Index

Message from the Chairperson's Desk

Dear readers,

Hearty Greetings from Coconut Development Board

All coconut growing countries across the Asia Pacific observe 2nd September as World Coconut Day every year in commemoration of the foundation day of International Coconut Community, (ICC) formerly known as APCC which is an international organization established for strengthening the regional cooperation among the coconut producing countries. ICC has been established under the aegis of UN-ESCAP with a vision to improve the socio-economic conditions of the coconut growers, processors, traders and all those who depend on this crop and crop based industries in the member countries through proper promotion, collaboration and harmonization of various coconut related activities. ICC assists the member countries to develop, provide or exchange technologies to make the coconut industry vibrant in the years to come. India is one of the founder members of ICC.

The objective of observing coconut day is to create increased awareness and importance of coconut and help focus the national and international attention to this crop and to enhance its potential to alleviate poverty, encourage investment in the sector and promote the total development of coconut community in the producing countries. This is an occasion to review policies and formulate plan of action in this sector. ICC's theme for the World Coconut day 2019 is 'Coconut for Family Wellness'.

In India, World Coconut Day is celebrated under the aegis of Coconut Development Board and this year it is decided to celebrate World Coconut Day in Bhubaneswar, Odisha. Around 500 coconut farmers from major coconut growing states and senior officials from the Department of Agriculture/ Horticulture and Agricultural Universities are invited to attend the programme. Technical sessions on coconut cultivation technology, processing, value addition, marketing, exports as well as on the health and wellness aspects of coconut will be held as part of the programme.

It is also an occasion of togetherness that the member countries of ICC comprising of the major coconut growing countries across the globe are meeting at Manila, Philippines for the annual ICC session and ministerial meeting during the last week of August. The session is the policy making body wherein the activities of ICC are planned. The second world Coconut Congress is also being organized during the same time in the Philippines which will provide an opportunity for the policy makers from different countries to gain awareness on the coconut industry of the Philippines and the value added products produced from coconut in the country.

Let us once again make this day an opportunity to pay our reverence to the 'Tree of Life' and collectively work towards realizing the maximum potential of 'Kalpavriksha.'

V Usha Rani IAS
Chairperson

Hybridization Technique in Coconut

Samsudeen, K., Niral, V., Sudha, R., and Ranjini, T. N.
ICAR- CPCRI, Kasargod

Introduction

Manifestation of heterosis or hybrid vigour in a perennial crop like coconut palm was first reported from India in 1937. Hybrid vigour in the nursery for vegetative characters such as height, girth at collar and number of leaves in the seedlings was observed in inter-varietal crosses involving the tall variety as the female parent and the dwarf variety as the male. These seedlings on planting had a rapid growth rate with a higher rate of leaf production, shorter pre-bearing period, high bearing capacity and economic nut characteristics. These findings in India emphasized the importance of hybridization or controlled cross breeding in coconut improvement and have been subsequently adopted as a widely recognized programme in the major coconut growing countries. Considerable work on production, evaluation and mass distribution of seedlings is now in progress in most of the major coconut growing countries. The inter-varietal hybrids produced in these countries for commercial planting were initially Tall x Dwarf and Dwarf x Tall with different parental combinations. Besides, intra-varietal hybrids like Tall x Tall and Dwarf x Dwarf combinations are also under evaluation.

Floral biology

Inflorescence

For any hybridization programme, it is essential to know the floral biology for undertaking effective controlled pollination. The inflorescence of a coconut palm is the 'spadix'. As the coconut palm is monoecious, it produces both male and female flowers on the same inflorescence. A coconut palm on reaching the normal bearing age produces a spadix from each leaf axil. The annual production of spadices, therefore, coincides with the number of leaves produced by the palm that under normal conditions ranges from 12 to 15. However, a few spadices fail to develop under unfavourable circumstances.

Fig 1. Inflorescence

The inflorescence develops within a strong, tough, pointed double sheath called spathe. When the spathe is fully grown, the entire structure collectively called the 'spadix' would be about 1 to 1.2m in length and 14 to 16cm in diameter at the broadest point. At this stage, it splits along its underside from top to bottom and releases the inflorescence. This usually

occurs 75 to 90 days after the first appearance of its tip in the leaf axil.

