely considered to be an environmental disease, due to ill-defined cultural, social, and lifestyle factors. Colorectal cancer may be one for which modifiable causes may be readily identified and theoretically preventable. Because the alimentary tract can interact directly with dietary components, stomach and colorectal cancer may be closely related to dietary intake. Since majority of all chronic diseases are lifestyle related, both human epidemiologic and animal studies have drawn an inverse relationship between consumption of plant-derived components and risk of carcinogenesis in different types of cancer. Plant-derived compounds suppress chronic diseases mediated by inflammation, hyperproliferation, and transformation. Thus, they may ultimately suppress angiogenesis and metastasis by blocking the cell cycle in tumoral cells, counteracting the dysregulation of proliferation and also synergize with chemotherapeutic drugs, thereby reducing the dose of treatment and toxicity. In this study, it is clear that CKf, containing polyphenolic compounds induced cell death in a dose-dependent manner. The number of apoptotic and dead cells

were also found to be increased in a time- and dose-dependent manner.

Two basic pathways involved in apoptosis are intrinsic (mitochondrial) and extrinsic (death receptor) pathways. Caspase-3/7 is one of the effector caspase that is involved in the final execution of dying cells, whereas caspase-9 is an initiator caspase that is involved in the intrinsic pathway. Caspase-3 is a frequently activated apoptotic death protease, catalyzing mitochondrial-dependent or independent cleavage of many key cellular proteins. To understand the mechanism of action induced by the extract, caspase-3 was evaluated. The results showed that with increasing concentration, the caspase 3 levels were found to be increasing which shows that CKf is influencing the caspase pathway in preventing the proliferation of these cell lines.

One of the triggers of apoptosis mediated by mitochondrial dysfunction is the accumulation of intracellular ROS. There are several biological molecules isolated from dietary components which are reported to induce ROS-dependent apoptosis in cancer cells. The study has shown that the extract possesses significant antioxidant activity in *in vitro* conditions. Studies showed that several antioxidant molecules isolated from dietary components induce apoptosis and autophagy in cancer cells which are mediated via ROS production. Antioxidants are reported to exert different biological activities in cancer cells and in non transformed cells. Antioxidants effectively induce apoptosis in HT-29 cells via increased ROS production. In the present study, CKf treatment dose-dependently increased ROS production with subsequent reduction in mitochondrial membrane potential.

Earlier studies have shown that BAX, a proapoptotic gene, induces apoptosis by increasing the activity of caspase 3 mediated through p53. The activation of BAX results in mitochondrial disruption and subsequent release of cytochrome c through the outer mitochondrial membrane into the cytosol. Inside the cytosol, cytochrome c associates with apoptotic protease activating factor 1 and activates caspase-9 which, in turn, triggers the activation of caspase-3. It is clear from our experiments that



the mRNA levels of BAX and p53 are significantly increased with increased concentration of CKf; meanwhile, the caspase 3 levels were also elevated in dose-dependent manner which indicate the role of the BAX-p53-caspase 3 axis in the apoptotic mechanism of CKf. The loss of mitochondrial membrane potential and subsequent increase in ROS was further supported by the increase in mRNA levels of BAK gene since BAK and BAX form large oligomeric pores in the mitochondrial outer membrane during apoptosis. It was reported that polyphenols induce intracellular oxidative stress and DNA damage with subsequent activation of kinases (MAPK, ATM, and DNA-PK) responsible for p53 phosphorylation leading to the activation of several other key molecules which activate cell death cascade in cancer cells.

Limitations of the study was that the polyphenol-rich extract derived from coconut kernel demonstrates a dose-dependent cytotoxic effect on HT-29 colon cancer cell line in our experimental observations. However, the study lacks in its ability to attribute the toxic effect of the extract to any one candidate molecule or a class of compounds. Structural analysis and component validation of the extract will strengthen our findings and add clarity to the identity of the active cytotoxic compound(s).

The results derived from the present investigation showed that CKf exerts apoptosis in HT-29 human colon cancer cells. A treatment period of 24 h seems to be necessary to achieve an apoptosis-inducing effect. The mechanism of the apoptotic effect involves mitochondria and BAX-p53-caspase-3-mediated pathway. All these results provide valuable preliminary mechanistic insight to the antiproliferative effects of CKf. These encouraging preliminary data may facilitate the development of novel chemotherapeutic food based on coconut for the effective management of colon cancer. ■

Harvesting and Post-harvest Management of Coconut

● CDB News Bureau, Kochi - 11

Coconut palms are productive throughout the year. However, the yield may vary from season to season. Almost on a monthly basis, a normal bearing coconut palm usually produces one harvestable bunch. On an annual basis, the number of bunches harvested per palm reaches about 14 from Tall varieties and 16 from Dwarf trees.

Coconuts are harvested for different consumptions. For the sweetest and tastiest coconut water, seed nuts usually take seven to nine months to grow from the flower opening before it matures. For copra, coconut milk and other derived food products, seed nuts take 10- 13 months to mature from the flower opening, so that the kernel is thick enough for commercial use

Harvesting of nuts

Twelve months old nuts are harvested at the interval of 30-45 days for seed as well as copra making and culinary purposes. For household use keep the nuts in vertical direction. However, for tender nut purposes 7 to 8 months old nuts are harvested. Nuts which are 11 months old give fiber of good quality. This is suitable for coir fiber.

In case of tall variety, the nuts harvested for seed purpose can be stored for 2 to 3 months period before sowing, whereas in case of dwarfs and hybrids, nuts should be sown within a period of 10 –15 days of harvest. On an average, we can have eight harvests, though the coconut palm produces inflorescence every month.





For oil extraction, nuts are generally sun dried for copra making. In this case there is a chance of dirt accumulation followed by oil quality deterioration, nuts can be dried in various types of driers available (Kiln, electric and solar driers) and also sun drying. Good quality copra can be obtained in short time by using these driers. Moisture content in copra for final use should be around 5-6%. Store the copra in polythene tar coated gunny bags. The oil yield of WCT palms under rainfed condition will be around 1.7 to 2 tons/ha.

Climbing, Power tiller operated ladder, Climbing cycle / equipment are the commonly used harvesting methods. Harvesting of coconuts is commonly done by climbing the tree with the help of a rope ring round the feet or ankles of the climber or by using a ladder. On reaching the top, the climber taps the nut in the lowermost bunch and if it is matured, he cuts the bunch at the base of the stalk when it drops down to the ground. If the ground is very hard or if tender nuts are to be harvested, the bunches are lowered by using a rope. The climber also cleans the crown and removes the dry leaves, sheaths and spathes.

In the West Coast and certain other tracts where coconut leaves are required for thatching houses, one or two lowermost leaves are also cut down at the time of harvest. The cutting down of green leaves is considered undesirable as it affects the yield of trees to some extent. Nuts which are to be stored for making ball copra are not harvested till they are completely ripe and dry.

Yield

The average yield of coconut palm is 80 – 100 nuts/palm/year depending on the variety. In dwarf

varieties, the yield varies from 70 to 80 nuts/palm/year. In tall varieties the yield varies from 80 to 100 nuts/palm/year where as in hybrids the yield is 100 to 130 nuts/palm/year

Post Harvest Management

Fully matured nuts should be harvested. For collection of seed nuts/tender coconuts the bunches should be harvested and brought down by using ropes to prevent the damage of nuts. Copra should be dried to 6% moisture by sun drying or by using copra driers. The storage period of copra can be increased up to 6 months by storing the copra in polythene tar coated gunny bags. For household storage, the nuts may be kept in vertical position.

Dehusking: Manual dehusking with the help of an iron rod driven to the ground is strenuous and skill oriented. Presently mechanical devices are used for dehusking.

