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Message from the Chairman's Desk



Dear friends,

The month of November started on a vibrant note in the coconut sector. The successful conduct of the Agriculture Quiz in Chennai by the Board in association with 'The Hindu in School' was an occasion to open the doors to posterity on the goodness and wellness of coconut. Agriculture is the mainstay of Indian economy and no generation can sever its ties with this sector. In fact mankind is strongly bonded to nature and agriculture for his day to day needs.

I am reminded of the famous verses,

“ Nature is a temple where living pillars
Sometimes let go off confused utterances
Man walk amidst forests of symbols
Watching him with familiar glances”

The Agriculture Quiz was organized at Chennai on 9th November 2018. Around 225 teams comprising of students from Chennai, Puducherry, Kancheepuram and Tiruvallur districts competed in the programme. The quiz cruised through a wide range of topics starting from agriculture in general through food crops and finally reaching coconut, the theme of the day. Knowledge on the history of coconut to its multifarious health aspects including its properties in curing Alzheimer's was shared through the various questions and it was a wonderful experience to see the students discussing in earnest and providing the apt answers. The event created a sense of pride in our young generation who are believed to live in a world of gadgets; but in actuality are on the ground, aware of the

realities and are capable of providing thoughtful solutions and options to take the world forward with sustainable agriculture.

Sitting through the event as a spectator, I was reminded of the famous dictum “ Youth is the legacy and pleasant spring of life with joy stirring in its dancing blood, the time when nature invites one with a thousand songs to share her general feast”. This initiative of the Board is a humble beginning to promote the culture of the flora, the richness of the environment and the completeness of Nature in our young and vibrant minds.

The Buyer Seller meet organized in Patna on 30th October 2018 was an initiative to explore the potentials to establish forward linkages of the Farmer Producer Organizations with the buyers in the consuming states of India. The Hindi heartland is a major consuming region for coconut and coconut products. The Buyer Seller meet was arranged taking into account the enormous demand for fresh coconut and dried coconut in November owing to the Chhaat festival. The meet provided an opportunity for one to one interaction of the farmer representatives from the Coconut Producer Companies and Federations in Tamilnadu, Karnataka and Andhra Pradesh with the traders dealing with coconut and its products in Bihar. The Board is planning to organize more interactions of the kind in selected cities in North and North West India in the coming months to promote and develop the market for coconut and its value added products.

At a time when the world is moving in the path towards nature and sustainable agriculture, coconut and its products offer healthy options to mankind, be it in the form of virgin coconut oil, coconut water, coconut milk or coconut sugar. Exploiting the potentials and capitalizing them to the benefit of the coconut farmers will definitely attract more of the younger generation to this sector.

I earnestly solicit the whole hearted cooperation of one and all to make all the new ventures of the Coconut Development Board sagas of success.

Jai Hind

Dr. Raju Narayana Swamy IAS
Chairman



Functional linkages and stakeholder interface for improved performance and sustained use of drip irrigation technology in coconut farming

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Introduction

The scientific approach for efficient crop production and higher yield emphasise optimum utilization of the available water. It is all the more important under the present day context wherein water supply situation is worsening due to a growing demand for water for domestic, industrial and agricultural sectors. Hence, the approach should be 'more crop per drop'. Drip irrigation, also known as "trickle" irrigation, is the method of water management that can be employed to put into practice 'more crop per drop' approach.

Under drip irrigation system, water is carried to the plant under low pressure, through small diameter plastic pipes and delivered at the root zone, drop by drop through drippers. Drip irrigation is widely practiced and established method of irrigation in developed countries and is slowly gaining popularity in India. It is most suited for horticulture crops including coconut. The system has its advantages and limitations. Its advantages are in terms of savings of water (50-60%) of that required for flow irrigation, effective use of fertilizers, less labour and energy cost. The limitation for adopting of this method is its high initial cost which is beyond the purchasing capacity of small and marginal farmers and thus mainly adopted by large farmers. As a policy to encourage adoption of drip irrigation systems, the Govt. of India under Centrally sponsored Scheme for small and marginal farmers to increase irrigation, provides subsidy to the extent of 50% of the cost of the equipment, the balance is made available by institutional credit.

Designs of drip irrigation system

The design of a drip Irrigation system involves estimation of the following parameters.

1. Area to be irrigated, type of plants, their spacing and numbers per hectare.
2. Peak water requirement of a plant per day. For estimation of total water requirement for a given area, the number of emitters required per plant, amount of water discharged per hour through each emitter and the total number of hours water is available should be known/estimated.
3. Design of Main and Lateral Drip Lines. This depends upon friction head loss which in turn is governed by the type of plantation/crop and field configuration.
4. Water required to be pumped from the well. This depends upon hydrogeological conditions in the area and water requirement of plants/crop
5. Horse Power of Pump set. This depends upon discharge and total head including friction losses over which water is to be lifted/pumped.

The design, number of emitters required for plant and their discharge are important factors in designing a drip irrigation system. Various emitters are designed for controlled release of water to the plants. It is necessary for manufactures of drip system to state optimum operating pressure and discharge and the emitter is so selected that application rate equals to the absorption rate of



soil so that no water stagnation takes place on the surface of the soil. In some systems a short length of flexible plastic tubing of small diameter is used as emitter. This tubing is generally of 0.96mm diameter and is inserted through holes in walls of the laterals. This is commonly known as micro tube system.

Layout of drip system

The main line in a drip system should follow land contour as closely as possible. If there is a slope, compensation should be made for pressure differences due to change in elevation. A fall of 1 m in elevation is equivalent to an increase in pressure of about 0.1 atmosphere. Where main lines are laid down on a slope, the increase in pressure due to elevation change may partly compensate the friction head loss. To provide nearly uniform pressure at each emitter, the tubing should be of sufficient diameter to avoid excess friction losses. The water delivered in the supply line is released through emitters spaced along the supply line.

The allowable pressure drop in mainline and laterals depend upon the operating pressure required at emitters. The pressure difference between the proximate and distant point along the supply line should not exceed 20% which will keep the variation of discharge within 10 of its value at the first emitter.

Drip irrigation in coconut gardens

Lack of irrigation is one of the major reasons attributed to the low level of productivity of coconut in states like Kerala. Scarcity of irrigation water is also considered as one of the major constraints

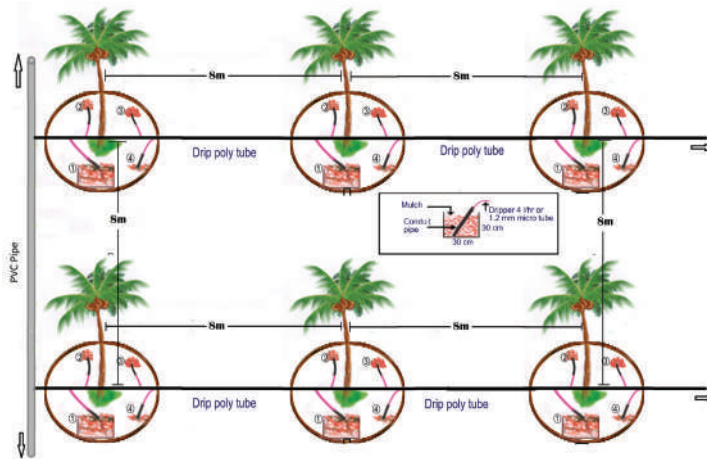
in resource use management in coconut farming. Experiments conducted in research stations have proved that productivity of coconut can be enhanced even up to one hundred per cent if irrigation is ensured. Drip irrigation is a micro irrigation system in which the water is applied to the root zone at the rate at which the palm can take up. It is ideal considering the advantage of water saving. Four pits with a size of 30 x 30x 30 cm have to be dug one meter away from the bole of the palm at equidistance and the pits filled with raw coir pith. The water has to be delivered to the pit through conduit tube placed in slanting position. Based on a study conducted at ICAR- CPCRI, it was concluded that yield of coconut with drip irrigation daily @ 66% of the open pan evaporation from December to May was adequate (32liters/palm/day when the evaporation rate is 4 mm day) and comparable to basin irrigation @ 200 litres per palm once in four days. Thus, there is 34 per cent saving of water in drip irrigation. This is applicable to varieties and hybrids and also in different soil types. The number of dripping points should be six for sandy soils and four for other soil types. The rate of water application should be 2-4 litres per hour per emitter.

Fertigation

Fertigation is an efficient method of fertilizer application through drip or any other system of irrigation. Drip fertigation helps to increase the fertilizer use efficiency, make savings in fertilizer costs, reduce labour requirement, enables uniform, precise and direct application to root zone and correction of micronutrient deficiencies etc. If there is drip irrigation facility, then the water soluble fertilizers like urea, DAP, phosphoric acid (commercial grade) and muriate of potash can be applied along with drip irrigation in six equal splits. Through fertigation, it is recommended to provide 91 g urea, 33 ml phosphoric acid and 170 g muriate of potash per palm per application. When DAP is used it is recommended to provide 70 g urea, 60 g DAP and 170 g muriate of potash for a single dose per palm. Fertigation can be done using a fertigation tank or venturi system. Compared to conventional method, we can save fertilizers up to 50 per cent because of the higher fertilizer use efficiency.

Improved performance and sustained use of drip irrigation technology

Many farmers have adopted drip irrigation system in their coconut gardens. However, it is seen



that a considerable proportion of the adopters of microirrigation technology did not possess the required level of know-why and know-how aspects, resulting in less effective field implementation of the technology. Results of a study conducted earlier by ICAR-CPCRI among coconut growers in Kannur and Kasaragod districts of Kerala state showed that a substantial number of farmers discontinued the drip irrigation technology. Lack of awareness and knowledge among farmers about the drip irrigation technology was an important factor that lead to discontinuance. Problems such as clogging, leakages and breakages of pipes as well as lack of expertise in repairing and maintenance of the system were all grave concerns. Farmers also did not get adequate technical support and after sales service which lead to discontinuance of the technology in some cases. Besides, lack of profitability in farming especially price fall of coconut, also resulted in inadequate attention paid by the farmers in the proper care and maintenance of the drip system.

The involvement and commitment of the farmer in the proper maintenance of the drip irrigation system is a major factor for the successful and continued use of the drip irrigation technology. The agricultural officers were to certify the proper lay out and installation of drip irrigation system in farmers' field to disburse eligible amount of subsidy. However, it was revealed that majority of the officers did not attend any specific training programme on drip irrigation technology and many of the officers opined that lack of effective training on the drip irrigation technology was a constraint in the proper monitoring and follow up of the field installation and maintenance of drip irrigation system in farmers'

gardens. Krishibhavan staff working at the grass root level are perceived to be overburdened with more of routine office work, which in turn affected the quality of field extension services. The important suggestions of extension personnel for avoiding discontinuance of drip irrigation technology by farmers were to improve after sale service by the dealers/agencies installing the drip irrigation system, to conduct training and demonstration programmes on maintenance of drip irrigation system for farmers and extension personnel and to streamline extension programmes on drip irrigation technology to give emphasis on ways of avoiding clogging.

Improved performance and sustained use of drip irrigation essentially requires not only knowledge of drip by farmers, but also an interactive network of different agencies for its application in the field on a continued basis. Hence, the main point of intervention should be to create a platform of these different agencies to analyse and monitor the application of drip irrigation technology in the field and organise continued interface and knowledge upgradation among the key actors, namely research, manufacturers, dealers, extension, training and farmers. Linkages between all the actors at different levels are to be established through some formal procedures. The coordination can be brought about by linking various actors with the implementation of schemes at grass root level with specific roles related to evolving specific technology recommendations, and capacity building of various actors including farmers, extension personnel, dealers, field staff etc. Department of Agriculture with a separate wing of agricultural engineering can take the crucial role of coordinating the stakeholders. ■

Why coconut farmers should take up vermicomposting of coconut leaves... ?

