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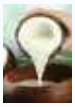

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From the desk of Chairman

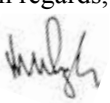
Dear Coconut farmers,

The increasing incidence of pests and diseases is one of the major constraints of coconut cultivation faced by the country. Coconut palm is infested by a number of pests and diseases. Some are lethal in nature while others reduce the production potential of the palm. Root (wilt) disease has adversely affected coconut production throughout Kerala and is spreading to the neighbouring states like Tamil Nadu and Karnataka. Apart from this, the increasing incidence of other diseases like Thanjavur / Ganoderma wilt, bud rot and leaf rot is also noticed. Incidence of other pests viz. mite, red palm weevil, leaf eating caterpillar and rhinoceros beetle also have adverse effects on the production of coconut. Nutrient deficiency symptoms, yellowing and crown chocking are other reasons for the declining productivity trends in some regions of the country.

Integrated Pest Management (IPM) schedule for major pests have been evolved and popularized among the farming community. Integrated Nutrient Management (INM) is also recommended to maintain the soil fertility at the optimum level. Though timely adoption of curative and prophylactic measures are recommended by research agencies for effective management of pest and diseases, the application of the same at the farmers' level is very low. Ignorance of farmers on the effectiveness of recommended management practices is one of the reasons for this. Further, adoption of Integrated Pest Management and Integrated Nutrient Management practices by few farmers alone in a locality affected by pest and diseases cannot control the incidence. A community / group approach is needed at grass root level to get the desired result of IPM / INM package. Farmer Producer Organization (FPO) can play an important role in organizing farmers for adopting IPM / INM packages on community basis in association with CDB, Department of Agriculture & Horticulture and Research Institutes.

Coconut Development Board is extending financial support for conducting large scale demonstration of IPM and INM packages on community basis in endemic areas under the Technology Mission on Coconut (TMOC). I request Farmer Producer Organizations (FPOs) formed in the coconut sector to play an important role in the transfer of IPM and INM packages and its adoption more effectively on community basis by organizing farmers in to groups. CDB propose to implement farmer's participatory demonstration of IPM and INM packages on community basis with financial support from the scheme Technology Mission on Coconut in the pest and disease affected areas. I request all the agencies to work together to protect the farmers from the increasing incidence of pest & disease

With regards,



A K Singh
Chairman

Coconut sector in India: Retrospection and Way Forward

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Introduction

Plantation crops sector in India, in recent times, is characterized by selective state intervention and the removal of tariff barriers wherein, its survival depends on international competitiveness. It is noteworthy that the sector is dominated by millions of small and marginal farmers and mainly confined to the economically and ecologically vulnerable regions, and plays a crucial role as far as the issue of sustainability is concerned. The changing crop use pattern, climate change concerns and constraints on natural resource use and reduction in profitability in the plantation scenario warrants innovative strategies and approaches to address new challenges and sustain accelerated growth of the sector. In the present context, the major challenge is to develop an equitable and sustainable plantation sector ensuring inclusive growth with international competitiveness.

Coconut, arecanut and cocoa are important plantation crops of India with a profound influence on the rural economy by supporting the livelihoods of millions in the country. The year 2016 marks the 100 years of coconut research in India. Coconut exerts a profound influence on the rural economy of the country by supporting the livelihoods of ten million people in the country. It also contributes to the national agrarian economy, with an annual contribution to the tune of Rs 9000 crores to the GDP and foreign exchange earnings of about Rs 1200 crores, besides supporting the subsidiary industrial development. However, of late coconut is faced with unprecedented crises on account of various macro and micro level factors. The productivity of the crop is constrained by the low input use efficiency in conjunction with other biotic and abiotic stresses which are priority areas of research. The aspects of mechanization also deserve adequate importance, considering the scarcity of skilled labour. Above all, the most important facet is value addition, which should be strengthened to mitigate the issue of low profitability of the sector. The post World Trade Agreement (WTA) and ASEAN Treaty regime witnessed integration of plantation economies across the globe that resulted in fierce competition among producing countries. The relevance of a retrospection and introspection of 100 years of research in the coconut sector arises exactly in this context, wherein the institutions strive for technology generation and dissemination to address the challenges and to convert the weaknesses to opportunities, in a concerted and synergized fashion.

Coconut: National Scenario

India has produced 20440 million nuts in the year 2015 from an area of 1.97 million ha with a productivity of 10345 nuts per hectare (Table 1). It is predominantly cultivated in small and marginal holdings. Most of these holdings neither provide gainful employment opportunities for the family labour throughout the year nor generate sufficient income to meet the family requirement. Presently coconut growers are more exposed to economic risks and uncertainties owing to the high degree of price fluctuations. In this context it is needless to emphasize the importance of crop diversification in coconut gardens. For brightening the future prospects of a sustainable coconut sector, it is imperative to delink the sector from the dependency on coconut oil and enhance the production of diversified value added products.

State	"Area (000 ha) "	"Production (nuts/ha) "	"Productivity (mn. nuts) "
Andhra Pradesh	106	1464	13808
Kamataka	515	5141	9982
Kerala	650	4897	7535
Tamil Nadu	465	6917	14873
Other States	240	2021	7295
India	1976	20440	10345

Source : CDB, 2015

Research Contributions over a Century

It is unique that the coconut sector has been evolved

through imbibing the scientific excellence for the past 100 years.The country has rich genetic resources to provide breeders with required genetic stock to tackle future challenges. It maintains the largest collection of coconut germplasm (438 accessions). It is noteworthy that an International Coconut Gene bank for South Asia (ICG-SA) has been established in the country under a tripartite agreement among ICAR-FAO-ITPGRFA. We have a National Coconut Gene Bank (NCGB) that serves as the National Active Germplasm Site (NAGS) for coconut. The focused research efforts to improve productivity and overall profitability to the farmers resulted in the development and release of high yielding varieties and hybrids. Eighteen improved high yielding varieties including twelve selections and six hybrids were released. There is tremendous potential for the released varieties as they are capable of yielding two to six times more than the average yield in different growing regions. The coconut based cropping system (CBCS) and coconut based mixed farming system (CMFS) categorically proved the advantages of the system approach (Sahasranaman *et al.,* 1983; Hegde *et al.,* 1990; Thamban and Arulraj, 2007; Das, 1991). The CBCS using multi species cropping of coconut with pepper, banana, nutmeg, pineapple, ginger, turmeric and elephant foot yam generated a net income of Rs 3, 62,595 per ha, which is 150% higher than that of coconut monocrop (Rs. 1,41,505), while the CMFS wherein the components are coconut, pepper, banana, crossbred cows, poultry birds, goat, and pisciculture generated a net return of Rs. 5,50,214 which is 288% higher than that of coconut monocrop.

Plant growth promoting rhizobacteria (PG PR) based product- Kera Probio has been released for clean and green cultivation of coconut to maintain sustainability. Integrated disease management strategies developed for root (wilt) and leaf rot affected coconut gardens could increase yield by 25-83% depending on severity of the disease. The coconut climbing model developed with the safety attachment has become an effective solution since it could be operated even by women with proper training. This gives much required confidence to the climbers especially the beginners. In an effort towards value addition, Institutes have developed complete package of practices for the production of virgin coconut oil, coconut chips, coconut honey, jaggery and sugar. Besides, the Institutes developed 'Coco-sap Chiller' for collecting fresh, hygienic and unfermented coconut inflorescence sap called `neera'. The research system has been producing quality planting materials in coconut for distribution to farmers. Seed gardens of improved varieties have been established at the Institute's level as well as in farmer's garden to augment planting material production.

It is worthwhile to note that coconut based microenterprises run by women SHGs have increased their income by 3-5 times compared to their previous income from copra, securing a steady source of additional income. Equally important, the intervention provided employment opportunities to formerly unemployed and under employed rural women resulting in enhanced self-esteem, and economic & social empowerment. It is striking that, trained women serve as `skilled coconut pollinators' for coconut hybrid production. Coconut climbing and pollination was men's territory so far, since the practice involved considerable drudgery and the risk. Women have learnt the steps in coconut pollination with ease and carry out the work with confidence.

In nutshell, the existing design of the research systems of coconut is well evolved and could be categorized under the sectoral system of innovation frame. The system is essentially a complex one with multitude of inter linkages at various levels of activities. In addition to this, system is also benefited by the coordination and replication functions provided by the All India Coordinated Reseach (AICRP) on palms. In the recent period there is a proactive movement to ensure maxiinum possible participation of the stake holders' through the formation of strategic research clusters. The system has evolved not only as a research hub meant for the productivity growth of coconut, but also as a crucial facilitator of the entire process of technology generation to the technology refinement options pertaining to coconut sector.

Research Gaps

However, the changing scenario of coconut sector warrants innovative strategies and approaches to address new challenges and sustain accelerated growth along with competitiveness and sustainability. In the present global scenario, it is evident that coconut requires to be promoted as a food crop for nutrition, health care and environmental services to safeguard the livelihood of millions of people. It is necessary to rope in global partners for collaborative programmes to address the long standing and complex problems in the sector. Efforts have to be intensified to gainfully utilize new frontiers of science and technology, which would include an understanding of structural and functional genomics, long term conservation of genetic resources through cryopreservation, development of varieties for biotic/abiotic stress tolerance and higher resource use efficiency, use of nanotechnology in disease diagnostics and targeted delivery of biomolecules, leveraging environmental benefits through sequestration of carbon as net carbon sinks and it benefits, product diversification and mechanization for sustainable use of coconut to provide quality life to the people. The praiseworthy achievement of the research front needs to be sustained

and taken forward in a strategic manner with concerted efforts.

Impediments in the Trade Spectrum

The significance of analyzing coconut sector in India in the light of recent policy issues, especially the ASEAN-India Free Trade Agreement (AIFTA) emerges in the context of commodity crisis (Veeramani et al. its, 2011; Lathika and Ajithkumar, 2009; Anoopkumar, 2012). The likely impact of AIFTA could not be undermined for three reasons. Firstly, the present context should be seen as a continuation of evolving trade liberalization regime and the effects of such a regime on plantation sector. Secondly, although coconut and coconut oil is put under the negative list, the tariff reduction in palm oil', which is a close substitute of coconut, would turn up detrimental in the near future (Table 2). The surging palm oil imports in the recent years are noteworthy and substantiate this argument. Thirdly, the agreement is evolving one and the tariff rates fixed are ceiling rates (the maximum level to which tariff can be fixed), thus providing adequate flexibility to fix the tariff rates to lower levels. Although coconut and coconut oil are in exclusion list of AIFTA, there is a general commitment under AIFTA to review the exclusion list every year with a view to improve the market access (Jayasekhar et al., 2014). Obviously, there will be pressure to reduce the number of tariff lines kept in the exclusion list. Therefore, there always exists a threat in the case of coconut, seeing that, the existing price difference may facilitate the cheap imports in case coconut is removed from the exclusion list.

Table 2. Tariff reduction schedule: special products

Tariff line	Base rate	2010	2015	2019
Crude palm oil	80	76	56	37.5
Refined palm oil	90	86	66	45
Coffee	100	95	70	45
Tea	100	95	70	45
Pepper	70	68	58	50

Regional trade agreements are becoming inevitable in the growth path of trade liberalization and globalization. The most important aspect in the evolving trade agreements regime is to appropriately reflect the sectoral interests/issues in the national agenda so that the sectoral apprehensions are well represented in the regional/ free trade agreements. In order to materialize this, in-depth sectoral studies in collaborative mode on various facets of coconut economy in India has to be conducted and well chalked out sectoral policy documents should be brought out. It is also necessary to find out the leverage points of the coconut sector wherein we can gain the competitive advantage vis-a- vis the other competing countries in the international arena.

The import duties on edible oils have moved basically in counter-cyclical nature to the level of edible oil prices in global markets. This is a rational policy choice which is required to stabilize edible oil prices in the domestic market. Since 2012, the palm oil prices have been declining and the import duty still remains at a low level. In view of fall in international prices of palm oil, the import duty on crude palm oil was increased to 2.5 percent but remains the same for refined palm oil.

The import duty for palm oil has to be dynamically adjusted to its international prices as palm oil prices acts as an anchor to all edible oil prices. A bearish trend in palm oil prices exerts downward pressure on prices of all edible oils with an adverse effect on domestic production and further rise in palm oil imports. Therefore, there is an urgent need to re-calibrate the import duty structure.

For better trade relations among the APCC countries it is imperative to form a regional coconut trade agreement among the APCC countries. The modalities of such a commodity specific trade agreement should be worked out with utmost care wherein we should end up in a win-win situation. In this respect we need to thoroughly analyze the existing tariff structure of each APCC countries, and an unbiased tariff reduction schedule should be proposed. It is also important to consider the existing tariff structures of close substitutes/ competing products of each countries and there by arriving at a consensus.

Problems of Existing Innovation System

We have seen that the current innovation system of coconuts in India has huge strengths on the research front of coconut, but the lack of price stability, inadequate price support mechanism and marketing facilitation are the factors detrimental to the functioning of coconut value chain in the state. The innovation system for coconuts in India is unique wherein several governmental agencies/ institutes undertake the research and development for the commodity, with evidently lacking collaborative efforts (Mani and Santhakumar, 2011). Eight components delineated in the sectoral innovation system of coconut are: (i) in the research front, Central Plantation Crops Research Institute (CPCRI), (ii) at the policy level, Coconut Development Board (CDB), (iii) for marketing aspects of coconuts, National Agricultural Cooperative Marketing Federation of India Ltd (NAFED), (iv) the unorganized producers with small and marginal holdings constitute the fourth component of the coconut innovation system (v) the evolving Farmer Producer Organizations (FPOs) in the forms of Coconut Producer's Societies, Federations and Companies (vi) The intermediaries in the coconut sector operate in a very large grey area forming syndicates, lobbies and also practice the copra/ coconut oil hoarding which causes continuous price

fluctuations in the market (vii) the state departments of agriculture/horticulture who are entrusted with the field level transfer of technologies. Besides these seven components, the most important but ironically the most underrated component is the local self governments which systematically operate at the grass root level. The lack of effective group coherence among different stakeholders is still remaining as a problematic facet in the sector. Though, there is huge potential for the collaborative synergy of these different Institutions, as a matter of fact, instead the convergence, the redundancy of efforts is much more prominent in the sectoral front. It is high time that, especially in the historic centenary year of coconut research, we the researchers, developmental agencies, farmers and all other sectoral agencies/actors come together on the same platform to channelize our strengths, skills, experience and passion towards achieving a common goal- a rejuvenated, vibrant and sustaining coconut sector.

