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Unusual Twins in Coconut

Building a Safe, Inclusive, Resilient and Sustainable Coconut Community amid COVID-19 Pandemic & Beyond

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Articles, research papers and letters on different aspects of coconut cultivation and industry are invited for publication in this Journal. All accepted material will be paid for. The Board does not accept responsibility for views expressed by contributors in this Journal. All remittances and correspondence should be addressed to the Chairman, Coconut Development Board, Kochi - 682 011.

Coconut Development Board

The Coconut Development Board is a statutory body established by the Government of India for the integrated development of coconut cultivation and industry in the country. The Board which came into existence on 12th January, 1981, functions under the administrative control of the Ministry of Agriculture and Farmers Welfare, Government of India, with its headquarters at Kochi in Kerala State and Regional Offices at Bangalore, Chennai, Guwahati and Patna. There are five State Centres situated in the states of Orissa, West Bengal, Maharashtra and Andhra Pradesh and in the Union Territory of Andaman & Nicobar Islands. DSP Farms are located at Neriyamangalam (Kerala), Vegiwada (Andhra Pradesh), Kondagaon (Chhattisgarh), Madehpura (Bihar), Abhayapuri (Assam), Pitapalli (Orissa), Mandya (Karnataka), Palghar (Maharashtra), Dhali (Tamil Nadu), South Hichachara (Tripura) and Fulia (West Bengal) besides a Market Development cum Information Centre at Delhi. The Board has set up a Technology Development Centre at Vazhakulam near Aluva in Kerala.

Functions

❒ Adopting measures for the development of coconut industry. ❒ Recommending measures for improving marketing of coconut and its products. ❒ Imparting technical advice to those engaged in coconut cultivation and industry. ❒ Providing financial and other assistance for expansion of area under coconut. ❒ Encouraging adoption of modern technologies for processing of coconut and its products. ❒ Adopting measures to get incentive prices for coconut and its products. ❒ Recommending measures for regulating imports and exports of coconut and its products. ❒ Fixing grades, specifications and standards for coconut and its products. ❒ Financing suitable schemes to increase the production of coconut and to improve the quality and yield of coconut.

❒ Assisting, encouraging, promoting and financing agricultural, technological, industrial or economic research on coconut and its products. ❒ Financing suitable schemes where coconut is grown on large scale so as to increase the production of coconut and to improve its quality and yield and for this purpose evolving schemes for award of prizes or grant of incentives to growers of coconut and the manufacturers of its products and for providing marketing facilities for coconut and its products. ❒ Collecting statistics on production, processing and marketing of coconut and its products and publishing them. ❒ Undertaking publicity activities and publishing books and periodicals on coconut and its products.

The development programmes implemented by the Board under the project Integrated Development of Coconut Industry in India are- production and distribution of planting material, expansion of area under coconut, integrated farming for productivity improvement, technology demonstration, market promotion and Information and Information Technology. Under the Technology Mission on Coconut, the programmes implemented by the Board are development, demonstration and adoption of technologies for management of insect pest and disease affected coconut gardens, development and adoption of technologies for processing and product diversification and market research and promotion.

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Message from the Chairman's desk

Dear Readers,

The Union Budget for the year 2022-23 calls for sustained development in the agriculture sector with emphasis on improving viability of agriculture with enhanced incomes and increased digitization and technology access not only for enhancing productivity but also for increasing market access and gaining competitiveness in global market. Promoting chemical free natural farming throughout the country for boosting sustainable agricultural productivity and income of the farmers is also targeted. Coconut being a crop suited for multiple cropping and mixed farming systems will be a viable option in the plantation sector for natural farming.

Introduction of kisan drones for crop assessment, spraying of chemicals etc which are planned in the budget will also be beneficial in a crop like coconut since drones can easily access the crown and help in efficient spraying of nutrients and other plant protection chemicals. Coconut Development Board also has facilitated research towards use of technology in cultivation and processing of coconut under the scheme Technology Mission on Coconut which has resulted in the development of technology for detection of spoilage in coconut water through sensors, early detection of infestation by red palm weevil, use of unmanned aerial vehicle for pest and disease surveillance etc. In order to reduce import dependence on edible oils, plans have also been announced for boosting the domestic production of oilseeds and this is definitely going to bring a positive turn for trade in the coconut sector.

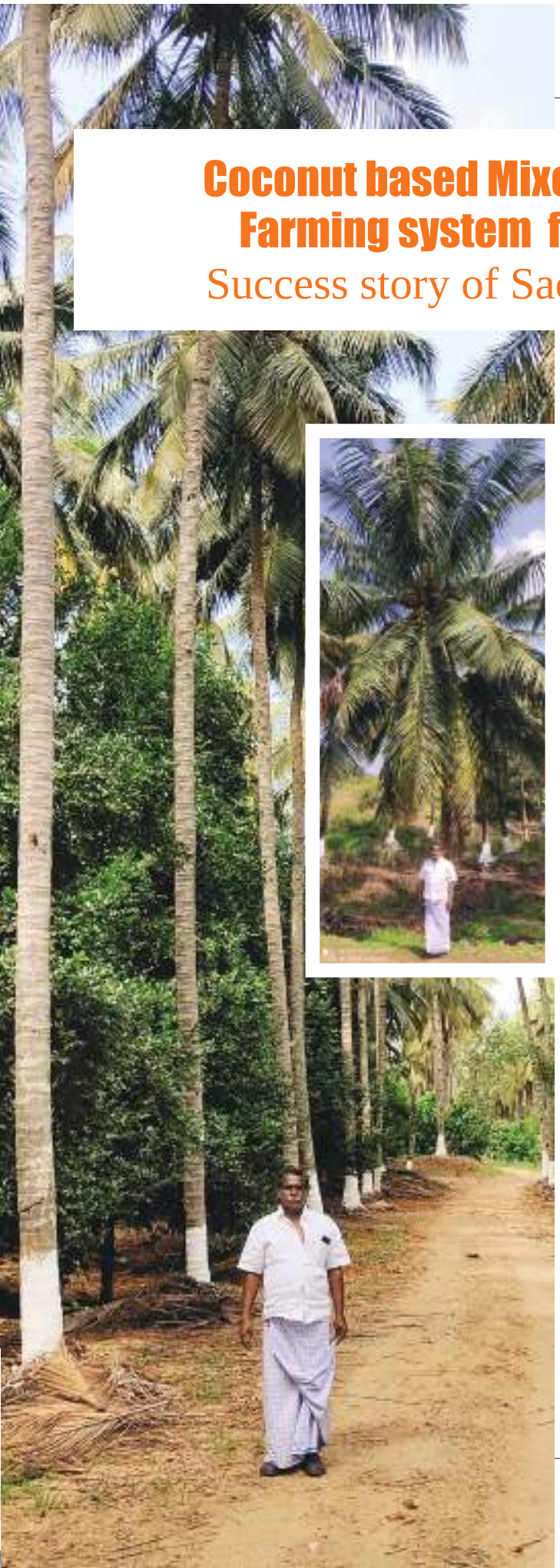
Efforts to enhance export of products and taking Indian products to consumers across the globe were intensified during the year in which the Indian Embassies have also actively participated. The participation of the Ministry of Agriculture and Farmers Welfare in the Expo 2020 Dubai during the latter half of this month holds much relevance in realizing an exponential growth in the export of agricultural products. Middle East is not only a major consumer of agricultural products from India but also is a corridor to the developed western world. Participation in the Expo will help in promoting and creating awareness on Indian products among the participating countries too. The Indian pavilion will also showcase coconut products which offer much prospects in enhancing immunity due to its nutritional and health attributes which is all the more relevant in the post pandemic period.

Let us be ambassadors in spreading the goodness of this Tree of Life to sustain agriculture, conserve nature and develop a healthy and prosperous community.

Rajbir Singh IFS
Chairman

Coconut based Mixed Cropping and Integrated Farming system for Realizing Higher Income

Success story of Sachidananda Gopalakrishnan



Thamban. C, P. Subramanian and A. C. Mathew,
ICAR-Central Plantation Crops Research Institute,
Kasaragod

'Of late, the coconut price situation in the market is not at all encouraging; only because of the cushioning effect rendered by the mixed cropping and integrated farming components in my orchard I am pulling on. It is learned that government is planning to intervene in the market by making arrangements for procuring coconuts through co-operative societies. Hope the situation will improve through these interventions. The practice of procurement of coconut through Krishibhavan as done earlier needs to be brought back...'. These are the words of Shri Sachithananda Gopalakrishnan from Meenakshipuram, Perumatty gramapanchayat of Palakkad district, Kerala. Sachithananda is a leading coconut grower of Meenakshipuram area bordering Pollachi taluk of Tamil nadu. His coconut garden is located at Kadamanpara in Moolathara village of Perumatty gramapanchayat. He entered farming profession at the age of 16 years and now he is 56 years.

Sachithananda's coconut farm in 16 acres has around 1000 palms. The palms, belonging to West Coast Tall variety, are mostly 25 to 30 years old and few are in the juvenile phase, planted five years ago. Black soil is the predominant soil type in the farm. Coconut is planted at a spacing of 7.5 to 8 metres. According to Sachithananda wider spacing is always better for higher productivity of coconut palms and also for effective and scientific intercropping.

Mixed cropping

Sachithananda is well aware of the advantages of mixed cropping system and hence has planted various crops like nutmeg, cocoa, arecanut, banana etc in his coconut garden.

Nutmeg: In five acres of his coconut orchard, nutmeg is planted as mixed crop. Each nutmeg tree is planted at the centre of four coconut palms. There

are around 350 nutmeg trees which are of 22-25 years age. The nutmeg is unique among tree spices as it yields two distinct spices, nutmeg and mace. Nutmeg is a very compatible intercrop which can be very well accommodated in the interspaces of coconut garden when it is planted at a spacing of 7. 5 m x 7. 5 m and more. Planting of nutmeg need to be done when the age of coconut palms attain 20 years and more since during that period light availability at the ground level is more than 40%. Besides, young nutmeg plants should be planted under 50% shade

as coconut plantation act as natural shade to the young nutmeg plants. Tap root system and compact canopy architecture of nutmeg makes it more suitable as intercrop in coconut garden. The feeding activity of coconut with fibrous root system is mostly confined to one meter depth and more specifically to 15 to 60 cm depth, whereas nutmeg is having taproot system and its feeding area goes beyond one meter depth and there is little competition between coconut and arecanut. Further coconut + nutmeg cropping system improve the microclimate condition and promote diversified beneficial microbiological activity.

According to Shri Sachithananda, though there is fluctuation in the price of nutmeg in the market, it a very compatible intercrop in coconut garden. No serious attack of pest and disease incidence is observed in nutmeg trees in his orchard, which is another advantage of nutmeg according to Sachithananda.

Cocoa: Around 1000 cocoa trees are being cultivated as a mixed crop in eight acres of his coconut orchard. Since cocoa is a shade loving crop, it is grown as one of the best intercrops in coconut plantation. As cocoa is highly susceptible to drought conditions, the option of growing it as intercrop makes it more productive. Various other advantages of growing cocoa as intercrop in coconut garden include the improvement of microclimate, reduction

in evaporation because of the canopy coverage and the regular litter fall which act as a natural mulching that improves the soil biological activity. Based on the physiology of cocoa, photosynthesis of cocoa leaves is saturated at 1/5th of the full day. Because of this reason cocoa perform better as intercrop compared to monocropping. The cocoa tree has tap-root system which grows straight if there is no physical obstruction. The success of intercropping of cocoa mostly depends on scientific and timely pruning. Pruning is an important operation in cocoa especially when it is grown as an intercrop. The main objective of pruning is to maintain the shape of the cocoa plant to make it more productive and efficient. According to Sachithananda, the price fluctuation and marketing issues are the major problems that he encounters in cocoa cultivation.

Arecanut: Though arecanut is not a recommended mixed crop in coconut garden, there are around 1000 areca palms planted in between coconut trees in his garden. These areca palms belonging to local variety are about 25 years of age. Areca seedlings were procured from local Krishibhavan.

