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Coconut as an Oil seed- Production and Trade in India

Jnanadevan. R
Dy.Director Coconut Development Board, Kochi-11

Coconut is not only a food crop but also a minor oil seed crop of horticulture origin in India. Coconut was declared as 'oil seed of tree origin' by Government of India in 1990 to give emphasis on the importance of coconut as an oil seed for price support operations. Global production of coconut oil in 2015-16 was 3.31 million tonnes which account for 1.77% of total vegetable oil production in the world. India is the largest producer of coconut which sustains the economic well being of nearly 12 million families. It is cultivated in 16 states and 4 Union Territories in 2.10 million ha. Out of the total production of 22.24 billion nuts in 2016-17 in India, four southern states, Kerala, Tamil Nadu, Karnataka and Andhra Pradesh contribute 89% of area and 91% of production. 98% coconut holdings are owned by small and marginal farmers in the country (less than 2 ha).It contributes

> "India is the third largest producer of copra and coconut oil in the world. India's export of copra and coconut oil is low compared to other major coconut growing countries."

more than Rs.2,50,000 million to GDP annually. The present production of coconut in the country is mostly utilized for meeting domestic demand and only a marginal surplus is available for foreign trade.

India is the third largest producer of copra and coconut oil in the world. India's export of copra and coconut oil is very low compared to other major coconut growing countries. However, export of coconut oil from India has increased manyfolds recently and it is the second largest commodity exported from India next to activated carbon.

Production and trade of copra in India

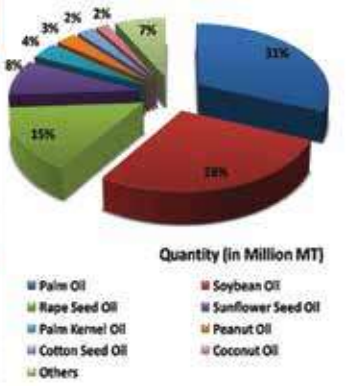
Copra, the dried kernel has highest oil content (65-68%) as compared with other oil seeds. Two types of copra are produced in India, milling or cut copra and edible or ball copra. Out of total production of coconut in India 39 percent is used for making copra ie,30 percent is used for making milling copra and only about 9 percent is used for ball copra. In Indian concept, milling copra equates to general concept of copra in other countries which goes for coconut oil extraction. The quantity of coconut converted to milling copra varies from state to state depending upon the area and production of coconut and culinary culture of the region. Except in the south, hardly any conversions from coconut to copra takes place in other coconut growing states of India.

Total copra production in India during 2016-17 was estimated at 1.246 million tonne out of which milling copra production was 0.973 million tonne .Trend of copra production in India is shown in Table 1.

Global Vegetable Oil Production (2015-16)

Sl. No.	Product	Quantity (in Million MT)	% share
1	Palm Oil	58.84	31.44
2	Soybean Oil	51.80	27.68
3	Rape Seed Oil	27.75	14.83
4	Sunflower Seed Oil	15.50	8.28
5	Palm Kernel Oil	7.14	3.82
6	Peanut Oil	5.37	2.87
7	Cotton Seed Oil	4.33	2.31
8	Coconut Oil	3.31	1.77
9	Others	13.10	7.00
	Total	187.14	100.00

Source: APCC Coconut Statistical Yearbook 2015



In India milling copra is produced only in six traditional coconut producing states in south India. Maximum copra is produced in Kerala (0.480 million tons) followed by Tamil nadu (0.406 million tonnes). Together they produce over 90 % of total copra produced in India. About 86 % of total world copra is produced by three countries. The Philippines produces about 36 %, followed by Indonesia about 28 % and India about 22 % (2015-APCC).

In India, the market price of copra is mostly dependent on price of coconut oil and often experiences very high fluctuation. During the last five years during 2012 to 2017, annual fluctuation in average market price ranged between (-) 28.31 % to (+) 70.19 % (Table-2).

To minimize the fluctuation in copra price, government of India has introduced a price support system. Based on the suggestions of Coconut Development Board, Commission for Agricultural Costs and Prices (CACP) recommends to government the minimum support price (MSP) for copra. On receiving approval, Ministry of Agriculture announces MSP for copra at the beginning of the year usually by January end. If and when market price of copra falls below MSP, National Agriculture Cooperative Federation (Nafed) intervenes in the market and start procuring copra at MSP through state cooperatives. During the last five years export of copra ranged

Table - 1 Etimated Production of Copra (Milling and Edible) in '000 MT

STATE/UT	2014-15		2015-16		2016-17*	
	Milling	Edible	Milling	Edible	Milling	Edible
1. Kerala	317	35	478	53	480	53
2. Karnataka	57	141	59	153	59	153
3. Tamil nadu	440	43	406	40	406	40
4. Andhra Pradesh	11	14	17	24	17	24
5. A&N Island and Lakshadweep	11	3	11	3	11	3
All India	836	236	971	273	973	273
Estimated production of Coconut Oil @62.5%(in Lakh Tonnes)	5.225		6.069		6.081	
Estimated production of Oil Cake @35%(in Lakh Tonnes)	2.926		3.399		3.406	

* First advance estimate, Department of Agriculture & Cooperation(Horticulture Division), Ministry of Agriculture & Farmers Welfare, Govt. of India

Table- 2: Trend of milling copra price in India				
Year	AMP (Rs / Qtl)	Fluctuation in AMP	MSP (Rs / Qtl)	Variation in AMP & MSP
2012	4332		5100	-15.05%
2013	5365	23.84	5250	2.19%
2014	9131	70.19	5250	73.92%
2015	8408	-7.91	5550	51.49%
2016	6027	-28.31	5950	1.29%
2017	9960	65.25	6500	53.23
AMP: Average market price. MSP: Minimum support price				

between 17619 tonnes to 54130 tonnes per annum which was only 1.43 % to 5.67 % of total copra produced in India. Growing demand and short supply of copra has pushed at an all time high prices during 2017. The price started increasing from January 2017 and now recorded an all time very high price. The average price of copra during the month of November is 12,650 per quintal. De-husked raw coconut is now being sold in the market at Rs.55/- per kg. The increasing demand in coconut sector for export and for production of value added products coupled with decline in production has caused the present all time high price for coconut.

Coconut oil production and trade in India

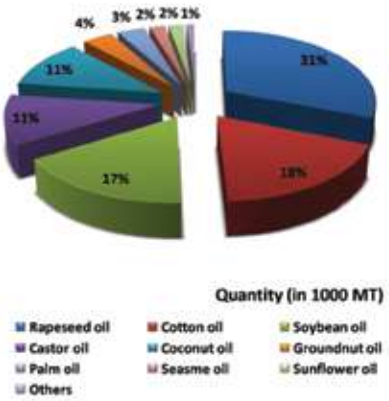
All over the world before the era of electricity, coconut oil was used for lighting and illumination and was exported from India as 'Cochin oil'. Still today, the word cochin like 'cochin copra' and 'cochin oil' synonymies with very high quality products in coconut sector. Indian coconut oil always had a distinct quality advantage and still continues to have a reputation of high quality with the pleasant flavour. There are two processing routes for extraction of coconut oil. One is drying process through the copra route and other is wet processing through coconut milk route called virgin coconut oil. Out of the total coconut oil produced in the country, about 40% is consumed as edible oil, about 40% toiletry and soap sector, 14% is used in various industrial applications and remaining 6% is exported.

The price of all coconut products including raw coconuts is determined by the ruling price of coconut oil supply and demand and its derivatives determine the growth and sustainability of coconut industry in India. The situation is similar in almost all the coconut growing countries of the world. Coconut oil economy dominates the coconut situation of the country. In

Vegetable Oil Production in India (2015-16)

Sl. No.	Product	Quantity (in 1000 MT)	% Share
1	Rapeseed oil	1724.50	31.10
2	Cotton oil	1013.50	18.28
3	Soybean oil	928.80	16.75
4	Castor oil	619.10	11.16
5	Coconut oil	606.90	10.94
6	Groundnut oil	207.00	3.73
7	Palm oil	187.10	3.37
8	Seasme oil	104.00	1.88
9	Sunflower oil	103.00	1.86
10	Others	51.80	0.93
	Total	5545.70	100.00

Source: Oil World Annual 2015



India primary processing of coconut into copra and milling of oil are dominated by small units which do not enjoy the economies of scale and therefore, are not globally competitive.

Estimated production of coconut oil in the country was 600 thousand tonnes (2016-17). The total global production of coconut oil was 3.42 million tonnes in 2015. Philippines was the largest producer of coconut oil with a share of about 45.77%, followed by Indonesia (about 28.94%) and India (about 13%) in 2015. These three countries contribute about 87.73 % of the global coconut oil production. India's share in global production almost remained constant at about 13% in 2015.

Indian coconut oil has an unbeatable quality advantage in the export market.

Irrespective of the price of Indian coconut oil, the ethnic population of Indians abroad prefers coconut oil of Indian origin. India mostly consumes what it produces. About 5.6% of total coconut oil production

is exported from India during 2016-17. Till June 2013 export of coconut oil was permitted only in consumer pack of 5 Kg. After withdrawal of this restriction, export of coconut oil picked up. since 2014-15 (Table–3).

Various edible oils are substitutable and link the price of coconut oil to price of other vegetable oils especially to that of palm oil. Palm oil is the closest and the cheapest substitute of coconut oil as far as industrial and culinary purposes are concerned. It is also the largest imported edible oil. Coconut oil commands a premium of around 16% over palm oil given its superior dietary value, aroma and customary taste preference for coconut oil in the country. However, palm oil has a price advantage over coconut oil, especially for price sensitive consumers, which exerts a downward pressure on the prices of coconut oil.

Table-3: Trend of coconut oil production and export from India

Years	CNO export '000 tons	Total CNO Production '000 tons	% export of total production
2011-12	6.52	588	1.11
2012-13	6.83	608	1.12
2013-14	7.07	563	1.26
2014-15	6.94	523	1.33
2015-16	8.55	546	1.57
2016-17	33.54	600	292

The domestic demand for coconut oil in India is influenced by coconut oil used as edible oil. During last two decades demand for edible coconut oil registered a slow decline owing to the adverse propaganda on the consumption of coconut oil branding it as 'not health friendly'. To disprove the hostile branding, India has initiated research on health and nutritional aspects of coconut oil as well as virgin coconut oil. So far, Coconut Development Board has sponsored 11 research projects to reputed research institutes and is also conducting awareness programmes on health benefits of coconut oil across the country. As a result of sustained campaign by Coconut Development Board, use of coconut oil as edible oil in India has improved.

Virgin Coconut Oil (VCO) is the wonder oil having high value use as nutraceutical and in cosmetic sector. There are many reports of its anti microbiological properties and VCO is being used as health support against quite a few important diseases like Alzheimer's, insulin disorders, autism etc. In India there are about 40 units of VCO at micro industry level and many of them are operating at low level of their installed capacity. Size of scale is the major problem which restricts them to continuously produce, attractively pack and aggressively market their products in spite of having an assured domestic demand. Total estimated production of VCO in India during 2016-17 was 18000 tonnes and average whole sale price was Rs 450 per kg. Estimated export during 2016 was 500 tonnes. From India, VCO was exported mainly to countries like USA, Britain, Japan, Australia and UAE.