At present, the ambience of coconut sector in the domestic arena is positive wherein the horizontal node of the value chain aspect is strengthened by the formation of Coconut Producer's Society at the grass root level to Producer's Company at the highest level. Is provides an excellent auxiliary support for the ambitious export orientation programmes. The strategic positioning of developmental and research support (CDB, CPCRI, KAU, NAFED) is another very important factor which will provide the much needed impetus for the sectoral development. Moreover, Indian export sector has become vibrant with very high growth rate since CDB has upgraded to the status of Export Promotion Council (EPC). The initiative taken by Govt. in promoting neera in 2013-14 is also expected to revive coconut economy of the country.

In the future, it is envisaged that globally well connected and highly interlinked commodity chains will evolve, requiring a reorientation of the scope of the research and developmental Institutes to accommodate the restructured commodity chains and changing concept of commodity markets. The Institutes should take a lead role to re-engineer and revitalize the coconut sector in the country by providing adequate emphasis on product diversification and creation of neo-market platform to promote coconut as an organic health drink with Good Management Practices (GMP), Good Agricultural Practices (GAP) and Hazard Analysis and Critical Control Points (HACCP). Institutes should facilitate co-creative, innovative, vibrant social enterprises which will enable to pass on the value creation in the coconut sector to farmers in an appropriate manner which reduces the social disparity. With the growing realization of lesser profitability in small farm holdings, producers/farmers should be encouraged to get together and form into small cooperatives or crop based organizations to develop and utilize community l'acilities for farm operations, post harvest processing and marketing to economize on production as well as marketing costs. Further, research orientation will lead to an increase in the number of economically viable coconut farms of different sizes and increase in the number of processing enterprises. As the technologies are adopted only when profitable, policy interventions in market and regulation of trade tariffs to the benefit of the industry to compete with global players are the way forward. To encourage investments in coconut sector, the government, as matter of policy, must consider coconut as a priority crop in its national agricultural development agenda.

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Integrated management of Ganoderma wilt / Thanjavur wilt - Need for farmer participatory intervention

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Ganoderma wilt affecting coconut was first observed in Thanjavur district of Tamil Nadu during 1952 and hence termed as Thanjavur wilt. In Karnataka, it is known by the popular Kannada name 'Anabe roga'. The disease is mainly prevalent in lighter soils in the coastal districts than in heavy soils. Recent studies and reports indicate that Thanjavur wilt disease is prevalent in some localities in Kerala state also.

Symptoms

• Yellowing of the leaves of lowest leaf whorl, decay and death of fine roots.
• Later, bleeding patches appear at the base of the stem near the ground level, roots decay extensively and there is no new bunch production.
• As the disease advances leaves droop in the outer whorl followed by heavy button shedding and barren nuts.
• Ultimately, all the leaves droop and fall off leaving the decapitated stem with the formation of fruiting body near the base of palm.

Etiology

Ganoderma disease of coconut is caused by two Ganoderma species, *G. Applanatum* (pers.) Pat., and *G. lucidum* (leys) Karst. These were isolated from roots of infected palms irrespective of the extent of bleeding symptom. The pathogenicity of *G. lucidum* has been established by inoculating the fungus in the trunk region. Ganoderma wilt disease is prevalent in sandy or sandy loam soils in coastal areas where coconut is grown under rainfed conditions and also in neglected plantations. Lack of soil moisture during summer months, water logging in rainy seasons, presence of old infections in the gardens and neglect of cultural operations were found to be conducive to the spread of the disease. The disease incidence was more between March and August. Trunk infestation with the scolytid beetle, *Xyleborus perforans* and the weevil, *Diocalandra stigmaticollis* accelerate the death of the palm.

Drying and drooping of lower leaves

Bleeding patches at basal portion

Fruiting body at basal portion

Disease Management

• Removal of dead palms, palms in advanced stages of the disease and destruction of the bole and root bits of these palms.

• Soil test based application of fertilizers and soil amendments

• Regular basin irrigation during summer months. In water scarce areas drip irrigation may be adopted.

• Mulching for moisture conservation with coir dust, coconut husks, green leaves, dried leaves, organic wastes or dried coconut leaves. Mulching should be done before the end of north east monsoon and before the top soil dries up.

• Isolation of diseased palms from healthy palms by digging isolation trenches of 1 m deep and 60 cm wide.

• Avoid flood irrigation or ploughing in infected gardens to prevent spread of the inoculum.

• Raising banana as intercrop wherever irrigation is possible since root exudates of banana has the property to suppress the fungal pathogen causing Thanjavur wilt disease.

• Soil application of *Trichoderma harzianum* (CPTD 28) enriched neem cake @ 5 kg/palm at quarterly intervals up to one year, irrigate the palms once in a week followed by mulching around the palm basin.

or

Root feeding of *Hexaconazole* @ 2% (100 ml solution per palm) at quarterly intervals and soil drenching @ 0.2% of *Hexaconazole* (40 l solution per palm) or with 40 L of 1 per cent Bordeaux mixture.

Method of mass production of Trichoderma in neem cake

• Salt free neem cake to be powdered to about 1 to 2 cm size and mix by sprinkling the water and moisture level should be maintained to 50%.

• Inoculate with *Trichoderma harzianum* talc powder at the rate of 1Kg per 100Kg of neem cake and cover with wet gunny bag.

• Incubate for seven days with the intermittent mixing once in two days and maintain the moisture level up to 50%.

Field level scenario and suggestions for adoption of IDM strategies

Recent studies and reports indicate that Thanjavur wilt disease is prevalent in some localities in Kerala state also. In a study conducted recently by ICAR-CPCRI in Kasaragod district, the incidence of Thanjavur wilt was assessed in terms of percent palms showing symptoms of the disease. Highest incidence was observed in Pilicode (4%) gramapanchayath followed by Pallikkere (1.6%) and Padanne (1.5%). The disease was more prevalent in Northern laterite agro-ecological unit of the district. The region is characterized by more dry spells and higher temperature and laterite soils which favours the pathogen causing the disease. Diagnostic field visit conducted by team of scientists from CPCRI also confirmed the incidence of Thanjavur wilt disease in various localities of Kozhikode district including various panchayats of Kunnummal block and Thodannur block. Severe moisture stress experienced during March, April and May months during this year was a major reason for drying and drooping of coconut leaves. Palms affected by moisture stress also succumbed to Thanjavur wilt. Hence, care should be taken to take up moisture conservation practices in coconut gardens. Mulching is an important practice for moisture conservation. The coconut basins can be mulched with coir dust, coconut husks, green leaves, dried leaves, organic wastes, and dried coconut leaves. Mulching should be done before the end of north east monsoon and before the top soil dries up.

The study conducted in Kasaragod district also revealed that the level of adoption of control measures against Thanjavur wilt disease was very low. Farmers perceived that unlike stem bleeding disease, coconut palms affected by Thanjavur wilt succumb to death easily and hence is more damaging. It was observed that vast majority of farmers in whose gardens the disease was observed were not aware about the symptom of the disease or about the control measures to be adopted. Besides, it was also observed that farmers have not adopted the integrated nutrient management practices required for coconut. Most of them applied only organic manures and that too not in sufficient quantity. Deficiency of potassium in the soil is known to make plant more susceptible to moisture stress, diseases and pest attack. In general, soil related constraints viz., soil acidity and inadequacy/imbalance of nutrients are found

Mixing of neem cake and Trichoderma talc formulation

adversely affecting coconut production in most of the coconut growing areas. Potassium deficiency is observed in many of the coconut gardens. It is always advisable to apply the nutrients based on soil test results. Apart from major nutrients, need based application of secondary nutrients like Magnesium and micronutrients like boron, zinc etc may also be taken up on priority basis.

Extension activities to create awareness among the coconut growers about various aspects of integrated management of Thanjavur wilt disease are to be organised on a priority basis. Demonstration plots on integrated management of Thanjavur wilt, management of nutrient deficiencies and moisture stress can be laid out in farmers' plots in selected localities as part of ongoing technology transfer initiatives under ATMA with technical support from research organisations like ICAR-CPCRI. Active participation of coconut farmers in such extension activities can be ensured through the Coconut Producer Societies functioning at grass root level. Frontline Demonstrations (FLDs) on integrated management of Ganoderma wilt of coconut was conducted in selected farmers gardens at Periya village in Kasaragod district. Disease management practices including bi-monthly application of Trichoderma enriched neemcake @5kg/ palm were demonstrated. In the demonstration plots the disease index of affected palms was reduced to 15.2 compared to the pre-treatment disease index of 46.

Trichoderma enriched neemcake

Availability of inputs, both in quality and quantity, required for the management of Thanjavur wilt disease can be ensured through the ongoing decentralised people's planning programme of Local Self Governments utilising the provision for formulation and implementation of location specific scheme.

Conclusion

Taking into cognizance the field level scenario reported from some localities in Kerala state, it is imperative that appropriate measures are taken on priority basis for the integrated management of Thanjavur wilt disease to avoid crop loss. Apart from prophylactic and curative measures, agrotechniques such as integrated nutrient management and moisture conservation practices also should be given adequate attention for effectively managing the disease. Farmer participatory extension initiatives are to be implemented to create awareness among coconut growers about the integrated management of the disease. ■

Challenges of Neera Production in Kerala

● **R Jnanadevan,** Deputy Director, CDB, Kochi

High cost of production and low income from coconut are the major constraints faced by the coconut farmers of Kerala. Profitability of this crop still depends on a single product, coconut oil. One of the novel initiatives being explored to increase the income from coconut tree to the maximum extent is extracting neera, the healthy, nutritionally rich natural juice from coconut inflorescence. Out of the 12 bunches of inflorescence (spadix) produced by a healthy coconut palm in a year, 50% can be utilized for neera production. From one healthy spadix @ 2 liters of neera per day a farmer will get 60 liters of neera per month. If he allows tapping six spadix in a year, he will get 360 liters of neera. If the farmer get minimum farm gate price @ Rs 20/- per liter excluding labour cost, he will get Rs.7200/- per tree. At the same time if he allow the spadix to grow for harvesting coconut, @12 nut per bunch he may get maximum of 72 coconut and @ Rs 10/- per nut the farmer will get an amount of Rs 720/-only from those inflorescences i.e., the income can be increased by ten times by tapping neera. It was with this objective that Coconut Development Board took the initiative to promote neera production, processing and marketing through Coconut Producer Federations and Companies facilitated by the Board. Though Kerala Government had issued approval to Coconut Producers Federations to tap Neera and eleven neera processing units each with capacity to process 4000 liters of neera per eight hour shift was set up with the financial support from the Board, the production and marketing of neera has not flourished at the expected level due to several challenges faced by the industry in the state as explained below:

Lack of skilled workers for neera tapping

Three major constraints in promoting neera production were: 1) Abkari act of Kerala did not permit tapping of neera freely by the farmers. 2) lack of infrastructure for processing and packing and 3) non availability of neera technicians. With the concerted efforts of the Board, the first two constraints only could be overcome in the state. Non-availability of tappers is still remaining as a serious problem. Neera tapping is a laborious process which requires continuous skilled labour. Once started, tapping of an inflorescence lasts up to 30 to 60 days. It is very difficult to get labourers for this risky job in a state like Kerala where lack of skilled workers is a major problem. Besides, labour is very costly in the state where an unskilled labour who works for 8 hours in farm operations is paid Rs 800/- per day.

Government of Kerala gave permission to tap neera to 486 Coconut Producer Federations (CPFs) facilitated by Coconut Development Board. At the rate of 5000 palms per Federation, 22 lakh palms are available for neera tapping in Kerala. But total number of palms utilized for tapping neera is 3465 only i.e. 0.16% of total palms are only utilized for neera tapping. The main reason for non utilization of palms is due to non-availability of neera technicians. For tapping 22 lakh palms, around 2.2 lakh neera tappers are required. CDB, through Coconut Producers' Federations is organizing training programme for creating neera technicians with financial assistance from the Board. But with the limited resource available, CDB alone cannot train such a huge number of neera technicians. Support of all agencies involved in coconut sector in the state is required to create sufficient skilled neera technicians.

The present wage rate of neera technician depends on the quantity of neera tapped per day. There is great variation in the quantity of neera obtained between cultivars. Naturally, the growing conditions of the palm and its vigor play an important role in neera production. If a neera tapper tap 10 trees per day, and the tree gives 2 liter neera, the tapper will get an amount of Rs.1000/-per day. If the neera yield is one liter per day, the tappers' share will be Rs.500/-per day which is less than the wage paid for unskilled labours in the state. Besides, during the preparation period for tapping, neera is not produced and in the initial periods of neera production, the quantity produced will be less and the labourers share on neera produced will be less. Hence the present wage rate is not attractive and it is suggested that an alternate system of remuneration to neera technicians on a monthly basis in consultation with the CPCs shall be worked out to attract more labourers to this field.