Banana: Banana is intercropped in about one acre; mostly cultivated for selling the leaves. In the main season of marriages and similar occasions leaves are sold @Rs 3/leaf.

Integrated farming

A major source of income in Sachithananda's farm is from the cattle rearing component in the integrated farming system (IFS). 10 cross bred cows are reared which produces around 10 litres of milk per cow per day

Fodder grass: Hybrid Bajra Napier Co-4 variety fodder grass is cultivated as intercrop in his coconut garden in three acres.

A bio-gas plant is installed as part of IFS unit since the last six years. Bio gas is used for domestic purpose and the slurry is recycled back to coconut palms, fodder grass and other crops in the system. Since the last one year a fish pond is also maintained in the IFS unit apart from dairy animals.

Crop management practices

Nutrient management

Since the last three years only organic manure is applied to coconut palms in five acres out of the total 16 acres of the coconut farm. According to Shri. Sachithananda there was a slight fall in the yield during the initial two years after changing to organic mode of nutrient management. Subsequently yield of palms improved to the previous level. Manuring of coconut palms is done in two splits with the onset of South West monsoon during May-June and after heavy rains during August-September. Vermicompost, cow dung, neem cake, poultry manure and coir pith compost are the various organic manures applied in his garden. Neem cake is applied to the palms @ 1 kg per palm every year. Cow dung and poultry

maure is applied @ 20 kg per palm and @ 10 kg per palm respectively applied during alternate years.

In the remaining 11 ha coconut farm, integrated nutrient management practices are adopted. Besides organic manures, chemical fertilizers are also applied to coconut palms in two splits @3 kg fertilizer mixture per split. Urea (1 kg), Muriate of Potash (2 kg) and Super Phosphate (2 kg) are the fertilizers used in the mixture. Cow dung and poultry manure are applied in alternate years @ 20 kg per palm @ 10 kg per palm respectively. Shri Sachithananda is planning to gradually reduce the use of chemical fertilizers and to fully convert to organic farming.

Cow dung @ 20 kg per tree twice a year is applied for nutmeg besides small quantities of Muriate of potash. One kg of chemical fertilizer mixture containing urea, MOP and super phosphate (in the proportion of the mixture given to coconut palms) is given for cocoa trees. Cocoa leaves obtained after pruning and also fallen dried leaves are recycled back to cocoa basin as organic manure. Areca palms are managed with organic manures like cow dung, vermicompost and poultry manure.

Mulching

All the dried fallen coconut leaves, bunch wastes and dried leaves are recycled to the palms as mulching in the basin as and when these materials are available. According to Sachithananda recycling of bio-mass available in the farm by way of mulching greatly helps in moisture conservation and also improves soil health in the farm.

Irrigation

There are four open wells in the farm which are the sources of irrigation water and the coconut palms are provided irrigation during summer months using drip system. Tap type drippers are used in the drip system through which water is provided @100 litres per palm per day. According to Sachithananda, drip irrigation system helps in saving labour and also less weed growth is observed in the farm.

Crop protection

No serious pest and disease problems are experienced in the coconut based cropping system except for the recently observed root (wilt) disease like symptom appeared in 2-3 coconut palms which of course is a concern according to Shri Sachithanada.

Labour management

Sachithananda is having three men and women permanent labourers from nearby areas of Tamil Nadu, for managing farm activities. He got a tractor for tillage and other works and a bush cutter for weeding. A chaff cutter is used for cutting the fodder grass to feed cattle

Productivity and income

On an average, the recorded yield in Sachithananda's farm is about 150 nuts per palm per year while few palms are having the yield of more than 200 nuts per palm. Coconut palms are harvested six times a year at 60 days interval. During the last few harvest Sachithananda could get on an average of Rs. 25 per kg of coconut. He feels the minimum

price should be at least about Rs 40 per kg nut to make the coconut farming remunerative.

Sachithananda has given 400 coconut palms for toddy tapping for which he is receiving Rs. 400 per palm per month which is realising a better income. Nutmeg is harvested twice in an year and he is getting on an average 4-5 kg fruits per tree. During the previous season he could get on an average Rs. 450 per kg nut and Rs. 1900 per kg mace. The average yield of cocoa from his farm is about 2-3 kg wet beans per tree. Cocoa beans are sold to the cocoa collection centre at Anamalai in Tamil Nadu. Arecanut is sold to local traders who collects it directly from the farm and unhusked fresh arecanuts are sold @ Rs 24-27 per kg. During the last season he could harvest about five tonnes of fresh arecanuts.

Shri Sachithananda's family which consists of his wife Smt Arunadevi and two daughters is wholeheartedly supporting him in managing his farm. Shri Sachithananda Gopalakrishnan is actively engaged in many social activities also. He is the president of Moolathara Co-operative Milk Producers' Society and also acting as the Director Board member of Moolathara Service Co-operative Bank. The milk society he heads has received the award for collecting the highest quantity of milk among the milk societies in Palakkad district. He is also actively involved in organising coconut growers of the locality into FPOs and is the President of Kadamanpara Coconut Producers Society (CPS). *Sachidananda can be contacted on 8547401126* ■

Unusual Twins in Coconut

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Coconut Development Board, Kochi - 11

Twins in plants, animals and human beings are always a matter of surprise. It is more surprising to observe twin coconut palms, which are 35-40 years old with exact morphological features and even comparable nut yield. In this article describes different type of twins observed in dwarf and tall varieties of coconut. The probable reason for twinning can be polyembryony and polycarpy.

Polyembryony in coconut

In coconut, ovary is tricarpellary and corresponding to the three carpels, there are three markings, commonly known as 'eye'. Of the three eyes, usually two eyes become abortive at an early stage of development and only one attains maturity and remains comparatively soft. The viable embryo is located beneath this soft/functional eye. The other two 'blind' eyes which represent the two aborted carpels are very hard and do not possess any embryo. Thus one nut on germination gives rise to a shoot. But rarely more than one shoot is seen emerging through a single eye. This phenomenon of producing more than one seedling from a single nut is known as polyembryony. The multiple embryos are found clustered beneath the soft eye of the nut, but they may not share any tissue.

In polyembryonic seedlings, two or more shoots develop from a single soft eye and grow as distinct shoots. These shoots squeeze their way out through the single soft eye, all the while maintaining themselves as separate individuals. The number of shoots that develop may be 2-4, of which one will be zygotic and others from nucellar tissues of the same ovule. There is variation in the growth and vigour of polyembryonic seedlings. Polyembryony is more frequently noticed in dwarf palms. Since dwarf palms are self pollinated, the polyembryonic seedlings are expected to be homogenous.

Polycarpy in coconut

Each carpel of a coconut fruit has an ovule inside, but usually only one seed develops out of

the tricarpic ovary. In some rare cases, two or all the three 'eyes' remain soft or fertile and emerge out as separate sprout from each eye. These palms are morphologically identical and known as twin palms. Twin palms are mostly noticed in talls (WCT).

Differentiating Polyembryony and Polycarpy:

As mentioned, polyembryony is the development of more than one ovule in a single carpel whereas polycarpy is the development of more than one carpel. Polyembryonic seedlings emerge from a single softeye, but polycarpic seedlings emerge separately from different eyes (carpels)

Extremely rare occurrence of twinning and haploidy in coconut:

Whitehead & Chapman (1962) reported a different type of twinning in coconut. The twins reported were found to be completely separated and showed considerable disparity in vigour. The suspicion that the less vigorous plant was haploid was confirmed when it was shown to have 16 rather than 32 chromosomes per cell. The diploid plant had bronze rachis whereas that of the haploid was green and the latter had noticeably more slender leaves. This was also the first report of haploidy in coconut. Such haploid-diploid twins are much less frequent in coconut that diploid-diploid twins.

Similar to the above observation, we hereby report another probable haploid-diploid twin noticed by Mr. Abe Jacob, Deputy Editor, Coconut Development Board, Kochi. One twin seedling had bronze petiole colour and the other had orange petiole colour. The orange petiole coloured seedlings was less vigour (based on collar girth, seedling height and presence of slender leaves). Another probable reason for occurrence of divergent twins may be due to the fact that one seedling (bronze coloured) had zygotic origin (fertilized by Tall male parent) and the other had nucellar origin (similar to maternal/ female parent). As reported by Toting et al., 2020, the other probable reason can be that it might have developed from two different cells in the embryo sac, which were fertilized by two different pollen grains. Detailed studies are needed to pin point the exact reason regarding production of divergent twins in coconut.

Conclusion

Though twins are rare and a matter of surprise, but haploid is really a good material for use in breeding programme. However, its real practical worth depends on the frequency of occurrence of haploids and the ease with which the haploids can be converted to double haploids by standard methods. References: Toting, D.J.A., Nuñez, T.C. and Ferraren, D.O. 2020. Comparative DNA analysis of coconut (Cocos nucifera L.) palms with polyembryonic and monoembryonic origins. Annals of Tropical Research 42 (2): 21-29 Whitehead, R.A. and Chapman, G.P. 1962. Twinning and haploidy in Cocos nucifera. Nature, 195:1228-1229 ■

Price fall in Coconut sector : a short term phenomena

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India has produced 14.70 million tonnes of coconut in 2020-21 from 2.2 million hectare area with a per hectare productivity of 6.8 tonnes/ha (FAO stat data 2021). Coconut production in the country has increased from 10.89 million tonnes during the year 2010-11 to 14.70 million tonnes in 2020-21 with 3.0 percent compound annual growth rate of production. Productivity also has shown an upward trend from 5.7 tonnes per hectare in 2010-11 to 6.7 tonnes in 2020-21.The compound growth rate of productivity was found to be 1.63 percent during the period. As per the latest estimates, the production of coconut during 2020-21 was recorded at 14.7 million tonnes with a positive growth rate of 7.6 percent over the previous year.

Kerala is the leading coconut producer in the country with an annual production of 4.81 million tonnes, followed by Tamil Nadu which produces 3.75 million tonnes annually. The coconut palm exerts a profound influence on the rural economy of many states where it is grown extensively and it provides sustenance to more than 12 million people. The export earnings derived by India from coconut during 2020-21 was around Rs.6074 crores, through the export of coir products (Rs. 3779 Cr.) and coconut products (Rs. 2295 Cr.). The processing and related activities centered on the crop generate employment opportunities for over two million people in India. As an oil seed, coconut holds around 15 per cent share of the total oilseed value output in the country.

Endeavoring to prioritize the issues associated with coconut, it is realized that coconut farmers are confronted with market-related difficulties such as low and highly fluctuating prices and difficulty to find favorable market outlets for their products. Moving up the global value chain poses many challenges for the coconut sector in the country since price competitiveness is less due to high domestic prices in comparison with the international market. However the gap between the domestic prices and the international prices is narrowing recently which is bound to increase the export competitiveness of coconut and its products.

During the current period, we are witnessing a decreased price trend in the domestic level while an increasing trend is found in the international

level. The Indian price of coconut oil averaged at Rs. 163/Kg in December 2021 which has come down from Rs.203/kg twelve months ago or a decrease by 20% as indicated in Table-1. The international price showed an increased trend during the same period. The international price of CNO averaged at Rs 144.95/kg in November 2021 which was up from Rs107.73/kg eleven months ago in December 2020 which was an increase of 34.5% over the period as indicated in table-1.