Copra Processing: The optimum moisture content in copra is 5-6 percent. Sun drying, smoke drying, kiln drying and indirect hot air drying are the commonly used drying methods.

(i) Sun Drying: Traditional system of copra drying is by spreading the cups (Split open coconut) on any open surface for sun drying. It takes about 8 days for sun drying. The deposition of dirt and dust on wet meat during sun drying results in deterioration of copra quality. Further, cloudy weather and low atmospheric temperature also reduce the quality of copra.

(ii) Solar Dryer: Use of a closed type solar dryer avoids the quality deterioration of copra due to deposition of dirt. Drying time is reduced to 3-4 days. A batch type of solar cabinet dryer with a capacity of 100 nuts developed at CPCRI takes only 3 days for drying.

(iii) Indirect Drying

Small Holder Copra Dryer: An indirect copra dryer of 400 nuts per batch capacity (using agricultural waste as fuel) developed at CPCRI is gaining popularity among coconut growers. The dryer requires only 3 sq.m for housing and could be carried by 2-3 persons. The drying time required per batch is 36 hours spread over 4 days. Kerala Agro Industries Corporation (KAICU) is manufacturing this type of dryer.

Large Holders Copra Dryer: Large size copra dryer with the capacity for 3500-4000 nuts is developed at CPCRI. The unit is suitable for large holding and copra processing societies.

3. Smoke Free Copra Dryer for Medium Holding

CPCRI has developed this dryer with a drying capacity of 1000 nuts per batch. This can dry coconut in 24 hours. It has got unique furnace where in the fuel used is only shell.

4. Electrical Copra Dryer: CPCRI has developed an electrically operated dryer with forced hot air circulation. Its capacity is 1000 nuts per batch with a drying time of 28 hrs.

(iv) Ball Copra: Ball copra is a superfine quality product which commands a premium price in the market. It is prepared by storing fully mature nuts for 10-12 months, when kernal get detached from the shell. CPCRI has developed dryer to prepare ball copra in shorter time by giving different heat treatments.

(v) Copra Grading: The copra is graded in the order of its market value. The grading is mainly based on moisture content, foreign matter and black copra. The maximum limits for the same are 10 per cent, 2 per cent and 5 per cent respectively. However, the good quality copra should have the following requirements:

The Good Quality Copra	
Particulars	(%)
Moisture	6
Oil content	71
Acid value	2.5
Foreign matter	0.5
Mouldy cups	5
Wrinkled cups	5 (free)
Black copra	1 (free)

Milling Copra	
Particulars	
Foreign matter (per cent by weight – maximum)	1.0
Mouldy and black kernels (per cent by count –maximum)	10.0
Wrinkled kernels (per cent by count – maximum)	10.0
Chips (per cent by weight – maximum)	10.0
Moisture content (per cent by weight – maximum)	6.0

Edible Ball Copra	
Particulars	
Size (diameter) minimum in mm	75.0
Foreign matter (per cent by weight – maximum)	0.2
Mouldy and black kernels (per cent by count –maximum)	2.0
Wrinkled kernels (per cent by count – maximum)	10.0
Chips (per cent by weight – maximum)	1.0
Moisture content (per cent by weight – maximum)	1.0

Safe storage of copra: Copra obtained from commonly cultivated varieties / cultivars is attacked by various insect pests in store. Among these ham beetle, *Necrobia rufipes* and saw toothed grain beetle, *Oryzophilus surinamensis* are of major importance, which can cause more than 15% loss to copra when stored for more than six months.

Precautions for safe storage of copra for more than three months:

Dry the produce to four per cent moisture content. Avoid heap storage, which causes maximum damage. Store copra in netted polythene bags or gunny bags.

Pests of Copra

Insects cause serious damage to copra in storage. Apart from loss in tonnage, insect attack adversely affects the quality. In severe cases, the financial loss on this account may even exceed that arising from loss by weight.

Carpophilus dimidiatus (Corn Sap Beetle)

It is the most common insect in copra godowns. In India also it is commonly present in copra stores. The beetle is small, flat, broad, and about 3 mm in length and 1.5 mm in width. It can be readily distinguished from the other beetles by its shorter wing covers, which do not completely cover the abdomen. The beetle completes its life cycle in about five weeks.

Necrobia rufipes (Copra beetle or Red – legged harm beetle)

Necrobia beetle has a world-wide distribution and is known as 'Harm Beetle' in America and 'Copra Bug' in the Pacific. It is generally metallic blue in colour but sometimes with a greenish lustre. Its

Coconut - DOs and DON'Ts

DOs	DON'Ts
Select good mother palm	Trees growing closer to house holds, cattle shed, compost pits and other favourable conditions to be avoided for mother palm selection.
Plant the seedlings in the right season	Trees habitually producing barren nuts are to be avoided even though they may produce high yield for use as mother palm.
Remove seed nuts that not germinated within 5 months	Don't collect immature nuts as seed nuts
Transplant 9-12 month old seedlings	Avoid over crowding in storage.
Fill up seedling pit with soil gradually every year by cutting from sides as the seedling grows	Avoid planting in rainy season in low lying areas.
Remove soil accumulating at the collar region of the seedlings during rains	Avoid nursery in open area
Adopt drip irrigation and fertigation wherever possible	Avoid horizontal sowing and too close / wide planting
Apply balanced manures and fertilizers based on soil test valve	Don't transplant seedlings below 9 months and after 12 months of age.
Provision of proper drainage facilities to prevent bud rot	Don't plough the garden frequently
Follow drip irrigation to prevent spread of Basal Stem Rot	Excessive irrigation should be avoided
Follow waiting period of 45 days for each harvest when chemical pesticides are used	Avoid non judicious use of fertilizers
Use plant products and biocontrol agents always for pest and disease management	Avoid injuries to the stem/roots
Hybrids should be grown under well managed conditions with assured irrigation	Don't cut green leaves
	Don't adopt flood irrigation
	Pheromone traps should not be placed in direct sunlight

length varies from 3.5 mm to 5.5 mm. The first five joints of the antennae are brown, the rest black, and the terminal three are expanded. It completes its life cycle in about 40 days.

(c) *Ahasverus advena* (Foreign grain beetle)

It is known as "Foreign Grain beetle," and is present throughout the world. It has been recorded feeding upon a variety of stored products. It is abundant in copra stores, but is practically mycetophagous. The adult beetle is very small, measuring about 2 mm in length and 0.75 mm in width, and is chestnut brown in colour. The life cycle of the beetle is completed in about thirty days.

(d) *Oryzaephilus surinamensis* (Saw-toothed Grain Beetle)

This Cucujid beetle is commonly known as "Saw Toothed Grain beetle," and it is a serious pest of

stored grains; copra and other stored food products throughout the world. The adult beetle is small, flat, elongate, dark brown, about 3 mm in length and 0.75 mm in width. The pro-thorax has three longitudinal ridges with two depressed areas and its lateral margins are each armed with six prominent tooth-like projections. The beetle breeds throughout the year in the moulds and crevices of degenerated copra, and completes its life cycle in about thirty days.

(e) *Tribolium castaneum* (Red flour beetle)

It is commonly known as "Red Flour beetle", and is primarily a pest of cereal products like wheat flour, 'suji' and 'maida' but causes damage to quite a number of other stored products including copra. The beetle is small, flat, elongated, reddish brown, about 3.5 mm in length and 1.25 mm in width. The

first seven joints of the antennae show a gradual increase in size and the last three are thickened into a club. In India, its life cycle varies from six to twelve weeks.

(f) *Trogoderma granaria* (Khapra beetle)

This pest is known as 'Khapra' in the towns and villages of India, and its principal food is wheat. The adults are harmless, and only the grubs are destructive. The beetle is about 3.5 mm in length and 1 mm in width, and has a characteristic oval shape. The head is disproportionately small and is concealed from above by the pronotum. The life cycle in humid places is completed in about two months.

