Index

Attention Readers: Due to the nationwide lockdown in the wake of the corona virus pandemic, March, April and May 2020 issues of the Indian Coconut Journal are combined and published together.

We deeply regret the inconvenience caused to the readers in this regard.

Message from the Chairperson's desk

Dear Readers,

Across India, all coconut growing areas are reeling under the widespread occurrence of whitefly attack and the resultant loss in yield. Whitefly is an introduced pest in coconut. Biosecurity planning assumes much relevance in the context of such invasive pest attacks. Biosecurity planning involves development and adherence to clear protocols for reducing and eliminating the risk factors related to introduction of new pests and diseases. With the outbreak of whitefly attack in coconut, the sector has to be very careful for undertaking such Biosecurity planning.

There are some other devastating pests like Brontispa (coconut leaf beetle), coconut scale insect etc in other coconut growing countries like Philippines, Sri Lanka etc. We have to exercise strict control measures and be diligent in adhering to quarantine measures to avoid further introduction of such pests. An introduced pest is more dangerous than a native pest due to the absence of natural enemies. Movement of coconut seedlings between states should be undertaken with diligence. Agricultural Officers who are also plant quarantine officers can play a major role in this regard.

Let us all work together not only in protecting ourselves from infectious diseases like corona but also in protecting our plant population from infectious pests and diseases.

G Jayalakshmi IAS

Chairperson

Scope of Floriculture in Coconut Garden

K.Nihad, A.Abdul Haris and S.Kalavathi
ICAR-CPCRI, Regional Station, Kayamkulam

Coconut, the major crop of coastal environment is an ecosystem provider with potential for multiple income generating avenues. Unlike other plantation crops the wider spacing (7.5 m x 7.5 m) adopted during planting coupled with unique canopy and root system, coconut can accommodate a variety of intercrops and enterprises. This possibility is exploited by most of the progressive coconut farmers which resulted in evolvement of successful coconut based cropping system models. The practical innovations adopted by such farmers serve as models for up scaling by farming community. Floriculture is a blooming agribusiness venture which has a steady growth of 20% during the past two decades. The compound annual growth rate of cut flowers in India is 26.66% and our country has a share of only 0.6% in global floriculture. One of the major reasons for lower adoption of floriculture is non availability of land and higher cost of cultivation due to requirement of hi-tech farming. But through adopting wider spacing coconut plantations can become a good niche for many tropical ornamentals.

Kadinamkulam is a coastal panchayath in the outskirts of

Thiruvanthapuram, the capital city of Kerala. The residents of the area depend mainly on fishing and coconut based farming systems for their livelihood and nutritional security. The major soil type of the panchayath is coastal sandy loam which is very low in water holding capacity and organic matter content. Generally, flower crops come up well in organic rich soils with good drainage facility. But the experience and expertise of Mr. Vinoo Karthikeyan,owner of seaside farm of this locaity reveals that through adoption of refined agricultural practices even bare sun scorched sandy tract can be converted to a commercial cropping system enterprise. This farm throws light towards the scope of cultivating ornamentals in open field condition under coconut canopy. The land was a barren tract when it was procured by the veteran agriculturist Mr.Karthikeyan, father of Vinoo, around five decades ago. It was then deeply ploughed and planted with four hundred elite WCT palms at a wider spacing of 10 meters. Along with the planting of coconut seedlings, his passion towards floriculture prompted him to include exotic tropical ornamentals in the interspaces, even though there was little demand for ornamentals in the local market. He was very keen in adopting soil moisture conservation measures and also improved the top soil's health by adding red earth and humus. In two decades time his farm become a novel model for many coconut growers. Mr.Vinoo his youngest son, who is a photographer by profession, had a passion towards floriculture and was always a helping hand to his father. By the year 2000, Vinoo has fully taken over the charge of the farm from his aging father. Vinoo showed interest in extensively studying about the various prospectives of floriculture as an agribusiness venture. His frequent visits to the major floriculture hub of South East Asia helped him in equipping with the latest trends in the business. He also put effort in adopting recent horticultural techniques of these leading countries in his farm for producing quality ornamentals keeping the standards of his brand name; Seaside orchids. For his outstanding contributions he bagged Kerala state government's best horticulturist award in 2013.

Based on the light availability and drainage the entire farm is divided into different portions exclusively for orchids, ornamental zingeberales (heliconias, alpinias and costus), cut foliages etc and coconut palm basins are planted with ornamental ferns. The cost of cultivation is reduced to the maximum through complete recycling of the farm wastes from the coconut plantation.The coconuts from the garden are sold as dehusked nuts and the husks are utilized for planting orchids. According to Vinoo, growing orchids on coconut around its trunk is not ideal for commercial cultivation as there will be more risk in flower damage due to falling of nuts and fronds. In this garden, orchids are planted in four rows of equidistant trenches taken in between two rows of coconut palms leaving an area of two meters from the palm basin. The trenches (45 cm wide and 60 cm deep) are filled with three layers of coconut husks with the upper layer spread out in convex shape and the interspaces of the husk are filled with organic manure. Orchid kiekies (rooted stems) are inserted carefully into the filled trenches at a distance of 15 cm apart. Inflorescence length is the major criteria for fetching higher price in cut flowers. For this, the plants are trailed to a height of 7 to 8 feet (3.5 m) for encouraging production of longer inflorescences. Ornamental foliages such as Massangeana (Dracena massangeana) are planted in between the orchid trench which serves as trailing standards for orchids as well. The leaf of these plants also has good market demand fetching two to four rupees per foliage with an average production of 30 to 35 leaves per plant per year.

The flower from his farm is highly preferred by the dealers for the prescribed quality and fetches reasonable price. He had the previous experience of marketing Annie Black variety orchid for more than thirty years. According to him, Annie Black being an old commercial variety in Indian markets for more than fourty years, its market price has diminished

due to market glut. Anticipating this in 2007, he introduced a new Aranthera variety, Teacher Julian, from Thailand and multiplied the planting material in his own farm. Now he is growing more than five thousand plants in his farm with an average sale of 3000 flowers in a week at a price of Rs.60/- per inflorescence. The whole farm is now slowly shifting to this new variety which has huge market potential in near future.

The major constraint for starting floriculture based commercial farming is the non availability of quality planting materials and seasonal changes in flower demand. Continuous monitoring of the flower business trend in neighbouring countries helps Vinoo in selecting and shifting the plant varieties catering to the market demand. High cost of planting materials is tackled by importing limited number of planting materials following the quarantine rules and multiplying them in his production unit. For this, an import license is aquired for procuring exotic and rare ornamentals based on the anticipated market trend.

The plant selection is another major criterion which determines the success of an agribusiness venture. The novel plants should be tested on a pilot basis for its agro climatic suitability before introducing in a wider area. His advice is to select varieties which produce inflorescences with superior vase life and less susceptibility to pests and diseases.

The capacity to supply ornamentals throughout the year is the key towards victory of floriculture business. For this he has planted different varieties of tropical ornamentals which produce flowers in different seasons of the year. Apart from flowering plants he has given equal importance to exotic cut foliages as well. Harvesting and packing of inflorescences are to be done by experienced hands as damage to single inflorescence will result in the rejection of the whole box of flowers. Vinoo has employed a dozen of highly experienced farm labourers for doing the farm operations under his direct supervision. Orchids are packed in bunches of 10 numbers and ornamental zingeberales are individually packed after stripping off the lower leaves. Heliconias are packed after removing all the foliages where as the flower spike of Alpinias are wrapped with its top most foliages. Packing of these inflorescences requires larger boxes of more than one meter length demanding double freight charges while orchids can be packed in smaller boxes of less than one meter length. The flowers from this farm are marketed mainly to Mumbai and Delhi markets.

Coconut palms in his garden are highly benefitted by his intensive horticulture in the interspaces. Since flower crops are shallow rooted, it demands frequent irrigation and nutrition. In this farm he is not giving any separate manuring or irrigation to his palms. The palm basins are frequently irrigated for the moisture seeking ferns and the interspaces are mulched with coconut husks for planting orchids. Soil moisture conservation has great impact in the yield of coconuts. He is harvesting an average of 5000 nuts fourty five days interval from the palms. The approximate weight of

de-husked nuts from his farm is 750g.

The economy of sale in marketing of flowers and foliage is created through involvement of small group of women farmers interested in floriculture. The area of production is thus widened ensuring the supply of produces throughout the year. The planting materials and other crtical inputs are supplied to these farmers and the produces are taken back by Vinoo. They are paid on monthly basis based on the marketing season of the ornamentals. Many women farmers are approaching him, as this farming can be adopted as a hobby and part-time job fetching good remuneration. Mrs.Mary Elden is one among them cultivating the plants supplied by Vinoo for the past fifteen years. According to her the floriculture farm in her coconut based homestead serves as a horticulture therapy unit for her autistic son. He helps her in irrigating and manuring the plants which made lot of positive changes in her son's attitude and behavior. The systematic and wider spacing of main crop is one of the major reasons behind the success of Vinoo's coconut based cropping system. Scientific planning and passion towards floriculture make his agribusiness a promising endeavor for sustainable income. The long lasting vision, passion and endurance made him a successful floriculturist, weathering all odds and uncertainties. ■

Statement of ownership and other particulars about
INDIAN COCONUT JOURNAL
FORM IV
(See Rule 8)

1.	Place of Publication	:	Kochi - 11
2.	Periodicity of Publication	:	Monthly
3.	Printer's Name	:	Mini Mathew
	Nationality	:	Indian
	Address	:	Publicity Officer Coconut Development Board, Kochi - 11, Kerala.
4.	Publisher's Name	:	Mini Mathew
	Nationality	:	Indian
	Address	:	Publicity Officer Coconut Development Board, Kochi - 11, Kerala
5.	Editor's Name	:	Deepthi Nair S
	Nationality	:	Indian
	Address	:	Deputy Director Coconut Development Board, Kochi - 11, Kerala
6.	Names and addresses of individuals who own the newspaper and partners or shareholders holding more than one percent of the total capital	:	The periodical is owned by the Coconut Development Board which is a body corporate set up by the Government of India under the Coconut Development Board Act, 1979.

I, Mini Mathew, hereby declare that the particulars given above are true to the best of my knowledge and belief.

Sd/

Date : 01-03-2020

(Mini Mathew)

Coconut in Dairy industry

Shameena Beegum, P.P., Manikantan, M.R., Pandiselvam, R., Hebbar, K.B.
ICAR- CPCRI, Kasaragode

There always exists a good and prospective market for dairy based products such as ice cream, kulfi, yogurt, milk shakes etc. Coconut milk can be the best substitute for dairy milk especially for those in the Asian countries where coconut is abundantly available and is an integral part of the daily diet. An increased demand for non-dairy probiotic products also have come mainly from lactose intolerance, vegetarianism and milk cholesterol content. Present scenario of price fluctuation in coconut has put the coconut farmers in agony. Value addition is the imperative alternative to improve the farmer's income and livelihood security. Incorporation of coconut products in ice cream and other frozen desserts is being practiced in countries like Thailand, Malaysia and Indonesia. In India, coconut pulp is added to ice cream to convert it into a premium product and sold as tender coconut ice cream by several brands including Naturals, Meriiboy, Lazza etc. According to FSSAI, ice cream means frozen milk product obtained by freezing a pasteurised mix prepared from milk or other products derived from milk, or both, with or without the addition of nutritive sweeteners and

Value addition is the imperative alternative to improve the farmer's income and livelihood security. Incorporation of coconut products in ice cream and other frozen desserts is being practiced in countries like Thailand, Malaysia and Indonesia. In India, coconut pulp is added to ice cream to convert it into a premium product and sold as tender coconut ice cream by several brands.