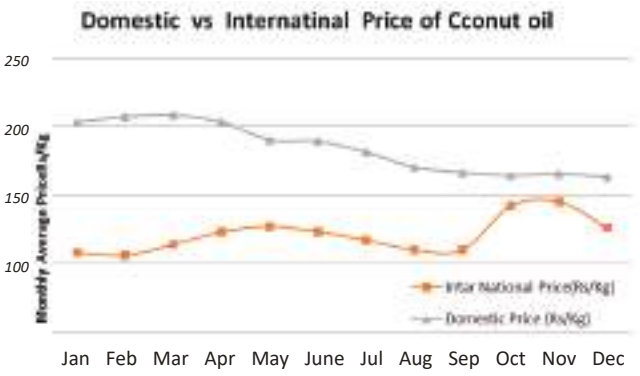
Table 1. Price trend in coconut oil in domestic & International market

Month	Average Int. price (Rs/kg)	Average dom. prices (Rs/kg)
Dec-20	107.73	202.97
Jan- 21	108.16	202.60
Feb- 21	106.79	207.45
Mar-21	113.90	207.95
Apr-21	122.69	203.12
May-21	126.80	189.85
June-21	123.51	188.67
July- 21	117.11	180.70
Aug-21	110.42	169.63
Sep- 21	109.78	166.36
Oct-21	142.14	164.22
Nov-21	144.95	165.69
Dec-21	125.71	163.00

Source: 1. World Bank Pink Sheet (December 2021).
2. Directorate of Economic & Statistics, Ministry of Agriculture & Farmers Welfare
3. Indian Coconut Journal, December 2020 to December2021-Market Review

Although some of the researchers analyses it as just a bubble, the decrease in trend in the case of coconut oil price in recent times in India has certainly caused confusion among all the stake holders of the sector. Since the price of raw coconut and copra depends on the price of CNO this down ward trend reflected in these main products also.

The copra price has started declining in accordance with the fall in domestic price of coconut oil in the third and last quarter of 2021 and reached below Minimum Support Price (MSP) for Fair Average Quality(FAQ) milling copra which was at Rs. 103.35 per kg in 2021 and further increased to Rs. 106.00 during 2022.It is essential to undertake price support operations at the MSP by the nodal agencies in the coconut growing States to protect farmers



from the price fall. During the month of November 2021, the price of milling copra at Kangayam a major copra market in Tamil Nadu opened at Rs. 97/- per kg and closed at Rs.99/- per kg which is very much below the declared MSP. Since majority of coconut farmers are small and marginal, it may not be possible for individual farmer to invest for installing copra making units. Government of Kerala has also taken initiatives to start procurement of de-husked coconut @ Rs 32/- per kg to protect the farmers from the price fall. Interventions for procurement at MSP under the Price Support Scheme have to be undertaken on priority basis for supporting the small and marginal farmers.

The domestic price of coconut oil (CNO) has been broadly stable during the first two quarters and started showing declining trend thereafter.

Major factors behind the price decline

It is pertinent to seek out the reasons behind the recent price fall in the domestic market , especially after having reasonable price experienced for a long time. The average open market price of coconut oil which touched a high of Rs 208 per kg in March 2021 was hovering around' Rs 163 per kg in December 2021. A variety of factors certainly have contributed to the persistence of this price decrease about which not much is still known. The price of coconut oil is influenced by several factors such as coconut production and its use in food and non-food sector, price of other substitute vegetable oils, trade policy for edible oils, world prices of edible oils in general and palm oil in particular. A modest attempt has been made in this paper to analyze some of these factors based on secondary data on price published by various agencies.

The coconut market in India is always unstable and uncertain resulting in frequent fluctuation in price. The seasonal and annual variation in production

apart from competition from other edible oils particularly palm oil also have an impact on the prices. The general trend noticed during the past years is a higher price reported during the lean production periods of November-December and lower price during April – May which coincides with the peak production periods in the major coconut producing states in India. These seasonal variations in prices of coconut and coconut oil are thus traced back to supply factors than demand factors. Usually, the magnitude of fluctuation is higher during lean period compared to peak period. Normally price should decrease in the peak production period. Contrary to this, during the last season the increasing trend continued in the peak season and the decreasing trend continued in lean season, which shows that the price fall is not strictly due to seasonal variation in production.

As per the second advance estimates of Horticulture Statistics Division, Department of Agriculture & Farmers Welfare, the production of coconut during 2020-21 was recorded at 14.6 million tonnes with a positive growth rate of 7.6 percent over the previous year. Further after a significant drop of 16.5 percent, coconut oil production in 2018-19, in the country has seen a gradual increase over the successive years. The CNO production increased by 8.53% from 5.3 lak MT in 2018-19, to 5.75 lak MT in 2020-21. The increase in supply due to the growth in production and increase in the balance stock of previous years may be one of the reasons attributed for the downward trend in the lean production season.

If we look in to the production and trend in coconut oil price and other main competing edible oils especially palm oil and soybean oil we can see that a tremendous shortfall in production of all edible oils have been experienced internationally which subsequently, resulted in the increase in prices of edible oils during 2021. The coconut oil sector had to directly compete with these edible oils in the international trade. Therefore, price of coconut oil is also influenced by the supply and demand of competing oils.

As per World Bank Commodities Price Data (The Pink Sheet) 2021, considerable increase in prices of coconut oil was observed in 2021 in the international market. The price averaged at US$ 1,960.68 /MT in November 2021 which was up from US$1464.96/MT a year ago in December 2020 or an increase by 34%. Like coconut oil, the price of palm kernel oil in 2021 also significantly increased by 99.9% to reach US$ 2,069/MT in November 2021 as against US$ 1035/MT in December 2020. Similarly, the prices of soybean oil have also risen by 106.3 percent and that of palm oil increased by 76.5 percent during the same period. Malaysia, from where major fraction of palm oil is imported to India, has been experiencing production deficits due to unsavory climate and acute labour shortage. This in turn, had curbed the price advantage enjoyed by palm oil.

Though international price of coconut oil has increased along with other edible oils in the second and last quarter of

2021, domestic price of coconut oil has been above the international price, but the gap between the two have been reduced significantly which was 87% in the month of January 2021 and reduced to 14% in the month of November 2021.This was indicated by the increasing import demand of coconut oil in European countries and increasing trend in international price. As the total import demand of lauric oils is higher than the export supply, it is predicted that the price of coconut oil in the world market for the coming months will remain high.

Import duty on edible oils is also a major factor that impacted the cost of edible oils and thereby domestic prices. Slashing down the basic import duty of all edible by the Government of India to control the increasing price of all edible oils in the domestic market is another reason for the steep decline in coconut oil price during the third and last quarter of the year 2021 in Indian market. In order to check increasing prices of edible oils in the country where more than 60% of which was imported to meet the demand, the Government of India, reduced the basic import duty on crude palm oil from 27.5 percent to 15 percent in February 2021. Further, from 30th June 2021 to 30th September 2021 the basic customs duty on crude palm oil was again reduced from 15 percent to 10 percent and that on refined palm oil from 45 percent to 37.5 percent. Further, Department of Commerce vide notification dated 30th June 2021 has issued revised import policy for RBD Palm Oil and RBD Palmolein by removing both from "Restricted" to "Free" category with immediate effect for a period up to 31st December 2021.This has resulted in tremendous increase in the import of these competing vegetable oils of CNO.

The imports of RBD palmolein rose to 24,000 tonnes in December 2021 from 900 tonnes in the year-ago period. Among soft oils, the import of soybean oil increased 21.57 per cent to 3.92 lakh tonnes in December 2021 as against 3.22 lakh tonnes in December 2020.Similarly, the shipment of sunflower oil rose 10 per cent to 2.58 lakh tonnes in December 2021 from 2.34 lakh tonnes in the year-ago period.

The move of the government to slash the standard rate of duty on edible oils and a massive difference in daily wholesale prices of all edible oils including coconut oil has been witnessed. The prices of eight types of edible oils including coconut oil in the wholesale markets across the country have been showing a declining trend since then. The wholesale prices of groundnut, mustard oil, vanaspati, sunflower oil, palm oil, coconut oil and sesame oil declined during the last two quarter of 2021.The daily wholesale prices of packed palm oil dropped by 2.50%, followed by sesame oil by 2.08%, coconut oil by 1.72%, packed groundnut oil by 1.38%, packed sunflower oil by 1.30%, packed mustard oil by 0.97%, packed vanaspati by 0.71% and packed soya oil by 0.68% in September 2021(Report by The Economic Times). The government has also taken steps against hoarding and asked wholesalers, millers and refiners to provide details of their stock on a web portal to boost domestic supply.

These measures leads to boost the supply of edible oils especially palm oil and sunflower oil in the domestic market which lead to substitution of CNO with other cheaper edible oils affecting the CNO market.

Conclusion

Through this analysis an attempt has been made to characterize the price fall in coconut sector in India during the past one year (2021) and also delineated the major possible reasons behind the price fall. The analysis reveal that the declining trend in coconut oil price associated with slash in basic import duties of all edible oils by Government of India is to control the domestic price of edible oil consequent to global shortfall in edible oil supply and measures to boost domestic supply and curb hoarding. However, the production may increase due to favorable climatic conditions during the last two years and is expected to reach peek in South India during January to March 2022. Nevertheless, the insufficient stock to cater to the large industrial demand, and the delicate demand-supply balance is expected to keep the coconut oil prices firm at least in a short period. However a systematic study on the various factors associated with the fall in coconut price is required to prove the extent to which the above factors affect the magnitude of fall in price of coconut oil copra and raw coconut and its sustainability.

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Building a Safe, Inclusive, Resilient and Sustainable Coconut Community Amid COVID-19 Pandemic & Beyond*

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World Scenario

Coconut, the 'tree of life', Kalpavriksha, 'tree of abundance' and 'nature's supermarket, cultivated in more than 92 countries worldwide, provides livelihood security to millions of people in the Asia and Pacific regions. Coconut is the environment friendly small- holder palm of the tropical environment covering 12.28 million hectares in 92 countries with an annual production of 68.3 billion nuts providing USD$7.76 billion per annum to global coconut industry (Fig.1). 70% is produced by Philippines, Indonesia, and India. The coconut industry, which traditionally relied upon copra and coconut oil and to some extent on coir, is presently experiencing tremendous transformation towards product diversification, high-value product development, by-product utilization and more importantly as a health benefited beverage & food substitute. In the modern era coconut products appears in global market with the dynamics of organic coconut water, virgin coconut oil, functional foods and health drinks from coconut including neera, coconut sugar, cosmeceuticals, oleo chemicals and biofuel/bio-lubricants in the consumer's market. Hence the global export and import of coconut products such as coconut oil, copra meal/copra cake, fresh coconut, desiccated coconut, coconut milk, cream, milk powder, coconut shell charcoal, activated carbon, coir and coir products are also elaborated. It is obvious that the diversification resulted in the increase in demand naturally and when the demand increases the supply of product also need to be proportionately amplified by regular and uninterrupted production and supply. However a downward trend is observed everywhere starting from farming sector to the coconut industry

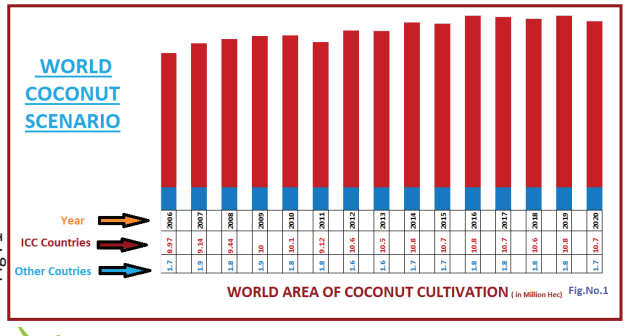


Fig : 1 Fig.No.1

*1st prize winning write up in the essay competition organized by International Coconut Community, during World Coconut Day 2021

especially during the COVID-19 pandemic situation. The increase in the demand of coconuts and its value added products shows the importance of this crop and its close relation to the mankind. Consequently it is felt necessary to accelerate the coconut farming for ensuring the well performance of the global coconut industries. Hence it has become inevitable to outline suitable action plans for "Building a Safe, Inclusive, Resilient and Sustainable Coconut Community amid COVID-19 Pandemic & Beyond" by implementing suitable approaches to face the present and future global challenges to transform coconut industry globally prospective.