Conclusion

Coconut was declared as oil seed of tree origin to emphasis the importance of coconut as an oil seed for price support operations only. As an oil crop alone coconut cannot compete with oil palm and other cheaper vegetable oils because of less oil output per unit area and prevailing high price. Coconut oil production per ha. is 1 to 2 tonnes per ha. where as oil output per ha. from oil palm is 4-6 tonnes. However there is very good scope for diversification for other value added products from coconut like virgin coconut oil. Hence value addition and byproduct utilization of coconut need to be promoted on a massive scale. Under the central sector scheme Technology Mission on Coconut Board provides financial assistance to the extent of 25% of the project cost as back ended capital subsidy limited to a maximum ceiling of Rs 50 lakhs for setting up of coconut processing unit. Considering the increasing demand of virgin coconut oil(VCO) in domestic and international market, more emphasis should be given to increase coconut oil production especially VCO. Considering the increasing demand for copra and coconut oil, coconut production should be enhanced to meet the demand and to ensure a remunerative price and on par with international price. Popularizing the health and nutritional benefit of coconut oil and coconut products in the national and international market is another focus area identified by the Board. More clinical studies need to be conducted. India has become the world leader in coconut production and expected to experience substantial improvement in production and trade of copra and coconut oil and other value added products within few years. ■

Decentralised planting material production in coconut

K. Samsudeen and C. Thamban
Central Plantation Crops Research Institute, Kasaragod

Coconut, the Kalpavriksha, is useful to mankind in many ways. It is cultivated all over the tropical world, mostly in the coastal belt. In India, it is cultivated in an area of 2.1 million hectares. While the all India average productivity of coconut is around 10614 nuts/ha, in Kerala it is 9641 nuts/ha. Cultivation of high yielding improved varieties is one of the important means to enhance productivity of coconut to make it a remunerative crop. The most important input for increasing productivity is cultivation of high yielding varieties. Traditional or local varieties in coconut yield up to 9000 kg/ha. of husked nuts and 15 kg copra/palm. Improved varieties have the potential to give yield up to 15000 kg/ha. of husked nuts and 25kg copra/palm. By cultivating improved varieties, the farmer can realise an additional 6000 kg/ha. of husked nuts or an additional 10 kg of copra/palm. Research on development of new varieties has received due attention from the very beginning.

Efforts to enhance genetic potential resulted in the development of many improved varieties. There are 25 selections and 16 hybrids in the country today developed by Central Plantation Crops Research Institute (CPCRI), Kerala Agricultural University (KAU), Tamil Nadu Agricultural University (TNAU), Andhra Pradesh Agricultural University (APAU), Konkan Krishi Vidyalaya (KKV) and Assam Agricultural University (AAU). Though a large number of improved varieties and hybrids have been released

> Cultivation of high yielding improved varieties is one of the important means to enhance productivity of coconut

by different research institutes, the level of adoption of these varieties by coconut farmers is not satisfactory. Lack of availability of quality seedlings continues to be a major problem faced by farmers in adopting the improved varieties. Coconut is a long duration crop with a long juvenile period spanning from 7 to 10 years and a long productive period of above fifty years. Hence, use of quality planting materials is very important in realizing high productivity.

For a sustainable growth of coconut sector, it is recommended to have tall, dwarf and hybrid varieties cultivated in the ratio of 60:20:20. However, the field level scenario indicates a different story; tall cultivars constitute more than 90 per cent of coconut palm population. In Kerala the productivity is low compared to other states like Tamil Nadu and Andhra Pradesh. Predominance of senile and unproductive genetically inferior local tall palm population is a major constraint in improving productivity of coconut in major coconut growing tracts like Kerala. Massive programmes for replacing old and unhealthy palms are necessary to increase productivity and make coconut cultivation profitable. Replacing old palms will require enormous quantity of seedlings.

Demand for coconut seedlings and present status of supply

In Kerala on an average 28-30 lakh coconut seedlings are required annually. But as per the official statistics of coconut seedling supply for the year 2014, State Department of Agriculture, the major agency involved in coconut seedling distribution in the state, could supply only about 6.5 lakh seedlings which include about 6 lakh WCT, 9000 dwarf and about 40000 hybrid seedlings, revealing a huge gap between demand and supply. Unscrupulous elements have been hugely benefitted by the situation which supplies inferior/spurious planting materials to farmers thus adversely affecting the sustainable growth of coconut sector.

Strategies for enhancing planting material production

Utilisation of superior genetic resources of coconut available in farmers' gardens is the most important short term strategy to meet the demand for coconut seedlings. However, it has to be ensured that utmost care is taken to locate and identify the superior mother palms of locally adapted coconut varieties in farmer's garden. Criteria fixed for identification of mother palms have to be scrupulously followed. Pressure to achieve the physical target should in no way dilute the scientific procedures to be followed in selecting mother palms. Public sector agencies including CDB and State Agri/Horticulture Departments are having programmes for procuring seednuts from farmers' gardens.

Decentralized farmer participatory seedling production

Farmer participatory seedling production initiatives are to be promoted to meet the planting material requirement utilizing the locally available resources/ mother palms. Decentralized approach for enhancing production of seedlings of improved varieties should be promoted by establishing more nucleus seed gardens. Such seed gardens may be encouraged in marginal and small farmer holdings. Identification of superior mother palms with farmer participation and its validation by seedling progeny testing as well as molecular markers assumes much significance. Such initiatives will empower local farming community for mother plam selection, controlled pollination for seednut production, community mangement of nursery and seedling selection. This can set in a movement that will result in the establishment of highly productive palms leading higher productivity in coconut. Coconut Producers' Societies (CPS), the grass root level collective of coconut growers facilitated by Coconut Development Board, and trained youths under the Friends of Coconut Trees (FoCT) programme can play a significant role in the decentralised production and distribution of quality coconut seedlings including hybrids. Empowering farmers and coconut climbers with the technique of hybrid production will help in localised production of coconut hybrids. The process can be technically supported by research organisations such as CPCRI.

Quality control in coconut planting material production

Ensuring a viable quality control mechanism in coconut planting material production is critical in promoting sustainable growth of coconut sector. Unfortunately such a mechanism is yet to be evolved in our country. Since there is a huge gap between the demand and supply of quality coconut seedlings coconut growers many a times are exploited by agencies which sell inferior quality seedlings. Nursery accreditation should be made mandatory to ensure quality control in coconut planting material production and distribution. A committee needs to be constituted for each state involving members from CPCRI, SAUs, CDB and State Departments to prepare norms for accreditation.

Mother palms in the seed gardens should be certified by the agency involved in developing the variety. Seed nuts should be collected only from the certified mother palms. All certified mother palms should be registered with CDB. Mother palm certification and registration should be made mandatory for nursery accreditation. There is a need to develop seedling standards, by the research agency which develop the varieties, for selecting 6, 9, 12 month old seedlings for distribution to farmers. Committee for nursery accreditation will have the responsibility for seedling certification and they also should ensure that only labelled seedlings are distributed from accredited nurseries. Training programmes for department personnel's/ Farmer Organizations/ Private Nurseries/ NGOs should be organized by research institutes/KVKs and certificate of attending such training will be made mandatory for applying for nursery accreditation.

Directorate of Plant Quarantine need to be requested to develop guidelines and monitor movement of coconut seedlings and enforce quarantine related rules. Only 12 month old coconut seedlings should be distributed to farmers for planting. Agencies distributing 6, 9 month old seedlings may do so after the seedling standards for such seedlings are developed.

Strengthening functional linkage

Strong functional linkages among CPCRI, Universities, CDB, State Department of Agriculture/ Horticulture, Farmers Organizations, NGOs and private sector agencies are essential for effectively streamlining and regulating the planting material production in coconut in the country.

The technique of coconut hybrid production

Breeding behaviour

Knowledge in breeding behaviour of coconut is a prerequisite for making hybrids. A coconut palm produces 12-15 inflorescences (bunches) in a year, which is approximately one bunch in a month. The inflorescence contains male and female flowers arranged on branches called spikes. In each spike, one or two (rarely more than two) female flowers, are found at the base. Male flowers, many in numbers, are found above the female flowers. The coconut palm is protandrous (male flowers mature before female flowers) and male flowers open immediately after splitting of the spadix. In tall palms, the duration of male phase is about 18-22 days. The female flowers are comparatively few in number in an inflorescence, about 20-40 in tall palms. Dwarf palms generally carry more number of female flowers in a spadix compared to tall palms. Female flowers become receptive when it opens with three protruding stigmas and nectar is secreted. Female phase is much shorter than the male phase and lasts for about 5-7 days in tall palms and twice as long in some dwarfs. In the tall coconuts, there is a distinct gap between the male and the female phases aiding cross-pollination. In dwarf coconuts, the interval between the two phases is either nil or negligible thereby increasing the chances for self-pollination. It takes about 11 to 12 months for the flower to develop to maturity after fertilization.

Making hybrids

Male and female parents are selected based on the hybrids to be produced. For DxT, dwarf is the female parent and tall is the male parent and it is vice versa for TxD. Production of hybrids starts with artificial pollination followed by harvest of mature nuts, sowing of nuts, nursery management and selection of hybrid seedlings. Pollination is the process of transfer of pollen from male flowers to the stigma of the female flowers to effect fertilization. In nature, it is aided by wind and insects. Artificial pollination is the application of pollen collected from male flowers to the stigma of the receptive female flowers by artificial means. It involves emasculation, bagging, pollination, bag removal, pollen collection and harvest of mature nuts.

Emasculation

The process of artificial pollination starts with emasculation, the removal of male flowers from the inflorescence of the female parent to prevent self-pollination. To avoid any chance of contamination, it is done on the day of inflorescence opening. Extreme care should be taken while removing male flowers from the spike. It should be done

without any injury to the spike or inflorescence. Individual male flowers can be removed by hand or the spike can be cut 5 cm above female flower and rest of the flowers can be removed by hand. Care should be taken to remove male flowers on the sides of the female flowers.

Bagging

Covering the inflorescence with a bag is called bagging. It is done to avoid unwanted pollination or contamination with other pollens. Bagging of emasculated bunches is required for the entire period of female phase and pollination. Inflorescence is covered five days before the first female flower become receptive. Another indication for timing of the bagging is the appearance of white dots on the female flowers. Bagging should be done before the appearance of white dots on any of the female flowers on the bunch. Flowers with white dots at the time of bagging should be removed.

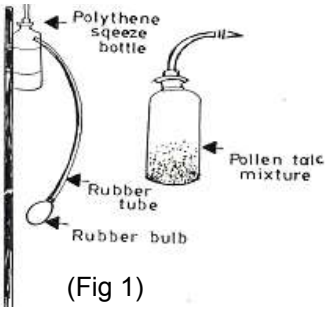
Pollen collection

Spikes with male flowers from the inflorescence of male parent are collected within 6 to 8 days after opening. Male flowers are then separated from spikes, kept between two layers of news paper, slightly pressed using a roller and dried in an oven at 35-40^{o}C for 10 to 12 hours or at room temperature for 48 hours. Dried male flowers are sieved in three tier sieve to collect pollen. Collected pollen should be used within 48 hours to avoid loss of pollen viability. Storage of pollen for using beyond 48 hours requires special care to control moisture content and temperature. For this, pollen collected in small vials or packed in butter papers are stored in desiccators (air-tight containers) containing calcium chloride or silica gel to absorb air moisture inside the desiccators. To extend the storage period, the desiccators can be kept under refrigeration. Pollen from different male parents can be collected, processed and stored under refrigerated condition in research stations where male parents are available. This stored pollen can be made available to centres where female parents are available for pollination. In this manner, various hybrids can be produced in various locations in a participatory mode.

Pollination

At the time of application, pollen is mixed with chalk powder in 1:9 ratio and carried in a plastic squeeze bottle. For effecting pollination, pollen is released to cover the female flowers in an inflorescence within the bag. The process is repeated on the alternate days starting from the day when the first female flower comes to receptivity and continuing till the last flower becomes receptive. The bags are removed 2-3 days after completing pollination. Each inflorescence is labelled to complete the artificial pollination. Pollinated female flowers develop in to fruits and fruit matures in 11 to 12 months time.