Coconut milk based ice cream

This is another innovation mainly formulated in response to the demand by one of the coconut processing industries to target the common public. Here, the fat source is coconut milk. In the view of the cost of tender nut, skimmed milk powder was used as source for Solids Non Fat (SNF). Refined suagr was used as sweetner. The product is having a total fat content of 11%. The standardized formulation was commercialized to M/s. Dinesh foods, Kannur. For technology support for coconut based delicacies, entrepreneurs can contact ICAR- CPCRI.

other permitted non-dairy ingredients. The said product may contain incorporated air and shall be frozen hard, except in case of softy ice cream, where it can be frozen to a soft consistency. Frozen desserts or frozen confections mean the products obtained by freezing a pasteurised mix prepared with edible vegetable oils or fats or vegetable protein products, or both. It may also contain milk fat and other milk solids with the addition of nutritive sweeteners and other permitted non-dairy ingredients. Similar to ice cream, the said product may contain incorporated air and may be frozen hard or frozen to a soft consistency. The only difference between frozen dessert and ice cream is that frozen desserts use vegetable fat in place of milk fat. The constituents of an ice cream are milk fat, milk-solids -non fat, sugar, stabilizers, emulsifiers, flavor and colour. Milk fat enriches and mellows the ice cream, giving it a

Frozen coconut delicacy containing coconut sugar

full, rich, creamy flavour. The fat also contribute to the body and melting resistance of ice cream while producing a smooth texture. Cream or butter are the common sources. Solids non fat consists of proteins, milk sugars, and mineral matter. It mainly improves the body and texture. The sugar present in it adds to the sweet taste. The protein helps to make the ice cream more compact and smooth. Sugar is added to increase the acceptability of the product. It is the cheapest source of total solids in the mix. Stabilizers are added to prevent the formation of large ice crystals during storage. Emulsifiers provide uniform whipping quality to mix and also to produce ice cream with smoother body and texture. We have tried to substitute the major source of fat and solids non fat (SNF) in ice cream ie. cream and skimmed milk powder with coconut milk and tender coconut pulp respectively. The first step for making ice cream is the selection and preparation of ice cream mix. Knowledge of calculation of ice cream mix is helpful for properly balancing a mix, in establishing and maintaining a uniform quality and in making a product that conforms to legal standards. Before making the mix, proximate composition of the major ingredients should be estimated and accordingly ice cream mix can be made with the addition of water for making upto hundred percentage. Tender

coconut water obtained after the extraction of pulp was added in place of potable water used for dilution. Refined sugar was replaced with coconut sugar which is a good source of vitamins, amino acids, minerals besides calories. Dairy milk contains a fat percent of maximum 3-3.5 % and that of coconut milk is 27-33%. Ice cream should have a fat percent of 10-12%. The challenge is to decrease the coconut milk fat to 10-11% either by cream separation or by dilution. Efforts were made to optimize the level of ingredient and machine parameters for getting an acceptable product. The optimized product was named as 'Frozen Coconut delicacy'.

Frozen coconut delicacy

The delicacy envisaged has exclusive coconut products such as coconut milk and tender coconut (pulp and water), coconut sugar apart from other ingredients such as stabilizer and emulsifier. Suitable stabilizes and emulsifiers for coconut milk were standardized. Here the fat content of coconut milk is reduced to 11%. The methodology followed were mixing, pasteurization at 75°C for 15 min, two stage homogenization at 2000 psi/ 1000 psi, ageing for an hour at 4°C, and freezing using a continuous freezer (-5ºC) and hardening at -28°C. The technology was commercialized to M/s. Hangyo Ice creams Pvt. Ltd. The firm has branded it as 'Vegan Coconut Delicacy'. Cocoa flavoured delicacy was also made and named as 'Choconut'. It is a premium product and was launched by Shri. Radha Mohan Singh, the then Hon'ble Union Minister of Agriculture and Farmers' Welfare at New Delhi during the 90th ICAR foundation day celebration held on 16th July 2018. With the help of Coconut Development Board, Kochi an ice cream plant was established at ICAR-CPCRI, Kasaragod.

Cost economics of frozen coconut delicacy (100 Litre mix)	
Particulars	Economic analysis of Frozen coconut delicacy made of Coconut milk+ Coconut sugar+ tender coconut (Rs.)
Cost of Machinery	
(50 L capacity)	18,60,000
Working capital	76,36,000
Selling cost	150/ L
Unit cost of production	81.02258
Breakeven period	58.0683
Net profit %	46

Coconut Nursery Establishment Techniques

S.Rani[1] and C.Sudhalakshmi[1] and H.P. Maheshwarappa[2]

[1]Coconut Research Station, Aliyarnagar – 642 104 (Tamil Nadu)

[2]ICAR-CPCRI, Kasaragod – 671 124 (Kerala)

Coconut palm is one of the versatile tree crops providing nutritious food and refreshing drink, oil for edible and non-edible uses, fibre of commercial value, shell for fuel, thatch for roofing, timber and an array of products of domestic and industrial applications. Indonesia, Philippines and India are the major coconut growers among the 93 coconut growing countries across the globe. India produced 21,384 million nuts from an area of 2.1 million ha, with productivity of 9,815 nuts per hectare as per CDB statistics 2018-19. In a crop like coconut which exhibits considerable genetic variations and is capable of being propagated only through seeds, the selection and use of planting materials of higher

Flat beds of width 1.5 m

intrinsic value assumes considerable significance. The palm continues to yield for over 80 years and the full bearing capacity becomes known only 10 to 15 years after planting. If the original planting material happens to be of inferior in quality, the garden will prove to be highly uneconomical and a continuous source of loss to the grower. Since coconut culture involves substantial pre-bearing investment, greater emphasis must be given to the selection and use of the right type of planting material. Success of coconut plantation establishment starts with the production of good quality planting materials and hence paramount importance is attached to nursery preparation and management.

Site selection for a nursery

Nursery area should be flat with low gradient, well drained with friable, sandy loam / loamy texture to facilitate removal of seedlings from the nursery at the time of planting. In Laterite soils, sand has to be applied to the nursery beds. Shallow soils with underlying hard rock, heavy clay soils and waterlogged soils are to be avoided. The ideal soil pH for a nursery is 5.5 to 7.0 and the seedlings are tolerant to a pH range of 4.5 to 8.5. Coconut seedlings tolerate soil salinity and alkalinity under irrigated conditions.

Nursery Structures

Nursery can be raised in the interspaces of coconut plantations. If it is an open space, nursery area should be provided with 50-75 % shade using shade net. About 120m^2 area is required to sow 1000 nuts in flat or raised beds whereas larger area of 200 m^2 would be required to maintain 1000 poly bag coconut seedlings. Nursery should have good source of water and should be accessible for transportation. It should be isolated from the potential sources

Horizontally sown seed nuts

Vertically sown seed nuts

of insect pests and diseases, e.g., saw mills, pile of decaying logs, manure pit etc. Nursery should have a fence for security and a shed to house the implements.

Seed beds & Sowing

Seed beds should preferably be laid in the centre of the nursery. To facilitate sowing of nuts it should be cleared, ploughed and harrowed to a fine tilth. The elevation of the seed bed should be 10 - 20 cm with a width of 1.5 m and length of 2 m. Pathway of 0.75 – 1m should be provided between seed beds to facilitate inspection, selection, maintenance and seedling transfer activities. Flat beds can also be used for sowing seeds.

Seed nuts should be sown vertically for seedlings that warrant long distance transportation. Seed nuts can be sown through out the year under favorable climatic conditions and good irrigation facilities.

The seed beds should be drenched with Chlorpyriphos @ 0.05% before sowing of seed nuts in areas with termite problem. To prevent bud rot in seedlings, the nursery can be drenched with 1% Bordeaux mixture in bud rot endemic areas. Before planting, the seed nuts devoid of nut water and rotten kernels should be discarded. Seed nuts should be planted in beds at a spacing of 30 x 30 cm horizontally at 20 - 25 cm depth and covered with soil to about 2/3 of their size buried. If the seed nuts are sown vertically, there will be a mild set back in the early stages but at the later stages the seedling growth is faster. Seed nuts should be sown vertically for seedlings that warrant long distance transportation. Seed nuts can be sown through out the year under favorable climatic conditions and good irrigation facilities. A name board should be placed in front of each bed bearing the details of the name of the variety/type, date of sowing, number of nuts sown, seed bed number, date when nuts are harvested and date when nuts are received in the nursery.

Maintenance of seed beds

Need based irrigation, weeding, partial shading and regular monitoring is essential. Sprinkler/ Micro Jet Sprinkler/ Hose irrigation systems are well suited for coconut nurseries. The seed beds should be irrigated regularly (once in three days normally and in alternate days during summer months) to ensure that the soil is moist. About 10 mm of water should be applied for every irrigation.

Germination of seed nuts

Generally, germination is recorded till the 5th month of sowing and a good seed lot will have 80 - 90% germination. Those seedligs which germinate within five months after sowing are to be selected and others should be discarded. The seedlings which are deformed or with stunted growth should be eliminated. Chemical fertilizers need not be applied to the seedlings in the nursery since the seedlings are usually nourished by the endosperm.

Seedling production in poly bags

Poly bag nursery system can be adopted for producing more vigorous seedlings with better root system, to ensure better establishment and early bearing, for reduced transplanting shock,


Growth stages of seedlings


Well Established Nurseries

for easier weeding and watering. In order to produce poly bag seedlings, the seed nuts are laid vertically and set close to each other and allowed to germinate in a pre nursery bed till the sprouts are 8-10 cm long. Germinated seedlings are picked out from the nursery once 80% of the nuts have germinated or 5 months from sowing, whichever is earlier.

Germinated seed nuts are transplanted in biodegradable, black, UV resistant polybags of size 60 x 45 cm for bigger nuts and 45 x45 cm for smaller


Poly bag nursery

nuts. The bottom corners can be folded inward for firm standing of the bags. Poly bags of bigger nut size require 13 – 15 kg of potting mixture to fill two third of the bag. The bottom of the bag is provided with 8 – 10 holes for draining the excess water. The germinated nuts are placed in half filled poly bags with the sprout positioned upwards in the centre of the bag and sufficient potting mixture is added to fill the remaining portion and the sides are slightly pressed to keep the nut firm.

Poly bags are to be placed at a spacing of 2 feet. To minimize shading, polybag rows should be oriented in North – South direction. The earliest germinating seedlings are placed in the first row in the eastern side of the area and the last ones to germinate are placed in the western side to reduce competition from sunlight for the early germination of seedlings.

Selection of seedlings

Seed nuts, which do not germinate within 5 months of sowing as well as those with dead sprouts should be removed. Only 9 – 12 months old good quality seedlings should be selected based on early germination, rapid growth and seedling vigour. Ten to twelve month old seedlings should possess six to eight leaves and nine month old seedlings should have four leaves. Collar girth should be 10-12 cm. Early splitting of leaves is a good indicator of the rapid development and early bearing.

Conclusion

The demand of coconut seedlings from the farm-front far exceeds the production and hence there exists ample scope for establishing commercial coconut nurseries. Since quality seedling fetches premium price in the market, establishment of coconut nursery shall be a viable and profitable business venture and open the gate of self employment opportunities for rural youth. Rearing coconut seedlings in a well-maintained nursery facilitates efficient selection of normal uniform seedlings. High quality planting materials provide a good start to sustain the coconut palms productive and economic for long years in the field under extremely variable conditions. Selecting the best planting materials before planting assures higher productivity per unit area per unit time. ■

Potential of coconut oil in Domestic and International market

Jnanadevan R
Dy.Director (Retd.) Coconut Development Board,Kochi

Coconut oil (CNO), the prime commercial value added product from coconut is traded all over the country since time immemorial. Copra is a highly valued commodity in the world market for oilseeds, oils and fats. With an oil concentration of 65 to 70 percent copra is the richest source of fat. Copra is the dried meat (endosperm) with moisture content reduced to 5-6% from 50 to 55% in the wet meat. Coconut oil constitute less than 5% of total oils and fats entering in to the world market. It is a mixture of chemical compounds called glyceride containing fatty acids called glycerol. Coconut oil processing methods are classified in two major types, the dry and wet processing. The oil extraction technology which use copra as raw material is called dry processing while the method that uses fresh coconut is generally called wet processing for production of virgin coconut oil. The world production of copra in 2018-19 was 4.23 million tons, while that of coconut oil was 2.88 million tons accounting for nearly 43% of the nuts produced. It rank ninth position among nine major edible oilseeds produced in the world contributing 1.44% of total oil produced by these countries. Rest of the nuts was used for either fresh for culinary purpose, tender nut and other value added products. Percentage contribution of nine major oil seeds in the world is shown at table-1.