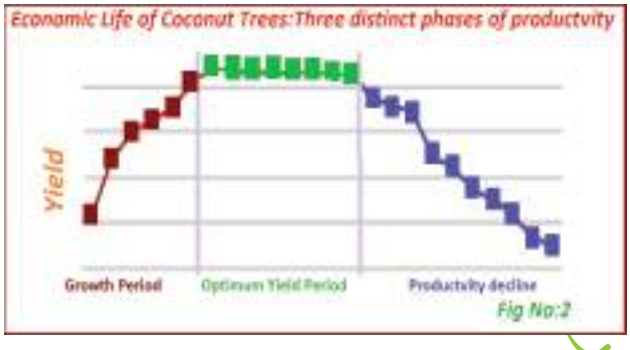
In order to proceed further, it is required to have an overall idea about the factors which are influencing coconut industry and farming sector both positively and negatively and also those areas that need to be paid more attention for enhancing benefits from this challenging situation. Proper understanding of the problems and drawing the best apt solutions is the need of the hour for decision making and for initiating further course of action.

Accordingly for self evaluation, SWOT analysis method is attempted in order to ascertain the various factors related to coconut farming and industry globally to switch on to a realistic and balanced approach with regard to production, processing including marketing of coconut and its value added products for a sustainable coconut industry for all coconut farmers and stake holders in the long run run (Table No.1). The reasons collected are generally not similar in all countries even though similar issues could be affecting in almost all coconut growing countries. In the light of the above, the relevant fields which require ample attention is examined and an attempt is made for making strategy formulations. It was observed that the major areas like production, processing and market promotions areas are in need of certain inclusion, reform, strengthening , upgraded actions with a synchronization among all for ensuring a solid and safe growth during the future.

Productivity Management

Improved agro-techniques have been standardized, through research conducted over several decades, to achieve sustainable productivity and profitability for coconut farming for realizing maximum profitability. Adoption of refined nursery techniques like poly bag nursery enables production of quality planting material with bio-priming of biofertilizers formulations which helps in production of superior quality seedlings. Good management practices validated to improve the productivity in adult coconut palms include integrated nutrient management, green manuring/cover cropping, soil and global water conservation measures, weed management, irrigation, fertigation and cropping/ farming system approach. Fertigation helps in increased fertilizer use efficiency, saves fertilizer costs, reduces labour requirement and ensures continuous nutrient supply in tune with the crop requirement. Sustainable cropping system models are evolved to optimize utilization of natural resources and in enhancing the economic viability. Integrated farming in the interspaces of coconut and integration of animal husbandry enterprises offer significant ecological and economic benefit including optimum utilization of the land resources, waste management etc. Effective formulations of agriculturally important micro organisms such as nitrogen fixers, plant growth-promoting rhizobacteria and arbuscular mycorrhizal fungi have been developed as valuable inputs for sustainable crop production. Lignocelluloses residues from coconut plantations can be converted into brown, granular vermin composting using earthworms. Organic farming practices with focus on building soil biological fertility foundations through integrated application of organic and bio-inputs including recycling of waste biomass, in situ cultivation and incorporation of leguminous cover crops and biofertilizers of Azospirillum and Bacillus and other cultural practices combined with micro-irrigation techniques, mulching to obviate moisture stress and enable sustainable coconut production, in an environment-friendly way can be followed.

Accordingly integrated approach with GAP correlated with INM & IPM (preferably adopting more biological control methods) right from community level may be introduced as the productivity improvement programme with utmost quality in order to achieve the maximum coconut production in anticipation to the increasing upcoming demand

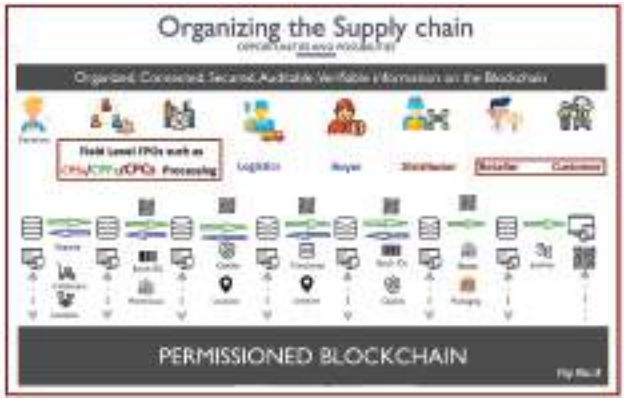


proportionate to world population needs. In order to enhance the productivity, various innovative steps should be introduced focusing on organic concepts to certain extent. The coconut farmers are also conscious in bringing in maximum possible area under coconut farming following scientific and economical means of cultivation in order to prevent intrude of other competitive oil crops.

Rejuvenation, replanting & plantation development

When the plantation become senile and once the productivity starts declining, rejuvenation of the garden is the basic requirement of any plantation crop in order to realize maximize profit from a given land area. However, it is an exception in the coconut sector where the growers are reluctant to uproot the palm even when it becomes senile and less productive. This is because of the fact that coconut has a long juvenile phase and therefore it takes long time to get the benefit from coconut. In general the economical life of a coconut can be divided in to growth, optimum and decline periods as shown in Fig.2. However, scientific knowledge of effective way of carrying out the replacement of senile coconut plantation is very important to maximize profit and minimize problems related to replacement. Farmers need to be given proper awareness with reasonable compensative support and assistance to encourage them in replacing the old and senile coconut plantation under the rejuvenation and replanting process of coconut plantation.

While taking into consideration the economical factors, an appropriate approach should be framed to attract the farmers to come forward for the rejuvenation of their plantation including small holders. Attractive schemes with compensative components should be designed by the authorities in order to achieve this goal as per the target. The responsible authorities of each country should take in to account that the agriculture is every nation's stabilizing essential investment with private participation which enable the population to meet their prime need of food and employment to a great extent in addition to the contribution to nation's economy. Hence it is required to process this in a project implementation approach in a phased manner by ensuring new plantation or by minimizing the duration by under planting, etc. in order to maintain minimum impact to the revenue-production status of farmers as well as the whole coconut industry.



Production of quality planting materials with high productivity – New Propagation methods- and production Seed/Seedling sharing.

The gradual reformation of the coconut farming sector to an enterprising plantation through the collective farmers group organizations will be highly beneficial to monitor and assist for healthy coconut plantations as a whole by development agencies and extension workers from government authorities of any country. Farmers need to be provided quality planting material for increasing the productivity, establishment of healthy long run coconut plantation and moreover for the growth of the coconut processing and value addition in the major coconut growing countries. The requirement of coconut seedling is not only for new planting but would also be in demand where the rejuvenation and re plantation programmes are being taken up. This immense task cannot be accomplished through traditional seed propagation. The ongoing researches on propagation methods need to be accelerated through necessary synchronization and co operation among the research organizations of different countries. Biotechnological alternatives like clonal propagation of Elite Coconut Cultivars, in vitro Micro propagation, Somatic Embryogenesis, and Plumule Rachilla, with its great propagation capacity, is an optimistic approach to develop highly efficient and commercially viable protocols which will hopefully create international sharing and assure the availability of seed/planting materials, since this is expected to result simplified transport options in secure storage condition with minimal phytosanitary hurdles. Hence for the time being production of quality assured coconut seedlings should be continued by following maximum yardsticks in this field right from seed selection to distribution and planting.

Development of Scientific cultivation suitable for inter/multi spices crops and Co ordination of international Research

The new planting of coconut need to follow scientific methods of cultivation and possibly the organic concept in order to make each farm produce competitive and quality assured acceptable products complying with the health and environmental concerns of each and every end user. The authorities may formulate suitable attractive, encouraging and assuring scheme components in order to maximize the area of coconut farming in every country. It can ensure that maximum suitable land is brought under coconut farming with required additional production in proportion with the increasing global consumption expected in future. Considering the consistency of the land recourse, it is advised to follow proper spacing and adopting required inter/ multi species crops not only for income generation to farmer but also for production of other food/fruit produces with zero wastage of the land recourses including other sharable inputs including the recycling usage of farm wastes in the respective territory for a balanced ecosystem with achievable food reserve for society. Achieving self sufficiency particularly in produce or products which are essential for primary need to human life can reduce the import by any country that helps the accumulation of reserves. Coconut cultivation is to be preferably promoted as a plantation mode gradually through collective farmers organizations in concentrated feasible areas or nearby localities folowing GAP operational activities by collective Farmers Produce Organizations (FPOs) and also for the development of processing and value addition activities since it will ensure the availability of raw farm produces or in raw material form benefitting both the farmers and traders.

Research correlation is highly appreciated among all the countries in all possible areas for sharing the innovative inventions and solutions mainly in adopting technologies in coconut cultivation as well as in post harvesting technologies. The farmers should be properly monitored by the development or extension agencies from time to time in updating the technologies including solving the field level issues which would be more effective. The authorities need to ensure sufficient compensation to the farmers on their losses occasionally happening due to natural calamities or severe and massive pest and disease attacks engaging advanced technologies such as observance through drone applications including the application of plant protection chemicals/ organic solutions etc. Harvesting need to done on community basis through the FPOs with the help of well trained taskforce. In general, the organized pattern of all agricultural activities through collective farming will lead to success and upgrade the status of farmers as well as farming jobs and is expected to create opportunities which will definitely attract the young upcoming generation.

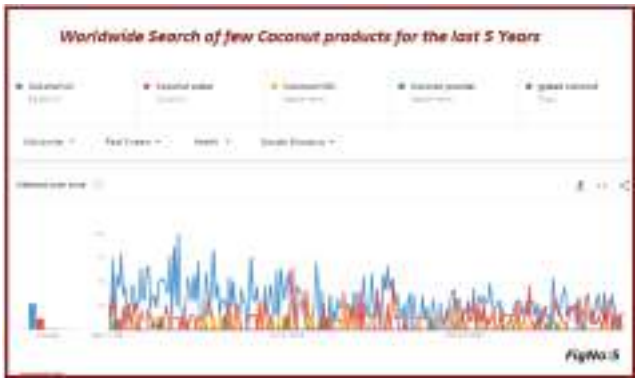
Further developing a communication strategy to increase farmers knowledge regarding coconut reproductive biology and breeding methods, including training tools, video guidelines, media communication, and an approach for marketing of genetic resources along with scientific cultivation aspects will also change the face of world coconut industry to a certain extent. The preservation of a world Germplasm collection of identified cultivars in respective of each country also can be useful for future research.

Republic Day

Coconut Development Board observed Republic Day on 26th January 2022 in the Head Office premises. Shri R. Madhu, Secretary hoisted the National Flag during the occassion. Officers and staff of the Board attended the programme.

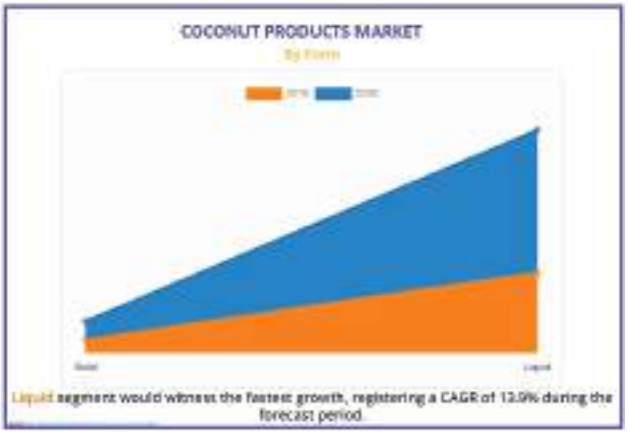
Integrated processing and value addition

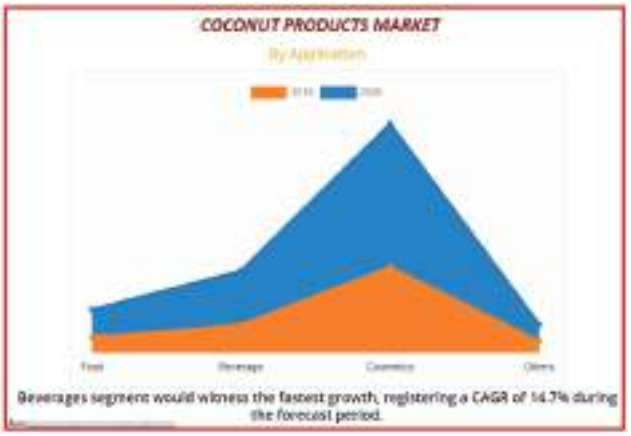
Processing and value addition plays an important role in the present scenario. There should be efficient and economical and modern processing technologies for value addition of the coconut products to produce the desired products to the end user by assuring quality and quantity. The FPOs can adopt field level minimal processing as an additional primary activity of value addition. The uppermost collective form of the FPOs can engage in major Integrated Coconut processing ventures in coconut as per demand.