A simple device has been developed to pollinate the dwarf palms from the ground. It consists of a polythene squeeze bottle, a rubber tube and bamboo pole (or aluminum rod). The squeeze bottle is tied at the end of a bamboo pole of 2 to 3m length. A rubber tube with a rubber bulb at one end is connected to the bottle just below the neck. When the rubber tube is pressed, it injects air into the squeeze bottle and in turn, the pollen-talc mixture kept inside the bottle is released. When the receptive female flowers are to be pollinated, the nozzle of the bottle is placed near the inflorescence through the window on the pollination bag and the rubber tube is pressed (Fig 1). The pollen-talc mixture released will cover the inflorescence effecting the pollination. The device can be used when palm is of suitable height and it helps to reduce number of climbing required for effecting pollination.



(Fig 1)

Bag removal

When all the female flowers in a bunch are pollinated, the bag covering inflorescence can be removed. But it is safe to keep bag for two more days after completing pollination to avoid contamination. Button shedding will be more if the bag is kept for more days. Hence, it should be removed as early as possible starting from the second day after completing pollination.






Harvest and Storage of nuts

Mature nuts are harvested at 11 months in dwarfs and 11–12 months in talls. Care should be taken not to injure the nuts while harvesting. Lowering of bunches by means of ropes may be done when the palms are tall and ground is hard. Unhealthy nuts are discarded. In the case of tall x dwarf (TxD) hybrids, seeds have to be stored in shade for a minimum period of 60 days prior to sowing in nursery. Seed nuts from dwarf x tall (DxT) hybrids can be sown within 30 days after harvest. Care should be taken to store seeds in shade to avoid drying of nut water. Seeds should be sown before complete drying of nut water.

Sowing of nuts

The seed nuts are planted at a spacing of 30 cm (between rows) x 30 cm (between nuts) with four or five rows per bed. The nuts can be planted either horizontally with the widest of the segments at the top or vertically with stalk-end up. While sowing vertically, the nuts are set firmly in either upright or slightly tilted position with the germ end at the top, covered with soil, with about 2/3 of their size buried.

Seedling selection

Seed nuts, which do not germinate and those with dead sprouts, are removed within six months after sowing. Only good quality seedlings are to be selected by a rigorous selection-based early germination, rapid growth and seedling vigour. One year old seedling should possess six to eight leaves, 10-12 cm girth at collar and should exhibit splitting of leaves. Change in collar colour is an indication that crossing was successful and can be used to select seedlings of DxT hybrids by selecting seedlings with green to light green coloured collar.

Genetic purity assessment with molecular markers

It is essential to verify the hybrid nature of seedlings at an early stage to ensure enhanced field performance and yield. Morphological markers used are not efficient in the selection of true hybrids and resulted in rejecting hybrids when strict compliance with criteria is applied. Informative molecular markers capable of distinguishing the parental lines have been developed. Based on the complementary banding patterns between the hybrids and their parents, a panel of microsatellite and RAPD markers has been developed to monitor the seed purity of DxT and TxD hybrid coconut combinations. Use of these markers will thus ensure hybrid seedling quality and supply of genuine hybrid seedlings to farmers. Hybrid seedlings developed in farmer's gardens can be tested by the research institutes using molecular markers for their purity.

High demand for hybrid coconut seedlings can be met only through decentralised production of seedlings. Any skilled climber can produce hybrids by selecting COD palms near to his place by collecting pollen from good high yielding WCT palms and using it to pollinate the selected COD palms. Alternately, pollen can be sourced from pollen storage centres. Following the scientific procedures for pollination, selection of seed nuts and seedlings will ensure production of quality hybrid seedlings. Mechanism for monitoring and supervision to maintain the quality of hybrids should be put into place. Capacity building of coconut producer's societies (CPS) and members of friends of coconut programme on the scientific methods of hybrid seedling production techniques thus assumes much significance. ■

Coconut + Cocoa intercropping

for doubling farmer's income

P.Madhavi Latha, H.P.Maheswarappa, M.Kalpana and J.Dilip Babu

ICAR- All India Coordinated Research Project on Palms, Horticultural Research Station, Vijayarai-534 475
Dr. Y. S. R. Horticultural University, Venkataramannagudem, Andhra Pradesh.

Coconut is one of the traditional plantation crops of coastal Andhra Pradesh. The coast line of Andhra Pradesh is located on the south east coast of Indian peninsula with 974 km coastal corridor spread along 9 districts viz., Srikakulam, Vizianagaram, Visakhapatanam, East Godavari, West Godavari, Krishna, Guntur, Prakasam and Nellore. This coast line is having humid tropical climate with 800 to 1200 mm annual rainfall, minimum temperature ranging from 15-20^{0}C, maximum temperature ranging from 30 to 35^{0}C and 60 to 75% relative humidity. This climate is suitable for plantation crops like coconut, oil palm and cocoa with assured irrigation facilities. Within the state some area of coconut is under rain fed particularly north coastal 3 districts. East and West Godavari are the two major districts covering almost 60% of coconut area of the state. As Coconut is "Kalpavriksha" due to its multipurpose uses, farmers cultivate coconut as traditional crop. At present copra, tender nut and fiber are the main source of income to coconut farmers in Andhra Pradesh. Due to low productivity, price fluctuations, aged plantations, lack of harvesting machinery and lack of awareness about post harvest value added products technology has caused unstable income per unit area for coconut farmers. The net income per unit area in coconut plantation need to be increased. This can be achieved by increasing land use efficiency with inter cropping. Among the different crops, cocoa is one of the best suited inter crop for coconut to exploit natural resources like sun light, land and water.

- Climatic requirement of cocoa (inter crop) and coconut (base crop) is almost similar.
- There is no competition for solar radiation as cocoa is a shade loving crop that can be grown in 40-80 % shade.
- There is no competition for water and nutrients as these two crops are having different type of root systems spread in varying depths of soil.
- Cocoa is a perennial crop
- Pest and disease problems in both the crops won't affect each other.
- Field operations like pruning and harvesting dose not interfere with each other.

Advantages of cocoa as an inter crop in coconut

- Cocoa adds lot of leaf biomass to soil which improves soil organic matter.
- Leaf litter acts as mulch for soil moisture conservation and also for weed control.
- Good yield potential.
- Long term storability of cocoa beans.
- Assured marketing facilities.
- Export potential of cocoa beans.
- Create round the year employment, particularly for women.
- Highly remunerative crop.
- Feasibility for processing and value addition in small scale.
- Popularly Kerala Agricultural University cocoa varieties (Seed pods from clonal gardens) are being raised by Andhra Pradesh farmers. Seedlings were raised by mondazole pvt. Ltd. Formerly cadbaury's India Ltd and supply to farmers on subsidy basis.

Success story of farmers from East and West Godavari Districts

Kanamathareddi Venkata Sunitha,
Village: Vijayarai, Mandal: Pedavegi, District: West Godavari.

Kanamathareddi Venkata Sunitha having 35 year old coconut orchard in which she planted cocoa in the year 2008. Cocoa was planted at 2.5x2.7m spacing. She used panchagavya as an organic source in manurial management. Yielding of cocoa plantation started from the fourth year onwards. During fourth year she got one quintal yield and during fifth year she got two quintal yield. For the last two years she is getting eight quintal per ha. She is getting net income of Rs. 55000/@ha. from coconut and Rs.87500/@ha. from cocoa. Overall from coconut+cocoa intercropping she is getting Rs.1,42,500/@ha.. She is giving employment for women labour for 200 man days in a year. Because of cocoa plantation, the weed problem in her garden was completely solved and she is getting satisfactory income from cocoa inter crop.

Nagabirava Dasarada Ramayya

Village:Vijayarai, Mandal: Pedavegi, District: West Godavari.

Nagabirava Dasarada Ramayya is having 37 year old coconut orchard. He planted cocoa as an inter crop in the year 2004 and now the cocoa is 13 years old. He is doing pruning twice in a year during June-July (first pruning) and October (second pruning). Fertilizers are applied in four splits in a year with 500:500:500 g of Urea, SSP and MOP along with 1kg vermicompost per plant per year. He is getting 110 nuts from coconut and nine quintal cocoa beans @ha. per year. He is getting net income of Rs.53000@ha. from coconut and Rs.1,17,500/@ha. from cocoa. Overall from coconut+cocoa intercropping he is getting Rs.1,70,500/- ha-1. He has adopted low cost vermicomposting in the inter rows of cocoa plants. He was having regular zinc deficiency problem in cocoa orchard, for which two micronutrient foliar sprays in a year and soil application of zinc @50g per plant per year are being followed. For the last five years hairy caterpillar and mealy bug were the main pests observed in his field, for which one protected spray with chloripyriphos prior to flowering and second spray with acephate after peak flowering and fruit setting stage was done. Last year he observed a new pest viz cocoa pod borer, where the pest bore a single hole near the fruit stalk portion and enter into the fruit. Because of this insect incidence cocoa beans became very hard and there was no mucilage for fermenting the beans.

Jasthi Rajan Babu

Village: Jaganadhapuram, Mandal: Pedavegi, District: West Godavari, Andhra Pradesh.

Jasthi Rajan Babu is having 31 year old age coconut garden. He planted cocoa as inter crop in his coconut garden in the year 1991. Coconut was planted at 8mx8m spacing with the plant population of 156 palms per ha. Now cocoa is 26 years old. He is getting 90-100 nuts per palm from coconut on an average. He is getting Rs. 55,000 @ha. net income from coconut. In cocoa he is getting nine quintal @ha. average yield with net profit of Rs. 1, 20, 000/@ha. Coconut + cocoa gives overall net income of Rs. 1, 75, 000/- @ha. The fertilizers were applied to cocoa and coconut in two split doses in the months of July- August and November-December. Pruning was done mainly after main harvest particularly after two rains in the months of June-July. Irrigation was given through micro irrigation. Plant protection measures were not undertaken in his field but during the last four years, because of sucking pest problems, he started 3-4 sprays of insecticides per year.

Raju

Village: Velagadurru, Mandal: Undrajavaram, District: West Godavari

Raju is having 42 year old coconut plantation from which he is getting 55,000 nuts from 600 palms with a net income of Rs. 42,000 from a hectare. He planted cocoa in the year 1986 in his 10 year old coconut plantation and now the cocoa plantation is 32 years old. He is getting 15 quintal cocoa bean @ha. with a net income of Rs. 2,20,000@ha. Overall from coconut + cocoa intercropping he is getting net income of Rs. 2,62,000@ha. He is using bio-fertilizes along with organic manures. He removes off season flowering to get high quality and good yield in the main season during February to April.

Remalla Madhusudana Rao

Village: Veeravaram, Mandal: Kadiyam, District: East Godavari

Remalla Madhusudana Rao is growing coconut for the last 38 year. He planted cocoa in 1995 in his 15 year old coconut plantation. He planted 200 cocoa seedlings per acre. He was doing pruning once in a year during June-July. Fertilizers were applied in two splits in a year with 250:250:250 g of Urea, SSP and MOP along with 10kg FYM per plant per year. He is getting yield of 120 nuts from coconut and 15 quintal @ha. cocoa beans per year. He is getting net income of Rs.34000/@ha. from coconut and Rs.2,25,000/@ha. from cocoa and overall from coconut + cocoa intercropping he is getting Rs. 2,59,000/@ha. per annum. He has adopted composting of cocoa biomass every year in the inter rows.