> **Coconut oil and Virgin coconut oil are gaining global importance as a contributing factor for health, nutrition and wellness of human being. Multiple medicinal and nutraceutical properties of CNO are being revealed day-by-day. This new development in health sector brought unprecedented increase in the demand of CNO.**

India is the largest producer of coconut which

Share of CNO in Global Vegetable Oil Production (Oct-Sept 2018/19)

Sl. No	Product	Quantity (in Million MT)	% share	Change over 10 years
1	Palm Oil	75.59	37.82	+67%
2	Soybean Oil	56.50	28.28	+56%
3	Rape Seed Oil	25.31	12.67	+17%
4	Sunflower Oil	20.01	10.01	+53%
5	Palm Kernel Oil	7.99	4.00	+52%
6	Cotton Seed Oil	4.68	2.34	No change
7	Groundnut oil	3.73	1.87	-10%
8	Olive Oil	3.13	1.57	+4%
9	Coconut oil	2.88	1.44	-12%
	World Total	199.82	100.00	+46%
Source: Oil world 2019				

sustains economic wellbeing of nearly 12 million families. Coconut was declared as oil seed of tree origin in the year 1990 by the Government of India to give emphasis on the importance of coconut as an oil seed for price support operations and a separate status was given to this crop and not included in the other oil seed group. Since then Government of India considers this crop for fixing minimum support price every year to protect the farmers from price fall.CNO especially VCO is gaining global importance as a contributing factor for health, nutrition and wellness of human being. Multiple medicinal and nutraceutical properties of CNO are being revealed day-by-day. This new development in health sector brought unprecedented increase in the demand of CNO

Competition from other oilseed crops

A comparison of world production of nine major oilseeds given in this paper vide table-1,clearly shows that the growth in production of coconut oil had been very weak, decreasing from 3.26 million tons in 2009-10 to 2.88 million tons in 2018-19.As against this production of other vegetable oil shows a tremendous increase during the same period. Palm oil production has increased from 45.27 million tons to 75.59 million tons registering 67% increase during 2018-19.While the production of soya bean oil increased from 36.11million tons to 56.50 million tones,rape seed oil increased from21.72 million tons to 25.31 million tones and sunflower oil increased from 13.04 million tons to 20.01 million tones. To sum up, while the world production of major vegetable oils increase from 46% in the last ten years, the corresponding increase during the same period in coconut oil was negative -12%. In palm oil and soya bean oil; it has recorded an increase of 67% and global market compared to other major oils coconut oil enjoys a greater consumer demand because of its unique characteristics. It maintained its demand in the domestic and international market both in the edible and non-edible sector unaffected and uninterrupted by other oils because of its uniqueness

Unique characteristics of coconut oil

Coconut oil has maximum digestibility coefficient(99.3) and it is more rapidly digested than any other fat including butter. It contains higher percentage of healthy fat, Medium Chain Saturated Fatty acids (MCSF) particularly lauric and myristic acids. Only two other vegetable oils. Viz. Palm kernel oil and Babassu oil have almost the same characteristics. Coconut oil has highest saponification value (253) which gives hardness and leathery property to soap. Coconut oil is classified under non-drying oil because of its lowest iodine value. Coconut oil has largest percentage of glycerol (13.84%) which is an important by product which is used in various industries especially in pharmaceuticals, food and oleo chemical industries. Unlike other edible oils, coconut oil can be used for cooking without refining. CNO obtained by direct processing of wet kernel (virgin coconut oil) and by crushing good quality copra in clean surroundings are used for cooking without refining. Coconut oil has highest smoking point ranging from 250 to 350 degree F and is good for high heat cooking compared to other oils. Shelf life of coconut oil is the highest because of the presence of anti-oxidants; VCO has a shelf life of one year. Another important advantage of coconut oil is that it is an important feed stock of oleo chemical industry. It is having a unique advantage of having

World Production of Coconut Oil production Vs Export-2018-19

Sl. No.	country	Production of CNO (in lakh MT)	Percentage share	Export of CNO (in MT)	Percentage share
1	Philippines	11.00 (75%)	38.17	9.54	48.97
2	Indonesia	7.50 (45%)	26.05	6.75	34.66
3	India	6.23 (30%)	21.60	0.07	0.36
5	Others	4.07 (6%)	14.13	3.12	16.01
	World	28.80 (43%)	100.00	19.48	100.00

Source: Oil world/ Coco info International 2019

fatty acids composition falling with the carbon chain spectrum highly desired by Oleo chemical industry.

World Production of coconut oil vs Export and Import

Coconut oil, the prime commercial product from coconut contributes nearly 2% of total supply of vegetable oil in the world. Philippines is the largest producer of coconut oil, which convert over 75% of coconut produced in the country in to 11.00 lakh tons of oil, while Indonesia uses 45% followed by India using 30% producing 7.5 tons and 6.23 tons of coconut oil respectively in 2018-19. Srilanka on the other hand converts only 9% for oil production, as over 70% of total production is used for household purposes. Coconut oil has substantial use in oleo chemical and cosmetic industries apart from its use as edible oil. Its uses as a diesel substitute and source of energy have been highlighted. It is evident from table - 1 that coconut oil production was decreased by 12% over the last 10 years. The world production in 2009-10 was 3.26 million tons which was decreased to 2.88 million tons in 2018-19.The global exports of coconut oil was 19.48 lakh tones in 2018- 19. Decrease in coconut production due to the cyclone to coconut plantations, prevalence of large number of senile and unproductive palms which are being replanted in a phased manner are the main reasons for the decrease in CNO production in the world. Philippines is the largest exporter of coconut oil with a share of 48.97 percent, followed by Indonesia (34.66 %).Though India is one of the major producers of coconut oil in the world, the country exports coconut oil in only small quantities recording a meager share of only 0.36% in 2018-19. Country wise production and export of CNO is given in table-2.

India's share of coconut oil export has declined significantly during 2017-18 and 2018-19 due to the very high domestic price of coconut oil and hence export has become noncompetitive. The domestic price of CNO in India went up by 2.5 to 3 times than that of international price. The international price of other major vegetable oils also ruled at a very low level during the same period. This has resulted in the decline of CNO export from India in 2017-18 and 2018-19. In such situations India should lay more emphasis on exports of high value products rather than on less competitive primary commodities so as to increase the value realization.

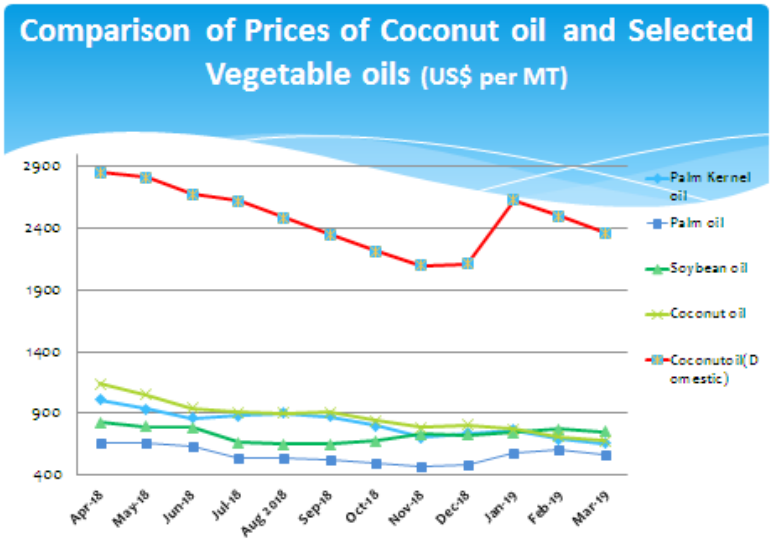
Malaysia is the largest importer of coconut oil with a share of 32 percent closely followed by USA (31 percent) and EU (10 percent). EU, USA and Malaysia accounted for about 73 percent of global imports of coconut oil. India does not import coconut and copra, though it imports small quantities of coconut oil. India was a net importer of coconut oil till 2009-10, but became a net exporter during 2010-11 to 2017-18 except in 2014-15. India's exports of coconut oil increased by about five times in 2016-17 (33,500 tones) over 2015-16, but declined significantly to seven thousand tons in 2018-19. Imports were also negligible in 2018-19.

Domestic and World Price of Coconut oil

The domestic and international prices of CNO and other major edible oils from April 2018 to March 2019 are given in table 3 and its trend presented in the graph. It is observed that domestic wholesale prices of coconut oil have been much higher than international prices. There has been a significant rise in domestic prices of copra and coconut oil from 2017 onwards. However, domestic prices were

Comparison of prices of Coconut oil & selected Veg. oils (US doll./MT)

	2018									2019		
Name of the oil	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar
Palm Kernel oil	1009	937	861	881	904	874	800	704	742	765	695	655
Palm oil	664	660	633	545	534	524	499	475	489	585	603	573
Soybean oil	827	793	786	665	654	651	681	734	726	748	773	750
Coconut oil	1138	1049	942	908	903	907	840	787	806	773	710	682
Coconut oil (Domestic)	2850	2808	2678	2620	2485	2346	2214	2100	2111	2627	2502	2363



Source: Oil world/ Coco info International 2019

lower than international prices during 2016 but thereafter it increased significantly. The 2018-19 domestic prices of CNO is significantly higher than the international price and it is almost 2.5 to 3 times higher than the international price and price of other major vegetable oils, palm kernel oil and soybean oil in the international market as shown in table 3

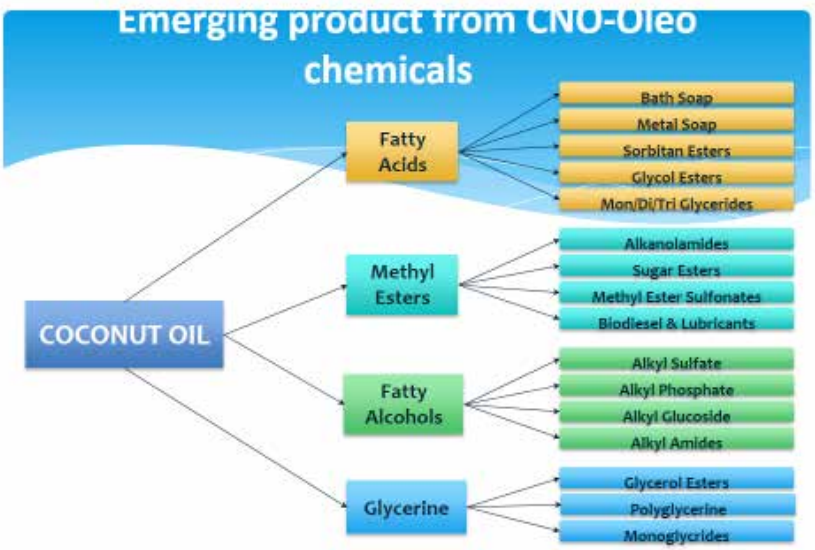
Scope and prospects of Value addition to CNO

Value addition reflects the difference between the price for which a firm sold its product and the cost involved in purchasing of input by them. Processing coconut is a means of value addition and increasing farm income. But the extent of value addition from processing coconut in to traditional products like copra and coconut oil is low due to high cost of production and less margin. Hence product diversification for high value added products is one of the approaches that could increase farm income. Though India is the largest coconut producing country in the world, utilization of coconut in to high value added products is low compared to other major coconut growing countries. Hence it was found difficult to survive the industry depending on copra and CNO alone because its share in the edible sector at international and national level is very low and also pose competition with other vegetable oils with less cost of production. Its price also depends on demand and supply of other edible oils with less cost of production. Hence copra-coconut oil centered industry has been diversified and tremendous progress is achieved in the field of product diversification and by-product utilization in the world.