Male flowers

The inflorescence consists of many flower bearing ramifications or spikelets situated on a control axis or peduncle. The number of spikelets varies from 30 to 35. On the spikelets, the male flowers are located at the distal end and the female flowers towards the base. The number of male flowers may vary from 250-300 per spikelet and there may be about 8000 to

Fig. 2. Single male flower

10000 male flowers per inflorescence. Male flowers have three outer perianth, measuring about 3-5mm, three inner perianth measuring about 15mm, six stamens and a rudimentary pistil.

Male phase

Generally, male flowers are the first to open immediately after splitting of the spadix. The first male flowers to open are those located at the sides of the female flowers and those at the tips of the upper spikelets. Flowering commences from the apex of the spike and extends downwards towards the base. Flowers bloom throughout the day but maximum blooming occurs during 8 and 10 am. After shedding their pollen, the male flowers whither and fall off, usually within two days after their opening. In tall palms, the duration of male phase, that is the time between the opening of the first male flower and shedding of the last male flower is about 18-22 days, depending on the palm's characteristics, the growing conditions and the season.

Pollen

When the anthers are fully mature, the pollen sacs burst along the two longitudinal slits corresponding to the partitions of the pollen sacs and shed their pollen before the opening of the male flower. The pollen grains are spherical and smooth when fresh but on exposure for a few seconds, turn ellipsoidal with a longitudinal groove in the middle. They measure about 0.063mm in length and 0.020mm in breadth. It is estimated that an inflorescence contains about 180-360 million pollen grains. The pollen output per anther in a flower of a healthy palm is estimated to be 1,11,000-2,21,000 pollen grains. Examination of the pollen grains under the microscope reveals the presence of shrunken pollen grains among the smooth and round pollen grains. The former are infertile and account for about 25% of the pollen grains.

Germination of pollen grain

The germination test of the pollen is a pre-requisite before using the same in pollination. The test is usually done in a solution containing 800mg of Sucrose, 200mg of gelatin and agar in 10ml of distilled water. Pollen with at least 50% germination alone should be selected for pollination.

Female flowers

Unlike the male flowers, the female flowers are comparatively few in number in an inflorescence. They may vary from 20-40 in tall palms. Dwarf palms, generally, carry a large number of female flowers in a spadix than that of tall palms. However, this trait is strongly influenced by the environmental conditions and the age of the palm. Young palms just starting to flower usually have fewer female flowers per inflorescence than mature palms. Palms with large nuts cannot carry many nuts in one spadix as there is just no room for them. Such palms usually have relatively few female flowers whereas the palms with smaller nuts have larger number of female flowers. The cultivar Laccadive Micro, a tall palm from Lakshadweep produces about 160 nuts/palm/year. Some of the spadices of this variety produce as many as 400-500 female flowers each during favourable summer months.

Fig.3 Receptive female flower

At the time of opening of the spathe, the female flower is a small spherical body about 1.3cm in diameter with great resemblance to a small nut and

is popularly known as button. The female flowers, like male flowers, consist of six floral leaves that are thicker, imbricately arranged and tightly folded over the inner parts of the flower completely enveloping the spherical pistil. The ovary is tricarpellate and each carpel has a single ovule. Normally, only one

Fig. 4. Insectes visiting receptive female flowers

ovule develops while the other two either abort or degenerate. But in exceptional cases bicarpellate and even tricarpellate fruits are also produced.

The stigmas are sessile. When the stigmas are receptive, nectar is secreted at the base of the stigmas and at the three pores on the pericarp towards the top of the ovary. When the female flowers become receptive, it opens at the apex and the three stigmas protrude from it like a three-pointed star. Receptivity in tall palms begins about 24 to 26 days after opening of the spathe. In most dwarfs, this period is only 2-7 days and in D x T hybrids and some green dwarfs, it is about 16-21 days.