(g) *Corcyra cephalonica* (Rice moth)

This pest is commonly known as the Rice Moth and is a serious pest of stored paddy, rice, cereals, copra and other stored food products. The head and thorax of the moth are brownish in colour. The fore-

wings are brown with a pinkish tinge, speckled with darker scales running longitudinally. The hind wings are shiny and silver grey. The wing expanse is about 25 mm.

(h) *Ephestia cautella* (Fig moth or Almond)

This is frequently referred to as the 'Almond' or the 'Fig Moth' and is one of the most important insects infesting dried fruits, cocoa, spices, cashew nut, copra and groundnut. The moth is about 6 mm in length with a wing expanse of 15 mm. Its colour varies with food and environments, but mostly the fore-wings are greyish-brown, somewhat mottled with a distinctly darker coloured transverse band. The average life cycle on mouldy copra is six weeks.

Reference: http://www.agritech.tnau.ac.in/expert_system/coconut/coconut/coconut_harvest_postharvest.html ■

Steamed Coconut Pudding

Ingredients

Tender Coconut with water
cleaned and pasted- 200 ml
Fresh Cream -200
Star Anise -1/2
Egg Yolk- 4

Method

Double boil the cream with star anise. Stir continuously. Take out star anise when the mix is boiled well. Beat the egg yolk and add sugar and mix well. Pour the mixture into desired bowl and double boil the mixture for 45 minutes. Chill the pudding and serve.



Technology Mission on Coconut

for accelerating value addition in coconut

● Sardar Singh Choyal, Deputy Director, CDB, Kochi - 11

Traditionally coconut is grown for making copra and coconut oil thus making these products controlling the price of coconut. Fall in price of copra and coconut used to adversely affect the price of coconut resulting in heavy loss to coconut farmers despite the Minimum Support Price (MSP) scheme of the government. The Price Support Scheme also could not make much impact in ensuring a fair, steady and reasonable price to the farmer. In this context, it was realized that product diversification and value addition would help the farmers to fetch better price for their produce. Thus new products were developed and commercialized through product diversification and value addition. These products would also have their role in controlling coconut price.

The coconut crop is also being affected by severe pests and debilitating diseases like root-wilt, ganoderma wilt, Thanjavur wilt and Tatipaka disease. It was realized that a major initiative is necessary for controlling the pests and diseases in coconut to improve its production and productivity and promote

product diversification for better value realization from various coconut products. This will help the small and marginal farmers who depend on coconut for their livelihood to realize better income.

In this context, to protect the interest of the coconut growers, the then Prime Minister announced launching of Technology Mission on Coconut (TMoC) in 2001-02. The Mission converge and synergize all the efforts and address the problems and bridge the gaps through appropriate projects in a Mission Mode to ensure adequate, appropriate, timely and concurrent action for product diversification and value addition and increase the production and productivity of coconut. This would help develop a mechanism which makes coconut farming competitive and ensures fair, reasonable and steady price to the farming community and would open avenue for novel coconut products.

Goals and Objectives

TMoC aims at coordinating with coconut



farming community, industry, market and research organizations and work on a mission mode for product diversification and value addition, production and productivity improvement, market research and market promotion for the overall development of coconut cultivation and industry. To ensure adequate, appropriate, timely and concurrent attention to all the links in the production, post harvest and consumption chain and to disseminate technologies through demonstration, acquisition and promotion for adoption to address the problems of coconut producers, entrepreneurs and market are the prime objectives of this scheme. Promotion of economically desirable diversification and value addition to generate skilled employment and maximizing economic, ecological and social benefits from the investment and infrastructure in coconut is also aimed through the scheme.

The Mission Approach

Mission approach is to evolve an approach for technology support which shall have synergy and convergence to address the existing gaps. Existing schemes of Coconut Development Board and other institutes will continue with existing pattern and shall be converged in a manner that vertical and horizontal integration are achieved. Issues which have not been addressed in existing schemes to meet the challenges and issues relating to development of technologies for management of insect pests and disease affected gardens, product diversification and market promotion, its demonstration and promotion for adoption are covered under the scheme. Missing links in existing programs with focused attention to achieve the goals of the mission will also be addressed under the programme.

National Steering Committee (NSC)

Technology Mission had a committee named National Steering Committee (NSC) at national level to guide and monitor the activities of TMOC and recommend suitable measures for improvement and effective implementation to the Govt. of India.

Project Approval Committee (PAC)

The projects received by the Board for consideration under Technology Mission (TMOC) are examined, reviewed and approved for implementation by a Project Approval Committee (PAC) representing State Govt., research organization, banks, food processing and marketing fields.

Focus Areas

1. Research and Development on product diversification, by-product utilization and value addition, production and productivity improvement and market development
2. Capacity building and participatory planning and implementation.
3. Infrastructure Development.
4. Integrated insect pest and disease management.
5. Quality, Quantity and Productivity Improvement.
6. Facilitating Credit Availability and Management.
7. Socially Acceptable and Ecologically Sustainable Schemes leading to large scale adoption and long-lasting effects.
8. Poverty Alleviation Linked with Sustained Natural Resource Management through judicious management of existing land use.
9. Post-harvest Processing, Product diversification and Value addition.
10. Agri-Business in coconut.
11. Equitable Access of People to benefits and equitable sharing by actually involving people at all levels during the project implementation, thus ensuring the evolution of a proper usufruct sharing mechanism for them.

Components and programme

Programme 1 - Development, Demonstration & Adoption of Technologies for Management of Insect Pests & Diseases Affected Coconut Gardens

Programme 2 - Development, Acquisition, Demonstration, Training and Adoption for Processing and Product Diversification

Programme 3 - Market Research and Promotion

Programme 4 - Technical Support, External Evaluation and Emergent Requirements.

Structure of the Technology Mission on Coconut

Processing & Product Diversification

Management of Insect Pests & Diseases

Technology mission

Market Research & Promotion, Technical Support, External Evaluation & Emergent Requirements

Eligible Institutions/ Organizations/ Individuals

SAUs, ICAR/CSIR Institutes, DEVELOPMENT OF TECHNOLOGIES, Any Research Organization having capability, NGOs, SAUs, ICAR/CSIR Institutes

Demonstration of technologies

Any Research Organization having capabilities, NGOs, FPOs, Farmers

Adoption of technologies

Entrepreneurs, Regd. Co-operative Societies/ Group of Farmers

Programme 1: Development, Demonstration & Adoption of Technologies for Management of Insect Pests & Diseases affected Coconut Gardens

A. Development of technologies

(i) Focus areas

- Identification of root wilt disease free palms in the midst of disease affected gardens in 8 Districts of Southern Kerala and subjected to serological / ELISA tests and making use of these palms for seed production for raising quality seedlings.
- Identification of natural microbial antagonistic agents against eriophyid mite.
- Evaluation of biological agents for management of Ganoderma/Tatipaka diseases / Stem bleeding in Tamil Nadu, Karnataka, Andhra Pradesh and other areas.
- Studies on recycling of organic waste in reducing insect pests and disease incidence and increasing the production including the use of biological agents.
- Large scale synthesis of pheromones against red palm weevil and mass multiplication of pheromones.
- Any other aspects of insect pest and disease management.
- Development of technology for insect, pest and diseases which are contrast to coconut products.
- Technology available outside the country could be imported with cost.
- Control insects, pests & diseases through improved cropping /farming systems, improved cultural practices including nutrient and water management.

(ii) Eligible institutions

- Indian Council for Agricultural Research (ICAR)
- State Agricultural Universities (SAU's)
- Non governmental organizations (NGO's)
- Any institution having capability to conduct research

B. Demonstration of technologies

Demonstration of all the proven technologies on management of insect pests and diseases.