Farmer's problems at field level

- Natural calamities like cyclones during flowering and fruit setting stage affect yield of cocoa.
- Shortage of women labour for cocoa harvesting.
- Regular and severe incidence of black hairy caterpillar and mealy bugs.
- Damage of ripen pods by rodents, squirrels and monkeys
- Problems at field level with diseases like black pod rot and cherelle wilt.

Retirement

Shri. G Balakrishna Kurup retired from the services of Coconut Development Board on 31st October 2017 on superannuation. He joined the Board in April 1982

Shri. K S Ajithkumar retired from the services of Coconut Development Board on 31st October 2017 on superannuation. He has rendered more than 23 years of service in the Board.

Bio- Fuel and Charcoal From Coconut Shell - A Renewable Energy Source

Dr. Lakshmi. K. Nair*, **Ms. Parvathy. M. Nair****, **Dr. T. Muraleedharan Nair*****

Coconut shell is a source for renewable energy in various forms. Pyrolysis is an effective technique for converting coconut shell into bio-oil and charcoal. Coconut shell composition includes moisture, hemi-cellulose, cellulose and lignin. The decomposition of these components takes place at various higher levels of temperature. Therefore, a feasible process development becomes inevitable and the characterization of the bio-oil becomes imperative. As a first step, the percentage decomposition of each component with respect to temperature was studied using thermo gravimetric analyzer (TGA). Applying these TGA data, pyrolysis of coconut shell was carried out in a rotating type reactor initially and continuous type reactor subsequently in nitrogen atmosphere. The yield of both bio-oil and charcoal were found increased under these conditions and also by introducing a chilling plant for efficient cooling and effective condensation of the cracked gases. It was found that between 200 and 350^{o}C the oil formation was highest, ie., 52% and with further increase of temperature to 450^{o}C, though 10% more oil is formed, it affected the charcoal yield which decreased to 20 from 38%.Therefore, considering the viability of the project industrially, the optimum temperature for maximum yield of bio-oil and charcoal was set at 350^{o}C. Interestingly, it was found that, a continuous type reactor, instead of rotating type, can increase the rate of production of fuel-oil and charcoal under similar conditions. The physical and chemical characteristics including fuel efficiency of these products were studied and the properties were found comparable with diesel.

Of the world's total energy requirement, among various sources of energy, biomasses also play a pivotal role which is considered as a sustainable source of renewable energy, especially in countries where there are more agricultural activities. The waste-to-energy (WTE) projects represent roughly 14% of U.S non-hydro renewable electricity generation. In India (2013), the contribution to power from renewable energy sources is 12.32%. Bio-oils are produced from agricultural wastes which are renewable and bio-degradable materials. Most importantly, it does not pollute the environment as there is no CO2 emission in application and hence no rise in greenhouse effect.

Coconut is abundant in the South Indian states which constitute around 90% of the total coconuts produced in the country. The Food and Agricultural Organization of the United Nations has reported that coconut palms are grown in more than eighty countries and that the total annual production of the coconut accounts to 61 million tonnes. Coconut shells are biomasses of coconut which are traditionally used for charcoal production and ultimately converted into activated charcoal. The heavy smoke produced at the time of charcoal formation by the destructive distillation of coconut shell is highly polluting. The pyrolysis technology has been used for generating liquid, solid and gaseous fuels from bio-masses and it has been used commercially for decades. Studies on forest and agricultural residues were also reported. Das *et al* has showed that pyrolysis of cashew nut shells in a fixed bed reactor under vacuum has produced bio-fuel. Khor *et al* has characterized bio-oil produced from oil palm empty fruit bunches (EFB) by slow pyrolysis. Works on bio-oil production from cotton stalk [10] and characterization of biomass-based flash pyrolysis oil [11] were reported. Paper on conversion of bio-resource (Oil palm EFB) into energy [12] and management of palm oil mills towards zero waste [13] were presented in journals and conferences.Research works on the recovery of fuels and chemicals from rice straw [14], sugarcane bagasse, rice husks, jute stick etc [15], olive bagasse, cotton stalk, corncob and tea waste [16] have been reported. However, there was no efficient process development known for coconut shell pyrolysis. Hence process development for effective coconut shell pyrolysis was an important objective of this work.

Bio-oil a high density oxygenated liquid unlike petroleum fuels which are hydrocarbons, can be used as a substitute for fossil fuels, in certain applications. It is a mixture of large number of major and minor organic compounds of alcohols, aldehydes, ketones, acids, ethers, esters, sugars, furan, nitrogen compounds and multifunctional compounds [17].Bio-oil can be used as a fuel in diesel engine with slight modifications in fuel pump, linings, and the injection system.

It can be blended with standard diesel fuels to form a pollution free green bio-diesel fuel. The nonpolluting performance is a speciality of these oils.This green oil can also be used in oil burners for thermal applications and in combustion boilers to generate electricity. Bio-oil based small scale power generating plants in remote areas and villages is the need of the hour as such plants are viable due to low investment and that the biomasses needed for bio-oil production is cheaply available.As a first step emphasis has been given to bio-oil sources and its production. Hence study of the characteristics of the coconut shell oil (bio-oil) and charcoal was another objective of this research work.

Materials and methods

Coconut shells were identified as a source for renewable energy. Dry coconut shells procured from Northern Kerala was subjected to biomass pyrolysis in specially designed rotating type reactor. Pyrolysis is a technology extensively used for the thermal cracking of different materials like biomass, waste tires, waste plastics etc into high energy gases known as 'Syn Gases'. Pyrolysis is thermal decomposition which takes place at higher temperatures under inert atmospheres, in the absence of oxygen and with the support of catalysts in some cases like plastics.

It was essential to ensure the maximum yield temperature of bio-oil and good quality charcoal as well.Thermo gravimetric analysis (TGA) was carried out to study these properties and found that the maximum yield of bio-oil and charcoal could be achieved by setting the decomposition temperatures appropriately. The TGA results were convincing that for higher yield of Bio-oil, the cracking process need to be raised to 450^{o}C and for maximum yield of charcoal, the cracking has to be controlled at 325^{o}C.

A pyrolysis reactor (Fig.2) with 16 mm wall thickness and size, 2600 mm X 7600 mm with pyrolysis capacity of 10 tonnes per day (TPD) was used for the coconut shell pyrolysis trial aimed to suit for industrial production. The reactor used was rotating type and motor driven.It has a large front door with airlock safety valves and has provision to flush out Syn gase and flue gase through separate pipe lines. A nitrogen purging device also was used

in the reactor for creating inert atmosphere inside the reactor which enables to prevent oxidation. The reactor heating was carried out with firewood and by consuming the non-condensable gases given out in the process. The dried coconut shell initially weighed is loaded in the reactor which follows the firing of the reactor.

Thermal decomposition of the coconut shell took place at various temperatures in nitrogen atmosphere and the Syn gases were cracked gases was liquefied in the condensers (Fig.3) and collected in the oil collectors (Fig.4). The non-liquefiable gases were sent for reactor firing.

Fig. 1 Coconut Shell

The process development was fine tuned by repeated trials with and without nitrogen purging (Fig.5) and with ordinary and chilled water simultaneously. The efficiency of cracking and the yield of bio-oil and charcoal were found increased when the cracking was done in nitrogen atmosphere and by cooling the condensers with chilled water. It was also noticed that the pressure and temperature control became easy when the diameter of the pipe lines for Syn and waste gases were increased from 3 to 6 inch.

The Bio-Oil characteristics to ensure the fuel efficiency were investigated as per ASTM standards. Calorific value (ASTM D240), Flash Point (ASTM D92), Viscosity (ASTM D445), Density (ASTM D189), Water content (ASTM D95), etc were studied. The oil efficiency can be further increased by refining the oil to the grade of bio-fuel. The charcoal characteristics were also studied as per ASTM standards.

Results and discussion

The thermo gravimetric analysis (TGA) of dry coconut shells revealed that the first decomposition, occurs between 100 and 200^{o}C, which followed the release of moisture (>10%) and a small amount (>1%)

Fig.2 Coconut Shell inside the Rotating Reactor

of waste gases. The second and third decomposition takes place between 200 and 350^{o}C which follows the cracking of hemicelluloses and cellulose [18] into the formation of volatile gases which on condensation is liquefied and in industry it is known as bio-oil (51.6%).

The fourth and final stage of decomposition takes place between 450 and 550^{o}C resulting in the decomposition of lignin which contributes another 10% of condensable gases, which in turn is liquefied as bio-oil.

Fig. 3 Bio-oil Condensers and Oil Collectors

Another important highlight of the TGA results is the residue weight, which is the charcoal (Fig.6) part of the coconut shell at the above decomposition temperatures. Coconut shell when cracked at higher temperatures in the absence of oxygen is converted into charcoal besides volatile gases. The residue weight at each higher temperature give a clear indication of the charcoal yield. It is worthwhile to note

Fig. 4 Bio-oil from Coconut Shell

Fig. 5 Nitrogen Purging Machine

that good quality charcoal was formed at 325°C, the yield was found 51.98%.

But,for higher yield of bio-oil (51.16%), the decomposition temperature needs to be optimized at 350°C. The yield of bio-oil and charcoal at various temperatures above 200°C is clear from Fig 7 and table 1.

The burning efficiency of bio-oil was found comparable with petroleum diesel and importantly no smoky emissions were noticed while burning the oil. Obviously, unlike petroleum diesel, there is no carbon dioxide emission noticed in Bio-oil burning.

Fig 7 and Table 1 show that between 200 and 350°C, at each temperature, specific amount of weight losses were recorded which corresponds to the total amount of volatile matter and moisture. The weight % of volatile matter which corresponds to bio-

Table-I TGA of coconut shell: Residue wt%, (Charcoal), Weight loss Wt% and Volatile matter Wt% excluding Moisture, (Bio-oil)

Temp.,°C	Resi-due,Wt %	Moisture* + Volatile Matter Wt %	Volatile Mat-ter, excluding Moisture, Wt%
28.9	99.99	0.001*	0
100	89.89	10.11	0
105	89.73	10.27	0
200	88.98	11.02	0
210	88.79	11.21	0.19
220	88.39	11.64	0.62
230	87.81	12.19	1.17
240	86.91	13.09	2.07
250	85.26	14.74	3.72
260	82.29	17.71	6.69
270	77.78	22.22	11.2
280	72.27	27.73	16.71
290	66.97	33.03	22.01
300	62.31	37.69	26.67
310	58.12	41.88	30.86
320	54.09	45.91	34.89
330	49.62	50.38	39.36
340	43.97	56.03	45.01
350	37.82	62.18	51.16
450	26.99	73.01	61.99
550	20.77	79.23	68.21
650	16.09	83.91	72.89
696	15.85	85.15	74.13

Fig. 6 Coconut Shell Charcoal

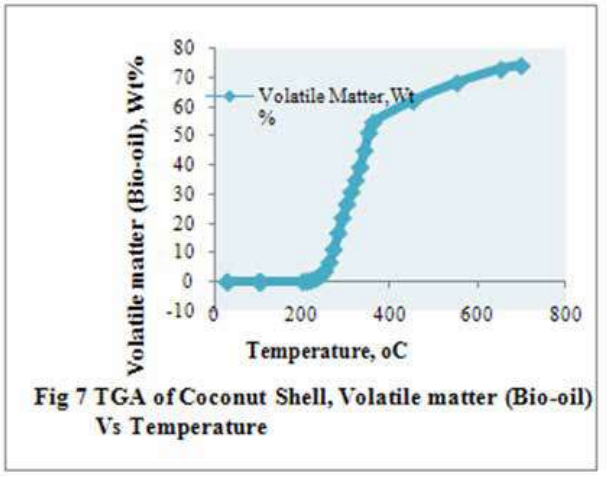


Fig 7 TGA of Coconut Shell, Volatile matter (Bio-oil) Vs Temperature

Table 2 Coconut Shell Oil (Bio-oil) Characteristics			
Parameters	Coconut shell oil (Bio-oil)	Plastic pyrolysis oil	Petroleum diesel
Calorific Value, K.Cals/Kg	6300	10298	10038
Flash Point, oC	>100	58	98
Density, gm/cm3	1.0955	0.9940	0.98
Viscosity at 30oC, cSt	1.99	2.023	3.05
Water content, %	8	0.50	__

oil is obtained by subtracting moisture weight from the weight loss at each temperature. In the same way, the residue weight corresponds to the respective charcoal weight at each temperature. For example, weight loss at 105^{o}C is 10.3% and, weight losses at 200, 250, 270, 290, 300, 325 and 350^{o}Cs are 11.02, 14.74, 22.22, 33.03, 37.69, 48.02 and 62.18% respectively.Similarly, the residue weights (Fig 8) at these temperatures are found as 89.7, 88.98, 85.26, 77.78, 66.97, 62.31, 54.09 and 37.82% respectively.