Female phase

Female phase, which is the interval between the receptive stage of the first female flower and the last female flower, varies with the condition of the palm. However, it is much shorter than the male phase and lasts for about 5-7 days in tall palms and twice as long in some dwarfs.

Interval between male and female phases

The interval between the end of male phase and the beginning of the female phase has an important bearing on the nature of pollination. In the coconut palm, especially in tall variety, there is a distinct gap between the male and the female phases as the female flowers become receptive after all the male flowers in the same spadix have shed their pollen. This makes cross-pollination customary. However, slight chances of self-pollination exist from the succeeding inflorescences (inter-spadix overlapping) especially during the summer season. In dwarf palms and hybrids, the interval between the two phases, is either nil or negligible (intra-spadix overlapping) thereby increasing the chances for self-pollination.

Fig. 5. Emasculated inflorescence

Genetically, dwarfs are considered autogamous (direct self-pollinating), the talls allogamous (cross-pollinating) and the hybrids and a few dwarf types, particularly green dwarfs, capable of uniting both the types. However, overlapping of phases of two successive inflorescences is a characteristic conditioned by the interaction between genotype and the environment.

Pollination

There is so far no consensus on the major agency responsible for pollination in coconut. Both wind and insects are considered to have equally important role as carriers in pollination. After fertilization, it takes about 11 to 12 months for the flower to develop to maturity. The unfertilized female flowers turn brown and fall from the inflorescence. A number of fertilized flowers also fail to develop properly and they too are shed. Generally, not more than 25 to 40 percent of the female flowers reach maturity.

Commercial production of hybrids

Emasculation

The first step in hybridization is the removal of male flowers from the inflorescence of the female parent to avoid self-pollination. This is called 'emasculation'. A coconut inflorescence has hundreds of male flowers and few female flowers. All the male flowers are to be removed well before the female flowers come to receptivity. To avoid any chance of contamination it is better to do the emasculation as soon as the inflorescence opens on the first day itself. This is done either by removing the individual male flowers by hand or by cutting the spikelets (with knife or secateur) about 4 to 5 cm away from the uppermost female flowers and removing the remaining male flowers by hand.

1 Fig. 6. Crushing mature male flowers

2 Fig 7 Drying male flowers in incubator

3 Fig. 8. Dried male flowers

4 Fig.9. Drying male flowers in fluid bed

5 Fig.10. Manual sieving of male dried flowers

6 Fig.11. Sieving of dried male flowers

7 Fig. 12. Pollen and talc for preparation of pollen-talc mixture

8 Fig 13 Processed pollen stored in desicator

Pollen collection and processing

In coconut inflorescences, the male flowers on the top and middle spikelets produce more fertile pollen compared to those on the lower spikelets. Therefore, collection of pollen from male flowers of lower spikelets is to be avoided. Maturity of the male flowers is indicated by the appearance of a bluish green tinge at the tip of the anthers. Collection of pollen from an inflorescence between 6 to 8 days after opening is recommended. The method of pollen collection is described in table 1.

A pollen drying equipment called 'Fluid-sero-culture' is available, which processes pollen within 4 hrs and thus can be used on the same day. The instrument is used for drying pollen by exposing the fresh male flowers to hot air. The air temperature and the speed can be regulated. At 40^0C, the pollen can be dried in about four hours. This is especially useful in seed gardens where a large quantity of pollen is required every day.

Pollination

Unlike emasculation and pollen processing, the pollination technique to be used in a garden depends on the type of plantation. When the female parents are scattered in a garden and one inter-planted with different types of tall cultivars 'controlled hand pollination' technique is to be used. This method involves bagging of emasculated bunches for the entire period of female phase and pollinating with desired pollen. The same procedure is also to be followed in the production of T x D hybrids. However, this method is not amenable for commercial production of hybrids as it is tedious and time consuming.