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Vermicompost, a low external input resource, is one of the major components of organic farming practice for sustaining soil health, fertility and crop productivity. Vermicompost production is a process that can recycle many of the agricultural refuse into wealth. Among plantation crops, coconut produces more than 6-8 tonnes of leaves as biomass from 1 ha. area on annual basis. The coconut leaves contain approximately 31% lignin, which offers high resistant natural decomposition, making them highly recalcitrant. However, certain group of earthworm that survives on organic matter alone (called compost worm) can enhance the decomposition process of such materials. For composting of coconut leaves, an indigenous strain of earthworm related to African Night crawler, *Eudrilus sp.*, is used, for which a low-cost grass-root level technology has been developed for large scale production of vermicompost from coconut leaves.

Using this technology, coconut leaves mixed with 10-20% cow dung, filled in cement tanks protected from direct sunlight and rains by a roof, aided by *Eudrilus sp.*, can be converted to vermicompost within 90 days period (Fig.1). The vermicompost produced by *Eudrilus sp.* from coconut leaves is dark brown coloured, granular matter possessing desirable C:N ratio, high organic carbon and humic acid content, easily available important plant nutrients. It usually is excreta of the earthworm obtained after organic matter undergoes physical, chemical and biochemical changes by the combined effect of earthworm and the microbial activities in the gut of the worm. It is also rich in plant growth promoting hormones viz. indole acetic acid, gibberellic acid and phenolics. Biologically, it harbours high counts of nitrogen fixing, phosphate solubilizing, cellulose degrading and plant growth promoting bacteria like fluorescent pseudomonads and *Bacillus spp.* Application of



Fig. 1. Production of vermicompost from coconut leaves

vermicompost improves the soil aggregation, aeration and water holding capacity, root growth, microbial activity and the overall crop production capacity of the soil in sustainable manner.

As much as 4000 kg of good quality vermicompost (air-dried with about 30% moisture) can be generated from around 6000 to 8000 kg of leaf biomass refuse obtained from 1 ha. of healthy, well managed coconut garden, every year by this worm that can meet a considerable percentage of nutrient need of the coconut palm. The vermicompost produced from coconut leaves can also be used for improving the productivity of other annuals, vegetables, fruits, flowers as well as cash crops. The coconut leaf vermicomposting technology is not only useful for farmers but also peri-urban horticulture crop growers, ornamental and floriculture crop cultivators, etc.

This technology is just not restricted to production of manures; it has a wide ramification in terms of environmental application that is extremely invaluable for society and the earth. The following points highlight this aspect-

Recycles tough coconut leaves quickly

Coconut leaves take more than a year to decompose naturally as they contain 39% lignin and 8% phenols which makes them resistant to microbial attack. But with the help of an indigenous strain of *Eudrilus sp.* earthworm isolated from CPCRI farm, this lignin-rich biomass admixed with 10-20% cow-dung can be converted to carbon rich granular vermicompost within 90 days. Thus, this technology offers an efficient method of recycling the 6-8 tonnes of leaf litter produced annually from 1 ha coconut garden to 4-5 tonnes of healthy organic manure.

Can convert other agro-wastes too

In addition to coconut leaves, the *Eudrilus sp.* can also digest pineapple wastes or banana pseudostem or glyricidia leaves or jackfruit leaves or mango leaves or sugarcane bagasse or coir-pith when mixed @ 25% (w/w) with coconut leaves and cow dung. Thus, the leaf or plant biomass wastes available from intercrops or homestead garden trees grown along with coconut can also be used as substrate for the vermicompost production.

Round the year activity

As large quantities of agro-wastes are available regularly and continuously, the conversion of these

wastes, therefore, becomes an year round activity for the end-users. The optimum weather conditions for efficient vermicomposting of coconut leaves by *Eudrilus sp.* is 28-32°C temperature and 90-95% RH which coincides with monsoon and post-monsoon periods in coastal tract of Kerala.

Circular carbon economy

Carbon is the energy currency of soil. Its rapid depletion leads to erosion of productive soil, loss of below and above-ground diversity and low agriculture output. The coconut leaf vermicompost is bulky stabilized manure with total carbon content of 35-37% and organic C content as high as 17-20%. Regular addition of this compost will be able to build organic matter content of the soil which is the main nutrient source for the plants and microorganisms. Thus, coconut leaf vermicompost returns carbon to soil and helps in producing higher plant biomass.

Replenishes soil with plant nutrients

As this vermicompost contains 1.8% N, 0.2% each of P and K, one tonne of this manure can add 18-21 kg of N, 2-3 kg each of P and K approximately to the soil. It can thus reduce application of chemical fertilizers to a great extent. For example, application of 25-30 kg of vermicompost/ coconut palm can meet all of its N requirement, but only 16% of P and 5 % of K which needs to be supplemented via other sources. Though the NPK content is low compared to chemical fertilizers, other positive aspects of this vermicompost makes it an ideal low-external input for improving the soil health and fertility.

Source of plant growth hormones

Coconut leaf vermicompost is rich in humic acid that improves the establishment of healthy root and shoot system in plants. It also contains indole acetic acid and gibberellic acid, which are known plant growth promoting hormones.

Conserves soil moisture

With 116-150% water holding capacity, addition of the coconut leaf vermicompost can significantly enhance water holding capacity of low water retention soils. This will greatly improve soil moisture conservation especially in rain-fed cropping areas to help overcome plants from water-deficit stress.

Adjusts soil pH

Coconut leaf vermicompost has near to neutral



As much as 4000 kg of good quality vermicompost (air-dried with about 30% moisture) can be generated from around 6000 to 8000 kg of leaf biomass refuse obtained from 1 ha. of healthy, well managed coconut garden, every year by this worm that can meet a considerable percentage of nutrient need of the coconut palm.



pH range of 6.2-6.5. Its addition can marginally improve those acidic soils having pH below 5.5 and as a result improve the availability of the nutrients to the plants.

Enhances soil microbial properties

Microbial biomass of this vermicompost is 20% higher compared to normal sandy loam soil. The biomass includes large population of plant beneficial microbial communities like nitrogen-fixers, phosphate solubilizers, plant growth promoting *Pseudomonas* and *Bacillus spp.*, cellulose degraders. The coconut leaf vermicompost, thus, becomes a novel source of plant beneficial microorganisms, which can be tapped for biofertilizer development as well for other biotechnological applications.

Can be used as manure for all crops

The coconut leaf vermicompost is an ideal source of organic manure for all types of crops. It can be one of the main components of the integrated nutrient management. The response to application of coconut leaf vermicompost can be best noted in case of vegetable and ornamental crops.

Source of liquid fertilizer

Vermiwash, liquid organic fertilizer, can be produced during the coconut leaf vermicomposting process. The vermiwash thus produced contains 2.8 ppm inorganic N, 10.28 ppm phosphorus, 205 ppm potash and 100-142 ppm humic acid. Application of vermiwash : water at 1:5 and 1:10 dilutions have shown to improve crop production capacities of soil and enhance the growth/yield of some agronomic and horticultural crops.

Can lock carbon in soil

The coconut leaf vermicompost is a stabilized form of manure which locks up carbon in its organic matter and retains it in the soil more than raw manure or inorganic fertilizer. With its total carbon content ranging from 35-37% and organic carbon around 17-20%, consistent application of it could gradually raise the level of carbon in the soils and can also lock organic carbon in soil for not less than 20 to 40 years owing to the presence of humic acids in it. The addition of this physically-protected humus organic carbon fraction of the vermicompost significantly improves the soil physical properties that enhance the root proliferation and nutrient acquisition by standing crop. Since the humus organic carbon remains in soil for long periods, even subsequent crops stands benefitted by its application. However, research data on the dynamics, stability of the coconut leaf vermicompost carbon as soil organic C over time needs to be generated for understanding the C-sequestration.

Ideal medium for soilless cultivation

Coconut leaf vermicompost is granular and of lighter density. It can be used as a substitute for peat in potting media. Already work done at ICAR-CPCRI has clearly indicated that coconut leaf vermicompost can be used as an alternative medium to potting mixture for raising coconut, arecanut, cocoa and vegetable seedlings in polybags/pot trays. It is therefore very much possible to use this vermicompost as soilless medium for raising several horticultural and ornamental plants.

Can be used as an animal feed

During the vermicompost production, there is multiplication of the earthworm numbers also. The earthworm biomass is a rich source of protein. It can be used as feed supplement for poultry, duckery and fish farming. The live worms are also good fish bait.

Improves farmers' economy

Production of coconut leaf vermicompost adds to the income of the family through the sale of vermicompost as well as the earthworms. If a farmer produces one tonne of vermicompost on his own farm with available infrastructure and substrates, he can earn approximately Rs. 12,000 from the sale of the vermicompost and earthworms, against production cost of Rs. 5500/- per production cycle. ■



Integrated Technology for Producing

Eco-friendly Coconut Biofuel

through Cost Effective Way

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Despite the nutritional and therapeutic benefits of coconut oil, its use as an effective biofuel by trans-esterification of the oil to coconut methyl ester (CME) has opened a new avenue in the field of coconut oil industry. The technical quality, functional feasibility and the ecofriendly nature of coconut methyl ester (CME) have given a distinct renewable energy status for coconut biofuel compared to other biofuels. The production of CME from coconut oil and its biofuel efficacy directly in diesel vehicle were optimized and confirmed by test run. The low carbon residue, minimal acidity and negligible sulphur element support coconut biofuel as ecofriendly. But the variable cost of the oil and the unstable nature of the quality of the oil available in the market are the serious constraints for the production of CME on industrial scale. Hence an integrated approach of producing CME from de-husked mature coconuts was designed for making the industry cost effective and stable. The implementation of integrated technology for developing CME from mature de-husked coconuts produce four sub products at each level of processing- i). shell, ii). mature coconut water (MCW), iii). oil cake,iv). glycerol. A rapid processing method was standardized for enriching mature coconut water (MCW) with natural nutrients for its conversion to a health drink, similar to tender coconut water. The commercialization of each sub-products derived during the processing of CME production from de-husked coconuts is found as a successful chain for bringing the total cost of the coconut biofuel to a reasonable price considerably less than the cost of petro-diesels. A consortium of

all coconut growing countries at global level and the technical support of APCC are inevitable for analyzing the feasibility of this 'new fire' in the midst of the present economic hike of fossil fuels.

Introduction

The crucial factor of determining the growth of a country or a state depends on the detection and effective utilization of the natural resources for the well-being of the society. As a tropical oleaginous crop, the multifaceted properties of coconut at nutritional, therapeutic and industrial level have been well established by several researchers^(1,2,3,4). A protocol for producing coconut methyl ester (CME) and glycerol from coconut oil and its functional efficacy as a biofuel in diesel engines under road trials have been optimized and confirmed⁽⁵⁾. Though the transesterification of coconut oil to coconut biofuel with better fuel efficacy has become a new trend of coconut biofuel research, ambiguity persists in the cost effective production of coconut biofuel for popularizing it under industrial scale. Based on the price variations of the coconut oil at global market, it may not be economically viable to produce coconut biofuel directly from the oil purchased from the market under industrial scale. Moreover, the purity of the coconut oil purchased from open market with respect to the free fatty acid, moisture and other contaminants itself will be a problem for maintaining the quality of the fuel. In the present investigation, an effort was taken to detect the new positives in the production of coconut biofuel initiating from mature de-husked coconuts by an integrated approach



so that the sub products derived at each level of production can be effectively utilized in order to stabilize the fuel quality and to make the production cost effective.