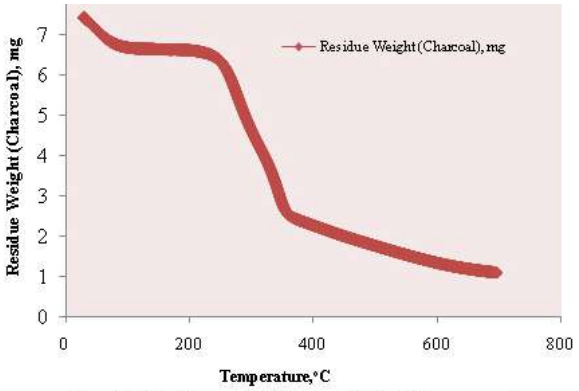


Figure 8 TGA of Coconut Shell: Residue Weight (Charcoal), mg Vs Temperature

Likewise the weight losses and residue weights from 350 and 450 are found as 62.18% and 37.82% and 73.01% and 26.99% respectively.

The results of industrial trial on coconut shell pyrolysis by both rotating and continuous type reactors were matching the results of TGA analysis. The rate of pyrolysis in continuous type reactor was higher than rotating type, as the reactor settings in continuous type reactor is so suited for non-stop operation whereas in rotating type the settings are suitable for separate batches only and it requires longer time for cooling the reactor before the next load is fed in. However, the quality of coconut shell oil (bio-oil) and charcoal were found same in both methods and the characteristics were found good in both cases. The quality parameters of the coconut shell oil are comparable with that of plastic pyrolysis oil and petroleum diesel and are given in Table 2.

The higher yield of bio-oil and charcoal are the interest of industry. Therefore, the yields of both bio-oil and charcoal were studied and the decomposition temperature were optimized for better yields. The coconut shell pyrolysis trials showed that the optimum yield of coconut shell oil and charcoal were 51.16 and 37.82% respectively at 350^{o}C.The bio-oil yield was found increased around 10%, between 350 and 450^{o}C, but above 450^{o}C the oil yield was noted decreased as the oil part above this temperature gets decomposed to permanent gases.Solid charcoal consists of small amounts of volatile hydrocarbons, solid hydrocarbons and inorganic compounds. Above 450^{o}C due to char loss, the charcoal yield also decreases.It will be interesting for the industrialists that the yield of pyrolysis products from five tonnes of coconut shells by rotating type reactor, comprises 550 litres (11 %) of moisture,1750 litres of bio-oil (35%),2000 Kg (40%) Charcoal and450 litres of other waste gases/permanent gases (9%). The bio-oil yield was found increased (45- 50%) when the decomposition temperature was kept low at 350^{o}C and by condensing the hot vapours by chilled water. The quality parameters of coconut charcoal are presented in Table 3.

The present study on coconut shell pyrolysis showed that a pyrolysis plant with rotating or continuous type reactors can produce maximum quantity of coconut shell oil (bio-oil, 51.16%) and charcoal (37.82%) at 350^{o}C in nitrogen atmosphere and chilled water coolingunder efficient reactor heating. The characterization of both bio-oil and charcoal has revealed that the calorific value, flash point, viscosity, density etc are comparable

Table 3 Coconut Shell Charcoal Characteristics	
Quality Parameter	Test Results
Moisture Content (%)	7.9
Volatile Matter (%)	12
Ash Content (%)	0.5
Fixed Carbon (%)	80
Dust Content (%)	0.2
Water content, %	8

with other oils like petroleum diesel and plastic pyrolysis oil and that the charcoal has shown excellent properties in comparison with charcoal produced by other conventional methods. It was further showed that temperature above 450°C will convert a portion of bio-oil into permanent gases and that the yield of oil found decreased above this temperature. Undoubtedly, charcoal yield was also found decreased above 350°C, due to char loss. The bio-oils are extensively used in boilers, furnaces and burners as fuel and in generators it is used in combination with diesel. The power crisis in remote and village areas could be addressed effectively by setting up small power generating plants where bio-oil can be easily supplied. The scope of exploiting bio-oil produced from abundantly available coconut shell for the rotation of turbines and generating electricity will be explored in future studies.

Acknowledgment

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*. Principal, N.S.S. Training College, Ottapalam, Kerala, India, drlakshmi12@yahoo.com

**. Assistant Professor, D.J. Sanghvi College of Engineering, Mumbai, India, pmn8590@gmail.com

***. Former Director, CFSC under Industries Department, Got. of Kerala, India, mdnair05@yahoo.com

*** *Corresponding Author: Mob: 09388479254, Website : www.rdtindia.com*

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Farmers grow coconuts in deserts

Rajpurohit's coconut farm in the desert state of Rajasthan is an inspiration to many prospective growers in the region. "It has become a tourist spot as people from different places of Rajasthan visit my farm every day," says Narpatsingh Rajpurohit.

Scores of men move under the shade of the tall coconut palms while visiting Rajpurohit's two-hectare farm in Kuwarda village of Jalore district, watching the 750 fruit-laden trees with interest. It is the first time that someone has planted coconut palms in the desert state of Rajasthan and is making a living out of it.

Originally from Rajasthan, Rajpurohit's family runs a guest house and has been residing in the palm-fringed Sawantwadi in Maharashtra's Konkan belt for years now. This explains the 58-year-old's fascination for growing coconut. Rajpurohit is one of the few farmers who prove that coconut could offer a livelihood even in places where they were not grown traditionally.

"After testing the soil in my ancestral village, I got saplings from Trivandrum. I planted them in the end of 2008, with the assistance of men who came from Kerala," Rajpurohit informed. He followed the advice of experts and irrigated the palms through drip system. Nine years later, the palms are lush with fruits.

The coconut palms of Ravindra Patil of Chaul village augment his income. Each day traders arrive at Rajpurohit's

farm to purchase his produce, paying well for his coconut. Having achieved the unachievable, Rajpurohit hopes to make more income every year from his coconut grove.

Among the several coconut farmers in the Konkan belt is 57-year old Ravindra Patil of Chaul village in Raigad district of Maharashtra. A chemist working in a fertilizer company, he augments his income by about Rs 10,00,00 per year through selling tender coconut. He gets this from the 187 palms in his 3.5 acre farm. The palms were planted by earlier generations successively.

Another person to have successfully grown coconut in a non-traditional area is 54-year-old Janardan Gyandev Tupe of Chanda village of Ahmednagar district. Besides growing sugarcane and custard apple, Tupe has 450 coconut palms growing on his six-acre farm, entirely irrigated through drip irrigation. Each day he sells around 150 tender coconuts picked up by the local tender coconut vendors. "Growing coconut can be a money spinner but you need to have patience as it takes around eight to 10 years to exhibit its full potential,".

Courtesy: https://www.villagesquare.in/

APCC Session/Ministerial Meeting - Tarawa, Kiribati

The 53rd APCC Session/Ministerial Meeting was held during 24-28 October 2017 at the House of Parliament in Tarawa, Kiribati. Dr. B.N.S. Murthy, Chairman, CDB represented the Government of India in the meeting and took part in the deliberations.

The Government of Kiribati, APCC Chairman for 2017 hosted the APCC Session through the Ministry of Commerce, Industry and Cooperatives and the Ministry of Environment, Lands and Agricultural Development, Government of Kiribati. The inaugural program was attended by His Excellency Taneti Maamau, President of Kiribati. Hon. Atarake Nataara, Minister of Commerce, Industry and Cooperatives and Hon. Alexander Teabo, Minister of Environment, Lands and Agricultural Development from the Government of Kiribati chaired the Session. Viam Pillay, Associate Minister of Agriculture from the Government of Fiji, Hon. Henry Ame MP, Vice Minister for Agriculture and Livestock from the Government of Papua New Guinea, Hon. Lopao'o Natanielu Mua, Minister for Agriculture and Fisheries from the Government of Samoa, Hon. William Bradford Marau, Minister of Commerce, Industry, Labour and Immigration from the Government of Solomon Islands and Hon. Jejwarwick Anton, Vice Speaker of Parliament, Republic of the Marshall Islands. Hon. Puakena Boreham Pasuna, Minister for Natural Resources from the Government of Tuvalu were the other ministries who attended the programme. Delegates and participants included senior government officials of APCC member countries and observers from the International Fund for Agricultural Development (IFAD), The Pacific Community (SPC), Centre for Agriculture and Bioscience International (CABI), Centro de Investigaci'on Cienti'fica de Yucatan(CICY), Caribbean Community (CARICOM) represented by the Caribbean Agricultural Research and Development Institute (CARDI) and the Melanesian Spear Group (MSG). A total of 72 delegates and observers participated.

The major highlight of the 53rd APCC Session/ Ministerial Meeting was the landmark decision of the Community to move to international status, enabling all coconut growing countries to become members of the Community. This decision comes following the agenda presented by the Government of India during the 51st APCC Session in Kochi in 2015 to upgrade APCC as an international organisation. A resolution on the approval was signed by all the Plenipotentiary Delegates from member countries which is to be sent to the United Nations Organisation for final endorsement of the international status.

The Delegates at the Ministerial Meeting also proceeded to sign the Tarawa Accord which declared the commitment of all member countries to affirm, support and effectively promote the health and nutritional attributes of coconut products. Coconut oil was facing much negative propaganda with

Dr. B.N.S. Murthy, Chairman, CDB

Mr. Uron N Salum, Executive Director, APCC

the Presidential Advisory of the American Heart Association on Cardiovascular Diseases and Saturated Fats. The delegates realised the gravity of the situation and committed to stand united and proactively promote the truth about healthy lifestyles with coconut diet and the healthy status of the edible products of coconut.

The country papers were presented by the Plenipotentiary Delegates from member countries which elaborated on coconut production, processing and marketing in the country, the constraints faced by the sector and the policies and programs implemented in the country to enhance farm productivity and increase the farmer's income. Updates on the research and development activities undertaken in the countries were also presented. The delegates also presented the suggested road map for the way forward for the coconut sector and the support solicited from APCC for the sustained development of the sector. The country paper presentations paved the way for understanding the developmental works undertaken in coconut in different countries, cross fertilisation of ideas, avenues for possible collaborations and technical assistance and learning from countries who were already ahead in crop production, quality assurance, processing and marketing.