High rate of drop out of neera technicians

All the CPCs that have started neera processing are facing acute shortage of neera technicians. High rate among trained neera technicians (people trained in tapping coconut palms for producing neera) is posing another tough challenge to the neera production sector, which is still in its fledgling stage in the State. According to the CPCs, only around 30% of the total persons trained for tapping neera under different CPCs facilitated by Coconut Development Board are available for the job. The rest have either left the job or turned to other sectors, including construction. The scarcity of trained hands is

also causing huge financial loss to the companies as huge amount was spent on giving training. To tide over the situation, interested people from northern states now working in Kerala, from Jharkhand and Bengal shall be trained and utilized in this sector. In view of the high attrition rate among trained technicians from the state, various CPCs are increasingly deploying neera technicians from outside states, including Lakshadweep, Assam, and Jharkhand. The high rate of desertion among the technicians is not only causing huge financial loss to the companies but also putting the nascent neera producing sector in serious crisis. Many CPCs in the southern districts have already started engaging people from northern states in the sector. Some long-term plans, including large-scale planting of early bearing DxT hybrid coconut trees with dwarf stature with high neera production can solve this problem to a certain extent.

Low Social status of coconut climbers for Neera tapping

Social status of coconut climbers is considered to be very low in the state. This might be the reason, which prevented the members of backward and forward cast from becoming coconut climbers and Neera tappers. Another reason behind it might be that coconut climbing is a traditional job. Even then, there were some coconut climbers from other caste and this might be due to the unemployment problem and high income obtained from coconut climbing. However, they quit palm climbing and Neera tapping whenever they get some other skilled work with high social status. Due to this reason, all the Neera technicians who have undergone training do not stick on to this work. Hence while selecting Neera technicians, utmost care should be taken by the Farmer Producer Organization and other agencies associated with training programme to select only interested persons as far as possible. Those who are in the palm climbing profession shall be selected for the training.

Cumbersome process involved in extraction of raw neera

The tapping process is essentially an art, and the result therefore depend upon the skill of the tapper. The best time to start tapping is prior to the splitting of the inner bract and the emergence of the spikes from the spathe. Sap yield is much lower if the tapping starts after the spadices have burst opened. The technique consists of carefully bruising and rupturing the tender tissues of the floral branch by gently hammering and pounding the spathe. Special care is taken not to reduce the flower buds inside the spathe to a pulp, in which case the spadix becomes useless.

The most effective harvesting cycle is twice a day. More harvests are not profitable in relation to the additional work, and fewer harvesters involve in the risk of breaking the spathe under the excessive weight of the container, and they may also create other problems such as sap fermentation and drying of cuts. If, for any reason the spadix is not sliced for a period of two days, a type of healing latex exudes from the wound which impedes the sap flow. Two weeks of tapping will then be required to recover normal sap production. Sometimes a closed spadix has to be abandoned. One or two days rest for the harvester may lead to a production loss of 15-20 days. It is therefore important that tapping be performed by a team, whose members can substitute each other in case of sickness, etc. About 3 weeks before the end of tapping, preparation of another spadix may be started. Due to the cumbersome process involved in neera tapping farmers are not attracted towards neera harvesting. Studies should be conducted in this line to simplify this process and develop modern equipments for neera extraction.

Non-availability of middle aged palms with medium height on a compact area

Tall palms yields much more neera than dwarf palms. Though 18 lakh coconut palms are available in the state middle aged healthy palms with medium height suitable for neera tapping is less in the state. It is also very difficult to get those palms in a same location, as it is highly scattered. This is another challenge faced by the nerra industry in the state.

High competition from other soft drinks in the market.

Soft drink industry is a highly competitive field in our country. Hence is very difficult to attract the market in this section with out large scale production of this product. Tapping is performed in most coconut growing countries, either for the production of fermented sap as an alcoholic beverage or for the production of palm sugar. In major coconut producing countries, Indonesia, Philippines, and Malaysia tapping of unfermented sap from young inflorescences is carried out mainly for the production of neera sugar. The health benefits of coconut sap sugar has already been established in other coconut growing countries and it is classified as low GI alternative sweetener for diabetics. There is vast scope for development of neera sugar industry also with economic prospects in the global market. Hence our neera industry need to focus on producing neera sugar and other value added products.

In order to tide over the situation, all the CPCs should collectively produce Neera utilizing the existing processing facilities so as to maximize the production. The CPFs extracting neera in adjacent areas should utilize the processing facilities established by the nearby CPCs. Consortium of CPCs should make all efforts for marketing of neera to neighbouring states outside Kerala. Establishment of new processing units may be planned only after the fully utilization of the existing units. ■

Technologies for utilization of co-products of virgin coconut oil

● **Shameena Beegum, Thamban C, Manikantan M R and Mathew C**
ICAR- CPCRI,Kasaragod

Today, coconut cultivation has reached an extent where the income obtained from the crops grown in between the coconut palms far exceeds than that of the harvested coconut. The bitter fact is that, in our country, cooking oil is the number one imported food item, keeping prices down since the market is flooded (full fledged) with other cheaper alternatives such as palm oil. Hence the need of the hour is to diversify the coconut into other value added products. A revival from the existing scenario has already been initiated as the farmers and entrepreneurs started focussing on other superior products like virgin coconut oil which is gaining popularity in recent times and has become a by-word in all parts of the world. The extolling articles, literatures, reports, news and advertisements on the functional properties as well as the premium market price of VCO made a positive impact on the adoption of the VCO technology among the farmers and entrepreneurs.

The so called mother of all oils, Virgin coconut oil (VCO) is the oil obtained from the fresh and mature coconut kernel through mechanical and natural means, with or without the use of heat. It is called 'virgin' because the oil obtained is pure, raw and pristine. During the process chain of VCO, a number of by and co products are obtained such as husk, shell, testa, nut water, coconut milk residue and VCO cake. VCO processing from 500 nuts give rise to about 200kg husk, 67kg shell, 50l nut water, 3.3kg testa, 25kg milk residue and 5kg VCO cake. Husk has immense uses in coir industries, preparation of potting mixture etc. Shell charcoal, activated carbon, and shell flour are the commercial products obtained from the shell. Mature coconut water is commercially utilized for the preparation of vinegar, production of Nata de coco and soft drink or squash. Testa is enriched with phenolic compounds (0.9 to 2.3g Gallic Acid Equivalent/ 100g dry weight), has good antioxidant activity and is used as an ingredient in high fibre digestive biscuits. Milk residue and VCO cake are the two co-products, presently underutilized or thrown as a waste.

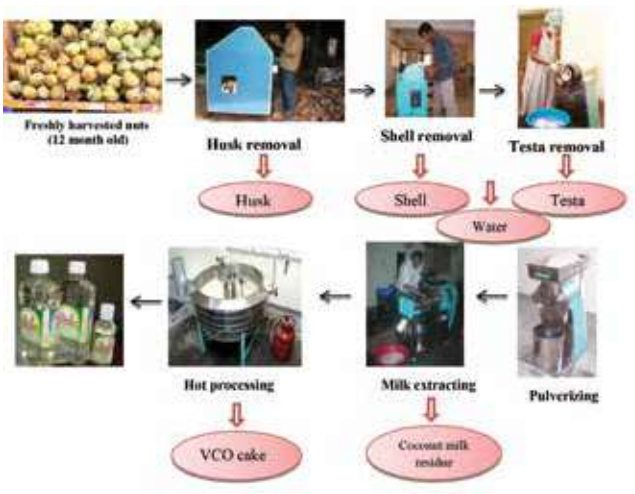
The per cent recovery of coconut milk residue and VCO cake ranged from 38.5 to 55.6% and 6.3 to 8.8% respectively. Utilizing these co-products would serve as a practical solution for the residue management and provide an additional source of income for the stakeholders. This article is focussed on exploring the diversified value added products from the milk residue and the VCO cake. The following process flow chart explains the extraction of milk residue and VCO cake during VCO production.

Utilization of coconut milk residue (CMR)

Coconut milk residue at 2.9% moisture level contains 46.5% dietary fibre, 5.3% protein, and 49.2% crude fat. It has 4 times more fibre than oat bran, 2 times than wheat bran, which in fact, is calorie free. It is loaded with nutrients and it is free from gluten and phytic acid. It is also a source of polyphenolics (23.5mg Gallic Acid Equivalent/ 100g) and has antioxidant activity (108.5mg Trolox Equivalent/ 100g). As a source of dietary fibre, it can improve the bowel movement, provide protection against coronary heart diseases, colon cancer and diabetes. Some of the value added products developed from the milk residue are described below,

Low fat desiccated coconut flour

Milk residue can be dried to 3-5% moisture content



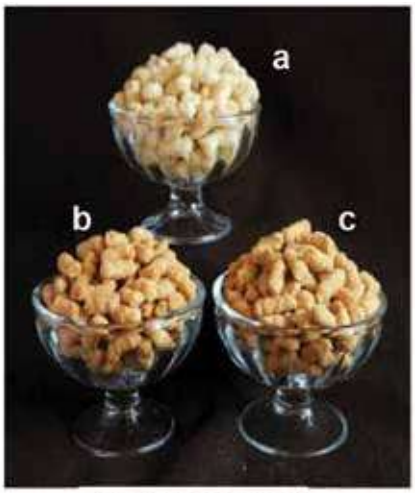
Process flow chart of VCO production along with the co- products generated

Low fat desiccated coconut flour packed in LDPE pouches

and sold as low fat desiccated coconut, which can be used for the preparation of bakery and of low calorie foods. It can be used as fillers, bulking agents and substitute for wheat flour, rice flour and potato flour at certain levels and incorporated into baked and extruded food products. Five percent coconut milk residue flour can replace proportionate amounts of wheat flour and non-fat dry milk powder used in school nutrition programmes without affecting the baking qualities and food value.

CMR based extruded snacks

Extrusion cooking is used worldwide for the production of expanded snack foods, ready to-eat breakfast cereals, baby foods, pasta and pet foods. Extrusion techniques are of two types. One is hot extrusion another is cold extrusion. The hot extrusion cooking process is high temperature short time process in which moist, soft grains are fed into the extruder where the desired temperature and pressure are obtained over the required period of time. Heat for cooking is achieved through shear and friction in the extruder.



Extruded snacks:
a. CMR + Broken rice
b. CMR+ Maize
c. CMR+ Pearl millet

Co-rotating twin-screw extruder (10.0 HP motor, 400 V, 50 cycles, L-TSE mode sic Technologies Private Ltd., Kolkata, India)

Coconut milk residue flour could be well utilized for the preparation of extruded snacks just like the kurkure available in the market. A composite formulation of coconut milk residue based cereal snacks was standardized at the ICAR- CPCRI and it was found that 20% milk residue was optimum for the preparation of extruded snacks with three types of cereals such as broken rice (20: 80), maize (20: 80) and pearl millet (20: 80) in twin screw extruder which had good acceptability with a maximum shelf life of 6 months when packed in laminated pouches.

CMR based pasta

Pasta is the main product prepared through cold extrusion. Pasta products are becoming popular in today's lifestyle because they are healthy, tasty and convenient for transportation and preparation. Approximately 12.3 million tonnes of pasta is produced worldwide with an estimate of 100,000 tonnes production of India. Among cereals, only wheat (in the form of semolina or suji) is used for pasta preparation because of the presence of the protein gluten in it. An attempt was made by the ICAR- CPCRI to enrich the pasta with dietary fibre by incorporating coconut milk residue at different concentrations. Among the different levels of coconut milk residue evaluated, 10% CMR was the optimum in terms of the cooking qualities, textural properties and sensory attributes. By supplementing 10% CMR in pasta, maximum Daily Recommended Allowance (DRA) of 6.5g fibre can be met.

Cooked pasta prepared with different levels of CMR

Pasta extruder

CMR based Bread

Refined wheat flour (maida) lacks dietary fibre; the partial substitution of refined wheat flour with coconut milk residue can fortify the bread with dietary fibre. The ingredients required for two loaves include, 500g refined wheat flour, 5g yeast, 10g sucrose, 10g shortening (vegetable fat), 8g salt and 300ml water. Maida was partially substituted CMR up to 20%. Then the dough was kept for fermentation at 30°C for a total of 240 min. The baking temperature was 230°C for 30 min.

CMR based sweets/ ladoo

The optimized recipe for the preparation of coconut milk residue based ladoo includes, 25% milk residue, 32% sucrose, 12% desiccated coconut, and 7% refined wheat flour, 12% shortening (vegetable fat), 9% water and 3% cashew nuts. Wheat flour was roasted with the shortening in a pan, followed by addition of desiccated coconut powder and coconut milk residue which was heated to 150°C for 15min and when it reaches down to 90°C, sugar (preferably powdered sugar), dried nuts and water were added. The mixture was continued to heat till it attains the consistency for making into the shape of ladoo. The size of the ladoo was standardized to 25g.

Coconut milk residue was used along with partially fermented neera to prepare ladoo. Partially fermented neera (5.5 pH) was boiled in a double jacketed vessel. When it reached at 75°Brix, dried coconut milk residue was added at 1.5% of the initial volume of neera and concentrated till it reaches the desired consistency.

CMR based porridge

The standardized ingredients for coconut milk residue based porridge includes, 25% residue, 25% sucrose , 20% skim milk powder, 10% pineapple powder, 8% green gram powder, 5% sweet potato powder, 5% carrot powder and 2% gooseberry powder.

Utilization of virgin coconut oil cake

The brown coloured VCO cake locally known as Kalkam is rich in protein (20.12 %), fat (35.57 %), crude fibre (3.8 %) and dietary fibre (12.75 %). It has 4 times more antioxidant potential (446.88mg Trolox Equivalent) and 6.5 times phenolic activity (158.07mg Gallic Acid Equivalent) than coconut milk residue. It also contains 22.08% total soluble sugars and 1.57% reducing sugars. VCO cake can be utilized for protein enrichment especially in cakes and snacks. The following products were standardized from dried VCO cake at ICAR- CPCRI.