Processing of Dehusked Matured Coconuts

The production of Coconut Methyl ester (CME) from mature de-husked coconuts was undertaken by two major steps. i). Extraction of the oil from matured coconuts ii). Trans-esterification of the oil to Coconut methyl ester (CME). In order to maintain the quality of the coconut oil with consistent level of moisture and FFA for the transesterification process, the extraction of fresh oil from coconuts is inevitable. So the entire production of coconut methyl ester (CME) was started from the de-husked nuts purchased commercially. For the study, mature de-husked nuts were used for the production of CME. The mature coconuts were purchased as per the current market price published by Coconut Development Board, Cochin. Figure 1 demonstrates the material balance of 10,000 de-husked nuts processed for the production of coconut oil.

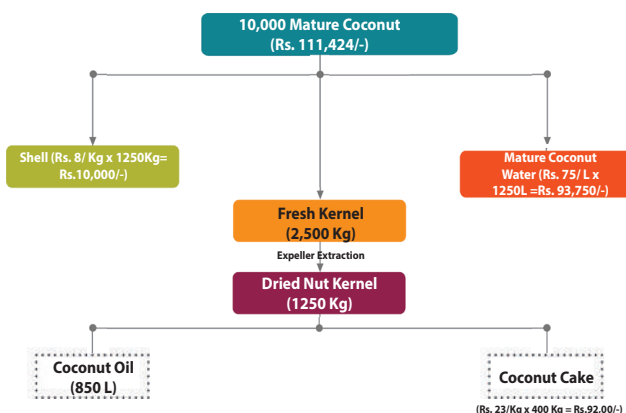


Figure 1. Material balance of 10,000 de-husked nuts processed for the production of coconut oil. The quantity and the approximate market value of each product is given in bracket.

Treatment of Mature coconut water (MCW)

As the first step of the process, the de-husked nuts were de-shelled in an aseptic condition with a mechanical cutter and the mature coconut water was filtered and stored in a sterile vessel containing the anti-fermentation mix. The filtered mature coconut water was further processed for enriching its nutrients by upgrading the quality similar to

tender coconut water (TCW). The enriched mature coconut water was pasteurized and bottled as soft drink similar to TCW. The schematic diagram showing the protocol of processing mature coconut water during the processing of de-husked nuts is displayed in figure 2.

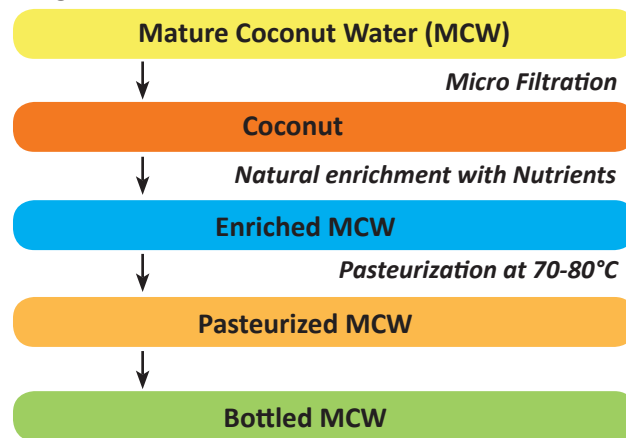


Figure 2. Schematic diagram showing the protocol of processing mature coconut water (MCW) derived as sub product during the processing of de-husked nuts.

Extraction of Coconut oil

The broken nuts with the wet endosperm were kept in hot air chamber for 8 hours for removing the shell from the endosperm. Initially the temperature of the chamber was kept at 90°C for 3 hours for the fast removal of moisture and subsequently the temperature was reduced to 70°C for avoiding the browning of the endosperm. After proper drying, the deshelled dry endosperm (copra) was subjected to the extraction of oil by expeller method. The shell was collected separately as the second sub product of the processing. The quality of the oil was checked by analyzing the parameters like moisture, fatty acid content, saponification value (6,7). The expeller extraction of oil from the dried endosperm provide coconut cake as the third sub product. Commercially coconut oil cake has a great demand in cattle feed industry.

Production of Coconut Methyl Ester (CME)

The extracted oil was used for the transesterification process as per the procedure optimized by Mohankumar *et al.*, 2015 (5). As per the protocol of the esterification of coconut oil, the processing of 10,000 de-husked nuts provide 850 L coconut oil and it can be converted in to 760 L of CME and 80-90 L crude glycerol at the rate of



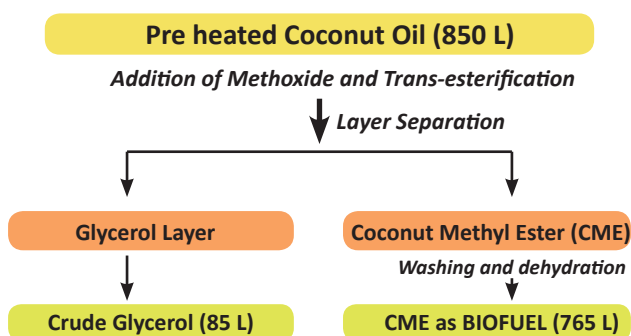


Figure 3. Processing profile of coconut oil to CME and glycerol by transesterification

one liter of coconut oil yields 900 ml and 100 ml Glycerol. Crude glycerol is the fourth sub product of the processing and it can be marketed either in the crude form or after purification in a higher quality. Figure 3 shows the processing profile of coconut oil to CME and glycerol by trans-esterification. For the transesterification process of 850 L oil extracted from the dried endosperm of 10,000 nuts, cost of the catalyst methoxide, electricity, man power and other miscellaneous can be rounded as a total of Rs. 40,000/-.

Market value of the sub products derived during the production of coconut methyl ester (CME)

The evaluation of the sub products with respect to its practical utility on commercial angle has got greater significance. The shell of coconut is actively used for the preparation of natural activated charcoal which is far better than wood and bone charcoal in the industry. Coconut shells are best suited for activated carbon as they have the capacity to withstand the heat during the process of pyrolysis because of the hardness which is 95%. As a nutritive health drink, tender coconut water has a prime position in the natural soft drink industry. During the development of young nut to mature from 6 to 11 months, a gradual physiological depletion of nutrients of tender coconut water (TCW) was occurred during maturation. But this diminishing level of nutrients can be compensated by enriching mature coconut water (MCW) with natural nutrients. Though the nutrient level is decreasing in mature coconut water during development, it still retains the flavor and the aroma of coconut water similar to TCW. So the enrichment of mature coconut water by supplementing nutrients will develop a new stream of development in coconut industry. The

fortified mature coconut water (MCW) with enriched nutrients can be marketed as a natural soft drink similar to tender coconut water and coconut Neera. Moreover this will indirectly solve the environmental pollution of spilling mature coconut water during processing in oil industry. The oil cake produced during the expeller extraction of coconut oil and the glycerol formed by chemical transesterification of the oil have developed separate marketing status for both the products, especially coconut glycerol. The shortage of pure vegetable glycerol is one of the major challenges of cosmetic industry today. So the coconut glycerol will be good source for meeting the need.

Coconut Bio- fuel @ Rs.50/-

Besides the eco-friendly nature of coconut bio fuel with negligible level of carbon, moisture, sulphur and other air pollutants, the production of biofuel as cost effective way is essential for popularizing this renewable energy source and it in turn helps the coconut farmers for providing a stable market price for their products. Hence an integrated approach of producing coconut biofuel from de-husked mature nuts by utilizing the sub products derived at each level of processing will make tremendous change in the field of biofuel industry in the country. The systematic way of utilizing the sub products like coconut shell, coconut water, oil cake and glycerol at commercial angle will definitely keep the price of one litre ecofriendly biofuel at a level less than Rs. 50/ without any subsidy from the government. Since the functional feasibility of coconut biofuel has been tested successfully in diesel vehicles, more road trial experiments are warranted to establish the utility of coconut biofuel in new generation vehicles. More extensive research innovations are essential to upgrade the quality of coconut biofuel by revealing its technical specifications for using it as jet fuel. So an immediate attention of national and international agencies for the promotion of coconut is warranted to meet the commercial feasibility of this new renewable energy source which would be a boon to all the coconut growing countries of the world.

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Community Nurseries for producing quality coconut seedlings

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Coconut has a huge market potential both internationally and in domestic market. India is the third leading country in coconut production and it is the largest consumer. Kerala being one of the leading Indian states in production and consumption of coconuts, has shown a gradual decline in productivity. One of the main reasons cited for such decline is the root (wilt) disease which has adversely affected the coconut production especially in the southern districts of Kerala.

A recommended way to revive the coconut cultivation in Kerala especially in root (wilt) disease affected areas is to uproot the affected palms and replant it with quality coconut seedlings. At present the recommended ratio for replanting of coconut is 60:20:20 with tall: dwarfs: hybrids. In places where dwarfs are to be planted, it is suggested to replant with resistant dwarf varieties. ICAR-Central Plantation Crops Research Institute (CPCRI) has released two dwarf varieties (viz; Kalpasree and Kalparaksha) for the root (wilt) disease prevalent tracts. Along with the increased resistance to root (wilt) disease, dwarf varieties also have the advantage of coming into bearing in 3 to 4 years while the tall varieties could take anywhere between 7 to 10 years. Although their nuts are comparatively small with a much lower copra content, they are best suited for tender nut water and these varieties are in great demand all over the state especially now, when there is a shortage of coconut climbers for harvesting the tall palms.

Farmers have started cultivating these dwarf varieties owing to their early bearing habit and suitability for tender nut water. Its short stature

is an added advantage where harvesting is concerned. In addition to the listed dwarf varieties, Chowghat Orange Dwarf (COD) is also popular in Kerala for its sweet tender water. But here lies the conundrum that there are not enough quality dwarf seedlings accessible to a farmer. ICAR-CPCRI Regional Station, Kayamkulam itself is able to meet only partially the demand of seedlings of dwarf varieties of coconut. Over the past ten years, 85% of the farmers approaching CPCRI Regional Station, Kayamkulam demand for seedlings of dwarf varieties of coconut as they are unable to identify genuine and trustworthy nurseries producing seedlings of dwarf varieties. Therefore, to combat this shortage of quality seedlings of dwarf varieties, Department of Agriculture Development & Farmers Welfare (Govt. of Kerala) has joined hands with the ICAR-CPCRI to execute a project titled 'Production and distribution of quality planting materials of dwarf and semi-tall varieties of coconut' during the year 2018-19 in 12 districts of Kerala excluding Idukki and Wayanad. As proposed, identification of dwarf mother palms (CGD, MGD & COD) are being done in the farmers' field and seed nuts are being harvested to be sown in a community nursery. The dwarf palms thus identified are being geo-tagged to ensure transparency and increased accessibility for future projects and surveys.

Criteria for identification of dwarf mother palms

- Palm should be older than 20 years.
- Palm should be true to type and show typical characters of that variety.

Characteristic features and identifiable traits of CGD, MGD and COD palms			
Characters	CGD	MGD	COD
Trunk/Stem	Uniform circumference	Uniform circumference	Uniform circumference
Leaf scars in 1n	> 35	20-25	>25
Male and female flowers	95% overlapping of male and female phase	60% overlapping of male and female phase	90% overlapping of male and female phase
Nut colour	Green	Green	Orange
Nut shape	Oblong shaped (with a distinct ring)	Oval shaped	Round

- Average annual yield should be more than 100 nuts/year and should show consistency in productivity.
- Palm should be free from pest and diseases
- Palms should have cylindrical stems, closely spaced leaf scars and absence of bole.

Community nurseries for raising dwarf coconut seedlings

Community nursery is perceived as an ideal solution to improve upon the large-scale production of coconut seedlings in Kerala to meet the rising demand for quality planting material. In a community nursery set up, a local farmer/group would be identified to undertake the responsibility of managing the nursery with locally procured planting materials. This nursery set-up ensures enhanced involvement of the farmers and local community in the seedling production and distribution with timely, appropriate scientific interventions.