The country presentations were followed by statements from observer organisations working for the development of the coconut sector. The Pacific Community (SPC), an intergovernmental organisation of 22 member countries who have land bordering the Pacific Ocean, presented on the Programme on Coconut Industry Development for the Pacific (CIDP) funded by the European Union and the Darwin Initiative Project on the Upgrading and Strengthening of the New South Pacific International Coconut Genebank. The activities of the International Fund for Agricultural Development (IFAD) and the International Funding Institutions with details of the projects in the coconut sector undertaken in Fiji, Tonga, Samoa, Kiribati and Solomon Islands were presented. This was followed by a presentation by the Melanesian Spearhead Group (MSG), a sub regional inter governmental organisation with Fiji, Papua New Guinea, Solomon Islands and Vanuatu as members. The Caribbean Community (CARICOM) was represented at the Session by the Caribbean Agricultural Research and Development Institute (CARDI) who briefed on the Coconut Industry Development Programs in the Caribbean which is implemented by International Trade Centre (ITC) under contract with the European Union (EU).

The APCC Executive Director, Mr. Uron N Salum presented the annual report of APCC detailing on the various activities undertaken by the Community, the global status of the coconut sector, the opportunities and challenges ahead, the urgent need for replanting and rejuvenation of coconut gardens which were increasingly turning unproductive due to senility and the future plans for coconut development.

The Session proceeded to discuss and deliberate on the different agenda items related to the programs and projects proposed to be undertaken by APCC. These included the International Certificate Course on Coconut Plantation Management proposed by the Coconut Research Institute, Sri Lanka in collaboration with APCC, the proposed project to Develop Holistic Regional Biosecurity Plan for Asia and the Pacific to be jointly undertaken by APCC and CABI, the proposed collaboration between APCC and Bioversity International in relation to the International Coconut Genetic Resources Network(COGENT) and CIRAD and the collaboration with CICY, Mexico in relation to Research Collaboration and Technology Transfer. The additional programs undertaken by APCC viz., International Coconut Tissue Culture Forum, International Coconut IPM Network and the International Coconut Oil Forum were also approved by the Session.

The Session further endorsed the Report and Recommendations of the 47th APCC COCOTECH, the technical panel of APCC. The theme of the 48th APCC COCOTECH Conference was finalised as Sustainable Coconut Development through Climate Smart Agriculture. The report of the Session was adopted and the Chairmanship was handed over to the Government of Malaysia who will host the 54th APCC Session/Ministerial Meeting in 2018 during the last quarter of the year.

The delegates were taken on a field visit on the 28th October 2017 to the Kiribati Coconut Development Limited (KCDL) (which manufactures coconut oil, virgin coconut oil and soaps), Kiribati Fish Limited (KFL), Umwanibong National Cultural Centre and Museum, Agriculture and Livestock Division Vegetable Project with Taiwan support and the Agricultural Nursery Yard. ■

International conference and Arogya Expo 2017

Coconut Development Board sponsored the International conference on traditional & alternative medicine and Arogya expo 2017 organized by St. Thomas College, Palai, Kottayam, Kerala on 18th and 19th September 2017. The programme was inaugurated by Padma Shri. Dr.P.R. Krishnakumar, Chancellor Avinashilingam University & Founder of AVP Research Foundation, Coimbatore, TN. In his inaugural address Dr. Krishnakumar highlighted the correlation between the alternative medicinal usage and the natural products. Further he explained about the beneficial role of virgin coconut oil in various diseases and its influence in the day to day life of public.

Dr. Muhammed Majeed, Founder & MD of Sami Labs Ltd. Bangalore, spoke on the scope of nutraceuticals. He gave an inspiration to all the delegates by his innovations in the field of nutraceutical formulation. Virgin coconut oil is one of the major products in his company. Coconut oil is one of the richest sources of saturated fat known to man, with almost 90% of the fatty acids in it are saturated. However, new data suggests that saturated fats are mostly harmless. Additionally, coconut oil doesn't contain your average saturated fats, like the ones you would find in cheese, or steak. Instead, it contains Medium Chain Triglycerides (MCTs) - which are fatty acids of a medium length. Most of the fatty acids in the diet are long-chain fatty acids, but the MCTs in the coconut oil are metabolized differently, hence they go straight to the liver from the digestive tract, where they are used as a quick source of energy, or turned into so-called 'ketones', which can have varied therapeutic effects. Amazing and plentiful health benefits of coconut oil include therapeutically effective against Alzheimer's Disease and epilepsy, cardiovascular support, fights against urinary tract infection and maintains optimal kidney and liver health, supports healthy inflammatory response, joint health, boosts immune system, helps maintain cognitive health and optimal brain function, improves energy and endurance, improves digestion, useful remedy for several skin conditions (Burns, Eczema, Dandruff, Dermatitis and Psoriasis), helps prevent gum disease and tooth decay, helps maintain healthy blood sugar levels and healthy weight management, said Dr. Majeed.

Dr. S. Sandya, Scientist, from Indian Institute of Science Bangalore and Dr. Ratheesh, Asst. Prof, Dept of Bio chemistry, St. Thomas college Pala, gave lecture on Neera and its health benefits. Alcohol abuse remains to be one of the main causes of morbidity and mortality in the world. Chronic alcohol exposure has been extensively reported to cause oxidative stress and inflammation in hepatic tissues. Neera is known to possess various beneficial properties including; antioxidant, anti-inflammatory, nephro-protective, analgesic, anti-ulcerogenic effects. However, there is a lack of pertinent information on its importance in chronic alcohol-induced hepatotoxicity. The hepatoprotective activity of Neera was investigated against alcohol induced hepatic inflammation. Shri. Sree Kumar Poduval, Processing Engineer, Coconut Development of Board (CDB), spoke on health and nutritional aspects of coconut and its products. The students, researchers and faculties from various Universities, Colleges inside and outside India participated in the conference and also visited Arogya Expo. Nearly 2000 people visited CDB stall and enquired about various value added products displayed in Board's stall. They enjoyed the taste of neera and neera products. ■

Tender coconut

CHOCOLATE DUET

Ingredients

Gelatin- 20gm

Milk 400 ml

Sugar-180 gm

Dark Chocolate- 100 gm

Tender coconut pulp- 100 gm

Method of preparation

Soak 20 gm gelatin in 50 ml water for 10-15 minutes. Boil 80 gm sugar and 400 milk in another bowl. Add the soaked gelatin mix and separate half of this mix to another bowl. Mix 100 gm chocolate powder in a bowl and mix well. Mix 100 gm tender coconut pulp to the other bowl and mix well. Pour the milk, sugar gelatin mix to mould of your choice and keep in freezer. When it is set, pour the chocolate, milk, gelatin mix over the previous mix. Keep in freezer for two hours. The item is ready to serve.

Recipe by : Roy Joseph Pothen

Executive Chef, The Flora Airport Hotel, Kochi

Thejaswini CPC, Kannur received National Entrepreneurship Award 2017

Thejaswini Coconut Farmers Producer Company Ltd, Kannur received the National Entrepreneurship Award 2017 under Barefoot Enterprises category instituted by Ministry of Skill Development and Entrepreneurship, Government of India. Mr. Sunny George, Chairman of the company along with Shri. Shaiby Zakaria, CEO of the Company received the award from Shri. Arun Jaitely Hon'ble Minister of Finance, Government of India on 9th November 2O17 at NDMC Convention Centre, Sansad Marg, New Delhi. The award consists of Rs. 5 lakhs, trophy and certificate.

Thejaswini Coconut Farmers Producer Company Ltd. (TCFPCL) is a producer company promoted by Coconut Development Board, Ministry of Agriculture Cooperation and Farmers' Welfare, Government of India. It was registered under Company's Act of India on 3rd June 2013. Thejaswini is implementing the central schemes of Government of India and state schemes of Government of Kerala for agriculture development of small and marginal farmers in agribusiness activities. The company also procures coconut and agri produces from farmers and process at their plant at Peringome, Kannur, Kerala. As part of Skill Development Training Programme of Coconut Development Board, the Company has organized 24 batches of FOCT and five batches of Neera Technician training programmes at their training centers.

Tejaswini is the pioneer in organizing small and marginal farmers under the ambit of Farmer Producer Organisations for equipping the farmers with collective power and economies of scale. At present 30000 plus small and marginal farmer members via 272 Farmer Producer Societies and 15 Farmer Producer Federations are affiliated with Thejaswini. It provides a platform for increased accessibility and cheaper availability of agricultural inputs to small and marginal farmers and in establishing forward and backward linkages in supply chain management. This initiative has triggered mobilization of farmers for aggregation across the Kannur and Kasargod districts of Kerala with ultimate aim of sustainable business model and augmented income. Recently the company has entered in to the field of Responsible Tourism (RT) initiatives of department of tourism, Government of Kerala to integrate the products, services and the local community for utilizing the opportunities in tourism.

The National Entrepreneurship Award is instituted by the Ministry of Skill Development and Entrepreneurship (MoSDE) to encourage a culture of entrepreneurship across the country. The objective is to recognize and honour entrepreneurs and entrepreneurship ecosystem builders for their outstanding efforts. The efforts and achievements of exceptional entrepreneurs and those individuals and organizations who are working in the field of entrepreneurship development are recognized through these awards. The Awards also seek to highlight models of excellence for others to emulate and improve upon.

CDB Conducts awareness programmes across the country

State Centre, Kolkata

Coconut Development Board, State Centre, Kolkata conducted a state level workshop on aspects & prospects of coconut production and value addition in association with various CPSs and CPFs at Golpark, Kolkata on 16th November 2017.

Smt Pratima Mondal, Hon'ble Member of Parliament, the chief guest of the programme during her address appreciated the initiatives of Coconut Development Board. She expressed her interest to interact with coconut farmers of the 24 South Parganas and offered to extend some of the schemes/funds of the MP for convergence with the CPSs so as to increase the area under coconut cultivation and value addition in the state. She urged the CPSs to undertake various value addition activities.

Swami Suparnandaji Maharaj, Secretary, RKM Institute of Culture in his presidential address expressed his gratitude to CDB for conducting the workshop for the welfare of the coconut farmers of the state. He called upon the farmers to come forward and to undertake value addition to increase the income of the farmer collectives. Since coconut have lots of health benefits along with medicinal importance, it should be tapped and utilized by the people of the state. He requested CDB to increase the area under coconut in the state by extending benefits of various schemes of the Board in all the districts of the state.

Dr. B.N.S. Murthy, Horticulture Commissioner and Chairman, CDB in his keynote address expressed his gratitude to the coconut farmers and the dignitaries and officials of the Dept. of Horticulture/Agriculture for attending the programme. He highlighted the global as well as the Indian scenario of coconut production and productivity. He stated that the state of West Bengal is progressing in terms of coconut productivity which is higher than the national average. He called upon the farmers to take up coconut value addition for realizing better income.

Technical experts from CPCRI & BCKV officials from State Dept/Agricultural Universities and more than 1000 coconut farmers from various districts of West Bengal attended the workshop.

Shri Khokan Debnath, Deputy Director, CDB, Kolkata welcomed the gathering and Dr. Anup Kumar Nandi, Secretary, CDB proposed vote of thanks. The inaugural session was followed by technical session under the Chairmanship of Shri Lungar Obed, Director, CDB, Guwahati. Shri Khokan Debnath, Deputy Director, CDB, Kolkata spoke on prospects of coconut cultivation in West Bengal. Dr. Dipak Kumar Ghosh, Scientist i/c, AICRP on Palms, BCKV, Kalyani spoke on production technology of coconut and Dr. Arun Kumar, Principal Scientist, CPCRI, Mohitnagar spoke on value addition of coconut and its uses.