VCO cake based Extruded snacks

VCO cake concentration was optimized in maize and broken rice based extruded snacks. VCO cake flour was mixed with maize grits and broken rice (sieved using 30 mesh size) at a fixed ratio of 2: 1 (maize to broken rice) on co-rotating twin-screw extruder (10.0 HP motor, L-TSE model, Basic Technologies Private Ltd., Kolkata, India) with die opening of 3.0 mm. Optimized condition obtained was 29 % VCO cake along with 2:1 ratio of maize and broken rice with 14 % feed moisture at 300 rpm which had good physical, textural and sensory properties. The resulted snack was enriched with 11.14% protein, 5.07% fat, 2.3% ash and 74.19% carbohydrate. The product was found to be shelf stable for more than 6 months when packed in laminated pouches. Because of the natural sweetness of VCO cake, the additional step of flavouring could be avoided.

VCO cake based muffins

Muffin is a sweet baked product appreciated among

the consumers of all age groups, especially children due to its good taste and soft texture. The ingredients of muffins such as refined wheat flour, sugar, fat, and egg play an important role in the structure, appearance, and eating quality of the final product.

Muffin batter formulations were made by progressively replacing the refined wheat flour with VCO cake. The optimized formulation consisted of refined wheat flour (26g/100g) which was replaced with 40% VCO cake flour, sugar (26g/100g), egg (21g/100g), full fat milk (13g/100g), shortening (12g/100g), sodium bicarbonate (1.1g/100 g) and salt (0.1g/100g). Effect of the cake on physical, textural, microbial and sensory attributes of muffin was evaluated and found superior in all the parameters. Moreover, the texture of the muffin became softer with the addition of VCO cake. 40g VCO cake/100g flour blend based muffin was enriched with protein (8.49%), fat (18.46%), crude fibre (1.14%) and minerals (1.15%).

In conclusion, Coconut milk residue and VCO cake are the two underutilized co-products obtained during the production of virgin coconut oil. They represent approximately 35-50% and 5-10% of the weight of the fresh grating respectively. Both of them contain appreciable amount of oil which could be recovered through commercial oil expeller (41.24 % and 25.72% in milk residue and VCO cake flour respectively) along with the friction material like testa or copra at 10% level. The dietary fibre rich milk residue and protein rich VCO cake have a huge scope in value addition. Hence, value addition of these co-products into processed products including extruded snacks, pasta, sweets and baked products such as muffins is completely a new intervention which could provide health benefits through enhanced nutrients and minerals and provides immunity because of the presence of phenolics and antioxidants. Even small and marginal entrepreneurs and Self Help Groups could be benefited through involvement in processing of this value added products. ■

Desiccated coconut

● **Sardar Singh Choyal,** Deputy Director, &
Jyothi K Nair, Food Processing Engineer, CDB. Kochi.

Desiccated Coconut Powder is obtained by drying ground or shredded coconut kernel after the removal of brown testa. It finds extensive use in confectioneries, puddings and many other food preparations as a substitute to raw grated coconut. In India the product is manufactured by units mainly scattered in Karnataka, Tamil Nadu, Kerala and Andhra Pradesh

A study conducted by the Coconut Development Board has revealed that a growing consumer demand for desiccated coconut powder could be developed in the country by resorting to organized market promotion activities for the popularization of the product in consumer packs for household uses. The survey has also shown that desiccated coconut powder in consumer packs is acceptable not only in non-coconut producing states but also in traditional coconut growing states such as Kerala. From the survey it was revealed that a sizeable section of the middle class and upper class families residing in cities and towns in Kerala would prefer desiccated coconut powder, if readily available, to raw nuts.

Health Benefits of Desiccated Coconut

Desiccated coconut is rich in healthy saturated fats with no cholesterol and is also a good source of dietary fiber. Lauric acid, the medium chain fatty acid from the fat of the coconut, is having antiviral, antibacterial, and antiprotozoal properties. Capric acid, another of coconut's fatty acid is also found to have antimicrobial properties. These fatty acids are found in the largest amounts in coconut. Also, recently published research has shown that natural coconut fat in the diet leads to a normalization of body lipids, protects against alcohol damage to the liver, and improves the immune system of body.

Coconut contains dietary fiber which passes through the digestive tract without being broken down or absorbed and is passed out of the body. Instead of contributing to health problems like starch and sugar, fiber promotes good health. Coconut is a natural low - carb, high - fiber food ideally suited for low carbohydrate diets. Coconut flour has been found in several studies to have a glycemic lowering effect, because coconut meat has simple carbohydrate content coupled with a high fiber, it yields a flour that is less disruptive to blood sugar levels. It is vegan and gluten free.

Food Safety Standards for Desiccated Coconut

As per FSSAI standards, Grated Desiccated Coconut means the product obtained by peeling, milling and drying the kernel of coconut (Cocos nucifera). The product may be in the form of thin flakes, chips or shreds. The product shall be white in colour, free from foreign matter, insects, mould and rodent contamination. The product shall have pleasant taste and flavour, free from rancidity and any evidence of fermentation.

The product shall conform to the following requirements as per the food safety and standards regulations, 2011:

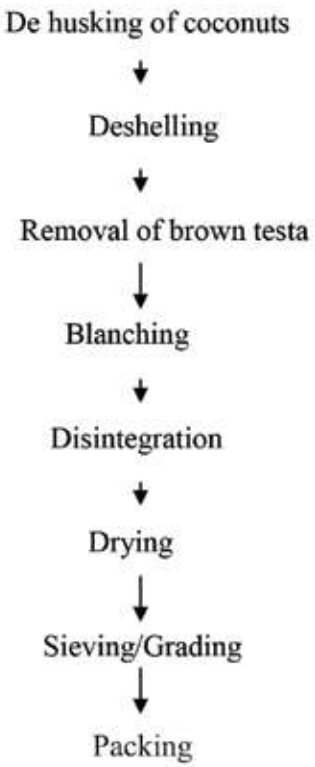
(i) Extraneous Vegetable matter	Not more than 15 units/100 gm
(ii) Moisture (m/m)	Not more than 3.0 percent
(iii) Total Ash (m/m)	Not more than 2.5 percent
(iv) Oil Content (m/m)	Not less than 55.0 percent
(v) Acidity of extracted fat pressed as Lauric Acid (m/m)	Not more than 0.3 percent
(vi) Sulphur Dioxide	Not more than 50.0 mg/kg

List of Food Additives		
Sl.No	Permissible Food Additive	Limit
1	Sulphur dioxide, Sodium/ Potassium/ Calcium Sulphite/ Bisulphate/ Metasulphite expressed as SO2	50mg/kg maximum

Microbiological Requirements		
Sl.No	Parameter	Limit
1	Total Plate Count	Not more than 40,000 per gm

Manufacturing Process

It is simple and well-established. Fully grown and matured coconuts of around 1 year are stored with husk for about a month to facilitate absorption of water and separation of coconut kernels from shell walls. After de-husking, shells are removed and brown portion (also known as Testa) is removed by scrapping it off and in this process around 12-15% of the kernel goes as paring which is further processed to obtain oil, and thus there is a ready market for this by-product. Subsequently, de-shelled coconuts are broken into pieces, washed and disintegrated in powder form. This powder is then dried in tray drier at about 80 -90°C and powder is stirred occasionally to ensure uniform drying. On cooling, it is passed through vibratory screen with different mesh sizes to segregate the powder according to mesh size. Finally, it is packed in moisture and oil-proof polythene-lined plywood boxes of 10, 25 or 50 kgs and even in retail packets of 200 / 400g. Recovery of desiccated coconut largely depends upon quality of coconuts. But on an average processing of 100 coconuts gives around 10 kg of coconut powder. By-products like parings and shell can be sold in the market. The process flow chart is as under:



According to IS 966:1999, DC is produced by a mechanical process of disintegrating, cleaned and dried pieces of pared kernel of fully matured and fresh coconut. The product should be natural white in color. It shall have characteristic taste, odor and flavor. It shall be free from cheesy, smoky, musty or any other objectionable odors, fungus and insect infestation. It shall be crisp, free from rancidity and does not show fat sweating. DC is categorized into three types based on the particle size and are as follows:

•**Fine** – if size of particle is between 1.40mm and 1.00 mm or if it is retained on 1.00mm IS test sieve.

• **Medium**- If size of particle is between 1.70 mm and 1.40 mm or if it is retained on 1.40 mm iS sieve.

• **Coarse** – If size of particle is more than 1.70 mm or if it passes through 1.70 mm IS test sieve.

Yield of the product is 1 tone from 10,000 coconuts.

Composition of the Product

Sl. No	Item	Quantity
1	Moisture	1.3-2.5%
2	Protein	6.0-6.6%
3	Oil	68-72%
4	Carbohydrate	18-20%
5	Crude fibre	4-6%

Source* - Tropical Foods, Chemistry and Nutrition, Volume 2, George E Inglett

Low fat Desiccated Coconut

Desiccated coconut is of two types: High fat and low fat. High fat means the desiccated coconut powder produced without removal of coconut milk. Low fat desiccated coconut powder is produced as the byproduct of coconut milk/VCO/ DC units and is having a fat percentage upto 38-40%. It is a good source of dietary fiber. Low fat DC is used for the manufacturing of coconut flour and dietary fiber.

Export Potential of Desiccated Coconut

Desiccated coconut is gaining more export value nowadays. During the year 2014-15 and 2015-16, the quantity of DC exported from India was 2606.34 MT and 4260.97 MT amounting to Rs.42.42 crores and Rs.52.60 crores respectively. The export during the month of April 2016 was 1208.35 MT which is 279.67% more than the export of desiccated coconut in April 2015. This steep increase in the export shows the immense export potential of this sector. The major export destinations of desiccated coconut are Iran, UAE, Saudi Arabia, Qatar, Oman, Kuwait, Spain and US.

Export Promotion Activities

Government of India has provided promotional measures to boost India's exports under Foreign Trade Policy 2015-20. Entrepreneurs are entitled to receive the following incentives for exporting of coconut products:

(1) Merchandise Exports from India Scheme (MEIS)

Under the MEIS scheme, the Government of India provides incentive for exporting notified goods/products to notified markets. The rate of benefit ranges from 2-5% of the realized FOB value of exports.

(2) Duty Drawback Scheme

Duty Drawback has been one of the popular and principal methods of encouraging export. It is a method of refund of custom duties paid on the inputs or raw materials and service tax paid on the input services used in the manufacture of export goods. The duty drawback benefit are as stated in the table below.

Benefits secured under MEIS (Merchandise Exports From India Scheme) and Duty Drawback Scheme				
ITC HS Code	Products	MEIS benefits in percentage of FOB Value	Duty Drawback Scheme benefit in percentage of FOB Value	
			Drawback rate when cenvat facility has not been availed	Drawback rate when cenvat facility has been availed
8011100	Desiccated coconut	5	1	0.15

List of Plant and Machinery	
Sl.No	Item
1	Coconut de shelling machine
2	Brown skin removing machine
3	Washing Unit
4	Whole nut inspection conveyor
5	Disintegration Unit
6	Blanching Unit
7	Dryer with pre drying circuit and dust collection system
8	DC powder cooler
9	Lump breaker
10	Vibro sieve
11	Intermediate Conveyors

Capital Investment		
Components	Capacity	
	15,000 coconuts per day	25,000 coconuts per day
	(Rs. in lakhs)	
Land (min 50 cent)	Own/Leased	Own/leased
Building & Civil Works	35.00	45.00
Plant & machinery	67.00	87.00
ETP	5.00	5.00
Electrification	4.00	5.00
Generator	10.00	10.00
Pre-operative expenses	0.67	0.87
Working capital margin	8.00	13.00
Total	129.00	165.87

CDB Scheme for Promotion of Coconut Industries

Coconut Development Board under Technology Mission on Coconut extends financial assistance to the limit of 25% of the eligible project cost limited to Rs. 50 lakhs per project. Under this scheme, CDB has supported 91 desiccated coconut powder manufacturing units with a processing capacity of 909.45 million nuts per year which comes to 38% of the total coconuts used for processing in India (2001-2015).

For technical enquiries and for availing subsidy, contact :cdbtech@gmail.com. For export related enquiries, contact : epccdb@gmail.com. ■

Virgin coconut oil - the mother of all oils

● **Dr. S Anuradha, B Niveditha and C Vidhya Bama**
Vellalar College for Women, Erode-12.

The coconut palms belong to the family Arecaceae (palm family). It is the only accepted spices in the genus coco. The term coconut can refer to the entire coconut palm, the seed or the fruit which botanically is a drupe not a nut. Coconut has been the part of people's diet and livelihoods mainly in the tropical countries of Asia, the Pacific, South and Central America and Africa for thousands of years. Every part of coconut tree and it's fruit can be either consumed by human or animals or converted into other valuable products.Fresh unopened coconuts can be stored at room temperature for up to four months depending on it's origin, freshness when purchased etc. The hexane fractions of coconut peal may contain novel anticancer compounds. Coconut water has a high level of sugar and other salts that makes it's possible to the rise in the blood stream or dextrose water. Coconut is one of the few foods that can be classified as a "superfood". It is a unique combination of fatty acids which can have profound positive effects on health. Coconut oil is prepared from coconuts by cooking the decorticated Granulated coconuts having good oil content are preferred for this purpose. Coconut oil is nature's richest source of lauric acid.

Health Benefits of Virgin Coconut Oil

Thyroid-stimulating : Research shows that coconut oil contains a medium-chain fatty acid accelerate that stimulates metabolism and gives more energy.

Lowers cholesterol : It is rich in lauric acid which protects heart by reducing total cholesterol and increase good cholesterol.

Helps with weight loss : Even though it is a fat, virgin coconut oil actually helps with weight loss! Healthy medium chain fatty acids do not circulate in the bloodstream like other fats. They are sent directly to the liver and are converted into energy. Thus the body does not store the fat in coconut oil as fat; it uses it to produce energy instead.

Helps keep diabetes in check : Virgin coconut oil does not produce an insulin spike in your bloodstream, instead it helps control blood sugar by improving the secretion of insulin.