Eligible institutions :-

- Indian Council for Agricultural Research (ICAR)
- State Agricultural Universities (SAU's)
- State Agriculture/ Horticulture departments
- Public sector/Non governmental organizations (NGOs)
- Registered cooperative societies/Individuals/ Group of farmers
- Any institution having capability to demonstrate technologies

C. Adoption of technologies

Adoption of all the proven technologies on management of insect pests and diseases as well as on improved cultural practices

(i) Eligible institutions :

- Indian Council for Agricultural Research (ICAR)
- State Agricultural Universities (SAUs)
- State Agriculture/ Horticulture departments
- Public sector/Non governmental organizations (NGOs)
- Registered cooperative societies/Individuals/ Group of farmers
- Any institute having capability to adopt technology

Programme 2 : Development, Acquisition, Demonstration Training and Adoption of Technology for Processing and Product Diversification

A. Development of Technologies

(i) Focus areas

- Convenience oriented coconut foods, Coconut oil based medicinal formulation
- Bio-diesel and Oleo-chemicals
- Coconut shell based chemicals and coconut water & skim milk based beverages
- Coconut timber processing
- Technologies developed at laboratory level shall be field tested at pilot plant level to assess the technical and economic viability of the technologies
- Technologies shall be transferred through demonstration and training of entrepreneurs in the appropriate areas
- Any technology available outside the country and could be imported.

ii) Eligible institutions

- Council for Scientific and Industrial Research (CSIR)

- Defence Food Research Laboratory (DFRL)
- Central Food Technological Research Institute (CFTRI)
- Regional Research Laboratories (RRL)
- State Agricultural Universities (SAUs)
- NGOs, Individual entrepreneurs
- Public sector and other research organizations
- Any institution having capability for conducting research

B. Acquisition Training & Demonstration of Technologies

All the proven technologies in processing / product diversification

Eligible institutions

- Council for Scientific and Industrial Research (CSIR)
- Defence Food Research Laboratory (DFRL)
- Central Food Technological Research Institute (CFTRI)
- Regional Research Laboratories (RRL)
- State Agricultural Universities (SAU's)
- NGO's/ Registered cooperative societies/Individual entrepreneurs
- Public sector and other research organizations
- Any institute / organization having capability

C. Adoption of Technologies

All the proven technologies in processing / product diversification

Eligible institutions: Registered co-operative societies/ individual / entrepreneurs / NGOs / Any institutions having capability to adopt technology

Programme 3. Market Research and Promotion

(i) Focus areas

1. Review the present situation of coconut development in particular area / State
2. Develop primary/secondary data of various aspects on coconut
3. Identify constraints and suggest their remedial measures
4. Develop short term and long term strategies for systematic development of coconut
5. Provide consultancy services, expert services & establishing labs etc. in pursuance thereof
6. All other aspects related to promotion and utilization of coconut products in India and outside

7. Potential technologies available abroad.

8. Assessment of consumer preference, assessment of value added products and trend analysis

9. Awareness campaign on health aspects of coconut products

10. Providing support for establishment of parlours for coconut products, media support, literature, participation in exhibition / trade fairs, etc. within and outside the country

(ii) Aspects of Studies / Surveys:

a. Techno Economic Feasibility Studies for development of coconut in States/UTs/Belts/Zones etc

b. Market Studies/special problems/Area Commodity based study/other aspects

c. Expert Services for project identification, formulation, implementation, monitoring & evaluation etc

d. Multi-disciplinary and specific studies as approved by PAC

(iii) Eligible institutions

1. All the Govt. agencies, NGO's, Registered cooperative societies and individuals
2. Any institute/organization having capability

Programme 4 : Technical Supports, External Evaluation and Emergent Requirements

When emergent requirement arises, technical and financial support is given for coconut cultivation, industry and market promotion on project basis and projects are approved by the PAC.

Pattern of assistance

(1) Development of technologies for management of insect, pests and diseased affected gardens:

(A) Development of technologies:

The projects received for the development of technologies for management of insect, pests and diseased affected gardens from

(a) Central/State Government organizations, public sector organizations and cooperative sector are given the assistance of 100% of the project cost limited to 50.00 lakh and

(b) NGOs and other organization assistance is 50% of the project cost limited to Rs. 25.00 lakh.

(B) Demonstration of the technologies:

The projects received for the demonstration of the technologies from

(a) Central / State Governments Organizations/Public Sector Units / Cooperative Societies- the assistance is 100% of the project cost limited to Rs. 25.00 lakh per project

(b) individuals / group of farmers / NGOs/ Private Companies assistance is 50% of the project cost limited to Rs. 10.00 lakh.

(C) Adoption of the technologies:

The projects received for the adoption of these technologies from the group of farmers/NGOs/ other organization are assisted at the rate of 25% of the project cost.

(2) Development of technologies for processing and product diversification:

(A) Development of technologies:

The projects received for the development of technologies for processing and product diversification from

(a) Central/State Government organizations, public sector organization and cooperative sector are given the assistance of 100% of the project cost limited to 75.00 lakh and

(b) NGOs, individual entrepreneurs and other research organization to the tune of 75% of the project cost limited to Rs.35.00 lakh.

(B) Acquisition, training, demonstration of the technologies: The projects received for the Acquisition, training, demonstration of the technologies from

(a) All the Governments and Cooperative Societies- the assistance is 100% of the project cost

(b) NGOs, individuals entrepreneurs and other organizations to the tune of 50% of the project cost.

(C) Adoption of technologies: The projects received for the adoption of the technologies from

(a) NGOs, individual entrepreneurs and other organization, projects are assisted by 25% of the project cost limited to Rs. 50.00 lakh.

(b) SC/ST women farmers are assisted by 33.3% of the project cost limited to Rs. 50.00 lakh.

(c) high value agriculture in Union territory of Andaman and Nicobar and Lakshdweep are assisted by 50% of the project cost limited to Rs.50.00 lakh.

(3) Market research and Promotion:

(A) Market research: The projects received for market research from

(a) Government agencies and Cooperative Societies are given the assistance by 100% of the project cost

limited to 25.00 lakh

(b) individuals, NGOs and other Organization are assist-ed by 50% of the project cost limited to Rs. 12.50 lakh.

(B) Market promotion: The projects received for market promotion from

(a) Government agencies and Cooperative Societies are given the assistance of 100% of the project cost limited to 25.00 lakh

(b) Federation of CPS (FPOs) are assisted by 50% of the project cost limited to Rs. 6.00 lakh

(c) NGOs and private institutes are assisted by 50% of the project cost limited to Rs. 15.00 lakh.

4) Technical Support, External Evaluation and Emergent Requirement: Support is extended on need basis as decided by the Project Approval Committee of TMOC.

Submission of Projects

a. The projects on research for development of technology for product diversification and value addition, insect, pest and disease control and market research may be submitted by the eligible organizations / institutions for consideration of the PAC.

b. The projects on demonstration, acquisition and training may also be submitted by the eligible organizations / institutions for consideration of the PAC.

c. The projects on adoption of technology for processing and product diversification needs to be submitted in the form of Detailed Project Report (DPR) along with prescribed application form. The projects on adoption are supported by back -ended subsidy so promoters must avail a minimum of 40% of the project cost as term loan from any nationalized / scheduled bank and submit the project along with





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



bank term loan sanction and appraisal report to the Board.

Conditions for subsidy under Adoption of Technologies for processing and product diversification

(i) Back ended capital investment subsidy per project shall be provided under the scheme to those projects which are found technically and financially viable.

(ii) Subsidy would be sanctioned and released under the scheme on the pattern approved by PAC and MoU executed among entrepreneur, Bank and Board.