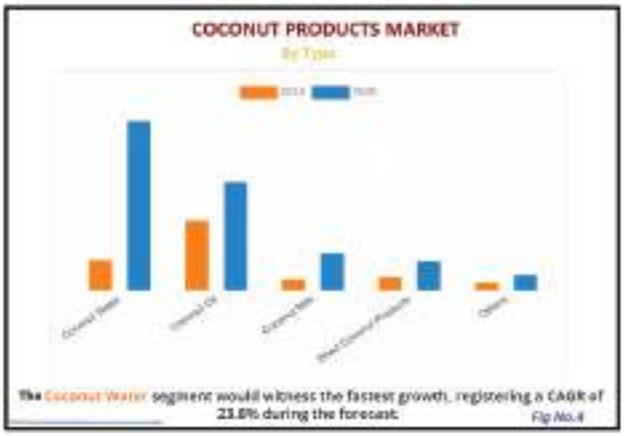


The integrated from of processing with diverse production lines for different value added products can effectively balance the production or value addition as per the demand and influences of the seasonal, geographical and market elements. For example, the fall in consumption of coconut oil due to it's solidifying feature in the peak winter season should be accounted and the production should be regulated with feasible market elements such as suitable package or may be diverted or regulated till the period demands for change. Zero wastage is another important factor which can be achieved to a maximum extent by this integrated processing units with multi production lines. In the case of production of virgin coconut oil, many parts of the coconut need to be processed to avoid the wastage such as the husk in to fibers and coir pith, the shell in to shell powder and shell charcoal or activated carbon, coconut water in to vinegar/ Squash /Nata-de-coco etc. which can become profitable in the long run process through moderate initial investment. In this area, an effective Value Supply Logistic chain should be established for a balanced and cost effective farming – postharvest & procurement – transportation - inventory management - production process in coconut sector. It is also convenient to have the cold chain logistic for advanced production and processing of coconut products. The government authorities of many countries are providing the facility of transportation which can be made use as and when required during processing & marketing (Fig. 5)

The research organizations and agencies should assist the industry by developing technologies for health conscious products, preservation methods, including packing for the products in globally acceptable product developing combinations. This is all the more relevant since the quality and quantity is the most preferred aspect of the customer over its price due to the growing health consciousness of the consumers.







Awareness, Marketing and Promotion

According to the statistics, the global coconut products market size was at $11.5 billion in 2018 and is anticipated to reach $31.1 billion by 2026, with a Compound Annual Growth Rate (CAGR) of 13.6% during the forecast period. The market is expected to exhibit an incremental revenue opportunity of $19.7 billion from 2018 to 2026. Out of this coconut oil segment was valued at $6.1 billion and is expected to grow with a CAGR of 5.6% from 2019 to 2026, to reach $9.4 billion by 2026 (Fig 4). Market growth is propelled by the rise in demand for coconut water as an energy drink. Health conscious of consumers cause the shifting in their preference towards natural alternatives to caffeinated and sugar-based energy drinks. Hence, the demand for coconut water as a natural energy drink is growing rapidly due to its nutritional and health properties which are expected to drive the coconut products market growth. Increase in the use of coconut-based products in food and beverage applications is expected to drive the market for coconut products in the future. Coconut products are widely used as ingredients in a variety of processed food products such as cookies, cakes, pies, soups, salads, milkshakes, and ice cream. The growth in consumption of processed food products owing to the rise in urban population will accelerate, the demand for coconut products is at a significant rate in near future.

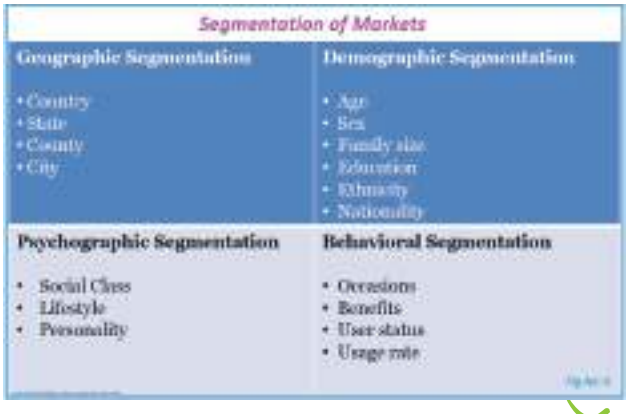
The coconut products market is segmented on the basis of type, application, form, and region. Based on type, the coconut products market is categorized into coconut water, coconut oil, coconut milk, dried coconut products, and others. Coconut oil is widely used in cosmetics industry and is one of the prime products in hair care, thus is expected to influence the overall coconut products industry. After all, the marketing of the product is an important aspect for the well balanced existence of the industry right from coconut farming to consumer or the end user. Coconut and its products have an advantageous constraint that farming of coconut depends geographical and climatical factors. The beginning of any product or service is as per the wish and need of customer / consumer.

Here arises the necessity of an apt marketing strategy formulation in a well deliberate manner in all means. It can be redefined that "Marketing is all about identifying and meeting the customer needs with profitability". The new market penetration with low pricing policy is for new and existing products will attract larger number of buyers and a large market share. This strategy increases the product sales in the company's present markets through an aggressive marketing mix. The product portfolio of coconut industry can be developed similarly. Communication to the respective market segmentation is a direct access of awareness to the desired groups regarding coconut products. Health benefits to the health sector, cosmetics to the young generation are few examples. Seminars, conferences exhibitions, B2B, B2C programmes are very essential for creating awareness about coconut products and its wellness & health aspects.

The markets for high-value coconut products are currently expanding, strongly driven by products like coconut water and Virgin Coconut Oil (VCO). This is indicated by world web data leading to the maximum search for coconut oil and water through internet (Fig.4). In future these markets will become more and more competitive and selective so that the producers, processors and exporters will have to differentiate by the distinguishing factors of their product. The way coconut palms are cultivated in respect to environment and health of consumers, the special characteristics of the varieties which are cultivated, and the notions of "terroir" or "branding by origin" are becoming increasingly important in marketing coconut products. Formation of consortium of processors in each territory (country) will lead to integrated formation of policy initiatives such as market analysis, supply schedules, efficient resource mobilization and logistics increased strength of bargaining, market presence etc.

Formation of a Marketing Strategy for coconut value added products

In general, the success in marketing comes from knowing who your customer is and being able to fulfill their needs. Marketing should be customer



SECTOR	Strength	Weakness	Opportunities	Threat
FARMING	Geographical specialty on Farming (Traditional & Nontraditional areas or cultivable and non cultivable areas)	Less awareness for economical farming	Maximum utilization of suitable land for coconut production by adopting other inter & multi layer crops adopting scientific methods in an enterprising method	Lack of all infrastructure and natural recourses.
	Existing plantation and regularized productivity	About 25% senile and below average or unproductive old plantations.	Schemes for Rejuvenation & Replantation with deserving incentives and compensations, assistances to the farmers.	Lack of Quality planting materials and drastic financial impact on the farmer. In sufficient compensations through the schemes from Govt.
	Long Run Crop with lengthy life span,	Steadiness in income of farmers Production declining trend	Adoption of inter / multi layer cropping system	Laps of renovated timely logistic – marketing system.
	Uniform maintenance of the farming causes avrage productivity.	Less productivity causes falling interest, following of traditional methods	Adoption of innovative new scientific production technologies.	Fluctuations of demand price due to unbalanced market supply & market competitions. life style changes
	Scientific method of farming	Maintenance cost hike & less productivity, for old plantation declining productivity. Changes in government policies.	Group farming by organizing FPOs within the farming community and cost effective farming operations. Conversion in to Plantation concepts	Climate Change Impacts on Coconut Production, Global changes, Trade reforms, revoke of pests/diseases, changes or decline natural recourses and continuing natural calamities
	Supportive schemes from the Coconut Development authorities of each country to the farmers.	Lack of Admn & organizational and organizing laps. Requirement for innovated technologies for farming and processing. The trend authorities reducing subsidy factors for farmers	Organic IPM INM, Biological control method and demand for Organic farm produces, insurance schemes, Organic certification.	Cost hike on inputs and price fluctuations on coconut. Absence of logistic – marketing system. Threat and encouragement for other oil crop farming (palm Oil)

oriented and targeting and defining of marketing is the preliminary process of marketing. Before entering the market or marketing, awareness on market as well as knowing your competitor in the territory are the important things to be well studied initially. The markets can be defined such as consumer, industrial and government markets. Further, each market defines to segments called market segmentation. Geographical, demographical, physiographical and behavioral segments are the other segments (Fig.6). Here comes the selection of the required geographic territory market and the choice of the segment depending on the attributes of the product or vice versa. Defining of market objectives and the marketing mix such as product, price, promotion, and place are the next strategic steps in the process of marketing. Then the above four factors move one by one or simultaneously.

Product should be suitable and generally acceptable to the consumers that follows acceptable quality and quantity standards and marketing can be made by projecting its richness of health friendly properties. Packed Tender Coconut Water, Virgin Coconut oil, Coconut Milk, Neera etc are primary golden products from coconut industry to be projected. The health benefits of these products itself is a marketing tool with in many market segments. Promotional activities can be initiated simultaneously after pricing along with placing and finding the people for selling and customer/ consumers. Pricing strategies in marketing such as, cost based, and status-quo is mainly adopted to fix any of the Flexible, Static, Penetration and Skimming prices for the product considering the cost and competition status in the market under selection. In continuation to this, setting up of distributors, stockiest for selling process to the targeted places such as Malls, Hospitals, Educational Institutions, Hotel & Restaurants etc by feasible transportation could be taken up. Meanwhile the promotion mix could be implemented adopting suitable or

PROCESSING	Scope for product diversification, value addition Field level Processing, scope of health benefit.	Lack of Innovative processing, awareness on coconut products, and proper availability.	Opportunity for options for FPOs in the field level at least minimal processing developing management skills.	Intermittent market supply due to absence of proper managerial co ordinations.
	Developing advanced Integrated processing Technology.	Innovative cost effect production technologies Lack of Financial encouragements	Project based technology development through recognized research agencies. Zero Wastage processing	Market development and conquering market promotion
	Un interrupted supply of cconut for processing	Production/price fluctuations including harvesting transportation hurdles.	Backward integration with farmers for the supply of coconut as raw material with out interruption.	Lack of knowledge & guidance in time operational activities both in the farming and marketing facilities
	Advanced processing	Limited availability of Organic production	Health Cosmetic orientation of the product and production, Export oriented units	Must follow International standards and uniintrrupted supply.
PROMOTION	Versatility and potential of COCONUT product	Lack of proper projection in awareness	Diversification of the coconut products, by projecting health benefit aspect, Organic production exploiting the nontraditional area demand, with developed logistic scopes,	Global competition and less awareness on benefit of coconut products on health aspects and its acceptability.
	Market Segmentation	Finding segmented groups and appropriate market promotion activities	Product wise categorized into food, beverage, cosmetics, and other different segmented groups	Alternate products
	Potential for health conscious value added Coconut products	Lack of awareness	Modern fast reaching media, social media	Ensure prompt market availability
	Health benefits to mankind and it acceptance	Lack of availability in market laps in promotional activity.	Branding, Social media coverage's, authentic events such seminars, exhibitions and research conferences	Lack of coordination and attention by the Govt. Agencies
MARKETING	Trend towards product acceptance and search	Proper marketing strategies	Domestic- international- Global market opportunities	Rising quality standards of markets and competing countries,
	Health conscious in processing and products	Availability of Organic products	Production of demandable products on health conscious preferably organic standards. Consortium of processors	Improve quality and food safety to meet growing world quality standards and price
	Marketing of health conscious coconut products (health benefited beverages & food substitute)	Marketing Networks	Advanced marketing strategies and network marketing, Online sales. Growing positive attitude towards health benefited products.	Competition and Alternate products. Taste habit constraints
	Find the customer oriented need for the coconut product	Highly diversified value addition Need of product customer use are different.	Concentrated production on high demand coconut product and its production with all quality standards. Preference to natural healthy products	Competition and Alternate cheap products Substitutes and lack of availability of desired products.
	Adoption of organized marketing Strategy	Promotion, and supply Logistic value chain supply	Improved promotional activities, developing logistic value chain concepts. Supportive govt. Schemes from govt/ financial institution	Financial implications
GENERAL	Country based Coconut Developmental agencies and International agency for coconut industry development	International Co ordination, and inter govt supports, freedom of in involvement due to rules of each country	International Agency for any international co ordination and monitoring	Limitations in support and financial constraints

combined form of promotional tools like advertising, Personal selling, Sales promotion, Public relation, Social media etc. (Fig 7) Effective execution of marketing strategy helps in achieving stable market linkage and resulting significant market share among the competitors.