Regional Office, Patna

Coconut Development Board, Regional Office, Patna organized farmers awereness programme at Motipur, Bihar on 14th October 2017. Shri Sunil Kumar Chaudhary , SMS, K.V.K. Raghopur, Supaul, Md Hakim, PACS Chairman, Raghopur, Shri Ramdev Das, Sarpanch Motipur Panchayat, Shri Rajeev Bhushan Prasad Dy. Director, Coconut Development Board, Regional Office, Patna, Shri Santosh Kumar Jha, Chairman, Gram Bharti Foundation Trust, Simutala, Jamui Dist. Shri. Amrendra Yadav, Ex Mukhiya, Hariraha Panchayat Shri. Pankaj Kumar Technical Officer CDB, RO, Patna, and farmers of Bhimnagar Block and other dignitaries were present during the occasion.

Shri Santosh Kumar, Chairman, Gram Bharti deliverd the welcome address and Rajeev Bhushan Prasad, Deputy Director made the introductory remarks. Shri Sunil Kumar Chaudhary , SMS, K.V.K. Raghopur , Supaul in his inaugural address informed the farmers that CDB, has been doing a good job in the area and called upon the farmers to come forward and to take benefits of CDB schemes .

In the technical session which followed, Shri Sunil Kumar Chaudhary, Supaul spoke on coconut cultivation, disease, pest, management, and how to improve the marketing of coconut. Shri Rajeev Bhushan Prasad detailed on nursery establishment and management, coconut cultivation practices, processing, value addition, marketing etc. Shri Santosh Kumar, Gram Bharti spoke on vermi compost cultivation and its use. Shri Pankaj Kumar, Technical Officer spoke on CDB schemes. The awareness programme concluded with vote of thanks by Shri Santosh Kumar Jha.

Coconut Development Board, Regional Office, Patna organized farmers awareness programme at Bhimnagar Bihar on 13th October 2017. Smt. Leela Kumari, Principal, Mod Naryan Inter College, Bhimnagar, Supaul, Dr. B. K. Mandal, Programe Coordinator, K.V.K. Raghopur , Supaul , Shri Rajeev Bhushan Prasad, Dy. Director , Coconut Development Board, Regional Office , Patna , Shri Santosh Kumar Jha , Chairman , Gram Bharti Foundation Trust , Simutala Jamui Dist. Shri Pankaj Kumar Technical Officer CDB, RO, Patna, and Farmers of Bhimnagar Block and other diginitries

Shri Santosh kumar, Chairman, Gram Bharti deliverd the welcome address and Shri. Rajeev Bhushan Prasad, Deputy Director, Coconut Development Board , Regional Office , Patna delivered the Introductory remarks. Smt. Leela Kumari Chief Guest in her inaugural address called upon the farmers to take benefit of CDB Schemes and motivated the farmers to undertake coconut cultivation. Shri Pankaj Kumar, T.O.,Patna proposed vote of thanks.

In the technical session which followed Dr. B. K. Mandal Programe Coordinator, K.V.K. Raghopur, Supaul spoke on coconut cultivation, pest and disease management and how to improve the marketing of coconut. Shri Rajeev Bhushan Prasad, Dy. Director , Coconut Development Board, Regional Office Patna spoke on coconut cultivation technology, processing and value addition. Shri Santosh Kumar, Gram Bharti spoke on vermi compost cultivation and its use. Shri Pankaj Kumar, TO spoke on CDB schemes . An interaction session was also held as part of the programme.

Regional Office Guwahati

Coconut Development Board, Regional Office Guwahati conducted a district level workshop on scientific coconut cultivation technologies and value addition in coconut at Krishi Vigyan Kendra Karimganj on 13th September 2017 in association with Universal Coconut Producers Society.

The programme was chaired Mr. S.K.N.K.Singh, District Development Commissioner, Karimganj. He motivated the farmers to attend the training programmes of CDB for the benefit of young unemployed youth to generate better income. Shri. Lunghar Obed, Director CDB, Guwahati in his key note address made a detailed presentation about the various schemes of the Board, coconut scenario in Assam and value addition in coconut.

Mr. Asish Tarul Paul, District Agricultural Officer, DAO, Karimganj thanked Coconut Development Board for organising the workshop on coconut in Karimganj district. He encouraged farmers to take up block plantation and also expansion of coconut area in the village. He encouraged farmers for scientific plantation of coconut so that the production of coconut can be increased.

Dr. Abdul Hafiz, Senior Scientist & Head, KVK, Karimganj, spoke on value addition and importance of coconut. He encouraged farmers to attend training programmes of CDB especially coconut based food training and handicraft training. He requested CDB to conduct training on coconut processing technology. Dr. Safikul Hussain, Chief Scientist, RARS, Karimgnaj, suggested to increase the area under coconut cultivation and also intercropping in coconut garden so that the farmers can make better income. Shri Ravindra Kumar, Technical Officer, CDB, Guwahati

spoke on coconut cultivation technologies. Mr. Fakrul Islam, Secretary of Universal CPS delivered the welcome address and Mr Fakrul Islam, Secretary of Universal CPS proposed vote of thanks. Around 135 farmers attended the programme.

Coconut Development Board, Regional Office, Guwahati organised a block level farmers awareness programme on coconut cultivation technologies, post harvest / value addition on 4th August 2017 at Dhupguri, Sukuniapara, Boko in collaboration with Shine Coconut Producers Society, Boko. Shri Pranab Thakur, President of Shine Coconut welcomed the guests. Shri Lunghar Obed, Director, CDB, Regional Office, Guwahati in this keynote address, spoke on value addition of coconut. Shri Raju Rai, CDB spoke on schemes of the Board. Shri Ravindra Kumar, Technical Officer, CDB, spoke on coconut cultivation technologies. Shri Utpal Rabha, President, Bekial Rabha Student Union and Shri Naren Ch. Rabha, General Councilor, Autonomous Rabha Council, Boko also spoke during the occasion. Farmers raised various queries on coconut plantation, plant protection and about various schemes of the Board in the interactive session which followed.

CDB, State Centre, Port Blair

Coconut Development Board, State Centre Port Blair organized a farmer's awareness programme on coconut on 15th November 2017 at Calicut village South Andaman, Andaman & Nicobar Islands. Shri. M. Ganeshan, Pradhan, Calicut inaugurated the programme. Dr. Ajit Arun Waman, Scientist, Spices & Plantation Crops, ICAR-Central Island Agricultural Research Institute (C.I.A.R.I), South Andaman, Shri. Avinash Norman, Technical Officer CDB, State Centre, Port Blair and farmers from different areas of South Andaman were present during the occasion.

Shri. M. Ganeshan, Pradhan, Calicut village, in his inaugural address, informed that since coconut is a major crop of the Islands, farmers can definitely get the benefit of Coconut Development Board's programmes. He called upon the farmers to take up cultivation of coconut on a larger scale.

In the technical session which followed, Dr. Ajit Arun Waman, Scientist, Spices & Plantation Crops, ICAR-Central Island Agricultural Research Institute (C.I.A.R.I) briefed the farmers on coconut cultivation, nursery techniques, various cultivars, irrigation, organic production of coconut, mother palm selection, coconut disease and pest management, etc, Shri. Avinash Norman, Technical Officer spoke on CDB schemes like, area expansion programme, laying out of demonstration plot, value addition, FOCT, CPS, CPIS etc.

An interactive session was also held as part of the programme wherein farmers clarified their doubts on coconut cultivation. More than 40 farmers took part in the programme.

Business Entrepreneurs Meet on Coconut

CDB State Centre, Kolkata conducted a business entrepreneurs meet on coconut at Ramakrishna Mission Ashram, Kolkata on 16th November 2017. FPO members and around 150 coconut entrepreneurs cum coconut farmers from various districts had participated in the programme. Dr. Manas Ghosh, Pricipal, ATC, RKM Ashram, Narendrapur, Dr. Arun Kumar, Principal Scientist, CPCRI, Mohitnagar, Dr. Narayan Chandra Sahu, Sr. Scientist and Head, SS KVK, Narendrapur, Mr. Lungar Obed, Director, CDB, Guwahati, Dr. A. K Nandi, Secretary, CDB and Mr. Khokan Debnath, Dy. Director, CDB, Kolkata took part in the session. In the technical session, Mr. S.S. Choyal, Dy. Director and Mr. K.S. Sebastian, Asst. Director (Export Promotion), CDB Kochi made presentations.

The inaugural session was followed by technical session wherein Mr. Pradeep Ahuja, Marico Ltd, Coimbatore spoke on coconut oil and copra and other value added products. He expressed his willingness to procure good quality FAQ copra from the farmers by providing minimum support price. Mr. K.S. Sebastian, Asst. Director (Export Promotion), CDB Kochi spoke on coconut value added products and its potential exports. He briefed on export incentives like MEIS and duty draw back schemes Mr. S.S. Choyal, Dy. Director spoke on the scheme Technology Mission on Coconut and briefed about the financial assistance provided by the Board for establishment of coconut based units under TMOC programme.

CDB observed Vigilance Awareness Week

In order to create awareness among the officers and staff regarding the eradication of corruption in all spheres of life, Coconut Development Board observed Vigilance Awareness Week from 30th October to 4th November 2017. The theme of the week was My Vision-Corruption Free India. The observance of the Vigilance Awareness Week commenced with the Integrity Pledge by all the staffs of the Board on 30th October, 2017.Shri. R Jnanadevan, Vigilance Officer of the Board spoke on the relevance and importance of observing the vigilance awareness week. As part of the vigilance week, Shri. M D Balasubramaniam, Vigilance Officer, Cochin Shipyard addressed the employees of the Board. He called upon the officers and staff to be transparent and responsible in their official duty which is the primary requirement for eradicating corruption. The valedictory function of the Vigilance Awareness week was held on 3rd November 2017. Shri. Saradindu Das, Chief Coconut Development Officer, CDB, Dr. A.K Nandi, Secretary and Shri. R Jnanadevan, Deputy Director and Vigilance Officer of the Board spoke during the occasion.

The objective of observing Vigilance Awareness Week is to educate the public at large about the corruption related practices and also educating them how to report about it. It is a mass movement of involving people in saying no to corruption.

Monthly operations in coconut garden -December

Andaman & Nicobar Islands: Pile up soil into mounds in sandy and loamy soils. Hoe or plough in other types of soils.

Andhra Pradesh: Spray young seedlings affected with black-headed caterpillar (Opisina arenosella) with 0.05 per cent malathion or phosalone or 0.02 percent dichlorvos on the lower side of the leaves. Release stage specific parasites like Bethylid, (Goniozus nephantidis) for 3rd larval stage and Chalcidid (Brachymeria nosatoi) for early pupal stage. Larval parasitoid Braconid (Bracon hebetor) an pupal parasitoid Ichneumonid (Xanthopimpla punctata) can also be used as promising parasitoids. In multistage condition of the pest, combined release of all the parasitoids is required. When an initial insecticide treatment is given the parasitoids may be released only after three weeks of spraying. Treat red palm weevil affected palms by injecting 0.1 per cent dichlorvos or one per cent carbaryl. Depending on the intensity of pest infestation about 1-1.5 litres of insecticide suspension may be required for one palm. In the case of crown damage, the damaged tissues have to be removed and the insecticide suspension may be poured in. When pest entry is through the trunk all the holes on the stem may be plugged with cement or plaster of paris to avoid further damage of the tree from the pest attack. Harvest cowpea, raised as an inter crop in coconut garden. Plough the land and leave it fallow.