(iii) Subsidy will be released in the subsidy reserve fund account of the promoter in three installments of 50%, 40% and 10% on submission of documents as per MoU.

(iv) The back ended subsidy credited in the subsidy reserve fund account will have a lock in period of five years reducible to 3 years as per conditions in MoU.

(v) On completion of lock in period and liquidation of entire term loan (except amount equivalent to subsidy in the subsidy reserve fund account) and submission of documents as per MoU the subsidy will be adjusted in the term loan account of the promoter.

(vi) The entrepreneurs who have availed Coconut Development Board's subsidy will not be entitled to avail any other Central Government Subsidy. However, they may avail State Government Subsidy as per the rule of State Government and the Board.

Projects on Adoption of Technologies for processing and product diversification :

Under adoption of technology for processing and product diversification projects may be submitted on the following:

(i) Processing and preservation of Neera and value added products

(ii) Processing and preservation of Tender coconut water

(iii) Manufacturing of desiccated coconut powder, virgin coconut oil, vinegar, nata-de-coco, coconut chips, coconut milk, milk cream, spray dried coconut milk powder, coconut shell powder, coconut shell charcoal, coconut shell based activated carbon etc.

d. The projects may be submitted on market research and market promotion by the eligible institutions / organizations / FPOs/ other eligible individuals for undertaking various market research, promotional activities for the consideration of the PAC.

Impact of Technology Mission

Many projects on research, adoption and market promotion have been assisted under Technology Mission on Coconut. Out of these 480 projects under adoption of technologies are assisted for establishment of various units for manufacturing coconut and coconut-based value-added products. These units are utilizing around 12% of the total coconut production of India for producing various value added coconut products. Consumption of coconut for producing value added products play a vital role in arresting the lead role being played by coconut oil and copra deciding the coconut price. The product diversification and value addition of coconut have supported coconut farmers and government to ensure a fair, reasonable and steady price to coconut farming community.

Technologies available for entrepreneurs

1. Hygienic harvesting, preservation and processing of Neera and value-added products
2. Processing, preservation and packaging of tender coconut water
3. Manufacturing of virgin coconut oil through cold press.
4. Blending of coconut oil and other edible oils
5. Coconut milk, cream and spray dried milk powder
6. Technology for manufacturing of vinegar, coconut chips and nata-de-coco
7. Minimal processing of tender coconut
8. Dietary fibre from coconut residue.

For more information, please contact:- Coconut Development Board, TMO Cell, Kera Bhavan, SRV Road, Kochi – 682011, Ph: 0484-2376265, 2377267, 2377266. Email : cdbtech@gmail.com

Innovations in Agricultural Marketing

● CDB News Bureau, Kochi - 11

Linking small farmers with modern markets such as supermarkets has been identified as one of the several pathways ways to make their farming viable. Here is the success story of two young educated agripreneurs who have ventured into direct marketing and reaping profit.

MBA graduate turns his organic farm into a profitable venture



Price fluctuation is one of the biggest challenges faced by farmers across the country and middlemen are blamed for this on most occasions.

An MBA graduate from Bengaluru city is beating this fluctuation by carrying out multi-crop organic farming on his 20-acre farm in Malavalli of Mandya district. He has made the profession profitable by adopting the direct selling model.

Instead of selling his farm produce to middlemen, he sells them directly to the customer, which is a win-win situation for both. Every day he earns Rs 2,500 as profit by selling fruits, vegetables and tender coconut grown in his farm.

Amogh S Jagthap, who pursued his MBA started his direct farm-to-customer centre on Malavalli-Mysuru road. His shop has been built next to his farm which is spread over 20 acres of land in Malavalli. After his MBA he decided to give a new touch to this farm.

Amogh divided the farm into several plots. These plots are dedicated for various crops. He has adopted organic farming. Instead of selling these farm products to middlemen, he opened a shop where all the products are sold directly to the customers. This is helping him earn good profit. Besides farming, he also adopted animal husbandry which has made agriculture a sustainable model for Amogh.

In farming, he hasn't incur loss since he is following sustainable model. According to Amogh, marketing the agriculture products is the key to make the profession profitable and he is doing the same.

Online market place to connect farmers to agriculture resources

After spending almost 11 years in the US, Balamurali Govindan, a software engineer, from Coimbatore, Tamilnadu came back to his home town to pursue his interest in agriculture.

He bought four acres of agricultural land at Devarayapuram near Thondamuthur and went ahead with cultivation of coriander. Sadly, during the time of harvest, he found that the price of fresh produce touched rock-bottom levels and he was unable to realise his cultivation cost. He tried tomato and there too, but failed miserably. This made him think that if technology and IT intervention could bring in a sea change in other sectors, why not try it to solve farmers' issues? He wanted to address the concerns on the supply chain front. He wanted to establish a direct connect between the farmer and the buyer and thus was born Tara Blooms Private Ltd.

Boosting supply chain

The start-up developed an online marketplace, a collaborative platform Farmer.Live, where the stakeholders in the agri supply chain — from grower, seller to buyer, dealer, or Farmer Producer Organisation (FPOs) can register for free.

This platform facilitates the farmer to sell his produce without any intervention by middlemen. There are more than 10,000 registered farmers and buyers on this platform, over one-lakh Facebook followers, 20,000+ mobile app

downloads and 100+ companies registered till date. The hit rate of the website is over 10,000 a month, notwithstanding App visitors.

Every registered farmer gets to access information such as best practices, daily market price, weather forecast, warehouse facilities and so on. Such information is sent to their registered mobile number or if the farmer has a smartphone, the same is shared as a notification.

Export enquiries

Babu Shanmugam, a registered farmer on Farmer.Live, deals with herbal products and coconut. Shanmugam is a management graduate who took to farming. Until recently, he was only relying on the local market. After registering on this platform, he is getting enquiries from buyers in Gujarat and other places.

Govindan is looking to extend it to farmers in other States in a phased manner. The challenge was in connecting to farmers and not building the application. Measures are initiated for providing information in 13 languages. Exporters too have registered on this platform. Govindan has invested around Rs. 1.5 crore in this venture and has engaged a team of 25 young agri graduates to keep the platform live and going.



Top 10 Apps Revolutionizing Indian Agriculture

Indian users comprise about 30% of the total volume of the global feature phone market, making it the second largest in the specified field. In 2015, India had 720 million mobile phone users, out of which 320 million were rural mobile phone users. This estimate also included 50 million Smartphone users with access to internet. According to 'The Rising Connected Consumer in Rural India', a study by the Boston Consulting Group, this share of rural India will jump to 48% by 2020. Steps taken by the Indian government may make this happen sooner than predicted. Digital India, launched in 2015 by Indian Prime Minister Narendra Modi, aims



towards the promotion of digital literacy and creation of digital infrastructure for empowering rural communities. Considering that 58% of rural households depend on agriculture as one of their most eminent source of livelihood, the role of Digital Agriculture is given more importance within Digital India.

The use of Information and Communication Technology (ICT) to support the transmission of localized information and services working towards making farming socially, economically and environmentally sustainable, while contributing to the delivery of nutritious and economical food for all – this comprises Digital Agriculture. This has also led to the rise and development of mobile apps which are helping existing government schemes, and other agriculture-based information to reach farmers in rural India. This digital change is acting as a game-changer for Indian agricultural conditions.



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website: www.dasd.gov.in

133rd Meeting of Coconut Development Board



The 133rd Meeting of the Coconut Development Board was held on 29th June 2018 at ICAR-National Institute of Animal Nutrition and Physiology, Bengaluru under the Chairmanship of Dr. B.N. Srinivasa Murthy, Horticulture Commissioner to the Government of India and Chairman, Coconut Development Board.