As part of the project (Production and distribution of quality planting materials of dwarf and semi-tall varieties of coconut) undertaken by ICAR-CPCRI, community nurseries have been identified to produce quality dwarf planting materials from the selected dwarf parental palms. The project aims to have at least three-four coconut nurseries in a district that would cater to the demand of the local farmers with the involvement of coconut farmer groups. The target of this project is to establish four coconut nurseries in four different blocks of each district. A Coconut Producers Society (CPS) / Coconut Producers Federation (CPF)/ Registered Farmer Group/ Non Governmental Organization (NGO) would be identified locally to handle this responsibility and an active farmer within that group with adequate land and experience in coconut farming is selected

jointly on the recommendation of the Department of Agriculture to raise the community nursery. The selected farmer(s), groups nominated by CPS/ CPF/NGO would be trained in establishing coconut nursery and a Memorandum of Understanding (MoU) would be signed to seal the contract.

Selected parental palms of dwarf varieties identified and geo-tagged by ICAR-CPCRI would be utilized for collection of mature seed nuts so as to ensure proper germination. Precaution would be taken to harvest only typical seed nuts from the selected parental palms and action for discarding deformed or poor quality nuts would be ensured. Although the seed nuts can be harvested every month, it is recommended that the months leading from January to May are best suited for sowing purposes. The support extended by the ICAR-CPCRI to raise the community nursery would include identification of mother palms and geo-tagging, scientific interventions, meeting transportation charges and initial labour charges for bed preparation and sowing of seed nuts. The selected farmer is expected to take care of the land preparation, irrigation and weeding until the seedlings are ready. The seedlings are also given a 'QR code affixed label' after inspection by the ICAR-CPCRI officials to double check the quality before distribution to the farmers at a nominal rate so as to ensure coconut seedling production in the coming years.

Thus, this project aims to ensure that farmers get access to quality seedlings of dwarf varieties of coconut locally through community nurseries by providing financial and scientific assistance to an enthusiastic farmer who just needed an opportunity and support to raise such a nursery which in the long run is expected to provide a steady supply of quality planting materials of coconut for that district. ■



Coconut farming can be remunerative –

‘Kera Kesari’ K. T. Francis

C. Thamban and Jesmi Vijayan

ICAR- Central Plantation Crops Research Institute, Kasaragod

‘Coconut farming can be remunerative, provided we effectively integrate resource conserving cultivation practices and adopt integrated farming’- says Mr. K.T. Francis of Maruthonkara, Kozhikode District. The ‘Kerakesari’ award instituted by Department of Agriculture Development and Farmers’ Welfare, Government of Kerala, for the best coconut farmer for the year 2018 was bagged by Mr. Francis.

Mr. Francis hails from an agricultural family, with his forefather’s having migrated from Pala about 120 years ago to settle in Maruthonkara. He was employed as a physical education teacher in St. Mary’s Higher Secondary School, Maruthonkara, Kozhikode, Kerala and after his retirement, he turned into a full time farmer.

Mr. Francis owns three acres of ancestral property in which he is adopting coconut based multiple cropping and integrated farming systems. He maintains about 200 coconut trees of which 150 palms are in bearing stage. Majority of the coconut palms belong to Kuttiyadi tall cultivar. Kerasree (hybrid variety), Malayan Yellow Dwarf and Gangabondam

“

Farming can be remunerative if we use the resources in an efficient and innovative manner and crop intensification and enterprise diversification is done scientifically

”

are the other varieties in his coconut garden. The farm is located in a sloppy terrain. Besides coconut, he is also cultivating nutmeg, cocoa, arecanut, banana, spices, tuber crops, fruit crops, medicinal plants, fodder grass etc. as intercrops. He has three local breed cows, 20 goats of Malabari breed and a vermicompost unit. A biogas plant is attached to his farm and slurry obtained from it is applied to coconut and other crops. He has a poultry farm wherein he maintains various types of fancy breeds, broiler breed, ducks, quail, layer breed etc. He has a fish tank with breeds of tilapia, gourami and guppies. He is also maintaining 70 honey bee colonies in his farm.

Earlier, one acre of his property was under rubber. But due to price decline in rubber, he has converted his one acre land of rubber plantation in to coconut farm. Coconut seedlings have been planted in pits of dimensions 2m width and 2m depth to which coir pith, along with dried cow dung powder, were applied at the time of planting. As a soil conservation measure, he has placed coconut husk in a concave mode in pits and covered it with soil and mulched with coconut leaves. According to him, this method of moisture conservation helps not only in good root establishment of coconut palms but also aids development of earthworms at the basins. The coconut basins are not opened up. He applies weeds and other farm wastes in coconut basins twice in a year.

Earlier, he used to apply chemical fertilizers in his farm which enhanced the yield of the palm in the initial years. However, he has been gradually reducing the chemical inputs over the years and presently he is mostly applying diverse types of organic inputs viz., poultry manure, coir pith compost, cow dung slurry, goat manure and fish tank sediments. The palms are regularly manured at bi-monthly intervals. Every year, during December, he applies 1 kg salt in coconut basins followed by 500 gm lime after 10-12 days. The basins are then irrigated and cowpea seeds are sown. This reduces the weed growth.

Irrigation is assured from a pond in the farm and sprinkler method of irrigation is followed. He is also maintaining 100 rain water pits and also rock and soil bunds for rainwater harvesting. At each harvest, three green coconut leaves are removed as Mr. Francis is of the opinion that this practice will provide more aeration facilitating mite control, early bearing, increased copra content in nuts etc.

Average yield of coconut palms in the system is 170 nuts per palm per year. He is getting 25000 nuts per year from his farm. Major portion of annual production is sold as seed nuts and seedlings. A small portion of the harvest is utilized for domestic purposes and remaining nuts are sold as ball copra and coconut oil. He has established a coconut nursery exclusively for Kuttiyadi ecotype, which is quite popular. He sells seedlings as polybag seedlings, seed nuts and sprouted nuts @ Rs. 125, Rs. 50 and Rs.

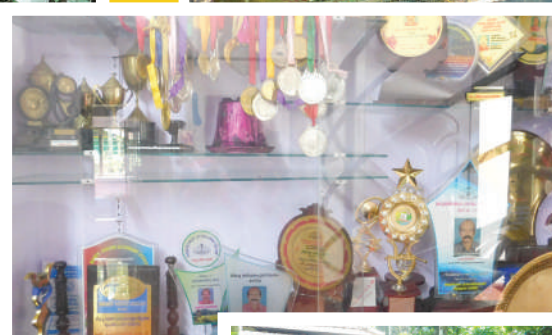
80 respectively. He has constructed a coconut storage house having capacity to store 20000 nuts at a time. The storage house was made using GI pipes and sheets, which facilitates drying of coconuts naturally and quickly. He is getting Rs. 25/- for ball copra.

Pepper is trailed on coconut and arecanut palms. About 125 nutmeg trees have also been planted as an intercrop among coconut palms.

In addition, he has a good collection of fruit trees in his farm, comprising of passion fruit, various type of guava, West Indian cherry, mango, jack fruit, miracle fruit, red lady papaya, durian, orange, grapes, gooseberry, pineapple, rose apple etc. Vegetables (cowpea, bitter gourd, amaranthus, ladies finger, chilly, ivy gourd, bird's eye chilli, elephant foot yam, colocasia, tapioca etc.) are cultivated in rain shelter constructed on terrace and manured with cow dung and cow urine. About 15 cents of land is maintained with forest trees and fodder grass (Co3) is cultivated in one acre amongst coconut palms.

As a full time farmer, he is able to use family labour to a great extent. His wife is a retired teacher who helps him in the farm. In his farm, pest and disease incidence is very low in coconut and subsidiary crops





except quick wilt in pepper and mahali disease in arecanut. Against quick wilt of pepper he regularly applies *Pseudomonas* and spray 1% Bordeaux mixture as prophylactic measure before the onset of monsoon. Similarly areca palms are sprayed with 1% Bordeaux mixture as prophylactic measure against mahali disease.

Integration of various components:

In the three acres farm, Mr. Francis has effectively integrated various crops and subsidiary enterprises like poultry, fish farming, goat farming, vegetable cultivation etc in a systematic manner. Poultry and duck shed have been constructed over the fish tank and the poultry waste provides the feed support to fishes. He maintains quail shed over vermicompost tank and utilizes the area on the terrace of his house by cultivating vegetables in rain shelter. Bush pepper is raised in the bunds which helps in the establishment of pepper roots very quickly.

Returns: Annually, he earns a net income of Rs. 14-15 lakhs from his three acres of integrated farming system. Major source of income is from coconut (Rs. 8-9 lakhs) and the remaining income is generated through other crops and subsidiary enterprises.

Awards and recognition

Besides Kerakesari award for best coconut farmer in Kerala, Mr. Francis has received various awards/recognition for his achievements in farming.

In 2015, he was selected as the best farmer in Maruthonkara panchayat and was selected by ATMA and has won the award for the best farmer adopting integrated farming system in Kozhikode district for the last three consecutive years. Thomas was awarded by Sarojini Damodhar Foundation, Bangalore as the best organic farmer in Kozhikode district during 2016-17 and as the best farmer of Kunnummal block for adopting integrated farming system. He is actively involved in the implementation of Haritha Keralam Mission project implemented by Kerala Government and is also a member in Regional Advisory Group of NABARD.

The success story of Mr. Francis clearly indicates that farming can be remunerative if we use the resources in an efficient and innovative manner and crop intensification and enterprise diversification is done scientifically.

Address of the farmer: K T Francis, Kaithakulathu house, Maruthonkara (PO), Kavilumpara, Kozhikkode-673513 Phone: 9947142849 / 8086482452 ■

Why Coconut Oil Really is Healthy



Despite the American Heart Association's Views

Dr. Bruce Fife *

Coconut oil increases HDL, large LDL and reduces small dense LDL. The overall effect is that coconut oil reduces the cholesterol ratio, thus lowering the risk of heart disease.

The anti-saturated fat fanatics are at it again, going after coconut oil and other healthy saturated fats promoting the use of polyunsaturated vegetable oils and statin drugs as the solution to the worldwide heart disease epidemic.

In June 2017 the journal *Circulation* published an online article prepared by the American Heart Association (AHA) titled "Dietary Fats and Cardiovascular Disease." The focus of the article was to reiterate the AHA's longstanding position against the use of saturated fats, recommending that we replace them with polyunsaturated fats, which they stated, are as effective as cholesterol-lowering statins in reducing the risk of heart disease.

This article was not the result of any new study but simply a statement of position by the AHA, supported by select (cherry picked) studies. The article demonized all saturated fats as bad because they increase LDL cholesterol, the so-called bad cholesterol, which in turn supposedly increases the risk of heart disease. Only half of one page, out of the 24 page article, addresses coconut oil specifically, along with discussions on dairy fats, trans fats, and

others. The article was not about coconut oil, it was about saturated fats. However, the editors at USA Today saw it as a way to stir up controversy by attacking the wholesome image of coconut oil with the attention grabbing headline, "Coconut Oil Isn't Healthy, It's Never Been Healthy."

Coconut oil has been gaining ground as one of the premiere healthy fats. The editors of USA Today knew that a widely perceived healthy fat that was now being labeled as unhealthy by the AHA would generate huge interest, and sell a lot of papers. And they were right!

Immediately following publication of the article, other publications quickly jumped on the bandwagon and started producing their own shocking stories with headlines such as "Coconut Oil As Unhealthy As Beef Fat" and "Coconut Oil May Not Be As Healthy As You Think."

These articles stirred up a swarm of confusion. Over the past few years numerous new studies, articles, and books have sung the praises of coconut oil and many people, including doctors and nutritionists have recommend it as one of the good fats. Now, all of a sudden, according to the media, the AHA is declaring it unfit for human consumption. What is going on here? What is the truth?