Virgin coconut oil, the highest value addition from raw coconut

Virgin Coconut Oil (VCO) introduced in the world market in 2000-2001 gave new dimension to coconut production, ie produce coconut for health and beauty. It differs from normal CNO mainly in its physical form of source. it method extraction and its subsequent benefits. The VCO contains biologically active components reported to enhance health and wellness. Hence it has got popularity as a functional food .It is rich in fatty acids, includes minerals vitamins and antioxidants. It has a wider use in neutrceutical and cosmoceutical products. It is a fastest growing product in the niche market. Over the last ten years the export experienced a fast growth among value added products from coconut. Philippines is the largest producer and exporter of VCO. Tremendous growth of export of this product was reported in Philippines. Export reached over 42 export destinations: USA (59.7%), Netherlands

(10.1%), Canada (8.5%) and balance to Europe, China, Japan, Singapore, Australia and SE Asia. Prices range between US$6,000 and 8,000/MT FOB Manila. Compound Annual Growth Rate of global demand of VCO projected during 2019 to 2024 is 9.5% and VCO market projected to reach 5 billion US dollars by 2024 (Reseachnester.com 2019). In India also the demand for VCO for domestic as well as export is increasing due to the increased awareness on the health benefits of this product.



Source: ASEAN Oleo chemicals Manufacturers Group & Philippines Oleo chemicals Manufacturers Association

VCO is one of the high value products from coconut. Return from coconut can be increased many fold by establishing VCO processing units. Production of one kg of normal CNO requires 10 coconuts, where as for production of one kg VCO requires 17 coconuts. At the present retail price of coconut @ Rs.20/-per nut of inputs required for production of 1 kg of normal CNO is Rs.200/-and retail price of one 1 kg packed CNO is Rs.220/- to 230/-, the extent of value addition is 20 to 30%. The cost of input required for production of 1 kg VCO is Rs.340/-and the retail price of bottled 1 kg VCO is Rs.900/-to Rs.1000/-, the extent of value addition is 200%.Under these circumstances processing of coconut into VCO is much profitable than normal CNO. Hence more emphasis shoud be given to increase its production and marketing.

Coconut oil raw material for oleo chemicals for higher value addition

Oleo chemicals are basic chemicals derived from natural oils such as coconut oil and fats. Coconut oil is an important feed stock material to oleo chemical industry because of its unique fatty acid composition which falls under the carbon spectrum highly desired by the oleo chemical industry. Palm kernel oil only has the composition almost similar to CNO. The main products are fatty acids, methyl esters, fatty alcohols and glycerol used in a wide range of industries. The main utilization currently is in the production of detergents, soap and cosmetics.

Use of coconut oil in oleo chemical industry is not new. Malaysia and Philippines had already started this business. Oleo chemicals produced from CNO is called coco chemicals. In view of major threats being posed by other vegetable oils it would be appropriate to seriously consider dependence on CNO as edible oil. Major CNO producing countries are less dependent on it as edible oil and is using it more in industrial sectors. Coconut oil is one of the most important raw materials for oleo chemical Industry in Philippines. There is huge demand for oleo chemical products in the domestic and international market. Basic oleo chemicals are further processed to produce oleo chemical derivatives. Fatty acids are one of the basic oleo chemicals present in coconut oil which is used as starting material for wide variety of oleo chemical products. The price of key oleo chemicals such as fatty acids and fatty alcohols is twice the price of inputs such as crude coconut oil and palm kernel oil. When the price of coconut oil in the international markets is 1159 US dollars the price of oleo chemical (fatty acids) is 2286 US dollars. One unit of coconut oil gives out 0.93 units of various coco chemicals and resultant products sell at a much higher price. Estimates have shown that an addition of 1200 dollars per ton of CNO exported can be earned with this value addition. This value addition is presently generated by the importing countries. The main constraints now faced by the oleo chemical industry is instability in supply of raw material and availability of competitively priced CNO.

The Way Forward

Considering the increasing demand of Virgin Coconut oil in domestic and international market, more emphasis should be given to increase coconut oil production especially VCO. In view of the

increasing demand for organic VCO in the export market, promotion of organic certification of coconut garden for production of organic coconut need to be promoted. VCO and CNO are exported with same HS code. A separate HS code is needed to analyse its potential. Hence it is suggested that separate HS code for VCO need to be provided. The reward rate extended under MEIS may be provided to VCO and CNO for promoting its export by government.

To counter the false propaganda need to be conducted to prove the goodness of coconut oil with international collaboration for promoting as edible oil. Impress upon international bodies like WHO,FAO and UNDP to recognize the health importance of CNO

There is an immediate need for major efforts to improve production and productivity of coconut. To ensure reliability and availability of CNO supply for both edible and non edible market, development agencies should pursue programmes to increase production and productivity.

The major threat being faced by other vegetable oils calls for intensified efforts towards diversification for different high value added products including oleo chemicals especially lauric acid because of increased demand of laurate in the international market.

Policy support and public investment is needed by Governments to foster inclusive growth and sustainable development of the coconut oil industry. Production of copra and CNO in more coconut growing states need to be promoted to meet the increasing demand. Assistance extended to other oilseeds under NMOOP may be extended to coconut also in addition to the support extended under MIDH. Modernization and automation of processing units to increase productivity and to reduce cost of production is also required. ■

Paper Presented in the National Seminar on Technological Innovations in Oilseed Crops for Enhanced Productivity, Profitability and Nutritional Security held at Hyderabad, February 2020

Cabinet approves Minimum Support Price for Copra for 2020 season

The Cabinet Committee on Economic Affairs, chaired by Prime Minister Shri Narendra Modi, has given its approval for the Minimum Support Prices (MSPs) for copra for 2020 season.

The MSP for Fair Average Quality (FAQ) of milling copra has been increased to Rs. 9,960/- per quintal for 2020 season from Rs. 9,521/- per quintal in 2019 and the MSP for ball copra has been increased to Rs. 10,300/- per quintal for 2020 season from Rs. 9,920/- per quintal in 2019. This will accrue a benefit of Rs 439/- per quintal in the milling copra and Rs 380/- increase in the Ball Copra. This is to ensure a return of 50 percent for milling copra and 55 percent for ball copra over the all India weighted average cost of production. The approval is based on recommendations of the Commission for Agricultural Costs and Prices (CACP).

The increase in MSP for copra for 2020 season is in line with the principle of fixing the MSP at a level of at least 1.5 times the all India weighted average cost of production which was announced by the Government in the Budget 2018-19. It assures a minimum of 50 percent as margin of profit as one of the important and progressive steps towards making possible doubling of farmers' incomes by 2022.

The National Agricultural Cooperative Marketing Federation of India Limited (NAFED) and National Cooperative Consumer Federation of India Limited (NCCF) will continue to act as Central Nodal Agencies to undertake price support operations at the MSP in the coconut growing states. Last year when there was crash in prices in Tamil Nadu, the timely intervention by Govt of India through purchase at MSP, this pushed the market sentiment upward benefitting the copra farmers. India is number one in production and productivity of Copra in the World.

The Potential of Coconut Oil and its Derivatives as Effective and Safe Antiviral Agents Against the Novel Coronavirus (nCoV-2019)

Fabian M. Dayrit, Ph.D.
Ateneo de Manila University, Philippines, National Academy of Science & Technology Philippines
Mary T. Newport, M.D., Spring Hill Neonatology, Inc. Florida, USA

As we write this, the World Health Organization has declared a global emergency over the novel coronavirus, nCoV-2019, that has spread beyond China. There is still no cure for nCoV-2019. nCoV-2019 has been shown to be related to SARS (Zhou *et al*., 2020), a coronavirus which caused an outbreak in 2003. Several researchers have been designing drugs to specifically target protease enzymes in coronavirus, but testing for these drugs is many months away. What if there is a treatment candidate against the coronavirus that might already be available and whose safety is already established? Lauric acid (C12) and monolaurin, its derivative, have been known for many years to have significant antiviral activity. Lauric acid is a medium-chain fatty acid which makes up about 50% of coconut oil; monolaurin is a metabolite that is naturally produced by the body's own enzymes upon ingestion of coconut oil and is also available in pure form as a supplement. Sodium lauryl sulfate, a common surfactant that is made from lauric acid, has been shown to have potent antiviral properties. Lauric acid, monolaurin, and sodium lauryl sulfate (which is also known as sodium dodecyl sulfate) are used in a wide range of products for their antiviral properties.

Mechanisms of action

Three mechanisms have been proposed to explain the antiviral activity of lauric acid and monolaurin: first, they cause disintegration of the virus envelope; second, they can inhibit late maturation stage in the virus replicative cycle; and third, they can prevent the binding of viral proteins to the host cell membrane.

1. Disintegration of the virus membrane. The antiviral activities of lauric acid and monolaurin were first noted by Sands and co-workers (1979) and later by Hierholzer & Kabara (1982). In particular, Hierholzer & Kabara showed that monolaurin was able to reduce infectivity of 14 human RNA and DNA enveloped viruses in cell culture by >99.9%, and that monolaurin acted by disintegrating the virus envelope. Thormar and co-workers (1987) confirmed the ability of lauric acid and monolaurin to inactivate viruses by disintegration of the cell membrane. Sodium lauryl sulfate has been shown to be able to solubilize and denature the viral envelope (Piret 2000, 2002).

2. Inhibits virus maturation. The Junin virus (JUNV) is the causative agent of Argentine hemorrhagic fever. In a comparison among the saturated fatty acids from C10 to C18 against JUNV infection, Bartolotta and co-workers (2001) showed that lauric acid was the most active inhibitor. From mechanistic studies, it was concluded that lauric acid inhibited a late 2 maturation stage in the replicative cycle of JUNV. From transmission electron microscope images, JUNV is an enveloped virus featuring glycoproteins that are embedded in the lipid bilayer forming viral spikes (Grant *et al.*, 2012); this is similar to nCoV-2019.

3. Prevents binding of viral proteins to the host cell membrane. Hornung and co-workers (1994) showed that in the presence of lauric acid, the production of infectious vesicular stomatitis virus was inhibited in a dose-dependent and reversible manner: after removal of lauric acid, the antiviral effect disappeared. They observed that lauric acid did not influence viral membrane (M) protein synthesis, but prevented the binding of viral M proteins to the host cell membrane.

Although lauric acid accounts for much of the reported antiviral activity of coconut oil, capric acid

(C10) and monocaprin have also shown promising activity against other viruses, such as HIV-1

(Kristmundsdóttir *et al.,* 1999). Capric acid accounts for about 7% of coconut oil. Thus, at least two fatty acids in coconut oil, and their monoglycerides, have antiviral properties. Hilarsson and co-workers (2007) tested virucidal activities of fatty acids, monoglycerides and fatty alcohols against respiratory syncytial virus (RSV) and human parainfluenza virus type 2 (HPIV2) at different concentrations, times and pH levels. They reported

the most active compound tested was monocaprin (C10), which also showed activity against influenza A virus and significant virucidal activities even at a concentration as low as 0.06-0.12%. Use of coconut oil and C12 derivatives in animals and humans

Coconut oil and its derivatives have been shown to be safe and effective antiviral compounds in both humans and animals. Because of the antiviral and antibacterial protection that it provides to animals, coconut oil, as well as lauric acid and monolaurin, is used in farm animals and pets as veterinary feed supplements in chicken, swine and dogs (Baltic et al., 2017). Monolaurin has been shown to effectively protect chicken against avian influenza virus (van der Sluis, 2015). Li and coworkers (2009) prepared a gel containing monolaurin and is found to be highly active against repeated high viral loads of Simean immunodeficiency virus in macaques and Kirtane and coworkers (2017) developed a 35% gel of monolaurin for application in the female genital tract to protect against HIV. Sodium lauryl sulfate (SLS) has been used at low concentrations to inactivate viruses in milk of farm animals (de Sousa et al., 2019). SLS is the active constituent in commercial disinfecting wipes and standard laboratory disinfectants, and is an emulsifying agent and penetration enhancer in pharmaceutical preparations.