Assam: Irrigate the garden. Collect seednuts from selected mother palms and store them in shade in a cool, dry place. If rat damage is noticed organize a planned group action in the whole locality covering the residential houses and surrounding crop field including coconut and other horticultural gardens. Use poison baits, traps, etc. against rats. Fixing rat

cones made of tin sheets on the trunk at a height of 2m above the ground will prevent the entry of rats on the palm. Clean the crowns of the palms periodically.

Bihar / Madhya Pradesh/ Chhattisgarh: Start irrigation depending upon the need. Keep the newly planted pits and basins of the palms weed free and remove the soil from collar region of the seedling. Protect young palms from winter scorching by providing suitable shade. Raise winter vegetable suited to the locality. Apply blitox @ 5g/ litre or dithane M-45 @ 2g/litre at the crown and bunches alternatively to avoid secondary infections due to cold injury and continue upto February. Check the palms for termite attack. Drench the soil with 0.05 percent chlorpyriphos twice at 20 to 25 days interval. The affected trunk may be swabbed with the above chemical. Do not cut the green leaves and other living plant parts.

Karnataka: Irrigate young seedlings. Keep the nursery free of weeds and continue discarding of poor seedlings. 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 azadiractin 1 per cent @4ml per litre or root feed azadiractin 5 per cent @ 7.5 ml with equal quantity of water. Collection of seednut from selected mother palm may be continued.

Kerala/Lakshadweep: Mother palms may be selected during the month for the collection of seednuts. Level down the mounds piled up earlier in the coconut garden. If the garden soil is sandy, add clay and if it is clayey add sand around the palms to improve the soil structure. Clear the irrigation channels. Clean the crowns of the palms periodically. Shade the newly planted and young seedlings. Apply sevidol 8G (25g) + fine sand (200 g) per palm in the top most 2-3 leaf axils against rhinoceros beetle and red palm weevil. Apply one-fourth of the recommended dose of fertilisers in the irrigated gardens. If mite infestation is noticed clean the crowns of the palms and spray neem oil - garlic – soap emulsion 2 percent (20 ml neem oil + 20 gm garlic emulsion + 5 gm soap in 1 litre water) or azadiractin @4ml per litre or root feed @ 7.5 ml with equal quantity of water.

Maharashtra/Goa/Gujarat: Plant yams as intercrop in the pits of 75 cm diameter and 15 cm depth spaced 100 cm apart. Before planting, fill the pits with farm waste and burn them. Level down the mounds piled up earlier in the garden.

Orissa: Seasonal intercrops may be sown. Irrigate coconut and the intercrops. Incorporate green manure. Coconut basins may be mulched with coir pith/ husk etc.

Mother palm

Plant protection chemicals may be applied according to the pest/ disease. If the attack of eriophyid mite is noticed root feed azadirachtin 5 per cent @7.5 ml with equal quantity of water. Clean the crown. Continue other maintenance operations to the intercrops as well as coconut.

Tamil Nadu/Puducherry: Treat all manure pits with carbaryl 50wp @ 0.01 per cent to destroy the grubs of rhinoceros beetle. Start irrigating the young seedlings. Keep the nursery free of weeds and continue discarding poor seedlings. Select mother palms for seednut collection. In areas where mite infestation 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 azadiractin 1 per cent @ 4ml per litre especially on the perianth region of buttons and affected nuts or root feed azadiractin 5 per cent @ 7.5 ml with equal quantity of water.

Tripura: Irrigate the palms. Mother palms may be selected during the month for collection of seednuts for next year. Partial shade should be provided in south-west direction to the newly planted seedlings to prevent scorching.

West Bengal: Start harvesting of nuts. Treat the manure pit. Keep the nursery free from weeds. Continue discarding of poor seedlings. Irrigate the nursery once in a week. ■

Market review – October 2017

Domestic price

Coconut Oil

During October 2017 the price of coconut oil opened at Rs. 16800 per quintal at Kochi market and Alappuzha market and Rs.18500 per quintal at Kozhikode market. The price movement in all the three markets in Kerala expressed a slight downward trend in the fortnight, but by the fag end of the month, the price of coconut oil at all three markets registered an unprecedented increase.

The price of coconut oil closed at Rs.17900 per quintal at Kochi market, Rs.17700 per quintal at Alappuzha market and Rs.19300 per quintal at Kozhikode market with a net gain of Rs.1100, Rs.900, and Rs. 800 per quintal respectively.

The price of coconut oil at Kangayam market in Tamilnadu, which opened at Rs.15200 per quintal, expressed a similar trend of that of Kerala markets and closed at Rs.16000 per quintal with a net gain of Rs.800 per quintal.

Table1: Weekly price of coconut oil at major markets Rs/Quintal)

	Kochi	Alappuzha	Kozhikode	Kangayam
01.10.2017	16800	16800	18500	15200
08.10.2017	16700	16700	18400	14800
15.10.2017	16600	16600	18400	NR
22.10.2017	16705	16600	18400	14867
31.10.2017	17900	17700	19300	16000

Milling copra

The price of milling copra at major markets moved in tune with the prices of coconut oil. During the month, the price of milling copra opened at Rs.11600 per quintal at Kochi, Rs.11300 per quintal at Alappuzha market and Rs.12100 per quintal at Kozhikode market. The price movement in all three markets in Kerala expressed a downward trend during the first three weeks. During the fourth week the price of milling copra at all three markets increased and thereafter expressed an upward trend.

The prices closed at Rs.12700 at Kochi, Rs.11800 per quintal at Alappuzha market and Rs.12600 per quintal at Kozhikode markets with a net gain of Rs.1100 per quintal at Kochi, Rs.500 at Alappuzha market and Rs.500 per quintal at Kozhikode market.

At Kangayam market in Tamilnadu, the prices expressed a similar trend of that of Kerala markets. The prices opened at Rs.10600 and closed at Rs. 11500 per quintal with a net gain of Rs.900 per quintal.

Table2: Weekly price of Milling Copra at major markets (Rs/Quintal)

	Kochi	Alappuzha (Rasi Copra)	Kozhikode	Kan-gayam
01.10.2017	11600	11300	12100	10600
08.10.2017	11500	11200	11900	10500
15.10.2017	11400	11200	11900	NR
22.10.2017	11500	11200	12000	10500
31.10.2017	12700	11800	12600	11500

Edible copra

The price of Rajapur copra at Kozhikode market which opened at Rs.14300 per quintal expressed a downward trend during the first three weeks of the month. During the fourth week the price of edible copra increased and thereafter expressed an upward trend. The prices closed at Rs.15300 per quintal with a net gain of Rs.1000 per quintal.

Table3 :Weekly price of edible copra at Kozhikode market (Rs/Quintal)	
01.10.2017	14300
08.10.2017	13500
15.10.2017	13200
22.10.2017	15000
31.10.2017	15300

Ball copra

The price of ball copra at Tiptur market which opened at Rs.13000 per quintal expressed an erratic trend during the month and closed at Rs.12800 with a net loss of Rs. 200 per quintal.

Table 4 : Weekly price of Ball copra at major markets in Karnataka (Rs/Quintal)	
	Tiptur
01.10.2017	13000
08.10.2017	12100
15.10.2017	11300
22.10.2017	12000
31.10.2017	12800

Dry coconut

At Kozhikode market, the price of dry coconut opened at Rs.10300 per quintal. The price expressed a slight downward trend during the month and closed at Rs.9850 with a net loss of Rs.450 per quintal.

Table5 : Weekly price of Dry Coconut at Kozhikode market (Rs/1000 coconuts)	
01.10.2017	10300
08.10.2017	9850
15.10.2017	9850
22.10.2017	9850
31.10.2017	9850

Coconut

At Nedumangad market the price of partially dehusked coconut opened at Rs. 18000 and closed at Rs. 19000 with a gain of Rs.1000 per thousand nuts. At Pollachi market in Tamil Nadu, the price of coconut opened at Rs. 17000 and closed at Rs.18000 per thousand nuts with a net gain of Rs.1000 per thousand nuts. At Bangalore APMC, the price of partially dehusked coconut opened at Rs.13500 per thousand nuts and ruled at the same price throughout the month. At Mangalore APMC market the price of partially dehusked coconut of grade-I quality opened at Rs.22,500 per thousand nuts and ruled at the same price throughout the month.

Table 6: Weekly price of coconut at major markets (Rs /1000 coconuts)				
	Neduman-gad	Pollachi	Banglore	Mangalore (Grade-1)
01.10.2017	18000	17000	13500	22500
08.10.2017	18000	17000	13500	22500
15.10.2017	18000	17000	13500	22500
22.10.2017	19000	17000	13500	22500
31.10.2017	19000	18000	13500	22500

Tender coconut

The price of tender coconut at Maddur APMC market in Karnataka opened at Rs.10000 per thousand nuts and remained at the same level throughout the month.

Table7 : Weekly price of tender coconut at Maddur market (Rs/1000 coconuts)	
01.10.2017	10000
08.10.2017	10000
15.10.2017	10000
22.10.2017	10000
31.10.2017	10000

International price

Coconut oil

The international and domestic price of coconut oil at Indonesia expressed an upward trend during the month, whereas the price of coconut oil in Philippines and India expressed an erratic trend. The price of coconut oil quoted at different international/ domestic markets is given below.

Table 8: Weekly price of coconut oil in major coconut oil producing countries during October 2017

	International Price(US$/MT)	Domestic Price(US$/MT)		
	Philippines/ Indonesia (CIF Europe)	Philippines	Indonesia	India*
7/10/2017	1370	1393	1370	2567
14/10/2017	1445	1387	1421	2552
21/10/2017	n.q.	1460	1469	2552
28/10/2017	n.q	1500	1568	2675

* Kochi Market

Coconut

The price of coconut quoted in Philippines and Indonesia market expressed a slight downward trend whereas the price of coconut in India and Srilanka expressed an erratic trend. The price quoted at different domestic markets in Philippines, Indonesia, Srilanka and India are given below.

Table 11: Weekly price of dehusked coconut with water during October 2017

Date	Domestic Price (US$/MT)			
	Philippines	Indonesia	Srilanka	India*
7/10/2017	204	203	352	584
14/10/2017	203	200	348	576
21/10/2017	200	197	352	576
28/10/2017	198	197	358	592

*Pollachi market

Copra

The domestic price of copra at Philippines and Indonesia expressed an upward trend whereas price of copra in India and Srilanka expressed an erratic trend during the month. The price of copra quoted at different domestic markets is given below.

Table 9: Weekly price of copra in major copra producing countries during October 2017

	Domestic Price(US$/MT)			
	Philippines	Indonesia	Srilanka	India*
7/10/2017	864	829	1529	1768
14/10/2017	865	836	1540	1752
21/10/2017	891	881	1553	1753
28/10/2017	912	911	1472	1875
30/09/2017	899	954	NQ	1815

* Kochi Market

Desiccated coconut

The FOB prices of desiccated coconut in major desiccated coconut exporting countries are given below:

Table 10: Weekly price of desiccated coconut during October 2017

	Domestic Price (US$/MT)			
	Philippines	Indonesia	Srilanka	India*
7/10/2017	2502	2430	3326	2511
14/10/2017	2502	2440	3369	2531
21/10/2017	2502	2450	3172	2514
28/10/2017	2502	2450	3666	2514

*FOB

Coconut shell charcoal

The FOB price of coconut shell charcoal in Philippines, Indonesia, Srilanka and India, during the month of October is as follows

Table 10: Weekly price of desiccated coconut during October 2017

	Domestic Price (US$/MT)			
	Philippines	Indonesia	Srilanka	India*
7/10/2017	452	466	404	460
14/10/2017	452	466	403	462
21/10/2017	452	466	403	465
28/10/2017	452	466	393	466

*FOB