These articles are examples of “fake news” perpetuated by editors solely to attract attention to their publications. Did you know that 50 percent of the media headlines about medical studies are deceptively wrong? And that these headlines don’t accurately match the content or conclusions of the medical journal articles on which they are based. This fact is from a review published in the *New England Journal of Medicine*. Today editors are often interested more in sensationalism than in reporting the facts and, consequently, we get a lot of fake health news misleading the public. This is the case with the attack on coconut oil. The AHA article was not specifically about coconut oil, it was a statement of their position on saturated fats.

The AHA has always maintained the stance that saturated fats are bad and increase cholesterol levels, which they claim increases the risk of heart disease. They argue that all saturated fats raise total cholesterol and LDL cholesterol and, therefore, increase the risk of heart disease. What they conveniently fail to mention is that total cholesterol is not an accurate indicator of heart disease risk. They also don’t mention that saturated fats, including coconut oil, increase HDL cholesterol, the good cholesterol that reduces the risk of heart disease.

Another fact they tried to downplay is that there are actually two types of LDL cholesterol: one that is small and dense, and another that is large and buoyant. The large buoyant LDL cholesterol is also a form of good cholesterol. It is the type of cholesterol that is used to make bile, hormones, and vitamin D; it is essential not only for good health, but for life itself. The small dense LDL, on the other hand, is the type of cholesterol that becomes oxidized, and all oxidized lipids are unhealthy and can contribute to heart disease.

Coconut oil increases HDL, large LDL, and reduces small dense LDL. The overall effect is that coconut oil reduces the cholesterol ratio, thus lowering the risk of heart disease. The cholesterol ratio is recognized as being a far more accurate indicator of heart disease risk than total cholesterol. Coconut oil may increase total cholesterol in some people, but it does so by increasing good LDL and HDL, not the bad LDL.

Blood triglycerides is another independent risk factor for heart disease. In fact, they seem to have a greater influence on heart disease risk than cholesterol. Sugar and refined carbohydrates increase triglycerides, while coconut oil reduces triglycerides, thus again lowering risk of heart

disease. Did the AHA report mention this? No, the authors seem to have forgotten to say anything about this important point. In fact, the AHA article seemed to leave out a lot of important information such as the fact that polyunsaturated vegetable oils increase the small, bad LDL cholesterol and increase the risk of cancer, neurological disorders (including muscular degeneration), and autoimmune disease. Or that coconut oil can prevent, and possibly even reverse, these conditions.

The following authors/articles have come out with statements regarding coconut oil and heart disease.

Dr. Anthony Pearson, a cardiologist at St. Luke's Hospital in St. Louis, provides an excellent rebuttal to the AHA article in his article, “Beware Of More Misinformation From The American Heart Association On Coconut Oil and Saturated Fats.”

Bestselling author of *Eat Fat, Get Thin*, Mark Hyman, MD, weighs in on the controversy in his article “Is Coconut Oil Bad for Your Cholesterol?”

Diana Rogers, RD, explains “Why Coconut Oil Won’t Kill You, But Listening to the American Heart Association Might!”

Mary Newport, MD, who used coconut oil to successfully treat her Alzheimer’s affected husband, comments on Facebook in an article titled “Response to AHA Advisory Committee on Dietary Fats and Cardiovascular Disease.”

Gary Taubes, an investigative science and health journalist and bestselling author, gives a detailed analysis in “Vegetable oils, (Francis) Bacon, Bing Crosby, and the American Heart Association.”

Consuming coconut oil lowers risk of heart disease and stroke:

Study shows

There is a love-hate relationship between coconut oil and the medical community. Many doctors and nutritionists extol it for its many healthy benefits. Best selling author Dr. Joseph Mercola claims that coconut oil is the healthiest oil you can eat. Neurologist Dr. David Perlmutter, the author of *Grain Brain*, recommends coconut oil as a means to improve brain health. Dr. Mark Hyman says it as a health food and weight loss aid in his bestselling book *Eat Fat, Get Thin*.

However, others claim that its high saturated fat content makes it unhealthy. Saturated fats, they say,

raise blood cholesterol, which in turn, increases the risk of heart disease. The American Heart Association (AHA) has been leading the attack against coconut oil. In a widely publicized report published in 2017 the AHA took a stand against all saturated fats, including coconut oil. They condemned saturated fats as a major risk for heart disease and recommended polyunsaturated vegetable oils as a healthier choice.

As soon as the report was released the media went wild churning out reports condemning coconut oil as one of bad fats, further perpetuating the myth that coconut oil and other saturated fats are unhealthy.

According to the AHA, dietary fat intake should be limited to 30 percent of total calories consumed and saturated fats should be limited to no more than 7 percent. Most of the fat in the diet should come from polyunsaturated vegetable oils because they have been shown to lower total cholesterol. To them, it's all about cholesterol.

Let's assume that cholesterol is as important as the AHA claims it is in determining heart disease risk, does that make coconut oil dangerous?

While some saturated fats do raise total cholesterol, they also tend to raise HDL cholesterol – the so-called good cholesterol that is believed to reduce the risk of heart disease. In fact, the rise in total cholesterol is due, in part, to the increase in HDL – which is a good thing.

So, does coconut oil improve or worsen cholesterol values?

To cut through all the rhetoric of the opposing viewpoints producers at the British Broadcasting Corporation's television series "Trust Me I'm a Doctor" decided to sponsor a study to get to the bottom of the controversy. The Trust Me team contacted Kay-Tee Khaw, MD, PhD and Nita Forouhi, MD, PhD, both eminent researchers at the University of Cambridge to conduct the study.

The study was designed to observe what effect eating different types of fat would have on cholesterol levels. Three different fats were compared in the study: coconut oil, which is 92 percent saturated fat; unsalted butter, which is 66 percent saturated; and olive oil which is 14 percent saturated and 77 percent monounsaturated.

A total of 94 volunteers, aged between 50 and 75 who had no history of diabetes or heart disease, were recruited to participate in the study. The volunteers were randomly assigned to one of three groups, with

each group assigned to add one of the three fats into their diet. Every day for four weeks, they were asked to consume 50 grams of their assigned oil – that's equivalent to about 3 tablespoons.

Before starting on their new high-fat regime blood samples were taken to get baseline measurements, focusing mainly on their LDL and HDL cholesterol levels. LDL cholesterol is often referred to as the "bad" cholesterol as it makes up most of the cholesterol in our blood.

As expected, the butter eaters saw an average rise in their LDL levels of about 10 percent, which was almost matched by a 5 percent rise in their HDL levels. Taken together the overall effect has a negligible effect on heart disease risk.

Those consuming olive oil had a small, non-significant reduction in LDL cholesterol but saw a 5 percent increase in HDL, supporting its health healthy reputation.

The big surprise was coconut oil. Not only was there no rise in LDL levels, which was what the researchers were expecting (and what the AHA claims it would do), but there was a particularly large rise in HDL, by an impressive 15 percent. The people consuming the coconut oil had significantly reduced their risk of suffering a heart attack or stroke.

The researchers were surprised by the results. Dr. Khaw confessed that she didn't understand why coconut oil provided better numbers than even olive oil. "I have no real idea," she said.

"Perhaps it is because the main saturated fat in coconut oil is lauric acid and lauric acid may have different biological impacts on blood lipids to other fatty acids. The evidence for that comes mainly from animals, so it was fascinating to see this effect in free-living humans."^[1]

This study provided further evidence that people consuming coconut oil are at reduced risk of developing heart disease, despite claims from the AHA who base their prejudice of coconut solely on its saturated fat content and not on actual studies.

This is not the only study to show that coconut oil reduces the risk of heart disease. Animal studies have clearly shown that coconut oil has the potential to reduce atherosclerosis and prevent, and perhaps even reverse, cardiovascular disease.^[2-3]

Although the AHA recommends polyunsaturated vegetable oils as a healthier choice over coconut



oil, human clinical trials show that in comparison to polyunsaturated oil, coconut oil does not promote cardiovascular disease even after long-term use.^[4]

Other human studies show that coconut oil reduces all of the common risk factors associated with cardiovascular disease such as waist circumference, body mass index, blood pressure, cholesterol ratio, blood triglycerides, blood glucose, and inflammation, among others.^[5-10]

Taken together, these studies strongly support the cardioprotective nature of coconut oil. No drug, dietary supplement, herb, or low-fat diet has been able to match the combined cardioprotective effects obtained from the regular use of coconut oil. If coconut oil was a pharmaceutical product invented in a chemist's laboratory it would be promoted as the world's most effective cardioprotective agent of all time. But since it is a natural product that cannot be patented and exploited and since it competes with a multitude of highly profitable drugs, it is condemned as dangerous.

These and many additional studies not referenced here were suspiciously ignored by the AHA's report on saturated fats. Was this just a negligent oversight, or was it a preconceived plan to bury studies that conflict with the AHA's viewpoint? Since the committee members who determine the AHA recommendations are all established academics, it appears it wasn't due to shoddy research, but more likely a conflict of interest – a common problem when non-profit organizations take money from big businesses that have an interest at stake.

The AHA's overemphasis on cholesterol as the major contributing factor to heart disease and lack of acknowledging the importance to other factors, such as excessive sugar consumption, could be leading us in the wrong direction.

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**Dr. Bruce Fife is a certified nutritionist and naturopathic physician. He is the author of more than 20 books including The Coconut Oil Miracle, The New Arthritis Cure, and Stop Alzheimer's Now!: How to Prevent and Reverse Dementia, Parkinson's, ALS, Multiple Sclerosis, and Other Neurodegenerative Disorders. He serves as the director of the Coconut Research Center in Colorado. ■ Source: <https://www.faim.org/>*

134th Meeting of Coconut Development Board



A view of the 134th Meeting of CDB

The 134th Meeting of the Coconut Development Board was held on 25th October 2018 at Bhubaneswar under the chairmanship of Dr. Raju Narayana Swamy IAS, Chairman, Coconut Development Board.

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, Shri. Sanjeev Kumar Singh, Bihar and Smt. Daksha Rami, Gujarat. Permanent Invitee, Shri. B Pradhan IAS, Additional Secretary to Government of India and Financial Advisor, Department of Agriculture, Cooperation and Farmers Welfare, Shri.Dinesh Kumar IAS, Joint Secretary (MIDH), Department of Agriculture, Cooperation and Farmers Welfare, Shri Saradindu Das, Chief Coconut Development Officer and Shri R. Madhu, Secretary, Coconut Development Board attended the meeting.

APCC upgraded to International Coconut Community



The 53rd APCC Session/ Ministerial Meeting held in Kiribati unanimously resolved to upgrade Asian and Pacific Coconut Community to a global organization through an Amendment to Article thus removing the geographical boundaries defining membership qualification. This enables all coconut growing countries to obtain full membership of the Community.

The decision to upgrade the Asian and Pacific Coconut Community to gain international status was subject of discussion and deliberation for many years including the 2015 and 2016 Ministerial Meetings in India and Indonesia respectively. The United Nations Secretary General was then notified as required by the Article. The UN Treaties Office responded with

the Depository Notification dated 20th March 2018 thus fulfilling all official requirements to establish the International Coconut Community (ICC). Currently 16 coconut growing countries are full members of ICC. The Asian Region members are India, Indonesia, Malaysia, Philippines, Sri Lanka, Thailand, and Vietnam. The Pacific Region members are Federated States of Micronesia, Fiji, Kiribati, Marshall Island, Papua New Guinea, Samoa, Solomon Island, Tonga, and Vanuatu. The associate members, Jamaica and Kenya would be submitting application to attain full membership. Timor Leste is the latest new member admitted in 2018 awaiting formal process of notification by UN Secretary General. The addition would bring total full member to 19 countries.