Coconut oil itself has been shown to have anti-HIV properties in small clinical studies. The first clinical trial using coconut oil (45 mL daily) and monolaurin (95% purity, 800 mg daily) against HIV-AIDS was conducted in the Philippines. This study involved 15 HIV patients, aged 22 to 38 years, 5 males and 10 females, for 6 months. There was only one fatality and 11 of the patients showed higher CD4 and CD8 counts after 6 months (*Dayrit, 2000*).

In another study, 40 HIV subjects with CD4+ T lymphocyte counts less than 200 cells/microliter were divided into a virgin coconut oil (VCO) group (45 mL daily) and control group (no VCO). After 6 weeks, the VCO group showed significantly higher average CD4+ T lymphocyte counts versus control (Widhiarta, 2016).

Conclusion

Several in vitro, animal, and human studies support the potential of coconut oil, lauric acid and its derivatives as effective and safe agents against a virus like nCoV-2019. Mechanistic studies on other viruses show that at least three mechanisms may be operating. Given the considerable scientific evidence for the antiviral activity of coconut oil, lauric acid and its derivatives and their general safety, and the absence of a cure for nCoV-2019, we urge that clinical studies be conducted among patients who have been infected with nCoV-2019 (see below). This treatment is affordable and virtually risk-free, and the potential benefits are enormous. On the other hand, given the safety and broad availability of virgin coconut oil (VCO), we recommend that VCO be considered as a general prophylactic against viral and microbial infection.

A proposed clinical study

We can propose that a clinical study be conducted on patients infected with nCoV-2019 accordingly:

- Group 1: Control group, standard care
- Group 2: standard care + VCO (45 mL, approx. 3 three tablespoons, daily or higher,)
- Group 3: standard care + Monolaurin (95% purity, 800 mg daily). Monolaurin is recognized as GRAS by US FDA.
- Group 4: standard care + Monocaprin (95% purity, 800 mg daily). Monocaprin is recognized as GRAS by US FDA.
- Group 5: standard care + SLS (pharmaceutical grade, 100 mg/kg/day). SLS toxicity: lowest NOAEL (repeated dose, rat): 100 mg/kg/day (hepatotoxicity) (Bondi *et al.,* 2015). ■

References: Baltić B, Starčević M, Đorđević J, Mrdović B, Marković R. Importance of medium chain fatty acids in animal nutrition. IOP Conf. Series: Earth and Environmental Science 2017; 85: 012048. • Bartolotta S, Garcí CC, Candurra NA, Damonte EB. Effect of fatty acids on arenavirus replication: inhibition of virus production by lauric acid. Archives of Virology, 2001; 146(4): 777-790. • Bondi CAM, Marks JL, Wroblewski LB, et al. Human and Environmental Toxicity of Sodium Lauryl Sulfate (SLS): Evidence for Safe Use in Household Cleaning Products. Environmental Health Insights 2015:9 27–32 • Dayrit CS. Coconut Oil in Health and Disease: Its and Monolaurin's Potential as Cure for FOR HIV/AIDS. XXXVIICocotech Meeting. Chennai, India. July 25, 2000. • De Sousa ALM, Pinheiro RR, Araújo JF, et al. Sodium dodecyl sulfate as a viral inactivator and future perspectives in the control of small ruminant lentiviruses. Arquivos do Instituto Biológico, 2019; 86. Epub Nov 28, 2019. • Grant A, Seregin A, Huang C, Kolokoltsova O, Brasier A, Peters C, Paessler S. Junín Virus Pathogenesis and Virus Replication. Viruses, 2012; 4: 2317-2339. • Hierholzer JC, Kabara JJ. In-vitro effects of monolaurin compounds on enveloped RNA and DNA viruses. Journal of Food Safety, 1982; 4(1): 1-12 • Hilmarsson H, Traustason BS,

Kristmundsdóttir T, Thormar H. Virucidal activities of medium- and long-chain fatty alcohols and lipids against respiratory syncytial virus and parainfluenza virus type 2: comparison at different pH levels. Archives of Virology 2007: 152(12):2225-36. • Hornung B, Amtmann E, Sauer G. Lauric acid inhibits the maturation of vesicular stomatitis virus. Journal of General Virology, 1994; 75: 353-361. • 4 Kirtane AR, Rothenberger MK, Frieberg A, et al. Evaluation of vaginal drug levels and safety of a locally administered glycerol monolaurate cream in Rhesus macaques. Journal of Pharmaceutical Science 2017; 106(7):1821-1827. • Kristmundsdóttir T, Arnadóttir SG, Bergsson G, Thormar H. Development and evaluation of microbicidal hydrogelcontaining monoglyceride as the active ingredient. Journal of Pharmaceutical Science, 1999; 88(10): 1011-1015. Li Q, Estes JD, Schlievert PM, et al. Glycerol monolaurate prevents mucosal SIV transmission. Nature 2009; 458(7241): 1034–1038. • Piret J, Déseomeaux A, Bergeron MG, et al. Sodium lauryl sulfate, a microbicide effective against enveloped and nonenveloped viruses. Current Drug Targets 2002; 3(1):17-30. Piret J, Lamontagne J, Bestman-Smith J, et al. In Vitro and In Vivo Evaluations of Sodium Lauryl Sulfate and Dextran Sulfate as Microbicides against Herpes Simplex and Human Immunodeficiency Viruses. Journal of Clinical Microbiology 2000;110-119. Sands JA, Landin P, Auperin D, Reinhardt A. Enveloped Virus Inactivation by Fatty Acid Derivatives. Antimicrobial Agents and Chemotherapy, 1979; 15(1): 27-31.= • Thormar H, Isaacs CE, Brown HR, Barshatzky MR, Pessolano T. Inactivation of Enveloped Viruses and Killing of Cells by Fatty Acids and Monoglycerides. Antimicrobial Agents and Chemotherapy, 1987; 31(1): 27-31. van der Sluis W. Potential antiviral properties of alpha-monolaurin. Poultry World. Downloaded from: https://www.poultryworld.net/Nutrition/Articles/2015/12/Potential-antiviral-properties-of-alpha-monolaurin2709142W. Widhiarta KD. Virgin Coconut Oil for HIV - Positive People. Cord, 2016; 32 (1): 50-57. • Zhou P, Yang X-L, Wang X-G, et al. Discovery of a novel coronavirus associated with the recent pneumonia outbreak in 2 humans and its potential bat origin. bioRxiv preprint first posted online Jan. 23, 2020; doi: http://dx.doi.org/10.1101/2020.01.22.914952.

Scientists study efficacy of coconut oil in COVID-19 treatment

Dhel Nazario

A study on whether certain coconut oil components can diminish or prevent the infectivity of SARS-CoV-2, the causative virus of coronavirus disease (COVID-19), is now underway as well as another project that that will aid in the monitoring and management of the infection.

In partnership with the Ateneo De Manila University (ADMU) and the Duke-National University of Singapore (Duke-NUS), the project will focus first on the determination of the anti-viral properties of the compounds and the results will be used for further studies.

The Department of Science and Technology – Philippine Council for Health Research and Development (DOST-PCHRD) supports this as well as other research and development of technologies and projects, after recognizing the risks posed by COVID-19 towards public health.

Faster application

In partnership with the Department of Health (DOH) and DOST-PCHRD, ADMU developed the Feasibility Analysis of Syndromic Surveillance Using Spatio-Temporal Epidemiological Modeler (FASSSTER) for Early Detection of Diseases application for visualizing the spread of diseases, using data from the Philippine Integrated Disease Surveillance and Response (PIDSR) system, Electronic Medical Records, and SMS-based reports of primary care facilities.

At present, it is used to create predictive models and visualize possible scenarios of outbreaks of dengue fever, typhoid fever, and measles at specified time periods. The research team will enhance the system for use in COVID-19 surveillance and response, as it will help support the planning and decision-making of the Department of Health (DOH), local government units, and healthcare facilities.

Transmission pattern

Meanwhile, the Research Institute for Tropical Medicine (RITM) will be conducting a study that aims to determine the transmission patterns of COVID-19 to help prevent its further spread and support the DOH in crafting policies for the containment and prevention of COVID-19.

Source :Manila Bulletin, Published on March 17, 2020

Strategies for Management of Whitefly in Coconut

Coconut Development Board organised a one day workshop on 'Strategies for management of whitefly in coconut' on 10th March 2020 at Kozhikode, Kerala. The session was attended by Shri. Saradindu Das, Chief Coconut Development Officer, CDB, Kochi, Smt. Bindu. R, Principal Agriculture Officer, Kozhikode, Deputy Directors and Agriculture Officers of State Agriculture Department from Kozhikode, Kannur, Kasargod, Malappuram and Wayanau districts in Kerala, CDB officials, farmer representatives from affected districts and representatives of CPCs in Kerala.

Shri. Saradindu Das, Chief Coconut Development Officer, CDB, Kochi in his introductory remarks pointed out that the main purpose of this workshop is to assess the extent of damage and percentage of loss caused due to white fly in coconut. He added that Department should take up a roving survey in all affected districts so that CDB can take up the matter to Govt. of India for support and to formulate suitable management programmes in farmers fields. He informed that CDB is taking initiatives throughout India for creating awareness among the farmers and for managing the whitefly in Coconut.

Smt. Bindu R, Principal Agriculture Officer, Kozhikode detailed the introduction of the white fly in Coconut in Kerala and informed that the management of this invasive pest could not be achieved even though the pest is prevalent for the last two years.

Smt. Deepthi Nair, Deputy Director, Coconut Development Board, Kochi in her welcome address pointed out that this workshop is being organised by Coconut Development Board to create an awareness among the practicing farmers on integrated management of the pest as well as to update with the strategies and protocol formulated for integrated management of the whitefly by the research institutions to the Agriculture Department officials working on coconut.

The inaugural session was followed by a technical session wherein Dr. Joseph Rajkumar, Principal Scientist, CPCRI, Kayankulam explained the management startegies to be adopted for RSW management and Dr. Madhu Subramanian, Professor AICRP on BCCP, Kerala Agricultural University, Vellanikkara handled a session on pest surveillance. In the discussion forum, Agriculture Officers and farmers raised their apprehensions and queries regarding whitefly management and the scientists explained the same.

Shri. Saradindu Das Chief Coconut Development Officer, Coconut Development Board, Kochi detailed in his special address about the different view of this work shop and also stressed that control of spiralling white fly is only possible through community based approaches and hence strategies for same to be formulated. Since the pest is prevalent for the two years, management of this invasive pest is not achieved so far. He also requested CDB to support the farmers with some schemes for controlling the existing situation.