In the light of the above facts it is expected that the demand for coconut products would increase remarkably resilient Covid -19 Pandemic period. Accordingly, all obligatory preparations to meet the expecting demand in a healthy manner with sufficient supply ensuring availability in every nook and corners of the globe with stipulating to international standards of quality, quantity and packaging etc. need to be attempted. Similarly attempts for creating a cognizant adoption of coconut products enabling to convey coconut as a necessary commodity to the upcoming generation also need to be done. This can be achieved only when an equilibrium production,

processing and marketing right from farming to processing/manufacture sector with strategically effective established marketing process is done. Finally basic growth alternatives viz. marketing activity, strategies for market development and product development are to be initiated for safe business operations (Fig 8,9,10) in due course.

Before concluding it is necessary to appreciate the vital role of International Coconut Community in its remarkable and predominant activities with the vision of "improved socio-economic welfare of farmers and other industry stakeholders for a vibrant Coconut Sector". It is expected that the ICC and other similar organizations would be able to initiate strategies for the swift acceleration of the coconut industry corresponding to the day-to-day changing global challenges with the co operation of its member countries.

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Isariafumosorosea: a Potential Biocontrol agent for Rugose Spiralling Whitefly on Coconut

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Rugose spiralling whitefly (RSW), Aleurodicusrugioperculatus Martin (Hemiptera: Aleyrodidae) is a highly polyphagous and invasive pest, recorded for the first time in India during 2016 in Tamil Nadu on coconut (Sundararaj and Selvaraj, 2017). Subsequently, it spread to other coconut and oil palm growing tracts in India. Rugose spiralling whitefly nymphs and adults not only feed aggressively on leaf sap resulting in depletion of nutrients and water which leads to premature leaf drop and drying but also produce wax and excretes sticky honeydew on infested areas leading to extreme growth of black sooty mould which results in the reduction of photosynthetic efficiency in palms. It has now become regular pest of coconut and oil palm in India, warranting control measures to avoid crop losses.

Two parasitoids, Encarsiaguadeloupae and E. dispersa(Hymenopetra: Aphelinidae) have been fortuitously introduced into India along with spiralling whitefly Aleurodicusdispersus during 1990s. Among these parasitoids, E. guadeloupaewas found to be most abundant and potential with natural parasitization to the extent of 60-82% on rugose spiralling whitefly on coconut and other crops (Selvaraj et al., 2016). In India, E. guadeloupae was well established by augmentation, re-distribution and various conservation strategies. Moreover, using a single biocontrol agent to suppress the whitefly population may be difficult under severe outbreak conditions especially for an invasive pest like rugose spiralling whitefly.

The entomopathogenic fungus, Isariafumosorosea Wize (formerly Paecilomycesfumosoroseus) is distributed world wide and effective against insect pests mainly whiteflies and can initiate epizootics under natural field conditions. This fungus is used as potential biocontrol agent against rugose spiralling whiteflyand Bondar's nesting whitefly on coconut in Florida (Ali et al., 2015). This bio control strategy may provide farmers with an alternative and viable option for the management of this invasive whitefly in coconut. Further,it is important to assess the interactions with parasitoidE. guadeloupae, for their

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simultaneous utilization of both the biocotrol agents for the management of rugose spiralling whitefly.

In vitro evaluation of NBAIR strains of Isaria fumosorosea: Two strains of I. fumosorosea(Pfu-1 &Pfu-5) were screening against rugose spiralling whitefly. Primary culture was tested against different stages of rugose spiralling whitefly using a leaf-dip method. Fungal culture of (ICAR-NBAIR Pfu-1 &Pfu-5) was produced on 100 gms of sterilized rice grains by inoculating 5ml of 4 days old shaker culture and incubated at 26 ± 10C for 15 days. Spore suspension was prepared by suspending one gram of conidiated rice in sterile distilled water containing 0.01% Tween 80. The suspension was filtrated through three layers of muslin cloth to get hyphal-free spore suspension and the concentration of the spore in the suspension was adjusted to 1x108 spores/ml using Neubauer's improved haemocytometer.

The fungus was effective in killing all the life stages of the pest including eggs. These strains showed 35.2 - 80.6% mortality on different stages of rugose spiralling whitefly, respectively at 1×104 - 1×108 spores/ml) at 5 days of treatment. Myclial growth can be seen with 24 hours after exposure. Among the strains, Pfu-8 is slow growth/mycosis as compared to other strains. Eggs and first instars of these invasive whiteflies were highly susceptible to I. fumosoroseaas compared to other life stages.Therefore, to get maximum reduction in pest population and sprays should be initiated in early stage of pest.

Development of formulation

Talc and oil formulations were developed with longer shelf life, persistence and higher bio efficacy. The strain can be mass produced using Sabouraud dextrose agar broth and talc/rice grain/oil based formulation as per Central Insecticide Board standards. All these formulations were evaluated in laboratory against rugose spiralling whitefly.

Field evaluation of Isariafumorosea:Pfu-5 has identified as promising strain and field tested against rugose spiralling whitefly in Andhra Pradesh, Karnataka, Kerala, Tamil Nadu, West Bengal and Maharashtra on coconut. Overall mortality (72.20-73.83%) was observed at Bengaluru, Karnataka and it was 74.26 to 75.83% at Rajahmundry, Andhra Pradesh with two sprays at 15 days interval. This fungus is recommended at 5 g or ml /litre with tween 80 with 5-7 litre water using high volume sprayer during evening hours. Dead stages turn brown, shrink and dry completely. Natural epizootic of this fungus on A. rugioperculatusis also observed in Andhra Pradesh.

The results of the present study suggest that the application of Pfu-5 was found to be highly pathogenic and seems to be potential biopesticide against A. rugioperculatus with very slight negative effects on beneficial parasitoid, E. guadeloupae. The compatibility of two different types of biological control agents is very important for sustained and successful pest management. It is evident from present findings that there are positive interactions between the I. fumosorosea and E. guadeloupae and these interactions could serve as an effective control strategy for A. rugioperculatus in coconut and oil palm ecosystem.

Demonstration: About 27 demonstrations were conducted in collaboration with other stakeholders across the pest infested regions such as Karnataka, Tamil Nadu, Andhra Pradesh and West Bengal for field validation. Due to its high field efficacy there is a huge demand for this biocontrol agent from the coconut farming community at farm level.

Training on mass production Isariafumosorosea and their distribution

About 11 trainings were conducted on mass production of this fungus at farm level at Andhra Pradesh and Karnataka and about 45 farmers from

different regions were trained on mass production. Different formulation and nucleus culture of this fungus distributed to farmers, state agricultural universities, Horticultural Universities, KrishiVigyan Kendra, Central Integrated Pest Management Centres, ICAR Research Institutions, Department of Agriculture, Department of Horticulture, All India Coordinated Research Project on Biological Control of Crop Pests Centres and other stakeholders.

Effect of Pfu-5 on Encarsiaguadelouape: To test effect of Pfu-5 on parasitized nymphs were treated with different concentrations and observed the emergence and mortality of parasitoid up to 15 days after treatment. Interestingly, about 81%

adult parasitoid emerged from nymphs exposed at 1×108 spores/mL and 94% at 1×104spores/mL. Since these two biocontrol agents are compatible, they can be utilized together in biointensive pest management programme for the control of A. rugioperculatusin coconut ecosystem.

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Farmers Field Day

Coconut Development Board in association with Thejaswini CFPC Ltd, Kerala organized Farmers Field Day Training programmes at Palavayal and Chittarickal in Kasaragod district from 17th and 18th January 2022.

Coconut Development Board , Regional Office, Bangalore, in association with ICAR-KVK organized Farmers Field day programme on scientific coconut cultivation at Tokuru, Dakshina Kannada District on 24th January 2022. 39 farmers attended the programme.

Coconut Development Board, Regional Office, Banglore in association with ICAR-KVK conducted Friends of Coconut Tree(FOCT) skill development Training Programme at ICAR-KVK (D.K), Mangluru

Coconut Development Board in association with Kanjiramkulam Panchyath CPS and Arumanoor CPS Thiruvananthapuram, Kerala organized Farmers Field Day Training programme on 13th February 2022.

Coconut based convenience food training

Coconut Development Board, Regional Office, Guwahati, Assam conducted coconut based convenience food training from 1st to 4th February 2022 at Regional office Guwahati. Participants from Kamrup, Assam attended the programme. Dr. Jyotsna Baruah, Retd Professor, Directorate of Extension Education, Guwahati and Dr. Sanjib Dutta, Retd SADO, Agriculture department, Assam attended the programme as Resource Persons. Coconut food making competition was also organized and cash prizes were awarded to the winners.

Block Level Seminar

Coconut Development Board, Regional Office, Guwahati, Assam in association with District Agriculture Office, Darrang conducted a Block Level Seminar on 2nd February 2022 at Hatimuria, Sipajhar, Darrang district, Assam. Shri Kaustubha Kanta Pandit, Sub-divisional Agriculture Officer (SDAO), District Agriculture Office, Darrang and Shri Pranab Bharali, Agriculture Development Officer (ADO) District Agriculture Office, Darrang were the Resource Persons in the programme. 50 farmers attended the programme.

CDB officers visited Lakshadweep

With an objective of creating more awareness on various schemes and programmes of Coconut Development Board in the Union Territory of Lakshadweep (UTL) Shri Pramod P Kurian, Assistant Director, Shri Kumaravel S, Development Officer and Shri Mohammed Massod, Technical Officer, CDB visited the Island and had discussion with the officers of Dept. of Agriculture, UT of Lakshadweep Administration, Scientists of KVK-Lakshadweep, officers of other related departments and farmers. The team visited Agatti, Kavaratti and Bangaram islands of Lakshadweep from 26th January to 1st February 2022

Dr. P N Ananth, Sr. Scientist & Head KVK-Lakshadweep (ICAR-CMFRI), Kavaratti appraised the status of implementation of extension and skill development activities being undertaken through the KVK, with the financial support of CDB. The activities that can be taken up in future in association with the Board for creating a better coconut situation with better productivity, increased level of awareness on scientific cultivation and adoption, skill development in harvesting, neera tapping, coconut based handicraft making, coconut based convenient foods preparation, value addition in coconut, improvement in existing products, etc. were also discussed. Dr. K. Mohammed Koya, Scientist, ICAR-CMFRI, Mrs. Jameena Jamal, Young Professional-II Mr. Shihab BK, Young professional-I of KVK were also present during the meeting.