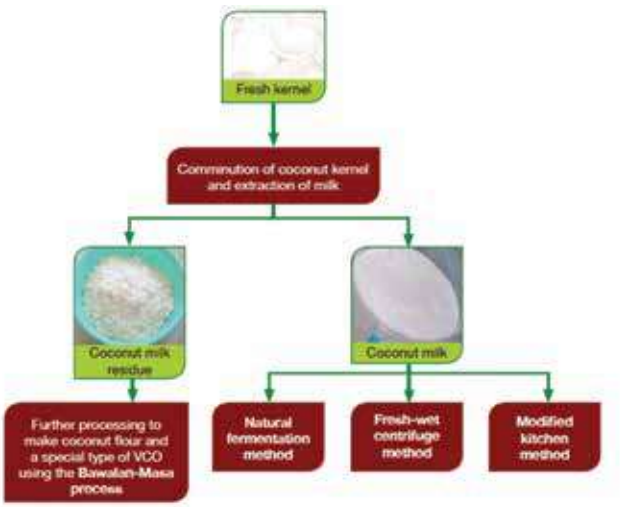
Reduces heart disease : Studies on people in the Pacific Islands found that their total caloric intake included thirty to sixty percent from fully saturated coconut oil. These Pacific Islanders have nearly non-existent rates of cardiovascular diseases.

Gastrointestinal mal-absorption diseases: Combining Vitamin E supplements with coconut oil through the skin is a good alternative for those with gastrointestinal malabsorption diseases.

Supports the immune system : Virgin coconut oil is rich in lauric acid, a nutrient that supports the body's immune system.**Good for the skin :**

When applied externally virgin coconut oil forms a protective antibacterial layer protecting the infected body part. Coconut oil also speeds up the healing process of bruises by helping to repair damaged tissue.

Nourishing for the brain : Studies show that virgin coconut oil improves cognitive function and stalls, or even reverses, neurodegenerative diseases in their early stages.



Speeds Recovery : People in Panama drink coconut oil to protect themselves from illness as it is believed to speed recovery from sickness.

Preparation of virgin coconut oil

Virgin coconut oil is directly extracted from fresh coconut flesh and it is different between coconut oil in term of nutrient composition and method of production. The conventional ways of breaking emulsions using heat was disadvantageous from both economic and environmental perspectives. In this study, the production of virgin coconut oil from coconut milk was investigated. Boiling method was used for separation of oil. The optimum temperature required to maintain the nutrients in the oil was about 60°C. Coconut milk was extract first by pressing from both aged coconuts and also from the fresh coconuts. Then milk was boiled in order to separate the oil from coconut milk. Coconuts were broken and the meat of coconuts were grated Muslin cloth was placed over a bowl.The grated coconut was kept over the cloth so that the coconut milk dripped into the bowl. A spatula was used to push the pulp and squeeze out as much liquid as possible. Place it in a saucepan on a burner and turn the heat from medium to high. Stirr constantly, until the water is evaporated and the cream is separated from the oil. The process of boiling the liquid is continued until it reach the right state. Stirr constantly. Filter the oil from the pan by using the funnel. Transfer it to a sterlized bottle. Store it in the normal temperature.

Processing steps

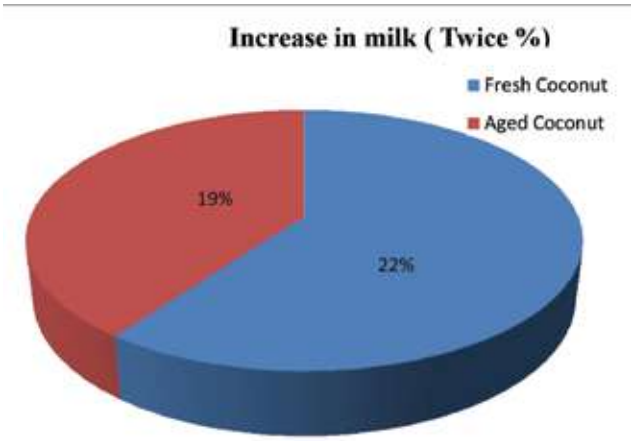
Virgin Coconut oil can be prepared from both fresh and aged coconuts and their appearance is as follows;

Coconut oil extraction is done by the addition of water to coconut meat and extracting the coconut milk by squeezing it in muslin cloth. This process is repeated for 2 – 3 times and the final coconut milk is used for extraction of oil.

The ratio of milk and water and its composition were listed in the table given below;

Results of Milking Coconut

Trail	Amount (g)	Milking Number	Coconut Milk Extracted (ml)	Oil Extracted (ml)	% Milk Increase when milked Twice
Fresh Coconut	200	1 st	116	33	19
		2 nd	24		
Aged Coconut	200	1 st	132	45	22
		2 nd	25		



From the table and figure, it is found that, first time milking yields more compared to the second time milking and aged coconut provide more amount of milk than the fresh white coconut.

The organoleptic evaluation of virgin coconut oil was done by comparing with the fresh coconut oil available in the market in which additives were added.In order to evaluate the taste, colour, flavor etc. of these oils, tapioca chips were made by using this oil. Organoleptic evaluation of the tapioca chips were also done and it concluded that there was not much difference between these oils.Regarding flavor, the product from virgin oil based, brought optimum acceptability among the evaluators.These evaluations were done among the students by using the score card which was given to each student.

Future recommendations

Awareness creation among the women to prepare virgin coconut oil easily in a short period of time under low cost method is most essential. Awareness creation also need to be done on the uses and nutritional levels of VCO in the community. Virgin Coconut Oil is very much useful and so it can be produced as a home scale product by adopting simple method by using simple equipments available at house hold level. ■

Wound healing property of coconut leaf sheath scale

● **Shameena Beegum**
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The popularly known 'Kalpa vriksha' is truly one of nature's wonders. Each and every part of the coconut palm is useful in one or another way. Because of the immense nutritional and medicinal value, it is called as "fruit of life". People from many diverse culture, religion and races across the world have revered coconut as a unique source of food and medicine. For example, in coastal jungles of Central and South America coconut is commonly used for all kinds of illness. In the Philippines, coconut oil is used to speed the healing of broken bones, burns, cuts, bruises, and even, massaged into swollen joints. In Polynesian islands, traditional healers use coconut as part of the cure. When it comes to India, coconut in its many forms is widely used to treat a variety of health problems. Before medically trained doctors were available, healers took care of the people's medical needs using coconut and its products. Coconut palm enjoys a pride of place as folklore and in the Ayurvedic medicinal system. Every part of the palm starting from roots, stem, leaf, leaf sheath, mid rib, spathe, spadix, fruit including the kernel, haustorium, oil etc. has diverse uses both as food and as a medicine.

An adult coconut palm comprises about 30-40 opened leaves. Leaf consists of a rachis (popularly known as leaf-stalk) and leaflets. The different parts of coconut leaf are shown in Fig.1. The leaf stalk continues as a mid rib or rachis till the tip of the leaf where it merges into a green leaflet. The leaf stalk attaches to the stem by means of a sheath in the form of a bracket firmly clasping the stem with its wings nearly round it, providing mechanical strength to it to withstand strain from the wind and the weight of the bunch. The young sheath is made up of a mass of parenchyma. With the development of leaf at the distal margin, a thin narrow tissue occurs (brown in colour) starting from the distal end, till the tip of young growing leaflet. The tissue may be completely used up, as the leaflet mature which is nothing but the leaf sheath scale. But usually towards the tip portion of the leaf which is first emerging, the structure persists forming a long drawn tip (Fig. 2). Towards the tip, the thickness of the tissue starts reducing. Anatomically, it is cell debris of the actively dividing meristematic tissue which is the leaf sheath scale. This meristematic tissue is fibrous in nature. Cell debris can be clearly visible under a compound microscope.

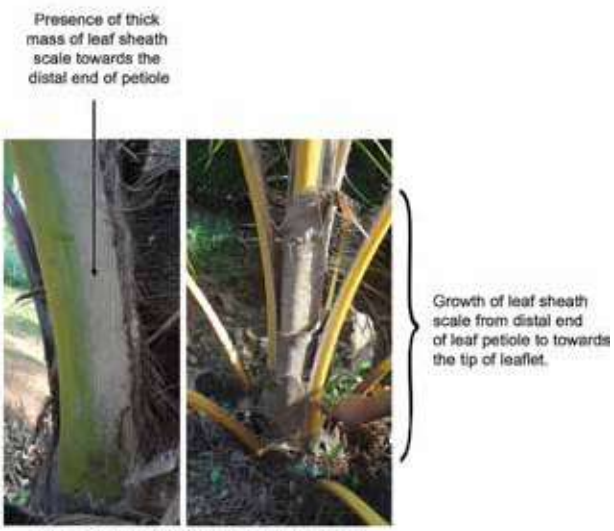

Fig. 2 Diagram showing the leaf sheath scale

Traditionally in rural areas, leaf sheath scale of coconut is used in wound healing (Fig. 3) According to them, it is very effective even for head injuries. Some studies have also been carried out to find their medicinal properties. This kind of scale can be seen in other palms also. It primarily protects the tender leaves from the changing environmental conditions and attack of microorganisms. In order to state its medicinal property, it is necessary to know the active compounds present in it. A study revealed that coconut leaf sheath scale contains ketone, amides, esters, unsaturated nitrogen compounds, polyphenols, sulphur compounds, halogen compounds, phytochemical radicals, fatty acids and cholesterol (Jose, 2006). Since it is derived from meristem, it may contain growth promoting factor like gibberellins. Sulphur present in leaf sheath scale hasten the production of fibrinogen (glycoprotein that helps in the formation of blood clots) which is another reason for blood clotting activity of leaf sheath scale. The wound healing activity of ketone is also well proven and documented (Kesl *et al.,* 2014). Presence of gibberellins helps in rapid cell proliferation. In addition to the effect of hormones, fatty acids also have a direct role in developing new

tissues since they are necessary for the creation of cell membranes. Role of fatty acids in building collagen and promoting wound healing had been reported in neem oil (Raina et al., 2008). A similar effect might be there in the fatty acids of coconut leaf sheath scale.

Wound colonization is polymicrobial involving numerous microorganisms. Antimicrobial activity of coconut leaf sheath scale is well documented. It is effective against Proteus vulgaris, Klebsiella pneumonia and E.coli which are the major facultative anaerobes responsible for wound infection. They generally contaminate wounds, thereby causing infections. Crude extract of coconut leaf sheath scale has shown effective in inhibiting zone formation in the bacterial cultures indicating its antimicrobial activity. Antimicrobial activity of polyphenols is also well known. The presence of polyphenols in the sheath scale has a distinct role in the antibacterial activity. All these bioactive compounds present in coconut leaf sheath scale contribute towards the wound healing as well as the antimicrobial activities.

Recently two students of Lakshadweep received innovation award at the India International Science Festival (IISF) at IIT Delhi for the science project on wound healing property of leaf sheath scale. The wound healing property is mainly due to three major reasons. Since it contains growth promoting factor, rapid cell proliferation is facilitated. Secondly, prevention of the microbial infection due to its antimicrobial activity or the antimicrobial ingredients and thirdly fibrous nature of the raw material assisting the wound healing by accelerating the clot formation. ■

Fig. 3 Scrapped Leaf sheath scale and the usage in cuts and wounds

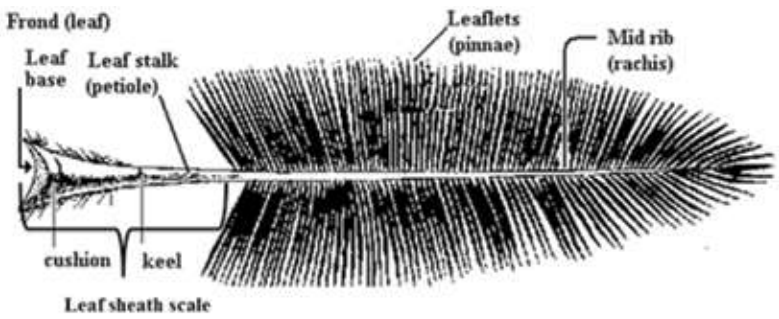

Fig. 1 Parts of Coconut leaf

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Web address: http://newsexperts.in/2015/12/08/awards-at-iris-national-science-fair-2015 ■

Utilisation of coconut milk residue for fibre enrichment in foods

● **Aneeta Joy**, Food Technologist & **Praseetha K C**,Chemist,
CDB Institute of Technology, Aluva

Milk residue is the solid material left behind when coconut milk is extracted from grated or shredded coconut kernel. It is generated as a by-product of processing of coconut milk based products like coconut milk, coconut milk powder, flavored coconut milk, coconut milk yogurt, VCO etc. This residue represents approximately 25–50% of the weight of the grated kernel on a wet basis, depending on the coconut milk extraction process that is used. Now a days, residue left after processing of coconut milk based products is utilized for the preparation of bakery or confectionary items. However, this residue posses good nutritional property which could be utilized for value addition of various food products.

Studies done at the Philippine Food and Nutrition Research Institute (FNRI) reveal that coconut residue has a much higher dietary fibre content (32%) than oatmeal (8%) and flax seed (23%), which are being promoted by American food companies as healthy foods. Based on FNRI analysis, dried coconut milk residue has the the composition of 51% carbohydrates, 32% dietary fibre, 38% fat, 5% protein, 4% moisture and 2% ash. Coconut milk residue can be used either dried or wet, depending on the application.

Coconut flour can be used as food supplement or additive in breads, cookies and snack food to enrich dietary fiber.

Preparation of coconut milk residue

Coconut milk residue after the extraction of coconut milk for various purposes is dried in an electric hot air oven upto a moisture content of less than 3%. Care should be taken to avoid colour change during the drying process. The residue is stirred in intervals so as to prevent browning.

Benefits of coconut flour

Coconut flour has proven to have high amounts of soluble and insoluble dietary fiber (49% - 60%) which is important in functional food development. (Based on the study made by PCA).