It was also suggested to researchers and university officials to develop climate resilient varieties for having tolerance to upcoming new pest and diseases in climate changing scenario. He also added that we should develop methodologies for climate forecasting and respective consequences and their precautions/ control measures need to be informed to farmers through text messages. Further he also pointed out the need for crop diversification as an essential tool for sustainable yields or income to the farming community. ■

PANACEA-2020

With an objective of creating awareness among people on various natural coconut products and byproducts for day to day use and to introduce distributers and entrepreneurs of coconut products and to highlight Board's activities at large, Coconut Development Board participated in PANCEA 2020 from 5th to 7th March-2020 at World Trade Centre Mumbai. The fair was organized by Scishido Communication, Mumbai. M/s. Keratech (P) Ltd. Thrissur, Kerala, manufacturer of Virgin Coconut Oil, Desiccated Coconut Powder, Virgin plus tablets and Coconut Cream, M/s. Kokoco Innovative Beverages Private Limited, Pune, manufacturer of minimally processed coconut and Tender coconut ice cream, and M/s.Madura Agro Process Pvt.Ltd. Coimbatore, Tamil Nadu, manufacturer of Coconut Water, Coconut Sugar, Coconut Chips etc. displayed their products in the Board's Stall. Coconut Development Board displayed various value added coconut products, informative charts, posters and Board's publications.

More than 5000 visitors including distributors, exporters, entrepreneurs, farmers, VIPs, officials of various government Departments, NGOs, business communities including foreigners from various countries attended the expo.

District Level Workshop

With a view to expand further area under coconut cultivation in nontraditional areas, a district level workshop on coconut product technologies was organized at Ahmednagar to communicate information on scientific coconut cultivation technology and value added products to the farmers to enhance their economic returns and for better growth of coconut sector. The workshop was jointly organized by Coconut Development Board, State Centre, Thane and District Superintendent Agriculture Office, Department of Agriculture, Govt. of Maharashtra on 25th February 2020. Around 112 farmers including officials from Department of Agriculture, Govt. of Maharashstra attended the programme.

Field Demonstration on Biological Control of Coconut Leaf Eating Caterpillar

Recently coconut gardens in the coastal areas of Mogral-Puthur gramapanchayat and nearby areas of Kasaragod district in Kerala are affected by Leaf eating caterpillar, an insect pest, damaging the coconut palms. A field demonstration of release of parasitoids as part of biological control of coconut leaf eating caterpillar was organised by ICAR-Central Plantation Crops Research Institute in collaboration with Department of Agriculture on 12th March 2020 at Chowki near Kasaragod.

The caterpillars live on the under surface of leaflets inside silken galleries and feed voraciously on the chlorophyll containing functional tissues. This adversely affects the health of the palm by reducing the photosynthetic area and results in yield reduction. In severe outbreaks of leaf eating caterpillar, the older leaves of the palms are reduced

to dead brown tissue and only three or four younger leaves at the center of the crown remain green.

Cutting and burning the heavily infested and dried 2 - 3 leaves helps to prevent the spread of the pest. Biological control is a feasible and viable approach against this pest. Augmentative release of stage specific parasitoids is effective in the sustainable management of the pest.

Arrangements have been made by the Parasite Breeding Station under the Department of Agriculture for the release of bio-control agents in the affected coconut gardens.

Mr. A. A. Jaleel, President, Mogral – Puthur gramapanchayat, Dr. Anitha Karun, Director CPCRI, Mrs. Sajanimol. K, Principal Agricultural officer, Kasaragod, Mr. Narasmhalu, Agricultural officer, Dr. Vinayaka Hegde, Dr. K. Muralidharan, Dr. Thamban C, and Dr. P.S. Prathibha, scientists of CPCRI participated in the programme.

State Level Farmer's Fair

ICAR-ATARI Zone VI, Guwahati organised a State Level Farmers' Fair on Farmers' Prosperity through Doubling Farmers Income on 26th and 27th February at HRS campus, AAU, Kahikuchi, Guwahati. Coconut Development Board Regional Office, Guwahati participated in the event. Around 1000 farmers from different districts of Assam participated in the programme. Coconut Development Board displayed coconut convenience foods, value added products from coconut kernel, coconut shell & coconut water, coconut shell/wood based handicrafts and leaflets, coconut journal and posters on the nutritional and health benefits of coconut and its products. Shri Atul Bora, Hon'ble Minister for Agriculture and Veterinary, Government of Assam, and Member of Parliament from Assam, Smt. Queen Oja visited Coconut Development Board stall. Queries from many farmers on food training workshops conducted at CDB Regional Office and the various schemes on coconut plantation were cleared by Board's officials.

Retirement

Shri. Lunghar Obed, Director retired from the services of Coconut Development Board from Regional Office, Guwahati on 29th February 2020 on superannuation after serving the Board for 25 years.

Shri. Jamun Prasad Sah retired from the services of Coconut Development Board on 31st December 2019 on superannuation. He has served the Board for 34 years.

Smt. K K Vasanthakumari retired from the services of Coconut Development Board on 29th February 2020 on superannuation. She has served the Board for 31 years.

Shri. P P Budhanathan retired from the services of Coconut Development Board on 29th February 2020 on superannuation. He has served the Board for 26 years.

Shri. H.B. Sadashivappa retired from the services of Coconut Development Board on 29th February 2020 on superannuation. He has served the Board for 29 years.

Shri. P Jayakumar retired from the services of Coconut Development Board on 31st March 2020 on superannuation. He has served the Board for 26 years.

Shri. P Chandrasekharan retired from the services of Coconut Development Board on 30th April 2020 on superannuation. He has served the Board for 38 years.

Shri. M. Kempe Gowda retired from the services of Coconut Development Board on 30th April 2020 on superannuation. He has served the Board for 30 years.

Smt. Sobha V, Accounts Officer retired from the services of Coconut Development Board on 31st May 2020 on superannuation. She has served the Board for 38 years.

Shri. B.N. Keshava Murthy retired from the services of Coconut Development Board on 31st May 2020 on superannuation. He has served the Board for 32 years.

'Friends of Coconut Tree' training programmes for jail inmates

ICAR-CPCRI, Regional Station, Kayamkulam conducted a six days 'Friends of Coconut Tree' training programme on 'Scientific management of coconut including harvesting coconut using climbing devise' for the inmates of Open Prison, Nettukaltheri, Thiruvananthapuram during 24th - 29th February, 2020.

The programme was funded by Coconut Development Board, Govt. of India. The training included sessions on Coconut varieties and hybridization techniques in coconut, Coconut cultivation practices and cropping systems, Coconut pest and disease management, Value added products from coconut, Coconut based integrated farming systems, Nutrient management and organic recycling in coconut gardens, Mother palm selection and nursery management in coconut, Positive thinking, leadership qualities, time management and decision making, Physical fitness, first aid and safety mechanisms, Banking, thrift and savings management Technical sessions were handled by experts from ICAR-CPCRI, KVK- Thiruvananthapuram and Kerala Agricultural University. The session on Positive thinking was handled by Dr.R.Prakash, Renowned Motivational Trainer (Rtd. Professor, Kerala Agricultural University). The session on physical fitness, first aid and safety mechanisms was handled by Dr.C.S.Pradeepkumar, Lecturer, G.V. Raja Sports School, Kannur.

The participants were trained in coconut climbing using machine and a climbing Olympics was conducted on the last day of the programme and the winners were given prizes during the valedictory session.

The valedictory function was held on 29th February 2020 at the Central Hall of Open Prison, Nettukaltheri. Sri. Rishiraj Singh, IPS (Director General of Prison & Correctional Services) was the chief guest. Sri. Ajith Singh W.S., Agricultural Officer offered the welcome address. Dr. Regi J. Thomas,Principal Scientist and Course Director explained about the project implemented at Open Prison, Nettukaltheri. Dr. S. Kalavathi, Head, ICAR-CPCRI, Regional Station, Kayamkulam offered felicitations and highlighted the effort of CDB in providing FoCT training all over India. Mrs. Chitra, Programme Coordinator i/c, KVK, Thiruvanathapuram also offered felicitations.

Sri. Rishiraj Singh, IPS complimented the efforts of ICAR-CPCRI in providing skill oriented training to inmates of Open Prison, Nettukaltheri which can be utilized for enhancing the income from Open Prison . He urged the inmates to fully utilize the skills learned from the training programme for earning livelihood after their release. Dr.K.M.Anes, Scientist acted as the course coordinator for the FoCT training.

Cultivation practices for coconut-June

Sowing of seednuts in nursery

Well-drained, coarse-textured soil near dependable irrigation water source should be selected for raising the nursery. The seed nuts can be sown in flat beds if there is no drainage problem. The seeds are to be sown in raised beds, if water stagnation is a problem. Nursery can be raised either in the open with artificial shade or in gardens where the palms are tall and the ground is not completely shaded. The seed nuts should be sown in long and narrow beds at a spacing of 40 cm x 30 cm either vertically or horizontally in 20-25 cm deep trenches. Advantage of vertical planting cause less damage during transit of seedling. However, in delayed planting, when the nut water goes down considerably, adopt horizontal sowing. It is better to go for horizontal sowing of seed nuts for better germination.

Seedling selection for planting

Only good quality seedlings are to be selected from the nursery for field planting. In tall varieties, vigorous seedlings which are one year old, more than 100 cm in height with 5-6 leaves and girth of 10 cm at the collar should be selected for planting. In dwarf varieties, the girth and height of good quality seedlings should be more than 8 cm and 80 cm, respectively. Early splitting of leaves is another character preferred for selecting good seedlings. Generally, one year old seedlings are preferable for planting. However, for planting in water-logged areas, 1½ to 2 years old seedlings are to be preferred.

Seedlings raised in poly bags perform better. The advantage of polybag seedlings is that, there is no transplanting shock since the entire ball of earth with the root system can be placed in the pits and the seedlings establish early and more vigorously. But the disadvantages include difficulty for transportation and higher cost of seedling production.

Planting

In well drained soils, seedlings can be transplanted with the onset of south-west monsoon during June. A spacing of 7.5 m x 7.5 m to 8.0 m x 8.0 m in the square system is generally recommended for coconut. This will accommodate 177 and 156 palms per ha, respectively. If the triangular system is adopted, an additional 25 palms can be planted. Hedge system can also be adopted giving a spacing of 6.5 m along the rows and 9.5 m between rows. For facilitating multiple cropping in coconut gardens, it is advisable to go for wider spacing of 10 m x 10 m so as to provide ample opportunity to accommodate a number of perennial and annual crops in the interspaces.

The depth of planting pits will depend upon the type of soil. In laterite soil with rocky substratum, deeper and wider pits, 1.5 m length x 1.5 m breadth x 1.2 m depth may be dug and filled up with loose soil, powdered cow dung and ash up to a depth of 60 cm before planting. In case of laterite soil, application of 2 kg of common salt will help in loosening the soil. In loamy soils with low water table, planting in pits of 1 m x 1 m x 1 m filled with top soil to height of 50 cm is generally recommended. The coconut seedlings are planted in the centre of the pit by making small hole within the pits and the soil around the seedlings must be firmly pressed, but soil should not be allowed

to bury the collar region of the seedling or enter into the leaf axils. However, when the water table is high, planting at the surface or even on mounds may be necessary. While planting on the surface or mounds also, digging pits and soil filling has to be done. While filling the pits with soil, it is advisable to use top soil. Two layers of coconut husk (with concave surface facing up) can be arranged at the bottom of the pit before filling up. This will help in conserving the moisture. The seedlings, after field planting, are to be protected from heavy wind by staking and from sunlight by proper shading using plaited coconut leaves or palmyrah leaves or any other suitable shading materials. If there is no rain after planting, seedlings are to be adequately irrigated.

Further, if continuous heavy rain occurs after planting, care should be taken to avoid water stagnation in the pit by providing drainage. Bund should be made around the planting pit using bottom soil to avoid run-off water entering the pit.