Dr. B.N. Srinivasa Murthy, Chairman, CDB highlighted the major achievements and activities of the Board. Annual Action Plan 2018-19 for Coconut Development Board Schemes under MIDH at a total budget of Rs.193 crore was approved by the Board. The Publicity and Extension activities of the Board for 2018-19, Skill development training and awareness programmes and the list of international and domestic exhibitions for participation was also approved. The meeting further discussed and decided on the component programmes proposed to be carried out under the scheme Marketing, Market Intelligence Services, Statistics and Strengthening of Export Promotion Council the year 2018-19 and Board's initiatives to distribute coconut seedlings @ 5 seedlings per family in the selected villages in Aspirational Districts Programme under Krishi Kalyan Abhiyan.

Shri M.R. Shankara Narayan Reddy, Vice Chairman and members of the Board, Dr. P. Chowdappa, Director, CPCRI; Shri K.K. Ragesh, Member of Parliament (Rajya Sabha), Shri P.C. Mohanan Master, Kerala, Shri P.R. Muraleedharan, Kerala, Shri S. Mohan Raj, Tamilnadu, Dr. Biswanath Rath, Odisha and Shri Sanjeev Kumar Singh, Bihar, Smt. K.N. Roopa Shree, Deputy Director, (Horticulture and Sericulture), Government of Karnataka representing the Principal Secretary, Government of Karnataka, Shri Saradindu Das, Chief Coconut Development Officer, and Shri R. Madhu, Secretary, Coconut Development Board attended the meeting.

Tender Coconut Water remains the most wanted thirst quencher and energy drink



The demand for tender coconut water records an increasing trend even in nontraditional states like Tripura on the wake of the temperature getting high. Tender coconut water enriched with vitamin and minerals, refreshes the body and boost energy to make one feel instantly energetic. A picture from 'Daily Desher Katha' a Tripura daily showing the rush around a tender coconut vendor in Tripura.

KRISHI KALYAN ABHIYAN

TO BE IMPLEMENTED IN ASPIRATIONAL DISTRICTS

1ST JUNE 2018 TO 31ST JULY 2018

CDB distributes quality coconut seedlings under Krishi Kalyan Abhiyan scheme

In line with the Hon'ble Prime Minister's vision of doubling farmers' income by the year 2022, the Ministry of Agriculture and Farmers Welfare has launched the Krishi Kalyan Abhiyaan from 1st June to 31st July 2018 to aid, assist and advice farmers on improving their farming techniques and raise the incomes of the farmers. The programme is undertaken in 25 villages which are having more than 1000 population each in 111 Aspirational Districts identified in consultation with Ministry of Rural Development. A short term Action Plan comprising specifically identified activities under various departments of the ministry viz., Department of Agriculture, Cooperation & Farmers Welfare, Animal Husbandry Dairying & Fisheries and Department of Agricultural Research & Education is being

implemented to saturate these 25 villages in each of the 111 districts with these activities.

The Coconut Development Board is taking part in this initiative by distributing 87,000 coconut seedlings @ five seedlings to each landed household (17,400 families) homestead/ backyard gardening in 21 Aspirational Districts in 9 States.

The distribution of coconut seedlings is being implemented directly by the Board's unit Offices in these States in association with the KVKs and State Departments. In order to take regular care of the palms by the beneficiaries, CDB is also doing awareness on planting and maintenance of the palms. Report of the various programmes organized by CDB in various states is furnished below.

Dhalai, Tripura

KVK, Dhalai in association with Coconut Development Board organized a workshop on coconut cultivation in the selected Aspirational district Dhalai, Tripura on 15th June 2018. Shri. Manoj Kanti Deb, Hon'ble Minister for Minister for Youth Affairs & Sports, Food, Civil Supplies & Consumer Affairs, Government of Tripura was the chief guest of the programme. Shri. Ashish Das, MLA, Surma and Shri. Dhananjay MLA, Rainavally attended the programme. Shri. Saradindu Das, Chief Coconut Development Officer, CDB represented the Board in the programme as resource person. Programme Coordinator, KVK, Dhalai, District Horticulture Officers and Agriculture Officers and around 400 farmers covering 25 villages selected under Krishi Kalyan Abhiyan from Aspirational district attended the programme. Board supplied 2000 quality coconut seedlings to 400 beneficiary farmers.



Goalpara, Assam



Coconut Development Board, Regional Office, Guwahati organized District Level Workshop cum Seedlings Distribution in association with Krishi Vigyan Kendra, Goalpara and District Agriculture Office, Goalpara on 11th July 2018 at KVK, Goalpara under Krishi Kalyan Abhiyan. Shri Dipak Rabha, MLA in his inaugural address called upon the farmers to undertake coconut farming and take benefit from schemes and programmes of Coconut Development Board. The MLA distributed 2500 seedlings to 500 farmer families. Dr. Hitu Choudhury, Programme Co-ordinator, KVK, Goalpara delivered the welcome address and Shri Lunghar Obed, Director, CDB spoke on Coconut Production, value addition and CDB schemes. District Agriculture Officer briefed on plantation of coconut and other crops. Department of Agriculture distributed mango seedlings, guava seedlings and orange seedlings. Dr. Utpal Bhattacharya, Sr. Scientist spoke on coconut pest and diseases. Shri Dipak Rabha, MLA Shri Ajanta Bharali, Field Officer, CDB, DSP Farm, Abhayapuri demonstrated method of planting coconut seedlings.

Golokganj, Assam

As part of the Krishi Kalyan Abayan Programme another Workshop on Coconut cum Seedlings Distribution was organized in association with Krishi Vigyan Kendra, Dhubri and District Agriculture Office, Dhubri on 13th July 2018 at Golokganj, Dhubri District, Assam. Dr. Subash Chandra Panwar, Joint Director, National Horticulture Board, Govt. of India, Shri Lunghar Obed, Director, CDB, Shri Rafiqul, SMS, KVK, Dhubri, Shri Bilich Dan Bara, Development Officer and Smt. Fariza Saheed, Field Officer, DSP Farm, Abhayapuri alongwith 130 farmers took part in the programme. Dr. Subash Chandra Panwar, Joint Director, NHB, Guwahati delivered the welcome address and Shri Lunghar Obed, Director, CDB spoke on various schemes and programmes of CDB. Smti Fariza Saheed, Field Officer, DSP Farm, Abhayapuri spoke on scientific coconut cultivation and demonstrated the method of planting coconut seedlings. Shri Lunghar Obed, Director, CDB, Regional Office, Guwahati and Dr. Subash Chandra Panwar, Joint Director, National Horticulture Board, Guwahati distributed coconut seedlings to the selected families.



Virudhunagar, Tamil Nadu



Coconut seedling distribution function was held at Collectorate on 19th July 2018. Mr. A. Sivaganam IAS, District Collector distributed 200 seedlings to the beneficiaries in the presence of Mr. Rajeev Bhushan Prasad, Director, CDB, Mr. S. Subramaniyan, Joint Director of Agriculture, Mr. Thavamuni, Dy. Director (GOI) Ms. L. Muthulakshmi, Asst. Director of Agriculture, Ms. S. Geetha, Agricultural Officer and Mr. Sasikumar C Technical Officer of Board. 40 farmers from Thathampatti village attended the function and collected the seedlings. After distribution a session on coconut planting techniques and its management was held.

Ramanathapuram , Tamilnadu



Coconut Development Board and the Dept. of Agriculture, Govt. of Tamil Nadu in association with the district administration, TNAU- ICAR and Krishi Vigyan Kendra organized a meeting as part of implementation of Krishi Kalyan Abhiyan on 17th July 2018. The meeting was chaired by District Collector Dr. S. Natarajan, IAS. Mr. Rajeev Bhushan Prasad, Director, CDB in his presidential address spoke on the importance of the scheme and the District Collector in his special address, emphasised about benefits of the scheme. He further appreciated the Board for distributing dwarf variety coconut seedlings to the beneficiary farmers. 800 coconut seedlings were distributed by the Board during the occasion to the farmers of Ramanathapuram and Thiruppullani block. A technical session was also held as part of the programme.