Test foods containing 15% - 25% dietary fiber from coconut flour reduces serum total and LDL cholesterol of humans with moderately raised serum cholesterol.

High-fiber coconut flour is used as food supplement/ additive in breads, cookies and snack food to provide dietary fiber sources. As a source of dietary fibre, coconut milk residue provides a number of health benefits in relation to coronary heart diseases, colon cancer and diabetes.

It has been reported that high fibre coconut flour products increased fecal bulk and lowered serum cholesterol. Coconut flour can also be used as fillers for emulsified products such as sausages, meat loaf and burger patties.

Properties of milk residue

Properties of milk residues left after the extraction of milk for products like virgin coconut oil, flavoured coconut milk coconut milk yogurt and coconut cream is as follows:

Physical properties	
Parameters	Characteristics of coconut flour
Colour	White/Off white
Odour	Slightly nutty odour
Taste	Bland taste
Particle size	Fine to medium
Shelf life	Min.6 months
Water absorption capacity	high

Chemical properties				
Parameters	Residue left after processing of:-			
	Flavoured coconut milk	Coco-nut milk yogurt	VCO	Coconut cream/ Thick coco-nut milk
Crude fibre(%)	6.63	7.89	8.63	5.4
Carbohydrates(%)	41.29	41.77	43.77	32.45
Protein(%)	3.79	3.21	1.44	3.61
Fat(%)	43.31	42.36	40.08	54.72
Total mineral matter (Total ash) (%)	1.79	1.52	0.84	1.4
(Source: CDB Institute of Technology)				

Value addition of coconut milk residue

Now a days there is an increase in the incidence of lifestyle diseases like obesity, diabetes mellitus, atherosclerosis etc. A practical solution for reducing the risk of these diseases is inclusion of fibre rich foods in our daily diet. More and more consumers are becoming health conscious. People are becoming more conscious on quality and nutritional contents.

Coconut milk residue can be used in making fibre-enriched foods and in the formulation of functional foods because of its high fibre content. It can be used as an ingredient and extender for home food preparations to enhance nutritional value. Coconut residue itself can be used as a major ingredient in some of the food products. Coconut flour or desiccated coconut used can be replaced by coconut milk residue.

Utilization of coconut milk residue in various food products for fibre enrichment

Fortification of coconut milk residue in products like bread, noodles etc will enhance the health benefits of these products. Specialty breads like high fiber white bread are on the rise. Todays consumers expect their foods to have multiple functional benefits. Still, they have high expectations when it comes to taste and flavor. For example formulating cereal based energy bars incorporating large amount of functional components like fibre and protein may be difficult, as these ingredients may impact the taste and flavor of the final products. Coconut residue has a bland taste and hence it does not detract from other flavours that may be added to snacks or other products to enhance their taste. Some of the food products in which fibre fortification was successfully done by incorporation of coconut milk residue are cookies, bread, rusk, noodles and energy bar. The recipes were prepared using 5-15% coconut milk residue.

Level of incorporation of coconut milk residue in different products

Type of product	% of coconut milk residue incorporated
Cookies	7 %
Bread/Rusk	12%
Noodles	6.5%
Energy bar	8%

Products prepared using coconut residue as major ingredient

Coconut milk residue can be used as a major ingredient for production of viable products which are of commercial importance. Products like instant theeyal mix, coconut chutney powder, coconut burfi and coconut ladoo were prepared either using coconut residue as the major ingredient or by partial substitution of coconut flour by coconut residue.

The health benefits of coconut residue if will create a market for high-protein coconut flour and encourage existing VCO, flavoured coconut milk and other coconut milk based products' producers to further process their by-products.

Type of product	% of coconut residue incorporated
Coconut chutney powder	40%
Theeyal mix	43%
Coconut Ladoo	40%
Coconut Burfi	30%
Coconut macroons	40%

Nutritional parameters of developed products					
Parameters	Carbohydrates (%)	Protein (%)	Fat (%)	Crude fibre (%)	Mineral matter (%)
Cookies	37.41	3.10	39.55	0.53	0.65
Bread	50.85	11.31	7.59	1.88	1.37
Rusk	76.4	7.21	8.32	0.58	0.92
Noodles	63.00	13.53	10.37	1.72	3.24
Energy bar	55.00	6.13	24.73	2.18	2.42
Coconut chutney powder	11.59	3.39	54.08	1.88	4.69
Theeyal mix	9.88	2.95	65.44	2.57	2.41

Indian Coconut products export growth continues

K.S. Sebastian, Assistant Director, Export Promotion, CDB.

Export of coconut products during the first quarter of the financial year 2016-17 touched Rs. 410.65 crores. Compared to the export during the corresponding period of the previous year an increase of 9.17% was recorded in coconut product exports. Significant increase was recorded in the export of desiccated coconut, copra and coconut oil. Export of coconut products from India during the first quarter of the financial year 2016-17 is given in table 1.

Table1

Export of coconut products from India during April to June 2016in April 2016

		June 2015		June 2016		2015 (April to June)		2016 (April to June)	
		Qty (in MT)	Value (Rs. In lakhs)	Qty (in MT)	Value (Rs. In lakhs)	Cum. Qty (in MT)	Cum. Value (Rs. In lakhs)	Cum. Qty (in MT)	Cum.Value (Rs. In lakhs)
1	Activated Carbon	5943.31	6242.73	5557.59	5717.05	16590.73	17247.21	15713.61	16228.73
2	Coconut Fatty Soap		207.60		384.10		697.84		778.12
3	Hair Cream		123.86		68.50		243.68		131.14
4	Coconut Oil	762.02	1654.75	1028.25	1299.47	2169.09	4612.95	2708.55	3876.82
5	Coconut Hair Oil				259.42		0.00		579.43
6	Coconut Water		94.54		3.78		186.91		104.52
7	Copra	275.40	250.84	1118.09	728.39	617.10	595.31	3956.97	2642.31
8	Desiccated Coconut	276.65	420.24	1449.47	1488.60	831.65	1242.83	4140.30	4224.89
9	Dry coconut	2085.05	2017.34	1163.02	1154.24	5067.37	5374.97	4003.28	3875.97
10	Fresh coconut	2523.82	961.28	5723.60	1296.63	8646.82	3175.99	15659.27	4050.15
11	Grated/sliced coconut	182.06	306.10	133.47	243.16	444.31	943.76	548.22	999.78
12	Oval coconut shell		93.41		82.60		222.87		323.62
13	Shell charcoal	691.57	236.16	1956.50	434.45	1753.09	584.44	3110.60	764.01
14	VCO	83.80	266.41	56.29	168.11	364.61	1167.20	91.07	310.08
15	Misc coconut products		539.26		577.21		1320.19		2175.27
	Total		13414.54		13905.71		37616.16		41064.83

Activated Carbon

The export of activated carbon from India during April to June 2016 was 15713.61 MT. United States was the major importer of Indian Activated Carbon, followed by United Kingdom. Details of export of Activated Carbon from India during the period April to June 2016 is given in table 2

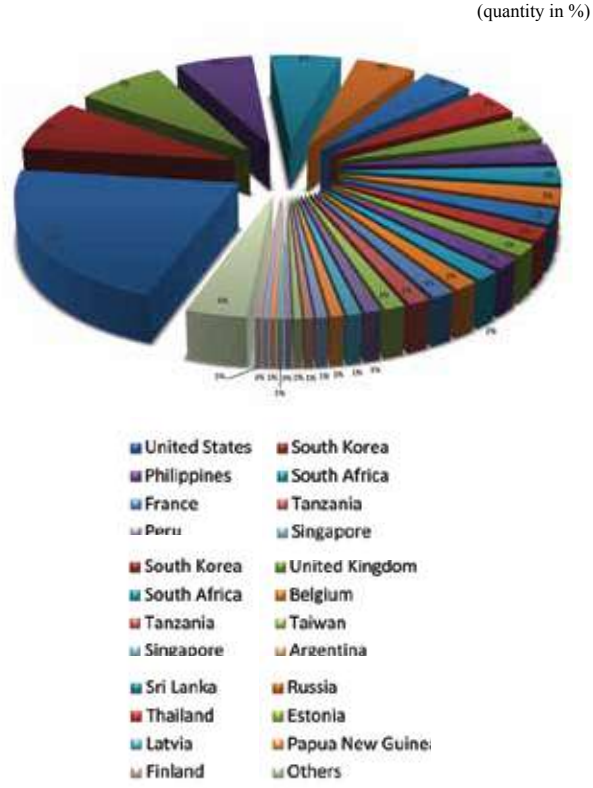
Country wise export of Activated Carbon during April to June 2016

Sl. No.	Country	Qty (in MT)	Value (Rs in lakhs)
1	United States	3365.61	3661.30
2	South Korea	1218.02	1242.43
3	United Kingdom	1155.46	1198.70
4	Germany	997.95	1102.63
5	Sri Lanka	918.98	811.22
6	Russia	784.74	804.64
7	Canada	658.18	672.40
8	Turkey	646.03	521.19
9	Netherlands	606.26	590.29
10	Philippines	470.32	486.37

11	South Africa	410.65	431.79
12	Belgium	406.81	375.85
13	Italy	361.00	297.60
14	Thailand	305.96	319.31
15	Estonia	294.00	296.64
16	Ghana	283.00	333.27
17	China	248.33	352.16
18	Japan	244.62	325.11
19	France	234.70	260.77
20	Tanzania	225.20	241.20
21	Taiwan	212.55	183.57
22	Australia	162.00	163.42
23	Latvia	148.00	150.65
24	Papua New Guinea	132.00	139.51
25	Sweden	116.80	121.77
26	Brazil	90.40	98.64
27	Malaysia	84.15	103.90
28	Peru	70.00	69.45
29	Singapore	60.37	55.60
30	Argentina	60.00	58.08
31	Iran	57.20	58.16
32	Finland	57.00	46.19
33	Others	627.32	654.92
	Total	15713.61	16228.73

Table 2

(quantity in %)



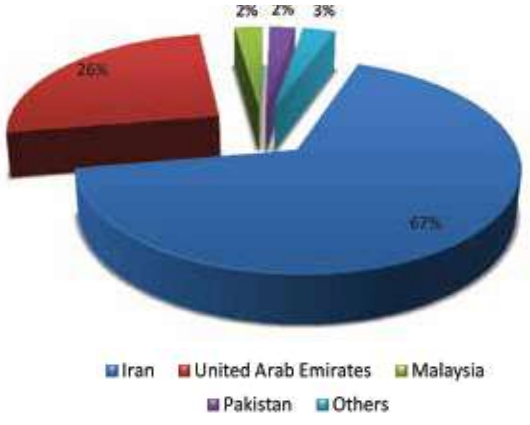
Dry Coconut

During the period April to June 2016, 4003.28 MT of dry coconuts were exported from India. Out of this 2671.03 MT was to Iran. Countrywise export of dry coconut from India during the first quarter of the financial year 2016-17 is given in table 3.

Export of dry coconut during April to June 2016			
Sl.No.	Country	Quantity (in MT)	Value (Rs in lakhs)
1	Iran	2671.03	2597.00
2	United Arab Emirates	1022.34	876.48
3	Malaysia	100.00	99.77
4	Pakistan	93.00	91.96
5	Others	116.91	210.75
	Total	4003.28	3875.97

Table 3

(quantity in %)



Fresh Coconut

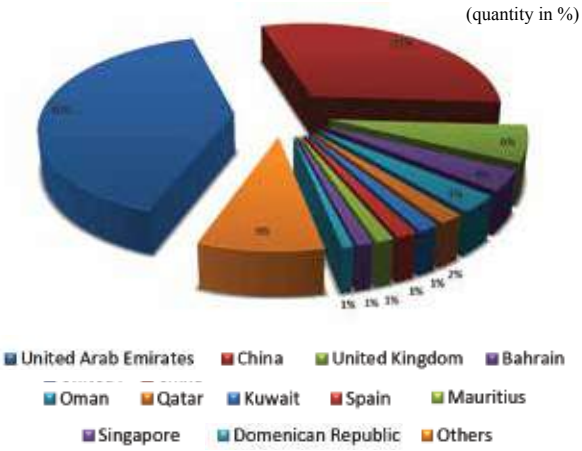
Export of husked coconut from India during the period April to June 2016 was 15659.27 MT. Countrywise export of fresh coconut from India during the first quarter of the financial year 2016-17 is given in table 4.