Obituary



Shri. Sardar Singh Choyal, Deputy Director, Coconut Development Board, Kochi passed away after a massive heart attack on 30th October 2018 while on official duty at Patna.

Shri. Choyal, native of Chhotikhargone of Khargone district from Madhya Pradesh was a graduate in Agricultural Science from Jawaharlal Nehru Krishi Vishwa Vidyalaya, Jabalpur and was a post graduate in Plant Pathology from Orissa University of Agriculture and Technology, Bhubaneswar. Shri. Choyal joined the Board in December 1987 at the DSP Farm, Kondagaon. He has served the Board at its various offices viz. State Centre Odisha, RO Patna, DSP Farm Madhepura, DSP Farm Neriamangalam and at the Head Office of the Board at Kochi.

Shri. Sardar Singh Choyal is survived by his wife Smt. Parvathy Choyal and daughters Manorama Choyal and Maneesha Choyal.

Coconut Board family deeply mourn in the sudden and untimely death of Shri. Sardar Singh Choyal.

Buyer Seller meet in Patna Traders interested in associating with FPOs

With an objective to explore the potentials to establish forward linkages of the Farmer Producer Organisations with the buyers in consuming states of India, a Buyer Seller meet was organized at ICAR Research Complex for Eastern Region in Patna on 30th October 2018. There is enormous demand for fresh coconut and dried coconut in Bihar in November owing to the Chhaat festival and organizing the Buyer Seller meet during this period would provide opportunity for building market relations.

The meet was inaugurated by Dr. Raju Narayana Swamy IAS, Chairman, Coconut Development Board. Shri. Sanjeev Kumar Singh, Board Member, CDB graced the occasion. Farmer representatives from the Coconut Producer Companies and Federations in Tamilnadu, Karnataka and Andhra Pradesh dealing with fresh coconut and dried coconut participated in the meeting. Around 20 traders in and around Patna and from Lucknow participated in the meet. Representatives from Bihar Industrial Association., Gram Bharati Foundation, Bazar Samiti Patna also participated.

A self introduction by the buyers and sellers was done followed by one to one interaction of the buyers and sellers on pricing, volumes, logistics etc. A small exhibition of major products from coconut was arranged. The FPOs had also displayed the different grades of fresh coconut and ball copra or dried coconut. The traders were interested in developing associations with the FPOs to get good quality products at reasonable prices. The Bihar Industries Association informed that they will take a lead role in organizing the buyers and facilitating the link with the FPOs. Once the association of buyers is undertaken, CDB will facilitate market relations with FPOs for fresh coconut and dried coconut.



Dr. Raju Narayana Swamy IAS, Chairman, Coconut Development Board inaugurating the Buyer Seller meet

State Level Workshop on Coconut Cultivation and its Value Addition



1. Dr. Raju Narayana Swamy IAS, Chairman, Coconut Development Board inaugurating the State Level Workshop.
2. A view of the audience

A State Level workshop on Coconut Cultivation and its Value Addition was organized by CDB, State Centre, Kolkotta at Biswa Bangla Convention Centre, New Town Kolkata on 4th November 2018. Dr. Raju Narayana Swamy, IAS, Chairman, Coconut Development Board, Shri Sampad Ranjan Patra, Director of Agriculture & Ex-Officio Secretary, Department of Agriculture, Govt. of West Bengal and Dr. Dipak Kumar Ghosh, Professor & Scientist-in-Charge, AICRP on Palms, BCKV, Kalyani were the distinguished guests of the inaugural function of the state level seminar.

In his keynote address, Dr. Raju Narayana Swamy, IAS, Chairman stated that in India more than 100 lakh coconut seedlings are required for expansion of area under coconut, out of which only 35 lakhs coconut seedlings are produced annually. There is a shortage of 65 lakhs quality coconut seedlings in India. The DSP Farms of the Board play a major role in the production of quality planting materials in the country. In this context the opening of DSP Farm at Fulia, Nadia District would be beneficial for the farming community of the state of West Bengal. He further spoke on the importance of the adoption of cultivation technology by the farming community and the necessity of establishing the DSP Farm at Fulia for the benefit of the State of West Bengal and he also expressed that, there is big opportunity for the establishment of coconut industry in the state. He requested for the support of the Government

of West Bengal for the overall development of coconut cultivation as well as industry and expressed that Board will extent maximum support for the betterment of small and marginal farmers of the state.

Shri Sampad Ranjan Patra, Director of Agriculture called upon the farming community to plant quality planting materials and to adopt integrated farming in coconut garden so that they can obtain maximum income from their gardens. He requested Coconut Development Board, for early establishment of the DSP Farm at Fulia so that land provided by the Govt. of West Bengal will be utilized in a proper way. Dr. Dipak Ghosh, Prof & Scientist-in –Charge, AICRP of Palms, BCKV requested the farmers for increasing the area under coconut and to effectively utilize coconut products and by products for improving their income.

A technical session followed the inaugural session. Dr. Narayan Chandra Sahu, Senior. Scientist & Head, SSKVK Narendrapur chaired the technical session. Dr. Partha Pratim Paul, Dr. Subhadeep Nath, Assistant Director of Horticulture, Department of FPI & Horticulture, Govt. of West Bengal, Dr. Dipak Kumar Ghosh, Professor & Scientist-in-Charge AICRP on Palms, BCKV and Shri. Khokan Debnath, Deputy Director spoke on various coconut related topics. More than 1600 farmers from different districts of the state attended the seminar.

Coconut Development Board and The Hindu in School'

conducted Agriculture quiz

**AGRICULTURE
QUIZ 2018**

Coconut Development in association with The Hindu in School' conducted an Agriculture quiz for students from Chennai, Puducherry, Kancheepuram and Tiruvallur districts at SBOA School Auditorium, Anna Nagar, Chennai on 9th November 2018. 450 students 225 teams from 8th to 12 standards competed in the programme.

M.Ganeshkaran and Tejas Nishad from The Study, Puducherry were the winners. Bharathi.B and Elankumaran.R from Petit Seminaire came second followed by Shreyas Sangameswaran and Surya Ari from Chennai Public School.

Top six teams that made to the finals were Petit Seminaire Higher Secondary School (Puducherry), DAV Matriculation Higher Secondary School (Mogappair), PSBB Senior Secondary School (Siruseri), The Study L Ecole International (Puducherry), PSBB Senior Secondary School (KK Nagar) and Chennai Public School.

Dr.Raju Narayana Swamy IAS, Chairman, Coconut Development Board inaugurated the programme. In his inaugural address, he congratulated the participants of the quiz and said that the initiative was a humble beginning to promote the culture of agriculture through young and vibrant minds. He gave away the trophies, cash award and certificates to the winners and finalists. All the participants were given certificate of appreciation.

The Guest of Honour of the event Dr.G.N. Hariharan Director, Biotechnology, M.S.Swaminathan



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Research Foundation encouraged the students to consume tender coconut water for its health benefits and also for helping the farmers. As part of creating awareness on coconut products, CDB distributed coconut based value added products like virgin coconut oil, coconut oil, neera, neera chocolate & coconut chips to the participants. Display of value added coconut products were arranged at the venue by the Board.

1 Inaugural Address

2 The winners, M.Ganeshkaran and Tejas Nishad receiving the prize

3 The participants

4 The audience

CDB observed Vigilance Awareness Week



Administration of Integrity Pledge by CDB Officers and staff

In accordance with the direction of Central Vigilance Commission, Coconut Development Board observed Vigilance Awareness Week 2018 from 29th October to 3rd November 2018 on the theme “Eradicate Corruption – Build a New India”. The Vigilance Awareness Week commenced with administration of Integrity Pledge on 29th October.

Shri.Saradindu Das, Chief Coconut Development Officer, Coconut Development Board administered the Integrity Pledge on 29th October 2018 in the presence of the staff and officials of the Board at Kochi. All the unit offices of the Board including the DSP Farms of the Board also administered the Integrity Pledge.

A Sensitization Programme was organized on 2nd November 2018 for the officers and staff of the Board. Shri.R.Jnanadevan, Vigilance Officer, CDB spoke during the occasion. Shri.T.R.Shaji, Vigilance

Officer, Fertilizers and Chemicals Travancore (FACT) was the Chief Guest of the Valedictory Session of the Vigilance Awareness Week-2018 held on 2nd November 2018 at the headquarters of the Board at Kochi. In his address he detailed on the theme ‘Eradicate Corruption and Build a New India’. He called upon the employees to take the lead role in eradicating corruption and in maintaining high standards of integrity, transparency and good governance in all aspect of office activities.

Shri.Saradindu Das, Chief Coconut Development Officer, CDB presided over the session. In his presidential address he advised all employees to maintain integrity and ensure code of ethics in official dealings. Shri.R.Madhu, Secretary spoke on the importance of distribution of scarce resources and ensuring proper distribution among the needy and entitled in a transparent manner. Shri.E.Aravazhi, Deputy Director proposed vote of thanks.

Fellow award

Dr. H.P. Maheswarappa, Project Coordinator (Palms), ICAR- CPCRI, Kasaragod was awarded with Fellow of Indian Society of Agronomy, New Delhi for his outstanding contribution in the field of Agronomy with specific aspects like palms cropping/farming system research, nutrient management in plantation crops and organic farming in plantation crops. The award was presented by Dr. Ramesh Chand, Member, NITI Ayog, Govt. of India, New Delhi at a function held on the occasion of XXI Biennial National Symposium at MPUAT, Udaipur (Rajasthan) on 24th October 2018.



Dr. H.P. Maheswarappa receiving the Fellow award from Dr. Ramesh Chand

Review Meeting on implementation of CDB schemes in North East Region held

A meeting to review the status of implementation of Coconut Development Board schemes in Northeastern Region was held at Guwahai, Assam on 31st October 2018 under the chairmanship of Dr. Raju Narayana Swamy IAS, Chairman, Coconut Development Board. Senior officers from Assam, Arunachal Pradesh, Manipur, Meghalaya, Mizoram, Nagaland and Tripura attended the meeting. Shri L. Obed, Director, CDB, Regional Office, Guwahati, Assam welcomed the participants. Dr. Raju Narayana Swamy, IAS, Chairman, CDB in his introductory speech informed that an amount of Rs. 19.30 cr. is allocated to North Eastern States under different schemes during the current financial year and urged the officers to utilize the allocation fully as per the approved action plan as well as by submitting suitable proposals on new initiatives within the framework of the guidelines for the schemes of CDB. The Village adoption programme, Establishment of Model farm, 'Ghar ghar mein naariyal' programme, Organising Buyer-Seller meet & National Coconut Festival in North East were discussed in detail by the meeting.



Review Meeting on implementation of CDB schemes in progress

Mrs. Mauchumi Barua, ACS, Joint Secretary Dept. of Agriculture, Govt of Assam, Mr. Jhunnar Rime, Director, Dept. of Horticulture, Govt. of Arunachal Pradesh, Dr. R. Elinthung. Lotha, Director, Dept. of Horticulture, Govt. of Nagaland, Mr. Keisam Brojen Singh, Joint Director, Dept of Horticulture, Govt. of Manipur, Shri. Sanjib Debbarma, Assistant Director, Dept of Horticulture, Govt. of Tripura, Shri. Abdul Jalil, Assistant Director, Dept of Horticulture, Govt. of Assam, Mr. Indra Mohan Talukdar, SDAO, Dept. of Horticulture, Govt. of Assam, Mr. Mardo Ninu, SHO, Dept of Horticulture, Govt. of Arunachal Pradesh, Mrs. F. Zorinsangi, HDO, Dept. of Horticulture, Govt. of Mizoram and Smt. Susunnah K. M. Sangma, DHO, Dept. of Horticulture, Govt. of Meghalaya attended the meeting.