Wayanad, Kerala

Coconut Development Board in association with Krishi Vigyan Kendra, Ambalavayal, Kerala Agriculture University and the Department of Agriculture Development & Farmers Welfare, Kerala organized Coconut Seedlings Distribution and Seminar at Kalpetta on 25th July 2018. Shri. P C Mohanan Master, Member CDB presided over and Shri. A. R. Ajayakumar IAS District Collector, Wayanad was the chief guest of the programme. Shri. Shaji Alexander, Joint Director of Agriculture, Wayanad in his felicitation spoke on the various schemes of agricultural development programmes implemented by the Dept. of Agriculture, Kerala, in the selected villages under Krishi Kalyan Abhiyan programme. Shri. R Jnandevan, Deputy Director, CDB delivered the welcome address and Dr. N E Safia, Programme Coordinator, KVK Ambalavayal proposed vote of thanks. In the technical session which followed under the leadership of Dr. P S John, Former Professor, College of Horticulture, KAU, Smt. Resmi D S, Assistant Director and Smt. Vincy Vargese, Technical Officer took classes. The technical session concluded with vote of thanks by Shri. S. Selvakumar, Development Officer, CDB.



AGRI VIKAS 2018



Coconut Development Board, State Centre, Pitapally, Odisha participated in Agri Vikas 2018 from 29th to 30th June, 2018 at Shiksha Anusandhan (SoA) University, Bhubaneswar. The event was supported by National Institute of Agriculture Marketing (NIAM) and KPMG as knowledge partners. Shri. Dharmendra Pradhan, Hon'ble Minister of P&NG and SDE, Govt of India. Shri. Gajendra Singh Shekhawat, Hon'ble Minister of State for Agriculture and Farmers Welfare and Shri. Giriraj Singh, Hon'ble Minister of State for Micro, Small and Medium Enterprises, Government of India were the other dignitaries who attended the function.

The Board displayed coconut seedlings of different 'varieties, coconut palm climbing machine, mature nuts of different coconut varieties, various value added products from Neera, value added products from coconut, like virgin coconut oil, virgin coconut capsule, desiccated coconut, coconut milk, coconut jam, squash, coconut oil, coconut milk powder, handicrafts items etc. Informative posters highlighting the health benefit and other aspects of coconut and its products, Board's schemes, activities etc. were displayed in the stall.



The Chief Guest and other dignitaries were received in the Board's Stall by Shri R.K.Pal, Deputy Director, CDB. In the technical session Shri. Sreekumar Poduval, Processing Engineer, CDB spoke on the opportunities in coconut processing.



Central and State govt. organizations, Farmer Producer Companies, NGOs, SHGs, Fertilizer Companies, Agricultural Machinery Manufacturers, Publishers, Organic Farming related enterprisers & seed companies participated in the exhibition. More than 1000 people from various states visited the stall.

AGRI INTEx – 2018

Coconut Development Board, Regional Office, Chennai participated in the 18th edition of Agri Intex – 2018 organized by CODISSIA Trade Fair Complex, Coimbatore from 13th to 16th July 2018. Board displayed various coconut based value added products like Neera Sugar, Neera Jaggery, Neera Cookies (Premium), Neera Chocolate, Coconut chips, Coconut Chunks, Haustorium Candy, Coconut Vinegar, Flavoured Coconut Milk, Virgin Coconut Oil, Coconut Oil, Soaps made of Coconut Oil, fresh Neera produced through vending machine, Packed Neera (With AFL Technology), Desiccated Coconut Powder, Coconut Milk, Coconut Milk Powder, Coconut Laddu and Coconut shell based Handicrafts. M/s. Anamalai Coconut Producer Company, M/s. Karpagaviruksham Coconut Producer Company, M/s. Pollachi Coconut Producer Company, M/s. Coimbatore Coconut Producer Company, M/s. Vinayaka Coconut Producer Company, M/s. Madathukulam Coconut Producer Company, M/s. Vadakara Coconut Producer Company, M/s. Palakkad Coconut Producer Company, M/s. Gobi Velan Vanigan Coconut Producer Company, M/s. Parasakthi Tools, Coconut Dehusking unit, and M/s. Jupiter Wood Works, Coconut shell based handicraft manufacturer had their sales cum display counters in Board's stall. A B2B meeting was also held as part of the programme



Monthly Operations- August



Andaman & Nicobar Islands:

Search for bud rot and rhinoceros beetle attack and adopt suitable control measures. If coconut husk is available, dig trenches of 50 cm wide and 50-60 cm deep between rows of palms and bury husk in them with concave surface up and cover with soil. Clean the basins of coconut seedlings planted in the main field.



Andhra Pradesh :

Plough *in situ* the green manure crops raised. Search for rhinoceros beetles on the crowns of the palms and hook out the beetles by beetle hook and destroy them. 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. Spray the palms with one per cent bordeaux mixture as a prophylactic measure against fungal disease. If the attack of the mite is noticed, spray neem oil - garlic - soap emulsion 2 percent (20 ml neem oil + 20 gm garlic emulsion + 5 gm soap in 1 litre water) or commercial botanical pesticides containing azadirachtin 0.004 per cent @ 4ml per litre water on the 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 : If stem bleeding disease is noticed (1) remove the affected bark tissues on the stem and

apply 5 percent calixin on the wound and apply warm coal tar (2) root feed the affected palm with 5 percent calixin @ 100 ml solution per root at quarterly intervals (3) apply 5 kg neem cake per palm per year along with the second dose of fertilizers (4) regulate optimum field moisture by providing drainage during rain and irrigate the palms during summer. Prevent accumulation of water in the pits of transplanted seedlings. Clean the drainage

channels to avoid chances of water logging.

Bihar / Madhya Pradesh : Open circular basins of 2m radius and 15-20 cm depth around the palms, if not taken during the month of July. Apply 30-50 kg farmyard manure/compost per palm in the basins already taken. If green manure crop is raised, plough it *in situ* or apply this to the basins around the palms. Transplanting of selected good quality seedlings can be done during this month. Plant the seedlings in such a way that the collar region is not covered with soil. Do not allow water to accumulate in the newly planted pits. Check the crown for bud rot or pest infestation and adopt measures to control them. Clean the crowns of the palms by removing all the dried and decayed matter which will come off easily when pulled by hand. Tie or prop up bunches to prevent buckling. If fertilizer application is not yet done, do it and cover the basins completely.

Karnataka : If green manure crop is raised cut them before flowering and apply it to the basins around the palms. Clean the crowns of the palms and tie or prop up bunches to prevent buckling. Search the crowns of trees for bud rot attack. If bud rot attack is observed remove all the affected tissues and apply bordeaux paste over cut ends and cover with polythene to avoid entry of water. Check for rhinoceros beetle and red palm weevil and adopt appropriate measures. Continue planting of seedlings in new plantations. If the attack of the mite is noticed, spray neem oil - garlic - soap emulsion 2 percent (20 ml neem oil + 20 gm garlic emulsion + 5 gm soap in 1 litre water) or commercial botanical pesticides containing azadirachtin 0.004 per cent @ 4ml per litre of water 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:

If leguminous green manure crops are grown plough *in situ* them. Clean the crown of palms and tie or prop up young bunches to prevent buckling. Soil application of phorate 10G @100g/palm or drenching the root zone with chlorpyrifos 20EC @ 2.5ml per liter of water during May- June and September – October controls the pest. If the attack of the mite is noticed, spray neem oil - garlic - soap emulsion 2 percent (20 ml neem oil + 20 gm garlic emulsion + 5 gm soap in 1 litre water) or commercial botanical pesticides containing azadirachtin 0.004 per cent @ 4ml per litre of water 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.