The team also attended the inaugural session of the training programme on 'coconut shell based handicraft making' on 27th January 2022 which was held from 27th January to 1st February 2022. The programme organised by the KVK, Kavaratti was attended by 30 trainees. The team had discussions with Shri. Santhosh Kumar Reddy V IFS, Special Secretary and Director of Agriculture and also with the officials of the Directorate of Agriculture at Kavaratti and reviewed the status of implementation of various CDB schemes especially Replanting & Rejuvenation, Laying out of Demonstration Plots etc. The programmes to be taken up during the next financial year were also discussed.

The officers also called on Shri Buzhar Jamhar, Block Development Officer, Agatti and briefed about the schemes of the Board. The officers visited units manufacturing coconut oil in Kavaratti and Agatti and field visits were undertaken in Kavaratti, Bangaram and Agatti islands along with scientists of KVK and the Dept. of Agriculture. The team had interaction with farmers on scientific coconut cultivation practices.

KVK-Lakshadweep organized Coconut Shell Based Handicraft training

KVK-Lakshadweep organized a six-day training on coconut shell based handicrafts for 30 participants from. Kavaratti, Agatti, Kadmat, Kiltan and Androth islands from 27th January to 1st February, 2022 at Kavaratti. The training sponsored by Coconut Development Board. Mr. Sivadasan from Kerala was the master trainer. The training was inaugurated Mr. Pramod P Kurian, Assistant Director, Coconut Development Board in the presence of Dr. P. N. Ananth, Senior Scientist and Head, KVK-Lakshadweep, Mr. Kumaravel S, Development Officer,CDB, Dr. K. Mohammed Koya, Dr. V. M. Abdul Gafoor of KVK-Lakshadweep Mr. Shareef, District Agricultural Officer and other dignitaries. Shri. Santhosh Kumar Reddy. V, IFS, Special Secretary (Agriculture), UT administration of Lakshadweep interacted with the participants and informed that the government will provide all support for establishing handicraft units. The valedictory session was attended by Mr. Abdul Kader, Chairperson of Kavaratti. The Chairperson appreciated the participants products made by the participants Dr. P. N. Ananth, Senior Scientist and Head, KVK-Lakshadweep coordinated activities of the training programme.

Sustainable Coconut Farming in Lakshadweep

ICAR-CPCRI and KVK-Lakshadweep have been jointly working since 2021 on issues pertaining to the coconut sector of Lakshadweep islands. The works carried out have been towards technology assessment, frontline demonstrations on thematic areas like quality neera production, processing and value addition using technologies of ICAR-CPCRI and standardisation of agronomic practices. In these lines, ICAR-CPCRI and KVK-Lakshadweep attempted to work on further assessment of research and extension needs in the coconut sector of the islands by employing interaction meets, Focus Group Discussions and a workshop on practice to policy from 7-11 February 2022.

A team of scientists from ICAR-CPCRI Kasaragod, KVK-Lakshadweep, extension functionaries of the Department of Agriculture, farmers, entrepreneurs and palm climbers and tappers were involved in the various deliberations. The programmes comprised of interactions and focus groups discussions, diagnostic field visits, interaction sessions with selected farmers and palm climbers employing case study methods, trainings and a workshop. The representation of Coconut Development was ensured in few activities.

Farmer interactions and Focus group discussions

Farmers interaction meet and focus group discussions involving scientists from ICAR-CPCRI Kasaragod, staffs from KVK, extension personnel from Department of Agriculture, farmers, palm climbers and tappers were conducted in Agatti, mAmini, Kadmat and Kavaratti Islands.

Thematic areas in the interactions and FGD's included adoption of cultivation practices for sustainable coconut production, constraints experienced and strategies to overcome the challenges in coconut farming, avenues for income and employment generation through coconut based microenterprises on value addition, relevance of farmer collectives and palm climbers' collectives, assessing effectiveness of technologies such as 'coconut sap chiller' in tapping of 'Kalparasa'(coconut inflorescence sap) in comparison with the traditional 'Meera tapping', preparation of value added products such as vinegar, jaggery, coconut sugar etc using coconut inflorescence sap, use of mechanical device for coconut tree climbing etc. A declining trend of coconut production, incidence of white fly, issues in marketing of coconut and few research and extension needs were elicited from the interaction meets and FGDs. A key observation was that there are many development interventions which needs further multi stakeholder consultations for triggering development in this sector. Above all a relook on the data pertaining to basic coconut statistics in the islands were few key observations. Issues on the organisations meant for agriculture development in the island and need to strengthen through an institutionalisation process was mainly observed which needs an immediate policy shift.

Field visits and interaction with farmers

Scientists from ICAR-CPCRI along with KVK personnel visited coconut gardens owned by farmers in Agatti, Amini and Kadamat islands and diagnosed

various field problems. The major field problems included deficiencies of potassium, nitrogen, boron and stem bleeding disease, eriophyid mite and white fly. Remedial measures for managing the field problems taking into account the organic farming policy being adopted in Lakshadweep islands were suggested. Detailed discussions were held by the team of scientists with selected farmers to analyse the cultivation practices currently followed vis-a-vis traditional practices adopted during earlier times, trend in coconut productivity, copra processing, marketing and various techno-socio-economic constraints experienced in coconut farming.

Training-cum-Demonstration on production of coconut sugar

A training-cum-demonstration programme was conducted at Kavaratti on 11th February 2022 on production of coconut sugar using the technology developed by ICAR-CPCRI. KVK personnel and selected entrepreneurs participated in the training programme. Dr. Shameena Beegum, scientist from ICAR-CPCRI Kasaragod briefed on production of coconut sugar and imparted hands on training to the participants.

Workshop on "Practice to Policy" "Prospective Coconut Development Strategies and Enterprises in Lakshadweep Islands"

The workshop on "Practice to Policy" "Prospective

Coconut Development Strategies and Enterprises in Lakshadweep Islands" was organised at Kavaratti on 11th February, 2022. The major objective of the workshop was to discuss and formulate strategies and interventions towards enhancing sustainability of coconut production and coconut based enterprises on value addition and marketing in Lakshadweep islands based on the findings of an earlier study conducted by ICAR-CPCRI.

Participants in the workshop included scientists, extension personnel, farmers and entrepreneurs. Mr. Santhoshkumar Reddy IFS, Special Secretary (Agriculture) inaugurated the workshop. Dr. Thamban, C., Dr. A.C. Mathew, Dr. P.Subramanian, Dr. Shameena Beegum, scientists from CPCRI Kasaragod; Dr. P.N.Ananth, Sr. Scientist and Head, KVK- Lakshadweep, Mr. Shareef, District Agriculture Officer, UT administration of Lakshadweep and Mrs. Leenamol, Development Officer, CDB Kochi presented in the workshop. During the interaction session Mr. Santhosh Kumar Reddy IFS emphasized the need to establish model coconut gardens in which appropriate technologies for sustainable coconut farming and value addition are demonstrated to the visitors. Varieties of coconut indicating the coconut genetic diversity available in Lakshadweep islands are to be planted in these model gardens. The latest aggregation model of FPOs were discussed in the workshop and strategies to strengthen the process in the islands were delineated. In connection with the workshop an exhibition was organised displaying various technological innovations and activities performed by ICAR-CPCRI, KVK and Coconut Development Board. Recommendations of the workshop for accomplishing the tasks were presented in the final session by the participants representing different stakeholder categories.

(Report Prepared by Dr. P.N.Ananth, Sr. Scientist and Head, KVK- Lakshadweep, Dr. Thamban, C., Principal Scientist and Dr. Shameena Beegum ICAR-CPCRI Kasaragod) ■

Cultivation practices for coconut -March

Collection and storage of seed nuts

Continue seed nut collection from the identified mother palms. Seed nuts should be carefully harvested and properly stored to prevent drying of nut water. Wherever the ground surface is hard, harvested bunch should be lowered to the ground using a rope.

Nursery management

Continue irrigation for the seedlings in the nursery.

Weeding has to be done wherever necessary. If termite infestation is noted in the nursery drenching with chlorpyriphos (2ml chlorpyriphos in one litre of water) should be done. Spiralling white fly infestation is observed in coconut nurseries in many localities. Spraying of water on the lower surface of leaves of seedlings can be done against spiralling white fly attack.

Fertilizer application

In irrigated coconut gardens, apply one fourth of the recommended dose of chemical fertilizers to the coconut palms.

Irrigation

Irrigation has to be continued in coconut gardens. If basin irrigation method is adopted, provide irrigation once in four days @ 200 litres per palm. Drip irrigation is the ideal method of irrigation for coconut. The number of dripping points should be six for sandy soils and four for other soil types.

Moisture conservation

Scarcity of water for irrigation during the peak summer days is a major problem in some of the

coconut growing areas. Hence, it is imperative that coconut growers judiciously use water for irrigation. Drip irrigation has to be adopted to save water. Mulching and other soil and moisture conservation practices should be adopted if not done earlier. In water scarce areas, wherever feasible, life saving/ protective irrigation has to be provided to coconut palms. Mulched materials are to be removed in the basin before giving such life saving/protective irrigation and immediately after providing irrigation the basin should be covered again with the mulching materials.

Shading

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

Management of pests and diseases

The month of March remains dry throughout, however, some summer showers at random could reduce the heat intensity and accelerate some humidity favouring outbreak of pests. The sucking pests such as whiteflies as well as coconut eriophyid mite could increase during the period. The slug caterpillar endemic regions should be strictly monitored and precautions should be carried out to prevent expansive spread by destroying pest-laden older leaves. Rugose spiralling whiteflies will find weather conditions very conducive and therefore suitable health management approaches such as nutrition and watering is very critical to upkeep proper health so as to put forward extra foliage to counter pest attack. Coconut seedlings in nurseries should be strictly monitored for rugose spiralling whitefly and nesting whiteflies. The odour plumes of deteriorating palm residues in the cyclone affected areas of Andhra Pradesh and Tamil Nadu could orient the red palm weevil for egg laying in the standalone palms for which strict monitoring is warranted. Crop residue burning on the palm basin should be avoided or it may soften trunk issues paving entry of stem bleeding and basal stem rot pathogens. March is thus known for strict monitoring days for maintaining good palm health and evading pest attack.

Red palm weevil *(Rhynchophorus ferrugineus)*

Incidences of rhinoceros beetle, would subsequently induce the invasive potential of the killer native pest, viz., the red palm weevil, which needs an injury for the weevils to orient towards the palm cue and lay eggs. Yellowing of leaves in mid whorl region, oozing of brown fluid, presence of bore holes, choking of spindle region and gnawing sound of grubs heard along the trunk are some early symptoms for timely diagnosis of pest damage. Farmers fail to detect the pest damage at an early stage due to concealed habitat of the pest. Dwarf genotypes and palms aged between 5-15 years are relatively more susceptible. All life stages of the pest were noticed inside the infested palms. Being a fatal enemy of palms, 1% action threshold has been fixed.

Adults weevils

Crown entry

Toppling of palm

▶ *Management*

- 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.

- Complete destruction of pest affected palms / crown toppled palms immediately
- 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 reduced pest incidence than mono-cropping.

Coconut eriophyid mite, *Aceria guerreronis*

Coconut eriophyid mite is the invasive pest reported from our country during 1998 and has been on the rise during post-winter season. It belongs to the spider family with two pairs of legs, sub-microscopic (200-250 microns size), lays about 100-150 eggs and the life cycle completed in 7-10 days. Mites infests the developng nuts immediately after pollination and are confined within the floral bracts (tepals) and feeds on the meristematic tissues beneath the perianth. Appearance of elongated white streak below the perianth is the first visible symptom. Within few days, yellow halo appears round the perianth, which turns as warts and finally develops as cracks, cuts and gummosis. Shedding of buttons, immature nuts, malformation of nuts are other indications of mite damage.