CDB participated in 38th India International Trade Fair 2018



CDB stall in India International Trade Fair



Chairman CDB in the CDB stall

Coconut Development Board participated in the 38th India International Trade Fair (IITF) from 14th - 27th November 2018 at Pragati Maidan, New Delhi. IITF, the largest integrated trade fair of the country with B2B and B2C components, was utilized by the Board as a platform to introduce various value added products in North Indian market. Coconut delicacies like packed tender coconut water, coconut milk powder and coconut milk, coconut chips, desiccated coconut, virgin coconut oil etc. produced by various coconut based entrepreneurs viz. M/s. KLF Nirmal Ind. M/s. Pure Tropic, M/s. Vadakara Coconut Producer Company, M/s. Madhukara Agro Products, M/s. Yogic Food, M/s. Marketfed, M/s. Pransu Coco Products M/s. Agricole, M/s. NGO Products and M/s. Keratech were displayed in Board's stall. The theme pavilion of the Board displayed various coconut based value added products, informative posters and publications of the Board. Dr. Raju Narayana Swamy, Chairman CDB visited CDB stall and had interaction with the entrepreneurs and visitors. Around three lakh people visited the expo.

Seminar on Promotion and Development of Coconut



Thiru. Pon.Radhakrishnan inaugurating the seminar



A view of the dignitaries

CDB, Regional Office, Chennai organised a State Level Seminar for the Promotion and Development of Coconut on 13th November 2018 at Nagercoil, Kanyakumari District, Tamilnadu. Thiru.Pon. Radhakrishnan, Hon'ble Minister of State for Finance and Shipping, Government of India inaugurated the programme. The Honourable Minister in his inaugural address expressed that though coconut is the major crop grown in Kanyakumari district, there is no coconut based value added industries in Kanyakumari which is inevitable for exploiting the huge potential for the promotion and development of coconut in the district besides augmenting employment opportunities.

Thiru.Mohanraj, Member, Coconut Development Board in his special address stated that different varieties of coconut seedlings are developed in CDB DSP farm, Dhali and he called upon the farmers to buy those quality seedlings from the farm of CDB.

Dr.Anantharamakrishnan, Director, IIFPT called upon the farmers of Kanyakumari district to concentrate more on value addition of coconut. Thiru.Prashant M.Wadnere, IAS, District Collector, Kanyakumari District who further spoke on the occasion also spoke on the need for value addition in coconut in the districts and called upon the coconut farmers of the district to fully utilize the benefits being offered by the State Government, NABARD and Coconut Development Board. Dr.K.Ramaraj, Director of Research, TNAU, Coimbatore in his special address requested the coconut farmers to maintain the coconut garden in scientific manner in spacing, fertilizer application etc. recommended by the Tamil Nadu Agricultural University. Thiru.Nizamudheen, Addl. Director, Department of Agriculture Marketing & Agri Business, Govt. of Tamil Nadu spoke on



Exhibition of coconut value added products

marketing strategies of coconut. Thiru.Sundararajan and Thiru.Rethinakaran, farmers of Eathamozy shared their experiences. Smt.T.Balasudhahari, Deputy Director (Dev.), CDB RO, Chennai delivered the welcome address and Shri. Jeyapandi, Deputy Director (Mkg), CDB RO, Chennai, proposed vote of thanks.

In the technical session which followed, Dr.A.Kartheikyan, Professor and Head, CRS, Tamil Nadu Agricultural University, Veppankulam, Thiru.K.Sushilkumar, Branch Manager, TIIC, Nagercoil, Thiru.Kamaraj, Sakthi Coco, Dr.K.Rajamanickam, Professor, CRS, Tamil Nadu Agricultural University, Aliyar, Thiru.Nandhakumar, Scientist, IIFPT, Thanjavur, Thiru. L. Narayanamoorthy, Department of Organic Certification, Government of Tamil Nadu, Thirumathi.Jareena Bubby, MSME, Thoothukudi, Thiru.Ramkumar, Lead Bank Manager, Nagercoil and Dr.Muralidharan, Assistant Professor, College of Agriculture, Tamil Nadu Agricultural University, Killikulam spoke on various coconut related topics. An exhibition of coconut value added products were also held as part of the programme.

More than 300 coconut farmers and officials attended the seminar.

Krishi Mela and Agri Expo



Inauguration of CDB stall in Agri Expo

To empower farmers with the latest farm technologies and to facilitate doubling farmers' income by 2022, CPCRI organised Kisan Mela and Agri Expo during 10-11 November 2018 at ICAR-CPCRI, Research station, Kidu, Karnataka. Various interface programmes involving farmers, entrepreneurs and other stakeholders along with the Farmers meet-cum -Agri-Expo were held as part of the programme.

Shri. V Sadananda Gowda, Union Minister of Statistics and Programme Implementation inaugurated the programme. In his inaugural address, the Hon'ble Minister appreciated the activities undertaken by CPCRI for the integrated development of plantation crops. Dr. Virendra Heggade, Dharmadhikari of Dharmasthala was the chief guest of the programme.

Shri. S Angara, MLA, Sullia, Shri. Sanjeeva Matandoor, MLA, Puttur, Dr. Raju Narayana Swamy IAS, Chairman, CDB, Dr. Ariz Ahammed, Managing Director of National Horticulture Board and other dignitaries were present during the occasion.

Dr. P Chowdappa, Director, CPCRI briefed the role of Kidu Research Centre of CPCRI in developing, maintaining and promoting coconut varieties. The International Coconut Gene Bank for South Asia in

Kidu is one among the five gene banks that was set up under the Coconut Genetic Resources Network (COGENT). With 39 countries as its members, COGENT promotes collaboration for the conservation and use of coconut genetic resources across the globe. Dr. K Samsudeen, Principal Scientist, CPCRI proposed vote of thanks.

Five publications of CPCRI were released during the occasion. Sessions on soil and water conservation technologies in plantation crops, crop protection, production technologies of plantation crops, improved varieties and planting material production in plantation crops was held as part of the programme.

The agriculture exhibition provided a good platform for growers, wholesalers and all the stakeholders of agriculture, horticulture, dairying and animal husbandry, farm machinery and equipment and allied sectors who wanted to expand and diversify their business activities.

Exhibition on machinery and equipment, crop protection, fertilisers and pesticides, urban farming/hydroponics, seeds/seedlings, government schemes and programmes for farmers welfare, poultry farming, aquaponics, farm equipment, nets and cages and others were also held.

Shining Maharashtra-2018

Coconut Development Board participated in Shining Maharashtra-2018 from 26th to 28th September 2018 at Gandhi Ground, Solapur, Maharashtra organized by Sansa Foundation, New Delhi.

The main focus of participation in Shining Maharashtra 2018 was to search for distributors, entrepreneurs and retailers for coconut products in Western Maharashtra. Coconut Development Board displayed various value added coconut products like packed tender coconut water, coconut oil, coconut milk powder, virgin coconut oil and informative charts and posters on coconut. Publications of the Board and technical booklets in English and Marathi were distributed in the CDB stall. VIPs, officials of various national & international companies and business communities visited CDB Stall.

Cultural practices for coconut during December

Seednut collection

- Seednuts can be collected from the identified mother palms to raise quality planting material.

Nursery management

- Five month old ungerminated nuts and dead sprouts should be removed from the nursery.
- Mulching with coconut leaves or dried grass or live mulch by raising green manure crops can be done in the nursery
- Provide irrigation
- Need based plant protection measures against pests and diseases are to be undertaken. Soil drenching of chlorpyrifos @ 2ml/litre is to be done in the nursery, if termite infestation is observed. Spraying of water on the leaves can be done against white fly infestation in the coconut nursery.

Irrigation for seedlings

- Seedlings are to be given irrigation either through drip or basin method. If drip irrigation is adopted provide on an average 10 litres of water per seedling per day. Through other methods like basin irrigation 60 litres of water once in four days is sufficient.

Irrigation for adult palms

- Clean the irrigation channels wherever irrigation water is guided to palm basins through channels. Regular irrigation can be started in coconut gardens. If basin irrigation method is adopted, provide irrigation once in four days @ 200 litres per palm.
- Drip irrigation is the ideal method of irrigation for coconut. 30-45 litres of water per palm per day is to be provided through drip irrigation system.
- Irrigation can be started to negate the effect of low temperature in the non traditional areas like Bihar, Madhya Pradesh, Chhattisgarh and North Eastern



states. Also ensure thick mulching in the basin to regulate soil temperature in such areas.

Drainage

- Ensure adequate drainage facilities in coconut gardens in localities having drainage problem.

Shading

- Provide shade to newly planted and young coconut seedlings

Manuring

- Apply one-fourth of the recommended dose of fertilizers in the irrigated gardens.
- Drip fertigation, wherever feasible, may be continued as per the monthly schedule.
- It is always desirable that the quantity of chemical fertilizers is worked out based on soil test results



Spear leaf damage



Inflorescence damage

*M Anisopliae* infected grubMass multiplication of
M Anisopliae

and yield targeted.

- Wherever Boron deficiency is noticed 100 g Borax may be applied in the basin.
- For coconut palms showing yellowing of leaves due to Magnesium deficiency, 0.5 kg of magnesium sulphate can be applied in the basins.
- Apply silt in the palm basin @ 50 kg/palm

Mulching and intercultivation

- Mulching of palm basins can be undertaken if not done earlier. Fallen dried coconut leaves available in the coconut garden can be used for mulching.
- Level down the mounds piled up earlier in the coconut garden.

Intercropping

- Suitable intercrops can be raised in the interspace of coconut gardens depending upon the agro-ecological situations

Plant protection

Cool and dry period triggers pest occurrence in the perennial system including coconut plantations. Wetness coinciding monsoon showers could diminish pest incidence, whereas advent of winter (December) opens up pest prevalence as well as subdues disease causing pathogens and therefore strict vigilance and sustained scouting should become more focussed for timely pest and disease diagnosis and management. Regarding common and perennial diseases such as leaf rot, stem bleeding and basal stem rot persists during this period for which adequate health restoration is the key for the palms to withstand the pressure incited by them and avoid further deterioration. The cosmopolitan insect pests viz., rhinoceros beetle and red palm weevil, as well as incidences of slug caterpillar, rugose spiralling whitefly, coreid bug and rodents could emerge and take an upper hand during this period in endemic

zones. Sustained monitoring and prophylactic treatments would suppress the damage potential of pest and disease and suitable health management strategies need to be adopted at the appropriate time.

Rhinoceros beetle (*Oryctes rhinoceros*)

In the post-flood fury, Kerala witnessed habitat destruction of breeding grounds of rhinoceros beetle (*Oryctes rhinoceros*) which could suppress the damage potential of the pest in adult palms. Being a ubiquitous cum cosmopolitan pest, incidence of rhinoceros beetle is invariably observed in all seasons and the juvenile palms are extensively damaged. Coconut seedlings planted during May-June should be customarily shielded from pest incursion during this period. More than 0.5% natural incidence of *Oryctes rhinoceros* nudivirus (OrNV) was recorded in Peninsular India and therefore the OrNV-insensitive Coconut Rhinoceros Beetle-Guam (CRB-G) strain is not prevalent in our country, as this strain is taking a great toll in South-East Asian region causing great concern among International community making extensive damage.

Management

- Prophylactic treatment of top most three leaf axils with either botanical cake [Neem cake /marotti cake / pongam cake (250 g)] admixed with equal volume of sand or placement of 12 g naphthalene balls covered with sand.
- Routine palm scrutiny during morning hours along with brushing of teeth and hooking out the beetle from the infested site reduces the floating pest population.
- Shielding the spear leaf area of juvenile palms with fish net could effectively entangle alighting rhinoceros beetles and placement of perforated sachets containing 3 g *chlorantraniliprole* /*flupronil*



Adults weevils



Crown entry



Toppling of palm

on top most three leaf axils evade pest incursion.