Application of fertilizers

Under rainfed conditions one third of the recommended dose of chemical fertilizers can be applied to the coconut palms with the onset of south west monsoon. Application of 500 g N, 320 g P2O5 and 1200 g K2O per palm per year is generally recommended for adult plantations. To supply one-third of the above nutrients it is necessary to apply about 0.36 kg urea, 0.5 kg rock phosphate (in acidic soil) or 0.7 kg Super Phosphate (in other soils) and 0.7 kg of Muriate of potash (MOP). The recommended dose of fertilizers may be spread around the palms within the radius of 1.8 m and forked in. It is always advisable to test soil in the coconut garden periodically (once in 3 years) based on the results of which, type and dosage of chemical fertilizers can be decided. Skipping of phosphatic fertilizer application is recommended if the available soil phosphorus is above 20 ppm.

If the coconut palms are maintained under irrigation, one fourth of the recommended dose of chemical fertilizers should be applied to the coconut palms during June.

It is always advisable to analyse the soil and leaf once in three years and based on the results, fertilizer application should be done.

Application of soil amendments

If application of soil amendments has not been done during May because of non-receipt of summer showers 1 kg of dolomite or 1 kg of lime may be applied per palm during June at least 15 days prior to the application of chemical fertilizers.

Application of biofertilizers

Biofertilizer application should coincide with the onset of monsoon, especially when the palms are maintained under rainfed condition. Formulations containing *Azospirillum spp*. and Phosphate solubilising bacteria prepared in carriers such as talc or vermicompost each are to be applied @100 g per palm.

'Kera Probio' (a talc formulation of *Bacillus megaterium,* a phosphate solubilising bacteria) can be applied to coconut seedlings @ 25 g per seedling mixed with vermicompost or farm yard manure while planting. Similarly an Arbuscular Mycorrhizal Fungal (AMF) bioinoculant, '*KerAM*' can be applied @50 g per seedling.

Basin management with legume cover crops

Green manure legumes like *Pueraria phaseoloides*, *Calopogonium mucunoides*, cowpea (*Vigna unguiculata*), sunhemp (*Crotolaria juncea*), horse gram (*Macrotyloma uniflorum*), daincha (*Sesbania aculata)* and *Sesbania spinosa* can be raised in the coconut basin and incorporated into the soil as green manure at 50% flowering stage. Seeds of these crops @ 100 g per basin can be sown in the palm basin at a radius of 1.8 m during June.

Dismantling of drip irrigation system

After the monsoon sets in during June, laterals of the drip irrigation system should be dismantled and rolled back and kept tied on a pole or on a coconut tree trunk at the starting point of the irrigation system in the coconut garden.

Planting of intercrops

Planting of suitable inter/mixed crops can be taken up in coconut garden during June. Intercrops like banana, pineapple, ginger, turmeric, tapioca, sweet potato and perennials like, black pepper, nutmeg, clove, cinnamon, vanilla, cocoa etc. can be planted.

Plant protection

Peninsular India, the dominant coconut growing

region in the country would receive South-West monsoon showers during the period of June. Palms therefore would re-adjust from dryness to wetness with the active formation of feeding roots in this period. Palm health need to be rejuvenated with soil-test based nutrition along with prophylactic management module and routine scouting to tackle pests and diseases. Heavy monsoon showers are likely to wipe away the sucking pest complex including coconut eriophyid mite and invasive whiteflies and also suppression of black headed caterpillar to a greater extent. Two major coconut pests, viz., coconut rhinoceros beetle and red palm weevil are a major concern in this period and the emergence of adult beetles of white grub would be quite prominent with receipt of monsoon showers which would be the right time for mechanical collection of beetles. Farmers should adopt all prophylactic measures such as leaf axil filling with neem cake admixed with sand and also application of 1% Bordeaux mixture in bud rot endemic zones. Timely prophylactic treatment in bud rot endemic zone is very critical to save the palm, as spotting the disease symptoms would be difficult in the initial stage of infection for which Unmanned Aerial Vehicle are smart tools in pest surveillance.

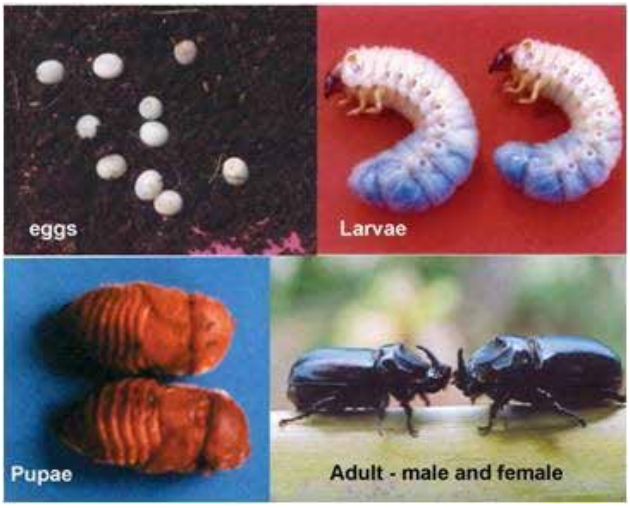
Pests

Rhinoceros beetle (*Oryctes rhinoceros*)

Being a ubiquitous pest, the incidence of rhinoceros beetle is quite common during all periods. However its damage is well pronounced during monsoon phase when seedlings are also planted. In seedlings just planted, the spear leaf gets damaged and distorted by beetle damage. Juvenile palms are also prone to pest attack and sometimes appearing as elephant tusk-like symptoms. Damaged juvenile palms are stunted and get delayed in flowering. Of late incidence of nut boring symptoms are also noticed. Moreover, the attack by rhinoceros beetle would invariably incite egg laying by red palm weevil as well as entry of bud rot pathogen in this period.

▶ *Management*

- Prophylactic treatment of top most three leaf axils with either botanical cake [Neem cake /marotti cake / pungam cake (250 g)] admixed with equal quantity of sand or placement of 12 g naphthalene balls covered with sand.



Life stages of the pest

- 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. This strategy could reduce the pest population significantly.

Nut damage

Elephant-tusk like symptom

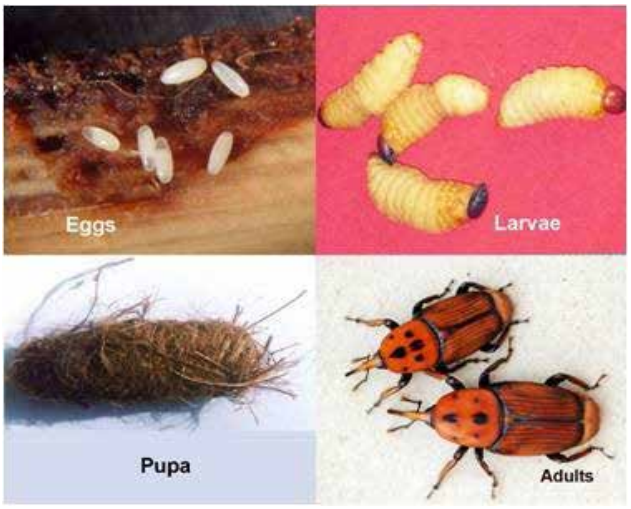
- Shielding the spear leaf area of juvenile palms with fish net could effectively entangle alighting rhinoceros beetles and placement of perforated sachets containing 3 g chlorantraniliprole / fipronil on top most three leaf axils evade pest incursion.
- Dairy farmers could treat the manure pits with green muscardine fungus, *Metarhiziumanisopliae* @ 5 x 1011spores /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, *Clerodendroninfortunatumin* to the breeding pits caused hormonal irregularities resulting in morphogenetic transformational aberration in the immature stages of the pest.
- Crop diversity induced by intercropping and ecological engineering principles would disorient pests and provide continuous income and employment as well.

Metarhizium packets

Red palm weevil

(*Rhynchophorusferrugineus*)

This is the fatal enemy of coconut and any injury to palms will predispose pest invasion. 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. Leaf splitting at base, yellowing of middle leaves, presence of boreholes and oozing of brown fluid



Life stages of the pest

are some of the visible damage symptoms. Correct geometry is very crucial for accommodating intercrops as well as pest avoidance due to multiple odour cues.

▶ *Management*

- Field sanitation is very critical and all residual population in crown toppled palms should be destroyed
- Avoiding palm injury is very critical to disorient the gravid weevils away from the field and therefore leave out at least one metre from palm trunk when petioles are cut.

Red palm weevil infestation on palms

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

Summer ploughing

White grub (*Leucopholisconeophora)*

This subterranean pest feeds on the roots of coconut and cause yellowing of leaves, premature nut fall, delayed flowering, retardation of growth and reduction in yield. Since grubs are hidden in soil, symptom diagnosis is very crucial in the identification of pest damage. Grubs initially feed on organic materials, roots of grasses and intercrops before feeding on the palm roots. Adults emerge from the soil during the month of June. The pest is very severe in certain sandy belts of Kasaragod, Kerala and parts of Karnataka.

White grubs

Adult beetles

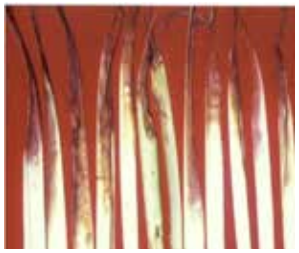
▶ *Management*

- Repeated summer ploughing to expose the immature stages for predation
- Handpicking of adult beetles during evening of two weeks commencing from the onset of monsoon.
- Application of neem cake in the palms basin @ 5 kg /palm for regeneration of roots.
- Soil application of aqua suspension of entomopathogenic nematode, Steinernema carpocapsae @ 1.5 billion Infective Juveniles /ha and need based repeated application.

Diseases

1) Leaf rot disease (*Colletotrichum gloeosporioides, Exserohilumrostratum*)

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 is 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 disease affected regions of spear leaf and other adjacent leaves in the terminal region
- Spot application of hexaconazole 5 EC 2 ml in 300 ml water on the affected spear leaf region .In disease endemic areas prophylactic fungicide treatment can also be given.

Bud rot or immature nut fall (*Phytophthora palmivora*)

In certain humid locations bud rot occurred regularly killing hundreds of trees.In India, bud rot incidenceis recorded as less than one per cent. Pathogen attacks the bud region leading to rotting of bud and death of palms. The first visible symptom is withering of the spindle marked by pale colour. The spear leaf or spindle turns brown and bends down. The affected spear leaf can easily be pulled out as the basal portion of the spindle is completely rotten emitting a foul smell. Temperature range of 20- 24ºC and relative humidity of 98% - 100% were found optimum for the development of the bud rot disease. Contiguous occurrence of such "favourable days" during rainy seasons determines the development of the disease and the intensity of infection. As Phytophthora diseases are known to be extremely fatal, a close scrutiny is mandatory during monsoon period to assess the health of the palm especially the spear leaf zone.

▶ *Management*

- Regular cleaning of the crown and prophylactic spraying of Bordeaux mixture (1%) to the crown just before the onset of monsoon and one more spray after 35-40 days help in reducing the bud rot incidence.
- Field sanitation and provide proper drainage during rainy season.
- Placement of two Trichoderma (Trichoderma harzianum CPTD28 isolate) enriched coir pith cakes in the inner most leaf axils just before the onset

of monsoon and again after every two months as prophylactic measure.

- In disease affected palms, remove the entire rotten portion of the spindle by cutting with a sharp knife and apply 10% Bordeaux paste to the wound and cover with polythene sheet to prevent entry of rain water. The protective covering has to be retained till normal shoot emerges.

Area wide and farmer-participatory adoption of prophylactic management practices could reduce the inoculum pressure of pest /disease even in favourable weather condition. Greater emphasis should be given for correct diagnosis and timely adoption of pest management practices. The concept of ecological engineering should be given due importance to obtain regular income from the farm and induce pest regression as well. Soil test based nutrition is also very crucial for improving palm health and endure biotic stresses. ■

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

Market Review – February 2020

Domestic Price

Coconut Oil

During the month of February 2020 the price of coconut oil opened at Rs. 16700 per quintal at Kochi, Rs. 16700 per quintal at Alappuzha market and Rs. 18100 per quintal at Kozhikode market. During the month, price of coconut oil at Alappuzha and Kozhikode markets expressed a downward trend. The price of coconut oil at Kochi market opened and closed at the same price respectively.