Table 4

Export of fresh coconut during April to June 2016

Country	Quantity (in MT)	Value (Rs in lakhs)
United Arab Emirates	6248.59	1770.76
China	4779.69	926.54
United Kingdom	1002.08	355.02
Bahrain	557.88	147.34
Oman	472.69	169.58
Qatar	281.29	87.11
Kuwait	231.60	97.21
Spain	223.00	97.13
Mauritius	195.81	52.68
Singapore	176.70	33.82
Domenican Republic	123.81	27.49
Others	1366.14	285.47
Total	15659.27	4050.15

(quantity in %)



Desiccated Coconut

Export of desiccated coconut powder during the first quarter of the financial year 2016-17 was 4140.30 MT which was 398 % more than the desiccated coconut export during the corresponding period of last year. Country wise export of desiccated coconut powder during the period of April to June 2016 is given in table 5

(quantity in %)

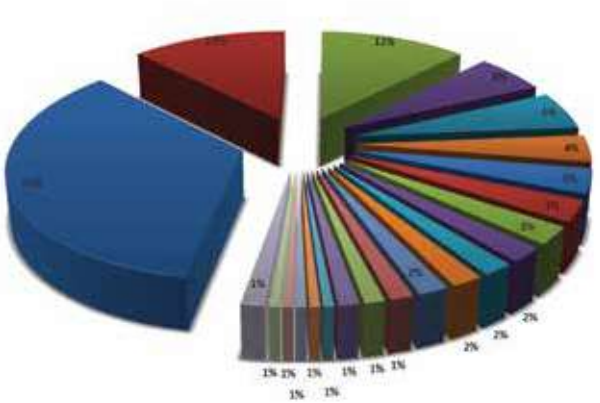


Table 4

Export of DC from India during April to June 2016

Country	Qty(in MT)	Value(Rs in lakhs)
United Arab Emirates	1445.82	1460.64
Egypt	524.00	521.24
Saudi Arabia	495.50	513.82
Brazil	239.00	263.13
United States	230.56	224.35
Kuwait	163.85	174.69
Spain	149.00	150.71
Iran	127.00	109.60
Qatar	107.25	117.94
Morocco	89.00	90.70
Algeria	77.00	75.79
France	77.00	86.28
Yemen	73.96	75.78
Nepal	57.19	66.34
Poland	50.00	49.39
Belgium	50.00	53.99
Israel	26.00	26.45
Oman	26.00	24.15
Bahrain	25.15	32.91
Lithuania	25.00	26.39
Ukraine	25.00	28.75
Others	57.03	51.85
Total	4140.30	4224.89

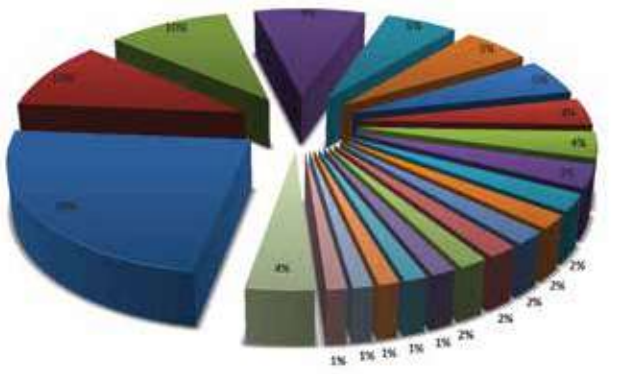
Coconut Oil

Export of coconut oil from India during the first quarter of the financial year 2016-17 was 2708.55 MT, which is 25 % higher compared to 2169.07 MT recorded during the corresponding period of last year. UAE alone imported 637.78 MT of coconut oil from India during this period.

Coconut oil was also exported to Srilanka, Myanmar, Saudi Arabia, Oman, Malaysia, United States, Qatar, Indonesia, Kuwait etc. Export of coconut oil from India during the month of April 2016 is given in table 6.

Table 6

Export of coconut oil during April to June 2016		
Country	Qty (in MT)	Value (Rs in lakhs)
United Arab Emirates	637.78	836.77
Sri Lanka	272.23	292.33
Myanmar	267.62	368.63
Saudi Arabia	242.44	313.36
Oman	158.71	209.06
Malaysia	147.26	146.83
United States	140.14	336.29
Qatar	106.45	154.05
Indonesia	103.80	83.99
Kuwait	88.77	120.17
United Kingdom	65.60	121.78
Bahrain	53.05	69.98
Nepal	52.25	73.29
Brazil	49.12	76.59
Ireland	46.05	85.06
Taiwan	39.78	46.85
Singapore	35.81	77.06
Yemen	32.90	62.59
Pakistan	31.83	63.02
Brunei	31.63	39.98
Others	105.33	299.15
Total	2708.55	3876.82



(quantity in %)

United Arab Emirates Sri Lanka Myanmar Saudi Arabia Oman Malaysia United States Qatar Indonesia Kuwait United Kingdom Bahrain Nepal Brazil Ireland Taiwan Singapore Yemen Pakistan Brunei Others

Import

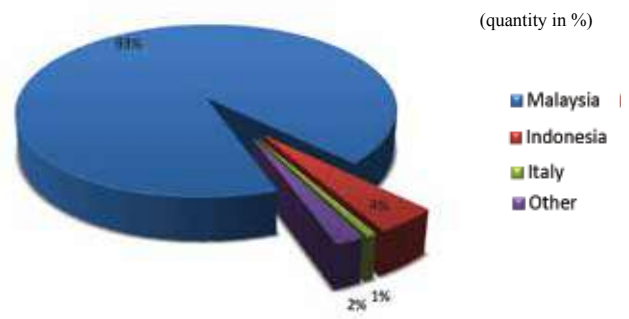
During the first quarter of the financial year 2016-17, India imported Rs 80.83 crores worth coconut products. Copra expeller cake and coconut fatty acid were the major items imported during this period. Details of import of coconut products into India during the first quarter of the financial year 2016-17 is given in table 7.

Import of coconut products to India during the period April to June 2016								
Item	June, 2015		June, 2016		April to June 2015		April to June 2016	
	Quantity (in MT)	Value (Rs. In lakhs)	Quantity (in MT)	Value (Rs. In lakhs)	Cum. Quantity (in MT)	Cum. Value (Rs. In lakhs)	Cum. Quantity (in MT)	Cum. Value (Rs. In lakhs)
Coconut fatty acid	640.67	560.18	828.88	756.92	1911.47	1672.47	2117.82	1856.64
coconut oil	244.31	178.34		0.19	1200.74	1100.02	0.00	0.19
Copra oil cake	10254.64	1654.23	7244.49	1120.89	29605.29	4605.46	34020.05	4986.35
Coconut shell charcoal	1641.10	495.84		0.08	4831.96	1511.65	324.62	96.42
Cream-milk-powder		74.68	173.05	355.81		277.03	173.05	876.60
Copra	0.00	0.00	0.00	0.00	74.42	56.38	0.00	0.00
Misc coconut products		238.09		86.73		381.25		266.83
Total		3201.38		2320.62		9604.27		8083.02

Table 7

Coconut Fatty Acid

Import of coconut fatty acid into India during the first quarter of the financial year 2016-2017 was 2117.82 MT, out of which 1965.68 MT was from Malaysia. Import of coconut fatty acid during the corresponding period of last year was 1911.47 MT. Details of import of coconut fatty acid to india from April to June 2016 is given in table 8.



Import of coconut fatty acid during April to June 2016		
Malaysia	1965.68	1725.01
Indonesia	94.40	77.21
Italy	15.00	29.97
Other	42.74	24.46
Total	2117.82	1856.64

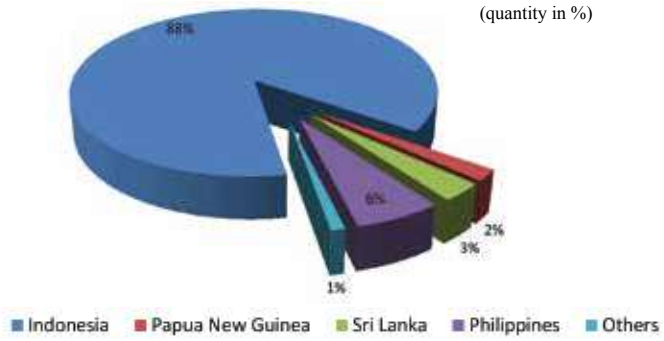
Table 8

Copra expeller cake

In terms of quantity and value copra expeller cake is the major coconut product importing to India. During the first quarter of the financial year 2016-17, the quantity of import of this product was 34020.05 MT of which 29750.80 MT is from Indonesia. Details of import of this product during the period April to June 2016 is given in table 8.

Table 9

Import of coconutoil cake during April to June 2016		
Country	Qty (in MT)	Value (Rs. In lakhs)
Indonesia	29750.00	4279.19
Papua New Guinea	687.51	117.78
Sri Lanka	1075.97	208.63
Philippines	2150.00	323.62
Others	356.57	57.12
Total	34020.05	4986.35



Horti Sangam 2016

Inauguration of Horti Sangam : Shri Ram Bilas Paswan, Hon'ble Minister of Consumer Affairs, Shri Radha Mohan Singh, Hon'ble Minister for Agriculture and Farmers Welfare and Dr. A.K. Singh, Chairman, CDB are seen.

Coconut Development Board, Regional Office, Patna participated in Hort. Sangam 2016 cum Horticulture Seminar at Hajipur, Bihar from 09th to 10th July 2016. The programme was organized by the National Horticulture Board in association with CDB, ICAR, NRC Litchi and State Agriculture Universities. Shri Ram Bilas Paswan, Hon'ble Minister of Consumer Affairs, Food & Public Distribution, Govt. of India inaugurated the programme. Shri Radha Mohan Singh, Hon'ble Minister for Agriculture and Farmers Welfare, Shri Awdhesh Prasad, MLA, Hajipur, Dr. A.K. Singh, Chairman, CDB, and Dr. R .C. Sriwastwa, Vice Chancellor, Rajendra Agricultural University, Pusa, Samastipur and other dignitaries were present during the occasion.

The Hon'ble Agriculture Minister in his presidential address said that product diversification is the only solution to solve the problems of farmer. Coconut Development Board (CDB) arranged 2500 coconut to seedlings for distribution among the farmers and distributed one coconut seedling each the farmers. The meeting was followed by a technical session An exhibition was also arranged as part of the programme wherein various government and non government organizations participated.CDB displayed coconut based products and handicrafts items.

Chairman, CDB Visited CFTRI, Mysore

Dr. A.K. Singh, Chairman, CDB in discussion with Director and Senior officials of CFTRI

Chairman, Coconut Development Board visited CFTRI, Mysore on 28th June 2016 and held discussions with the Director, CFTRI on value addition in coconut sector and on the projects proposed by CFTRI. He also had discussion with the scientists on the need for product development in coconut sector in a time bound manner. Shri. Hemachandra, Deputy Director, CDB, ROB accompanied the Chairman.

126th Board meeting

A view of the 126th Board Meeting

The 126th Meeting of the Coconut Development Board was held at Bangalore on 27th June 2016 under the Chairmanship of Dr. A.K. Singh, Chairman, Coconut Development Board. Members of the Board, Shri Nalin Kumar Kateel, Hon'ble M P, Shri Thota Narasimham, Hon'ble M P, Dr. P. Chowdappa, Director, CPCRI; Dr. Raju Narayana Swamy IAS, Secretary (Agriculture), Government of Kerala, Shri V.B. Pyarelal IAS, Additional Chief Secretary & Agricultural Production Commissioner, Government of Assam, Shri S.S. Thakur, Director (Cooperation), Ministry of Consumer Affairs, Food & Public Distribution, New Delhi, Dr. P.K. Pramanick, Director (Horticulture) Government of West Bengal, Dr. G.S. Pandey, Director of Agriculture, Andaman & Nicobar Administration and Shri Johar Khan, Andhra Pradesh attended the meeting. Meeting discussed various activities of the Board during 2015- 16 and 2016-17. Board also approved the scheme wise, state wise tentative Annual Plan allocation of the Board during 2016-17 with a total tentative plan allocation of Rs.130 crores allotted to CDB from the Ministry of Agriculture and Farmers Welfare as one of the sub scheme of MIDH. Out of the total plan allocation of Rs.130 crores, maximum amount of Rs.40 crores is allotted to the implementation of Replanting and Rejuvenation programme in the states of Kerala , Karnataka and Tamilnadu and Rs.30 crore for implementing the scheme Laying out of Demonstration Plot(LoDP) in all major coconut growing states. Meeting also approved the major publicity and extension activities of the Board for 2016-17.

Chairman, CDB visited DSP Farm, Mandya

Dr. A.K. Singh, Chairman, CDB and senior officials at CDB DSP Farm, Mandya.

Dr.A.K.Singh, Chairman CDB, visited DSP Farm Mandya, Mysore along with Dr.Chowdappa, Director CPCRI, Shri.Johar Khan Board Member, Dr.G.R.Singh, Chief Coconut Development Officer, Dr. T I Mathewkutty, Director, Dr.A.K.Nandi, Secretary, Shri. Hemachandra, Deputy Director and other officials of CDB on 27th June 2016. Chairman assessed the status of the Demonstration Cum Seed Production farm, Mandya and pointed out the shortfalls in scientific management of the farm and made suggestions for rectifying the same. He directed the officials to transform the Mandya Farm into a globally renowned demonstration cum germplasm unit. A demonstration of palm climbing using climbing device was also arranged at Mandya. Chairman also visited the parasite breeding lab and reviewed the activities of the lab including preparation of pollen grains for utilising for hybridization in coconut. He planted coconut seedlings in the farm premises.

Dr. G R Singh takes over as Chief Coconut Development Officer, CDB

Dr. G R Singh took over as Chief Coconut Development Officer, CDB on 27th May 2016. He has been holding the post of Director at the Market Development cum Information Centre of the Board at New Delhi. Dr. G R Singh is a postgraduate in Agriculture and subsequently Ph.D in Globalization of Coconut Industries and Coconut Farmers in North East Region and its Evaluation from Sido Kanhu Murmu University, Dumka,Jharkhand. Dr. Singh started his official career in the Ministry of Agriculture, Department of Animal Husbandry in 1980. Dr. Singh joined Coconut Development Board in August 1985 and subsequently served at various offices of the Board in Assam, Karnataka, Bihar and Maharashtra. As Director of the Board, he was in charge of various states like Gujarat, Madhya Pradesh, Jharkhand, Chhattisgarh and Bihar.

Senior Officer's Meeting of Coconut Development Board held

Dr. A.K. Singh, Chairman, CDB addressing the senior officers meeting

Annual review meeting of the Senior Officers of Coconut Development Board was held on 14th and 15th July 2016 at CDB, Kochi to review the activities and achievements of the Board in different states during the financial year 2015-16 and the action plan for 2016-17. Shri Dr. AK Singh, Chairman chaired the meeting.

Dr. G R Singh, CCDO apprised the meeting about the major activities of the Board during last financial year and action plan of CDB for the year 2016-17 . Shri A K Nandi, Secretary, briefed the financial and administrative status of the Board and requested all unit offices to carry out the activities for the betterment of coconut farming community. Officers from respective unit offices presented their achievement and target for the current year. The meeting was attended by all senior officers of the Board.