- Manure pits, breeding site of the beetles, may be treated with green muscardine fungus, *Metarhizium anisopliae* @ 5 x 10¹¹ /m³ (Application of 100 g of *Metarhizium anisopliae* in semi-cooked rice for one cow dung pit of 1 m³) to induce epizootics on the developing grubs of rhinoceros beetle. Area-wide farmer-participatory approach in technology adoption could reduce the pest incidence very effectively and forms an eco-friendly approach in pest suppression.
- Incorporation of the weed plant, *Clerodendron infortunatum* in to the breeding pits caused hormonal irregularities resulting in morphogenetic transformational aberration in the immature stages of the pest.

Red palm weevil (*Rhynchophorus ferrugineus*)

Reduction in the incidences of rhinoceros beetle, would subsequently suppress the invasive potential of the killer pest, viz., the red palm weevil, which needs an injury for the weevils to orient towards the palm cue and lay eggs. Dwarf genotypes and palms aged between 5-15 years are relatively more susceptible. All life stages of the pest were noticed inside the infested palms. Being a fatal enemy of palms, 1% action threshold has been fixed.

Management

- Avoiding palm injury is very critical to disorient the gravid weevils away from the field and therefore release out at least one metre from palm trunk when petioles are cut.
- Crop geometry and correct spacing is very crucial to reduce pest attack.
- Timely and targeted spot application of imidacloprid 0.002% (1 ml per litre of water) or indoxacarb 0.04% (2.5 ml per litre of water) on infested palms

would kill the feeding grubs and induces recovery of palms by putting forth new spear leaf.

- Crop-habitat diversification (Ecological Bio-engineering) through coconut based cropping system strategy inciting defenders and pollinators would diffuse the palm-linked volatile cues and encouraged pest suppression. Diversified cropping system reduced pest incidence than mono-cropping.

Slug caterpillars (*Darna nararia*)

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

Management

- Complete destruction of affected palm leaflets with caterpillar at early stages of infestation should be made immediately so that the pest build up is suppressed. Care should be taken as the caterpillars cause extreme itching when contacted with human skin due to the presence of poisonous scoli.
- Establishment of light traps and spraying *Bacillus thuringiensis* 5 g/litre was found effective along with inundative biological control using the eulophid larval parasitoid, *Pediobius imbrues*.

Rugose Spiralling Whitefly (*Aleurodicus rugioperculatus*)

This period could also witness the establishment



Slug caterpillar infested field



Mature caterpillars on palm leaflet

of the invasive rugose spiralling whitefly (*Aleurodicus rugioperculatus*) in new areas as well as re-emergence in already reported areas. Presence of whitefly colonies on the under surface of palm leaflets and appearance of black coloured sooty mould deposits on the upper surface of palm leaflets are characteristic visual symptoms of pest attack. In severe cases, advancement in senescence and drying of old leaflets was observed. Leaflets, petioles and nuts were also attacked by the whitefly pest and a wide array of host plants including banana, bird of paradise, *Heliconia sp.* were also reported.

Management

- In juvenile palms, spraying of water with jet speed could dislodge the whitefly and reduce the feeding as well as breeding potential of the pest.
- No insecticide should be used as this causes resurgence of the pest and complete kill of the natural aphelinid parasitoid, *Encarsia guadeloupae*.
- Installation of yellow sticky traps and conservatory biological control using *E. Guadeloupae* could reduce the pest incidence by 70% and enhance parasitism by 80%.
- Habitat preservation of the sooty mould scavenger beetle, *Leiochrinus nilgirianus* could eat away all the sooty moulds deposited on palm leaflets and cleanse them reviving the photosynthetic efficiency of palms.
- Close monitoring and systematic scrutiny of palms for timely detection of pests are critical to execute the correct approaches in pest suppression and reduce crop loss to double income.

Leaf rot disease (*Colletotrichum gloeosporioides*, *Exserohilum rostratum*)

It is commonly observed on palms affected by root (wilt) disease wherein foliar necrosis of terminal

spear leaf and adjacent leaves are registered. The disease prominently noticed in the post-monsoon phase during the month of December. Affected leaves turn necrotic and are not detachable from the palm and remain intact. This disease could be initially observed as minute lesions which later enlarge, coalesce and cause extensive rotting affecting the photosynthetic efficiency of palms. The disease is endemic to root (wilt) affected regions of Southern Kerala

Management

- Need based pruning and destruction of affected spear leaf and other adjacent leaves in the terminal region
- Spot application of *hexaconazole* 2 ml in 300 ml water on the affected spear leaf region

Stem bleeding (*Thielaviopsis (Ceratocystis) paradoxa*)

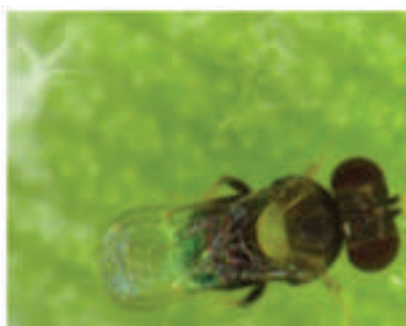
This disease is mostly confined in the acid soils of Kerala and becomes quite explicit during the period. Conspicuous exudation of reddish-brown gummy fluid is visible on the trunk which turns black on drying. It could be observed initially as small bleeding patch along the longitudinal crack, which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

Management

- Avoid burning of trash and palm residues near the trunk to avoid trunk/root injury
- Adequate irrigation and adoption of soil and water



Colony of rugose spiralling whitefly



Encarsia guadeloupae



Sooty mould scavenging beetle



Leaf rot disease in juvenile palm



Basal stem rot disease



Bracket fungus

conservation measures is advised.

- Application of 5 kg of neem cake enriched with *Trichoderma harzianum* and soil test based nutrition.
- Application of paste of *Trichoderma harzianum* talc formulation on the bleeding patches on the trunk was also found effective in preventing the spread of stem bleeding.

Basal stem rot disease (*Ganoderma* spp.)

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

viscous gummy substance. These brownish patches may extend up to one metre from ground level and at times bark peeling was also observed. Sometimes fruiting bodies (*basidiocarp*) of the pathogen develop from the affected trunk.

Management

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

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

Market review – October 2018

Domestic price

Coconut Oil

During October 2018 the price of coconut oil opened at Rs.15900 per quintal at Kochi and Alappuzha market and Rs.16200 per quintal at Kozhikode market. During the month, price of coconut oil at all three markets expressed a downward trend.

The price of coconut oil closed at Rs.14700 per quintal at Kochi and Alappuzha market and Rs.15400 per quintal at Kozhikode market with a net loss of Rs.1200 per quintal at Kochi and Alappuzha market and Rs.800 per quintal at Kozhikode market.

The price of coconut oil at Kangayam market in Tamilnadu, which opened at Rs.13667 per quintal, expressed a downward trend and closed at Rs.12333 per quintal with a net loss of Rs.1334 per quintal.

Weekly price of coconut oil at major markets Rs/Quintal)				
	Kochi	Alappuzha	Kozhikode	Kangayam
01.10.2018	15900	15900	16200	13667
07.10.2018	15900	15800	16000	13667
14.10.2018	15200	15300	15400	12667
21.10.2018	15100	15100	15400	12667
28.10.2018	14800	14800	15400	12200
31.10.2018	14700	14700	15400	12333

Milling copra

During the month, the price of milling copra opened at Rs.10200 per quintal at Kochi, Rs.10100 per quintal at Alappuzha market and Rs.10050 per quintal at Kozhikode market. During the month, price of milling copra at all three markets expressed downward trend.

The prices closed at Rs.9200 at Kochi market, Rs.9100 at Alappuzha and Rs.9350 at Kozhikode markets with a net loss of Rs.1000 per quintal at Kochi and Alappuzha market and Rs.700 per quintal at Kozhikode market.

At Kangayam market in Tamilnadu, the prices opened at Rs. 9300 per quintal and closed at Rs.8400 per quintal with a net loss of Rs.900 per quintal.

Weekly price of Milling Copra at major markets (Rs/Quintal)				
	Kochi	Alappuzha (Rasi Copra)	Kozhikode	Kangayam
01.10.2018	10200	10100	10050	9300
07.10.2018	10200	10100	10000	9300
14.10.2018	9600	9600	9400	8600
21.10.2018	9500	9400	9400	8600
28.10.2018	9250	9100	9350	8300
31.10.2018	9200	9100	9350	8400

Edible copra

The price of Rajapur copra at Kozhikode market which opened at Rs. 19000 per quintal expressed a fluctuating trend during the month and closed at Rs.18800 per quintal with a net loss of Rs.200 per quintal.

Weekly price of edible copra at Kozhikode market (Rs/Quintal)	
01.10.2018	19000
07.10.2018	19000
14.10.2018	19000
21.10.2018	19500
28.10.2018	19000
31.10.2018	18800

Ball copra

The price of ball copra at Tiptur market which opened at Rs.16800 per quintal expressed an overall downward trend during the month and closed at Rs.16600 per quintal with a net loss of Rs.200 per quintal.

Weekly price of Ball copra at major markets in Karnataka (Rs/Quintal)	
	Tiptur
01.10.2018	16800
07.10.2018	16500
14.10.2018	16000
21.10.2018	16000
28.10.2018	16200
31.10.2018	16600

Dry coconut

At Kozhikode market, the price of dry coconut opened at Rs.9450 per quintal expressed a declining trend during the first fortnight of the month. During the last week, price expressed an upward trend and closed at Rs.9350 per quintal.

Weekly price of Dry Coconut at Kozhikode market (Rs/Quintal)	
01.10.2018	9450
07.10.2018	9450
14.10.2018	9250
21.10.2018	9250
28.10.2018	9350
31.10.2018	9350

Coconut

At Nedumangad market the price of partially dehusked coconut opened at Rs.17000 per thousand nuts and closed at Rs.15000 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.12000 per thousand nuts and closed at Rs.11000 per thousand nuts. At Bangalore APMC, the price of partially dehusked coconut opened at Rs. 18500 and ruled at same price throughout the month. At Mangalore APMC market the price of partially dehusked coconut of grade-I quality opened at Rs.20000 per thousand nuts and ruled at same price throughout the month.

Weekly price of coconut at major markets (Rs /1000 coconuts)				
	Neduman-gad	Pollachi	Banglore	Mangalore (Grade-1)
01.10.2018	17000	12000	18500	20000
07.10.2018	17000	12000	18500	20000
14.10.2018	15000	12000	18500	20000
21.10.2018	15000	12000	18500	20000
28.10.2018	15000	11000	18500	20000
31.10.2018	15000	11000	18500	20000

International price

Coconut oil

The international price of coconut oil and domestic price of coconut oil in Indonesia expressed a mixed trend whereas the domestic price of coconut oil in Philippines and India expressed

an overall downward trend during the period. The price of coconut oil quoted at different international/ domestic markets is given below.

Weekly price of coconut oil in major coconut oil producing countries				
	International Price(US\$/MT)	Domestic Price(US\$/MT)		
	Philippines/ Indonesia (CIF Europe)	Philippines	Indonesia	India*
6/10/2018	865	820	810	1857
13/10/2018	846	818	811	1721
20/10/2018	853	810	812	1721
27/10/2018	805	803	802	1658

* Kangayam

Copra

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

Weekly International price of copra in major copra producing countries				
Date	Domestic Price (US\$/MT)			
	Philippines	Indonesia	Srilanka	India*
6/10/2018	516	422	1082	1264
13/10/2018	499	381	1076	1169
20/10/2018	484	408	1053	1169
27/10/2018	480	401	1047	1128

* 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*
6/10/2018	123	122	212	374
13/10/2018	123	116	179	367
20/10/2018	125	116	188	353
27/10/2018	124	119	188	340

*Pollachi market