Maharashtra/Goa/Gujarat: The green manure crops, weeds, etc. may be ploughed back into the soil. Tie up heavy bunches with a rope to prevent buckling. If attack of rhinoceros beetle is noticed, as a prophylactic measure 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.

Orissa : Dig up grass and weeds and turn them into the soil. Clean the crowns of the palms. Tie up tender bunches. Prepare land for sowing winter vegetables.

Tamil Nadu/Pondicherry:

If green manure crop is raised plough it *in situ* or apply to the basins around the palms. Clean the crowns of the palms and tie or prop up bunches to prevent buckling. In irrigated gardens apply $\frac{1}{4}$ th of the recommended dose of fertilizers (third dose). If the attack of the mite is noticed, spray neem oil - garlic - soap emulsion 2 percent (20 ml neem oil + 20 gm garlic emulsion + 5 gm soap in 1 litre water) or commercial botanical pesticides containing azadirachtin 0.004 per cent @ 4ml per litre of water 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 : Clean the crowns to protect the palms from any pest/ disease attack. The entire crown should then be sprayed with one per cent bordeaux mixture. If attack of rhinoceros beetle is noticed, as a prophylactic measure 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. Second dose of fertilizer should be applied during the month. After application of fertilizer if there is no rain, irrigation should be done.

West Bengal : Harvest matured nuts. Clean the crowns and remove dried leaves. Search for rhinoceros beetle and red palm weevil and take control measures. Spray one per cent bordeaux mixture or copper oxychloride preparations (0.5 per cent) on the crowns of palms against the incidence of bud rot, leaf rot and immature nut fall due to Mahali. ■

Market review – June 2018

Domestic price

Coconut Oil

During June 2018 the price of coconut oil opened at Rs.19300 per quintal at Kochi, Rs.19200 per quintal at Alappuzha market and Rs.19700 per quintal at Kozhikode market. During the month, price of coconut oil at all three markets expressed a mixed trend.

The price of coconut oil closed at Rs.18800 per quintal at Kochi market, Rs.18700 per quintal at Alappuzha market and Rs.19400 per quintal at Kozhikode market with a net loss of Rs.500 per quintal at Kochi market and Alappuzha market and Rs.300 per quintal at Kozhikode market.

The price of coconut oil at Kangayam market in Tamilnadu, which opened at Rs.17200 per quintal, expressed a mixed trend and closed at Rs.16667 per quintal with a net loss of Rs.533 per quintal.

Weekly price of coconut oil at major markets Rs/Quintal)				
	Kochi	Alappuzha	Kozhikode	Kangayam
01.06.2018	19300	19200	19700	17200
10.06.2018	18600	18600	19100	16667
17.06.2018	NR	19000	19500	17000
24.06.2018	18300	18400	19000	16533
30.06.2018	18800	18700	19400	16667

Milling copra

During the month, the price of milling copra opened at Rs.12450 per quintal at Kochi, Rs.12700



per quintal at Alappuzha market and Rs.12550 per quintal at Kozhikode market. During the month, price of milling copra at all three markets expressed a mixed trend.

The prices closed at Rs.12200 at Kochi market, Rs.12050 at Alappuzha market and Rs.12200 at Kozhikode markets with a net loss of Rs.250 per quintal at Kochi and Rs. 650 per quintal at Alappuzha market and Rs.350 per quintal at Kozhikode market.

At Kangayam market in Tamilnadu, the prices opened at Rs. 11500 per quintal and closed at Rs.11300 per quintal with a net loss of Rs.200 per quintal.

Weekly price of Milling Copra at major markets (Rs/Quintal)				
	Kochi	Alappuzha (Rasi Copra)	Kozhikode	Kan-gayam
01.06.2018	12450	12700	12550	11500
10.06.2018	12100	12050	12100	11200
17.06.2018	NR	12200	12400	11400
24.06.2018	11900	11850	11900	11300
30.06.2018	12200	12050	12200	11300

Edible copra

The price of Rajapur copra at Kozhikode market which opened at Rs.19000 per quintal expressed a declining trend during the month and closed at Rs.17100 per quintal with a net loss of Rs.1900 per quintal.

Weekly price of edible copra at Kozhikode market (Rs/Quintal)	
01.06.2018	19000
10.06.2018	18000
17.06.2018	18000
24.06.2018	18000
30.06.2018	17100

Ball copra

The price of ball copra at Tiptur market which opened at Rs.16000 per quintal expressed an overall upward trend during the month and closed at Rs.16100 per quintal with a gain of Rs.100 per quintal.



Weekly price of Ball copra at major markets in Karnataka (Rs/Quintal)	
	Tiptur
01.06.2018	16000
10.06.2018	15200
17.06.2018	15600
24.06.2018	16000
30.06.2018	16100

Dry coconut

At Kozhikode market, the price of dry coconut opened at Rs.9450 per quintal. The price expressed a slight upward trend during the month and closed at Rs.10100 with a net gain of Rs.650 per quintal.



Weekly price of Dry Coconut at Kozhikode market (Rs/Quintal)	
01.06.2018	9450
10.06.2018	9450
17.06.2018	9450
24.06.2018	9850
30.06.2018	10100

Coconut

At Nedumangad market the price of partially dehusked coconut opened at Rs.18000 and closed at Rs. 16000 per thousand nuts with a net loss of Rs.2000 per thousand nuts. At Pollachi market in Tamil Nadu, the price of coconut opened at Rs.15000 per thousand nuts and closed at Rs.14000 per thousand nuts with a net loss of Rs.1000 per thousand nuts. At Bangalore APMC, the price of partially dehusked coconut opened at Rs. 28500 and closed at Rs. 29000 with a gain of Rs. 500 per thousand nuts during the month. At Mangalore APMC market the price of partially dehusked coconut of grade-I quality opened at Rs.20000 and closed at Rs.23000 per thousand nuts.



Weekly price of coconut at major markets (Rs /1000 coconuts)				
	Neduman-gad	Pollachi	Banglore	Mangalore (Grade-1)
01.06.2018	18000	15000	28500	20000
10.06.2018	18000	14000	29000	23000
17.06.2018	17000	14000	29000	23000
24.06.2018	17000	13000	29000	23000
30.06.2018	16000	14000	29000	23000

International price

Coconut oil

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

Weekly price of coconut oil in major coconut oil producing countries				
	International Price(US\$/MT)	Domestic Price(US\$/MT)		
	Philippines/ Indonesia (CIF Europe)	Philippines	Indonesia	India*
2/6/2018	964	925	928	2538
9/6/2018	923	866	871	2459
16/06/2018	934	860	861	2509
23/06/2018	914	869	869	2440
30/06/2018	975	915	927	2459
* Kangayam				



Coconut

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

Weekly price of dehusked coconut with water				
Date	Domestic Price (US\$/MT)			
	Philippines	Indonesia	Srilanka	India*
2/6/2018	157	153	372	487
9/6/2018	155	153	346	457
16/06/2018	152	151	301	472
23/06/2018	144	151	282	443
30/06/2018	142	148	279	450
*Pollachi market				



Copra

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

Weekly price of copra in major copra producing countries				
	Domestic Price(US\$/MT)			
	Philippines	Indonesia	Srilanka	India*
2/6/2018	560	518	1376	1697
9/6/2018	540	466	1376	1653
16/06/2018	525	466	1427	1682
23/06/2018	520	462	1419	1667
30/06/2018	536	457	1359	1667
* Kangayam				