Monthly Operations- August

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

Andhra Pradesh : Plough in situ the green manure crops raised. Search for rhinoceros beetles on the crowns of the palms and hook out the beetles by beetle hook and destroy them. As a prophylactic measure against the infestation of rhinoceros beetle, fill the youngest three leaf axils with a mixture of 250g powdered marotti/ neem cake with equal volume of sand or place naphthalene balls(12g/ palm) and cover them with sand thrice a year. Spray the palms with one per cent bordeaux mixture as a prophylactic measure against fungal disease. If the attack of the mite is noticed, spray neem oil - garlic - soap emulsion 2 percent (20 ml neem oil + 20 gm garlic emulsion + 5 gm soap in 1 litre water) or commercial botanical pesticides containing azadirachtin 0.004 per cent @ 4ml per litre water on the bunches, especially on the perianth region of buttons and affected nuts or root feed neem formulations containing azadirachtin 5 per cent @ 7.5 ml with equal quantity of water.

Assam : If stem bleeding disease is noticed (1) remove the affected bark tissues on the stem and apply 5 percent calixin on the wound and apply warm coal tar (2) root feed the affected palm with 5 percent calixin @ 100 ml solution per root at quarterly intervals (3) apply 5 kg neem cake per palm per year along with the second dose of fertilizers (4) regulate optimum field moisture by providing drainage during rain and irrigating the palms during summer. Prevent accumulation of water in the pits of transplanted seedlings. Clean the drainage channels to avoid chances of water logging.

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

Karnataka : If green manure crop is raised cut them before flowering and apply it to the basins around

the palms. Clean the crowns of the palms and tie or prop up bunches to prevent buckling. Search the crowns of trees for bud rot attack. If bud rot attack is observed remove all the affected tissues and apply bordeaux paste over cut ends and cover with polythene to avoid entry of water. Check for rhinoceros beetle and red palm weevil and adopt appropriate measures. Against red palm weevil, inject one per cent carbaryl. Continue planting of seedlings in new plantations. If the attack of the mite is noticed, spray neem oil - garlic - soap emulsion 2 percent (20 ml neem oil + 20 gm garlic emulsion + 5 gm soap in 1 litre water) or commercial botanical pesticides containing azadirachtin 0.004 per cent @ 4ml per litre of water on bunches, especially on the perianth region of buttons and affected nuts or root feed neem formulations containing azadirachtin 5 per cent @ 7.5 ml with equal quantity of water.

Kerala/Lakshadweep: If leguminous green manure crops are grown plough in situ them. Clean the crown of palms and tie or prop up young bunches to prevent buckling. Soil application of phorate 10G @100g/palm or drenching the root zone with chlorpyriphos 20EC @ 2.5ml per liter of water during May- June and September – October controls the pest. If the attack of the mite is noticed, spray neem oil - garlic - soap emulsion 2 percent (20 ml neem oil + 20 gm garlic emulsion + 5 gm soap in 1 litre water) or commercial botanical pesticides containing azadirachtin 0.004 per cent @ 4ml per litre of water on bunches, especially on the perianth region of buttons and affected nuts or root feed neem formulations containing azadirachtin 5 per cent @ 7.5 ml with equal quantity of water.

Maharashtra/Goa/Gujarat: The green manure crops, weeds, etc. may be ploughed back into the soil. Tie up heavy bunches with a rope to prevent buckling. If attack of rhinoceros beetle is noticed, as a prophylactic measure fill the youngest three leaf axils with a mixture of 250g powdered marotti/ neem cake with equal volume of sand or place naphthalene balls(12g/ palm) and cover them with sand thrice a year.

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

Tamil Nadu/Pondicherry: If green manure crop is raised plough it in situ or apply to the basins around the palms. Clean the crowns of the palms and tie or prop up bunches to prevent buckling. In irrigated gardens apply ¼th of the recommended dose of fertilizers (third dose). If the attack of the mite is noticed, spray neem oil - garlic - soap emulsion 2 percent (20 ml neem oil + 20 gm garlic emulsion + 5 gm soap in 1 litre water) or commercial botanical pesticides containing azadirachtin 0.004 per cent @ 4ml per litre of water on bunches, especially on the perianth region of buttons and affected nuts or root feed neem formulations containing azadirachtin 5 per cent @ 7.5 ml with equal quantity of water.

Tripura : Clean the crowns to protect the palms from any pest/ disease attack. The entire crown should then be sprayed with one per cent bordeaux mixture. If attack of rhinoceros beetle is noticed, as a prophylactic measure fill the youngest three leaf axils with a mixture of 250g powdered marotti/ neem cake with equal volume of sand or place naphthalene balls(12g/palm) and cover them with sand thrice a year. Second dose of fertilizer should be applied during the month. After application of fertilizer if there is no rain, irrigation should be done.

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

Market review – June 2016

Highlights

- The prices of milling copra and coconut oil expressed an erratic trend in major markets in the country during June, 2016.
- The international price of coconut oil & copra expressed a slight upward trend during June 2016 compared to the previous month.

The month of June 2016 witnessed a fluctuating trend in the prices of coconut, copra and coconut oil at all important markets in the country.

Coconut Oil

The price of coconut oil opened at Rs.8300 per quintal at Kochi market and ruled at same price till 5th. On 6th it increased to Rs.8400 and remained same till 13th and again increased to Rs.8500 on 14th. On 15th it increased to Rs.8600 and ruled at same price till 19th. On 20th price declined to Rs.8500 per quintal and thereafter expressed a declining trend and closed at Rs.8200 with a net loss of Rs. 100 per quintal. The prices of coconut oil at Alappuzha market opened at Rs.8200, which increased to Rs.8300 on 2nd and then expressed a positive trend till 20th of June and reached at Rs.8600. On 21st the price declined to Rs.8500 per quintal, thereafter expressed a declining trend till the end of the month and closed at Rs. 8300 with a net gain of Rs.100 per quintal. At Kozhikode market the price opened at Rs.8600 per quintal and ruled at same price till 13th. On 14th it increased to Rs.8700 per quintal. But on 20th June the price decreased to Rs. 8600 and closed at Rs.8600.

The monthly average price of Rs.8392 per quintal at Kochi market, Rs.8384 per quintal at Alappuzha market and Rs.8619 per quintal at Kozhikode market were marginally lower than that of the previous month and 30 to 36 percent lower than that of the corresponding month last year. The monthly average price of Rs.7409 per quintal at Kangayam market in Tamil Nadu was marginally lower than that of the previous month and 34 percent lower than that of the corresponding month last year.

Milling Copra

The price of FAQ copra opened at Rs.5250 per quintal at Kochi market and ruled steady at same price till 5th. On 6th it increased to Rs.5450 and expressed a slight positive trend till the third week of June and reached at Rs. 5550 per quintal on 19th. On 20th price declined to Rs.5450 per quintal, then expressed a declining trend and closed at Rs.5300 with a net gain of Rs.50 per quintal. The price of Raasi Copra at Alappuzha market opened at Rs.5200 per quintal, increased to Rs.5250 on 2nd and reached at Rs.5300 per quintal on 6th. The price showed a slight increasing trend till the third week of June and reached at Rs.5400 on 20th. Thereafter the price depicted a downward trend and closed at Rs.5200 per quintal with no loss or gain.

The price at Kozhikode market opened at Rs.5250 per quintal, on 3rd it increased to Rs.5300 and ruled at same price till 12th. And then increased to Rs5350 on 13th, Rs.5400 on 14th, Rs.5450 on 15th and remained same till 17th. Thereafter price depicted a gradual declining trend and closed at Rs. 5200 with a net loss of Rs. 50 per quintal. The monthly average price of Rs.5408 at Kochi market , Rs.5288 at Alappuzha market , Rs.5312 at Kozhikode market were marginally lower than that of the previous month and about 33 to 38 percent lower than that of the corresponding month last year. The monthly average price of milling copra at Kangayam market in Tamil Nadu was Rs.5150 per quintal which was marginally lower than that of the previous month and 33 percent lower than that of the corresponding month last year. The monthly average price of milling copra at Ambajipetta market in Andhra Pradesh was Rs. 4500 per quintal which was 6 percent lower than that of the previous month and about 42 percent lower than that of corresponding month last year.

Edible Copra

The monthly average price of Rajapur copra at Kozhikode market was Rs.7079 per quintal, which was 11 percent lower than that of the previous month and about 46 percent lower than that of the corresponding month last year.

Ball Copra

The monthly average price of ball copra at Kozhikode market was Rs.6023 per quintal, which was 12 percent lower than that of the previous month and about 48 percent

Price behaviour of coconut oil during June 2016

Price behaviour of copra during June 2016

lower than that of corresponding month last year.

The monthly average price of ball copra at Tiptur APMC market in Karnataka was Rs.7526 per quintal. This was about 5 percent lower than that of the previous month and about 43 percent lower than that of the corresponding month last year. The monthly average price of ball copra at Arsikere APMC market in Karnataka was Rs.7539 per quintal, which was about 4 percent lower than that of the previous month and about 36 percent lower than that of the corresponding month last year. The monthly average price of ball copra at Bangalore APMC market was Rs.10688 per quintal. This was 10 percent lower than that of the previous month and 29 percent lower than that of the corresponding month last year.

Dry Coconut

The monthly average price of Rs.5699 per thousand nuts of dry coconuts at Kozhikode market was 7 percent lower than that of the previous month and about 46 percent lower than that of the corresponding month last year.

Coconut

The monthly average price of partially dehusked coconut at Nedumangad market was Rs.7192 per thousand nuts, which was 10 percent lower than that of the previous month and about 35 percent lower than that of the corresponding month last year.The monthly average price of partially dehusked coconut at Arisekere APMC market in Karnataka was Rs.8939 per thousand nuts, which were 3 percent higher than that of the previous month and 31 percent lower than that of the corresponding month last year. The monthly average price of partially dehusked coconut at Bangalore APMC market in Karnataka was Rs.10250 per thousand nuts, which was 14 percent lower than that of the previous month and about 40 percent lower than that of the corresponding month last year. The monthly average price of Grade-1 quality partially dehusked coconut at Mangalore APMC market was Rs.14280 per thousand nuts, which was 5 percent lower than that of the previous month and about 18 percent lower than that of the corresponding month last year.

Tender coconut

The monthly average price of Tender coconut at Maddur APMC market in Karnataka was Rs.10300 per thousand nuts, which was 3 percent lower than that of the previous month and same as that of the corresponding month last year.

International

The International monthly average price of coconut oil at Philippines (C.I.F. Rotterdam) market was US$ 1455 per MT. This was marginally higher than that of previous month and about 28 percent higher than that of corresponding month last year. The monthly average price of US$ 970 per MT of copra was marginally higher than that of the previous month and 15 percent lower than that of the corresponding month last year.

The domestic price of coconut oil during the month of June 2016 in Philippines was US$ 1449 per MT and in Indonesia the price was US$ 1452 per MT. The international price of Palm oil was US$ 697 per MT, Palm kernel oil (RBD) US$ 1237 MT and Soybean oil US$ 781 per MT during the month of June 2016.

Desiccated coconut

The domestic price of desiccated coconut in Philippines was US$ 2464 per MT during the first week, US$ 2475 per MT during the second week ,US$ 2524 per MT during the third week and US$ 2542 per MT during last week. The price of desiccated coconut in Indonesia opened at US$ 2050 per MT and ruled at same price till the third week and increased to US$ 2100 in the fourth week of June 2016. In Sri Lanka the market price was US$ 2141 during the first week, US$ 2172 during the second week and US$ 2140 per MT during the third week and US$ 2137 per MT during the last week.

The average FOB price of desiccated coconut in India during the month of June was lower than that of the international prices and FOB prices of major DC exporting countries. During the first week it was equivalent to US$ 1574 per MT, US$ 1562 per MT in the second week, US$ 1514 per MT in the 3rd week and US$ 1574 per MT in the fourth week. The average FOB during the last week was equivalent to US$ 1556 per MT. ■

Prices of coconut oil , copra and coconut at various marketing centres during June 2016

Date	Coconut Oil (₹/Qtl)				Milling Copra (₹/Qtl)					Edible Copra (₹/Qtl)	Ball Copra (₹/Qtl)				Dry Coconut	Coco-nut	Partially dehusked Coconut (₹/1000 nuts)		
	Kochi	Alappu-zha	Kozhi-kode	Kan-gayam	"Kochi (FAQ)"	Alappu-zha (Rasi Copra)	Kozhi-kode	Kan-gayam	Amba-jipeta	Kozhi-kode	Kozhi-kode	Tiptur	Ban-glore	Ar-sikere	Kozhi-kode	Nedu-man-gad	Ar-sikere	Banglore	Mangalore (Grade-1)
05.06.2016	8300	8275	8600	7450	5250	5238	5275	5238	4500	7400	6300	7565	NA	7650	5725	8000	10000	10250	15000
12.06.2016	8400	8400	8600	7472	5450	5300	5300	5192	4500	7408	6317	7525	11750	7650	5700	7167	9375	10250	15000
19.06.2016	8550	8500	8683	7556	5525	5350	5417	5233	4500	7233	6183	7606	NA	7575	5683	7000	8733	10250	15000
26.06.2016	8350	8400	8600	7328	5375	5292	5292	5092	4500	6775	5717	7476	9750	7450	5633	7000	8250	10250	13333
30.06.2016	8275	8300	8600	7175	5338	5238	5238	4963	4500	6488	5525	7417	9500	7425	5600	7000	8725	10250	13000
Average	8392	8384	8619	7409	5408	5288	5312	5150	4500	7079	6023	7526	10688	7539	5669	7192	8939	10250	14280

Source: Kochi: Cochin Oil Merchants Association and Chamber of Commerce, Kochi - 2, Kozhikode: The Mathrubhumi daily

Alapuzha: The Malayala Manorama daily, Arsikere : APMC, Arsikere. Price quoted for office pass copra at Kozhikode and Rasi copra at Alappuzha markets.