The price of coconut oil closed at Rs. 16600 per quintal at Alappuzha market and Rs. 17700 per quintal at Kozhikode market with a net loss of Rs.100 and Rs.400 per quintal at Alappuzha and Kozhikode market respectively.

The price of coconut oil at Kangayam market in Tamilnadu, which opened at Rs. 14000 per quintal, and closed at Rs.13800 with a net loss of Rs. 200 per quintal.

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

	Kochi	Alappuzha	Kozhikode	Kangayam
01-02-2020	16700	16700	18100	14000
08-02-2020	16800	16800	18300	14150
15-02-2020	16700	16700	18000	13900
22-02-2020	16500	16500	17600	13675
29-02-2020	16700	16600	17700	13800

Milling copra

During the month, the price of milling copra opened at Rs.11000 per quintal at Kochi, Rs.10900 per quintal at Alappuzha market and Rs.11300 per quintal at Kozhikode market. The price of Copra at Alappuzha market and Kozhikode market expressed a downward trend during the month. The price of coconut oil at Kochi market opened and closed at the same price.

The prices closed at Rs.10800 per quintal at Alappuzha market and Rs.11100 per quintal at Kozhikode market with a net loss of Rs.100 and Rs.200 per quintal at Alappuzha and Kozhikode markets.

At Kangayam market in Tamilnadu, the prices opened at Rs. 9700 per quintal and closed at Rs.9500 per quintal with a net loss of Rs.200 per quintal.

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

	Kochi	Alappuzha (Rasi Copra)	Kozhikode	Kan-gayam
01-02-2020	11000	10900	11300	9700
08-02-2020	11000	10950	11400	9700
15-02-2020	11000	10850	11200	9700
22-02-2020	10800	10800	10900	9400
29-02-2020	11000	10800	11100	9500

Edible copra

The price of Rajpur copra at Kozhikode market opened at Rs. 12000 per quintal expressed a downward trend during the month and closed at Rs.11800 per quintal with a net loss of Rs.200 per quintal.

Weekly price of edible copra at Kozhikode market (Rs/Quintal)

01-02-2020	12000
08-02-2020	12200
15-02-2020	12000
22-02-2020	11900
29-02-2020	11800

Ball copra

The price of ball copra at Tiptur market which opened at Rs.10800 per quintal expressed a downward trend and closed at Rs.10000 per quintal with a net loss of Rs.800 per quintal.

Weekly price of Ball copra at major markets in Karnataka (Rs/Quintal)

01-02-2020	10800
08-02-2020	11000
15-02-2020	10500
22-02-2020	10300
29-02-2020	10000

Dry coconut

At Kozhikode market, the price of dry coconut opened at Rs.9850 per quintal and expressed a downward trend during the month. The prices closed at Rs.9250 per quintal with a net loss of Rs.600 per quintal during the month.

Weekly price of Dry Coconut at Kozhikode market (Rs/Quintal)	
01-02-2020	9850
08-02-2020	9650
15-02-2020	9350
22-02-2020	9250
29-02-2020	9250

Coconut

At Nedumangad market the price of partially dehusked coconut opened at Rs.18000 per thousand nuts and closed Rs.18000 per thousand nuts and the price was almost steady during the month.

At Pollachi market in Tamil Nadu, the price of coconut opened at Rs.16000 per thousand nuts and closed at Rs.14000 with a net loss of Rs. 2000 per thousand nuts during the month.

At Bengaluru market, the price of partially dehusked coconut opened at Rs.17500 per thousand nuts and closed at the same price during the month. At Mangalore market the price of partially dehusked coconut opened at Rs.25000 per thousand nuts and closed at Rs.22000 with a net loss of Rs. 3000 per thousand nuts during the month.

Weekly price of coconut at major markets (Rs /1000 coconuts)				
	Neduman-gad	Pollachi	Banglore	Mangalore (Grade -1)
01-02-2020	18000	16000	17500	25000
08-02-2020	18000	15000	17500	25000
15-02-2020	19000	15000	17500	25000
22-02-2020	18000	15000	17500	22000
29-02-2020	18000	14000	17500	22000

International price

Coconut

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

Weekly price of dehusked coconut with water				
Date	Domestic Price (US$/MT)			
	Philippines/ Indonesia (CIF Europe)	Indonesia	Srilanka	India*
01-02-2020	162	145	265	486
08-02-2020	166	147	265	467
15-02-2020	168	146	237	454
22-02-2020	167	139	237	454
29-02-2020	168	140	250	447
				*Pollachi market

Coconut Oil

The domestic price of coconut oil in Sri Lanka and India expressed a mixed trend during the month whereas international price as well as the domestic price of coconut oil in Philippines and Indonesia expressed a downward trend during the month.

The price of coconut oil quoted at different international/ domestic markets are given below.

Weekly price of coconut oil in major coconut oil producing countries					
	International Price(US$/MT)	Domestic Price(US$/MT)			
	Philippines/ Indonesia (CIF Europe)	Philip-pines	Indone-sia	Sri lanka	India*
01-02-2020	940	855	903	2150	1868
08-02-2020	874	822	830	2260	1888
15-02-2020	878	830	830	2232	1854
22-02-2020	838	798	798	2227	1824
29-02-2020	844	800	798	2200	1841
					* Kangayam

Copra

The domestic price of copra at Philippines and India expressed a downward trend and Indonesia and Srilanka expressed a mixed trend during the month. 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* * Kangayam
01-02-2020	567	483	1295	1294
08-02-2020	536	484	1323	1294
15-02-2020	539	511	1328	1294
22-02-2020	539	494	1325	1254
29-02-2020	534	498	1144	1267

Market Review – March 2020

Domestic Price

Coconut Oil

During the month of March 2020 the price of coconut oil opened at Rs. 16700 per quintal at Kochi, Rs. 16600 per quintal at Alappuzha market and Rs. 17700 per quintal at Kozhikode market.

The price of coconut oil closed at Rs. 16900 per quintal at Kochi market and Rs. 16900 per quintal at Alappuzha market and Rs. 17900 per quintal at Kozhikode market with a net gain of Rs.200, Rs.300 and Rs.200 per quintal at Kochi, Alappuzha and Kozhikode market respectively.

The prices of coconut oil at Kangayam market in Tamilnadu, which opened at Rs. 13600 per quintal, and closed at Rs.13800 with a net gain of Rs. 200 per quintal.

Weekly price of coconut oil at major markets Rs/Quintal)				
	Kochi	Alappuzha	Kozhikode	Kangayam
02.03.2020	16700	16600	17700	13600
09.03.2020	16900	16900	17900	13667
16.03.2020	16900	16900	17900	13667
23.03.2020	16900	16900	17900	13800
30.03.2020	NQ	NQ	NQ	NQ

Milling copra

Milling copra During the month, the price of milling copra opened at Rs.11000 per quintal at Kochi, Rs.10800 per quintal at Alappuzha market and Rs.11100 per quintal at Kozhikode market. The price of Copra at Kochi market and Alappuzha market expressed an upward trend during the month. The price of Milling Copra at Kozhikode market opened and closed at the same price.

The prices closed at Rs.11200 per quintal at Kochi market and Rs.11050 per quintal at Alappuzha market with a net gain of Rs.200 and Rs.250 per quintal respectively.

At Kangayam market in Tamilnadu, the prices opened at Rs. 9500 per quintal and closed at Rs.9700 per quintal with a net gain of Rs.200 per quintal.

Weekly price of Milling Copra at major markets (Rs/Quintal)				
	Kochi	Alappuzha (Rasi Copra)	Kozhikode	Kan-gayam
02.03.2020	11000	10800	11100	9500
09.03.2020	11200	11050	11100	9600
16.03.2020	11200	11050	11050	9600
23.03.2020	11200	11050	11100	9700
30.03.2020	NQ	NQ	NQ	NQ

Edible copra

The price of Rajpur copra at Kozhikode market opened at Rs. 11800 per quintal expressed a fluctuating trend during the month and closed at Rs.11700 per quintal with a net loss of Rs.100 per quintal.

Weekly price of edible copra at Kozhikode market (Rs/Quintal)	
02.03.2020	11800
09.03.2020	11600
16.03.2020	11400
23.03.2020	11700
30.03.2020	NQ

Ball copra

The price of ball copra at Tiptur market which opened at Rs.10000 per quintal expressed an upward trend and closed at Rs.10200 per quintal with a net gain of Rs.200 per quintal.

Weekly price of Ball copra at major markets in Karnataka (Rs/Quintal)	
02.03.2020	10000
09.03.2020	10000
16.03.2020	10000
23.03.2020	10200
30.03.2020	NQ

Dry coconut

At Kozhikode market, the price of dry coconut opened at Rs.9250 per quintal and expressed an upward trend during the month. The prices closed at Rs.9450 per quintal with a net gain of Rs.200 per quintal during the month.

Weekly price of Dry Coconut at Kozhikode market (Rs/Quintal)	
02.03.2020	9250
09.03.2020	9050
16.03.2020	9250
23.03.2020	9450
30.03.2020	NQ

Coconut

At Nedumangad market the price of partially dehusked coconut opened at Rs.18000 per thousand nuts and closed Rs.17000 per thousand nuts and expressed a downward trend during the month.

At Pollachi market in Tamil Nadu, the price of coconut opened and closed at the same price during the month.

At Bengaluru market, the price of partially dehusked coconut opened at Rs.21500 per thousand nuts and closed at Rs. 20500 during the month with a net loss of Rs 1000 per thousand nuts. At Mangalore market the price of partially dehusked coconut opened and closed at the same price during the month.

Weekly price of coconut at major markets (Rs /1000 coconuts)				
	Neduman-gad	Pollachi	Banglore	Mangalore (Grade -1)
02.03.2020	18000	15000	21500	22000
09.03.2020	18000	15000	21500	22000
16.03.2020	17000	15000	20500	22000
23.03.2020	17000	15000	20500	22000
30.03.2020	NQ	NQ	NQ	NQ

International price

Coconut

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

Weekly price of dehusked coconut with water				
Date	Domestic Price (US$/MT)			
	Philippines/ Indone-sia (CIF Europe)	Indone-sia	Srilan-ka	India*
07.03.2020	169	168	265	436
14.03.2020	NQ	162	249	443
21.03.2020	NQ	156	243	443
28.03.2020	NQ	156	240	443
29-02-2020	168	140	250	447
				*Pollachi market

Coconut Oil

The domestic price of coconut oil in Sri Lanka expressed a mixed trend during the month. Whereas international price as well as the domestic price of coconut oil in Philippines and Indonesia expressed a downward trend during the month.

The price of coconut oil quoted at different international/ domestic markets are given below.

Weekly price of coconut oil in major coconut oil producing countries					
	International Price(US$/MT)	Domestic Price(US$/MT)			
	Philippines/ Indonesia (CIF Europe)	Philip-pines	Indone-sia	Sri lanka	India*
07.03.2020	852	798	805	2171	1807
14.03.2020	852	NQ	805	2215	1808
21.03.2020	840	NQ	795	2166	1825
28.03.2020	840	NQ	795	2140	1825
29-02-2020	844	800	798	2200	1841
					* Kangayam

Copra

The domestic price of copra at Sri Lanka expressed a downward trend and India expressed an upward trend. The domestic price of copra at Indonesia opened and closed at the same price during the month. 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* * Kangayam
07.03.2020	543	456	1143	1270
14.03.2020	NQ	442	1143	1270
21.03.2020	NQ	402	1127	1283
28.03.2020	NQ	456	1127	1283
29-02-2020	534	498	1144	1267

Since none of the domestic markets functioned/reported any transaction during the month of April 2020 owing to covid-19 national level lockdown, the market review report could not be prepared for the month.