Mite damaged nuts

Mite colony

Progression of mite damage

▶ *Management*

a) Removal and destruction of dried spathes, inflorescence parts and fallen nuts to subdue the pest population

b) Spraying 2% neem-garlic emulsion or azadirachtin 10000 ppm @0.004% or root feeding with neem formulation containing azadirachtin 10000 ppm at 10 ml with equal volume of water three times during March-April, October-November and December –January is recommended.

c) Application of talc-based preparation of acaropathogen, Hirsutella thompsonii@ 20 g / litre/ palm containing 1.6 x 108cfu three times in synergy with neem formulation.

d) Kalpaharitha (a selection from Kulasekharam Tall) was found field tolerant to mite damage.

e) Application of recommended dose of fertilizers, recycling of biomass, raising of green manure crops in palm basin and incorporation during flowering, summer irrigation including soil and water conservation measures improve the palm health and reduce the pest attack.

Rugose Spiralling Whitefly (*Aleurodicus rugioperculatus)*

This period could also witness the establishment of the invasive rugose spiralling whitefly (Aleurodicus rugioperculatus) in new areas as well as re-emergence in already reported areas. The pest population is increasing very high due to favourable weather factors of high day temperature and fall in relative humidity. Presence of whitefly colonies on the under surface of palm leaflets and appearance of black coloured sooty mould deposits on the upper surface of palm leaflets are characteristic visual symptoms of pest attack. In severe cases, advancement in senescence and drying of old leaflets was observed. Leaflets, petioles and nuts were also attacked by the whitefly pest and a wide array of host plants including banana, bird of paradise, Heliconia sp. were also reported. Continuous feeding by whiteflies cause health deterioration in palms for which agronomic care is very critical.

▶ *Management*

- In juvenile palms, spraying of water with jet speed could dislodge the whitefly and reduce the feeding as well as breeding potential of the pest.
- Ensure good nutrition based on soil-test recommendations and adequate watering to improve the health of juvenile and adult palms. Agronomic

health management of palms is very crucial including planting of intercrops wherever possible to diversify volatile cues and improve microclimate disfavouring flare up of whitefly.

- No insecticide should be used as this causes resurgence of the pest and complete kill of the natural aphelinid parasitoid, *Encarsia guadeloupae*. A pesticide holiday approach is advocated for the build up of the parasitoid.
- Installation of yellow sticky traps and conservatory biological control using *E. guadeloupae* could reduce the pest incidence by 70% and enhance parasitism by 80%.
- Habitat preservation of the sooty mould scavenger beetle, *Leiochrinus nilgirianus* could eat away all the sooty moulds deposited on palm leaflets and cleanse them reviving the photosynthetic efficiency of palms.
- A close scrutiny should be made for the presence of other whiteflies including the nesting whiteflies on coconut system.

Nesting whiteflies *(Paraleyrodes bondari and Paraleyrodesminei)*

In addition to the rugose spiralling whitefly, two more nesting whiteflies (Paraleyrodes bondari and Paraleyrodes minei) are found associated with palm leaflets. Nesting whiteflies are smaller in size (1.1 mm) than rugose spiralling whitefly (2.5 mm). The nymphs are flatter with fibreglass like strands emerging form dorsum whereas the nymphs of rugose spiralling whitefly are convex in shape. Adult nesting whiteflies construct bird's nest like brooding chamber and sustains in the chamber. P. bondari had X-shaped oblique black marking on wings with two minute projections on rod shaped male genitalia whereas P.minei is devoid of black markings on wings and possesses cock-head like genitalia. Nesting whiteflies compete with rugose spiralling whitefly and reduce the aggressiveness of rugose spiralling whitefly in many cases.

▶ *Management*

- In juvenile palms, spraying of water with jet speed could dislodge the whitefly and reduce the feeding as well as breeding potential of the pest.
- Ensure good nutrition and adequate watering to improve the health of juvenile and adult palms
- Effective nitidulid predators belonging to Cybocephalus sp. were observed on the palm system and pesticide holiday is advised for conservation biological control.

Slug caterpillars *(Darna nararia)*

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

Slug caterpillar infested field

Mature caterpillars on palm leaflet

Management

- Complete destruction of affected palm leaflets with caterpillar at early stages of infestation should be made immediately so that the pest build up is suppressed. Care should be taken as the caterpillars cause extreme itching when contacted

with human skin due to the presence of poisonous scoli.

● Establishment of light traps and spraying *Bacillus thuringiensis* 5 g/litre was found effective along with inundative biological control using the eulophid larval parasitoid, Pediobius imbrues.

Stem bleeding *(Thielaviopsis (Ceratocystis) paradoxa)*

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

Management

● Avoid burning of trash and palm residues near the trunk to avoid trunk/root injury

● Adequate irrigation and adoption of soil and water conservation measures is advised.

● Application of 5 kg of neem cake enriched with Trichoderma harzianum and soil test based nutrition.

● Application of paste of Trichoderma harzianum talc formulation on the bleeding patches on the trunk was also found effective in preventing the spread of stem bleeding.

Basal stem rot disease *(Ganoderma spp.)*

It is a destructive disease observed in all coconut growing regions and found very severe in soils with higher pH and moisture stress condition. The pathogen invades the root system during early stages of infection that are not visibly noticed. The disease is very severe in areas of Thanjavur, Tamil Nadu, parts of East Godavari, Andhra Pradesh and Arsikara, Karanataka. The outer whorl of leaves turn yellowish, then gradually become brown and droop from their point of attachment and hang vertically downwards to form a skirt around the trunk apex. In course of time, the apex of the trunk shows tapering with the advancement of the disease, and bleeding symptoms may appear on the bole region. At the base of the stem a characteristic reddish brown discoloration develops, accompanied by the exudation of a brown viscous gummy substance. These brownish patches may extend up to one metre from ground level and at times bark pealing was also observed. Sometimes fruiting bodies (basidiocarp) of the pathogen develop from the affected trunk.

Basal stem rot disease

Bracket fungus

Management

● Avoid burning of trash and palm residues near the trunk to avoid trunk/root injury

● Removal of dead palms and palms in advanced stage of the disease as well as destruction of the boles and root bits of the diseased palms to remove disease inoculums.

● Isolation of neighboring healthy palms, by digging isolation trenches (60 cm deep and 30 cm wide) around the affected palm (1.2 m away from the base of the trunk).

● Application of neem cake (5 kg) fortified with Trichoderma harzianum (CPTD 28) talc formulation (50 g) per palm per year at six monthly intervals reduced the disease intensity.

● Root feeding of hexaconazole @ 2% (100 ml solution per palm) and soil drenching with 0.2 % hexaconazole or with 40 l of 1% Bordeaux mixture in the coconut basin are recommended

Hence, sustained monitoring and prophylactic treatments would suppress the damage potential of pest and disease and suitable health management strategies need to be adopted at the appropriate time. Timely pest management strategies has to be implemented in March to upkeep sound palm health for ensuring sustained production and keep away from pest and disease infections.

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

Market Review – January 2022

Domestic Price

Coconut Oil

During the month of January 2022 the price of coconut oil opened at Rs. 15900 per quintal at Kochi and Alappuzha market and Rs. 16500 per quintal at Kozhikode market. The price closed with a net loss of Rs. 200 per quintal at Kochi and Rs. 300 per quintal at Alappuzha market and Rs. 800 per quintal at Kozhikode market.

The price of coconut oil closed at Rs. 15700 per quintal at Kochi market and Rs 15600 per quintal at Alappuzha market and Rs. 15700 per quintal at Kozhikode market.

During the month, the price of coconut oil at Kangayam market opened at Rs. 13333 per quintal and closed at Rs. 13000 per quintal with a net loss of Rs. 333 per quintal.

Weekly price of coconut oil at major markets Rs/Quintal)				
	Kochi	Alappuzha	Kozhikode	Kangayam
01.01.2022	15900	15900	16500	13333
08.01.2022	16000	16000	16500	13400
15.01.2022	15700	15700	16100	NR
22.01.2022	15600	15600	15900	12467
29.01.2022	15600	15500	15700	12800
31.01.2022	15700	15600	15700	13000

Milling copra

During the month, the price of milling copra opened at Rs.9500 per quintal at Kochi and Rs.9450 per quintal at Alappuzha market and Rs. 9800 per quintal at Kozhikode market.

The prices of milling copra closed at Rs. 9300 per quintal at Kochi market, Rs. 9150 per quintal at Alappuzha market and Rs. 9400 per quintal at Kozhikode market with a net loss of Rs.200 at Kochi , Rs. 300 per quintal at Alappuzha market and Rs. 400 per quintal at Kozhikode market.

During the month the price of milling copra at Kangayam market opened at Rs.8700 and closed at Rs.8900 per quintal with a net gain of Rs.200 per quintal.

*NR-Not reported

Weekly price of Milling Copra at major markets (Rs/Quintal)				
	Kochi	Alappuzha (Rasi Copra)	Kozhikode	Kan-gayam
01.01.2022	9500	9450	9800	8700
08.01.2022	9600	9550	9850	8900
15.01.2022	9300	9250	9650	NR
22.01.2022	9200	9150	9400	8400
29.01.2022	9200	9050	9400	8600
31.01.2022	9300	9150	9400	8900

Edible copra

During the month the price of Rajpur copra at Kozhikode market opened at Rs. 18800 per quintal and closed at Rs. 16700 per quintal with a net loss of Rs. 2100 per quintal.

Weekly price of edible copra at Kozhikode market (Rs/Quintal)	
01.01.2022	18800
08.01.2022	17400
15.01.2022	16800
22.01.2022	16500
29.01.2022	16700
31.01.2022	16700

Ball copra

The price of ball copra at Tiptur market opened at Rs. 18000 per quintal and closed at Rs. 17000 per quintal with a net loss of Rs.1000 per quintal.

Weekly price of Ball copra at major markets in Karnataka (Rs/Quintal) (Sorce: Krishimarata vahini)	
01.01.2022	18000
08.01.2022	16600
15.01.2022	17400
22.01.2022	17000
29.01.2022	NR
31.01.2022	NR

Dry coconut

At Kozhikode market, the price of dry coconut opened at Rs.15100 per quintal and closed at Rs.14900 per quintal with a net loss of Rs.200 per quintal.

Weekly price of Dry Coconut at Kozhikode market (Rs/Quintal)	
01.01.2022	15100
08.01.2022	14900
15.01.2022	14900
22.01.2022	14900
29.01.2022	14900
31.01.2022	14900

Coconut

The price of coconut at Nedumangad market in Kerala, Pollachi market in Tamilnadu, Bangalore and Mangalore markets in Karnataka during the month of January 2022 is given below.

Weekly price of coconut at major markets				
	Nedumangad (Rs./1000 coconuts)#	Pollachi (Rs./MT) ##	Bangalore Grade-1 coconut,(Rs./ 1000 coconuts) ##	Mangalore Black coconut (1 ton) ##
01.01.2022	16000	NR	NR	NR
08.01.2022	16000	26000	NR	28000
15.01.2022	16000	NR	NR	NR
22.01.2022	16000	25500	NR	28000
29.01.2022	16000	26000	20000	26000
31.01.2022	16000	26500	20000	30000

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	Srilanka	India*
01.01.2022	209	224	296	NR
08.01.2022	208	223	296	347
15.01.2022	209	224	301	NR
22.01.2022	208	223	301	340
29.01.2022	NR	222	290	347
				*Pollachi market

Coconut Oil

International price and domestic price of coconut oil 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)	Philippines	Indonesia	Sri lanka	India*
01.01.2022	2093	NR	1647	3111	NR
08.01.2022	1988	NR	1619	3160	1787
15.01.2022	1882	NR	1615	3095	NR
22.01.2022	2017	NR	NR	3181	1663
29.01.2022	NR	NR	NR	3292	1708
					*Kangayam

Copra

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

Weekly International price of copra in major copra producing countries				
Date	Domestic Price (US$/MT)			
	Philippines	Indonesia	Srilanka	India* * Kangayam
01.01.2022	980	1016	1618	NR
08.01.2022	1011	966	1667	1187
15.01.2022	1032	984	1733	NR
22.01.2022	1056	1004	1726	1121
29.01.2022	NR	1035	1713	1147
				* Kangayam

#(Source: Epaper,Kerala Kaumudi),
##(Source: Star market bulletin)

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