The plantations of pure blocks of dwarf and dwarfs inter-planted with a single tall cultivar are suitable for commercial production of coconut hybrids. The former is more suitable than the latter, as when the talls and dwarfs are inter-planted only a single hybrid combination can be produced in that garden without bagging. In this case, all the inflorescence in dwarf palms is to be emasculated so that only pollen from tall is available in the garden. All the nuts collected form the dwarfs after emasculation will be hybrid nuts (D x T). However, to increase the setting percentage, assisted pollination with the tall pollen is advisable. In the plantations of pure blocks of dwarfs more flexibility is possible. Depending on the need, by changing the pollen in the assisted pollination technique, different combinations of hybrids can be produced. However, assisted pollination is mandatory in the pure blocks of dwarf, while it is optional in blocks inter-planted with talls. As the procedure is simple, it is very easy to produce a large number of hybrids from this (pure blocks of dwarfs) type of gardens.

	Table 1
1.	Cut the portion of the spikelets containing mature male flowers.
2.	Separate the male flowers from the spikelets.
3.	Place the male flowers between folds of thick paper and gently crush them with the help of a rolling pin (crushing is done only for separating the perianth parts and should not damage / break the anthers).
4.	Keep the crushed male flowers in an oven at 390 (+/- 10C) for 24hrs.
5.	Sieve to separate the pollen from the debris (use 0.2 mm mesh sieve).
6.	Test the germination as mentioned earlier. Only pollen with at least 50% germination should be used for pollination.
7.	Collect pollen in glass vials and store in desiccators over fused calcium chloride. Pollen so stored can be used for 10-15 days.
8.	When longer duration of storage is required, seal the glass vials and store them in deep freezer (- 200C). This pollen can be used upto 3 months.
9.	Dilute pollen with neutral talc powder in 1:9 proportion before use. If pollen is available in large quantity, the ratio can be 1:2 or 1:8. When the pollen stored in deep freezer is to be used, first allow it to stand at room temperature before diluting.

For effective and speedy pollination, a simple device has been developed. It consist of a polythene squeeze bottle, a rubber tube and bamboo pole. The squeeze bottle is tied at the end of a bamboo pole (or aluminum rod) 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 present inside the bottle is released as a cloud. When the receptive male flowers are to be pollinated, the nozzle of the bottle is placed near the inflorescence and the rubber tube is pressed. The pollen-talc mixture released will cover the inflorescence effecting the pollination. The process is repeated on the 1st, 3rd and 5th day starting from the day when the first female flower comes to receptivity. When the stigmas turn brown and black the female flower is no longer receptive. By this method most of the dwarf palms can be pollinated from the ground level. Even the few dwarf palms, which are taller, can be reached with the help of a small ladder. As the laborious process of tree climbing can be avoided, a single pollinator can attend to about 150 trees a day. The setting percentage is very high (about 50%) when compared to that in nature (20-25%).

References: ● *Chowdappa P., Niral V., Jerard B.A. and Samsudeen K. (Eds.) (2017) Coconut. Daya Publishing House, A Division of Astral International Pvt. Ltd. New Delhi, India. 440p.* ●*Patel, J.S. (1937) Coconut breeding. Proc. Assoc. Econ. Biol.5: 1-16.* ■

CDB celebrates World Coconut Day celebration at Bhubaneswar

In India, every year World Coconut day is celebrated under the aegis of Coconut Development Board. Coconut Development Board is celebrating this year's World Coconut Day at Kalinga Institute of Industrial Technology, Bhubaneswar Odisha on 2nd September 2019.

Shri. Narendra Singh Tomar, Hon'ble Minister for Agriculture and Farmers Welfare, Government of India will be the Chief Guest and Dr. Arun Kumar Sahoo, Hon'ble Minister for Agriculture and Farmers' Empowerment, Government of Odisha will be the Guest of Honour. Shri. Sanjay Agarwal IAS, Secretary, Dept. of Agriculture, Cooperation & Farmers Welfare, Government of India will preside over.

All coconut growing countries in the Asia and Pacific region observe 2nd September as World Coconut Day every year. The foundation day of the International Coconut Community (ICC) an intergovernmental organization is observed as the World Coconut Day in the member countries. The objective of observing coconut day is to create increased awareness and importance of coconut and help focus national and international attention to this crop. The theme announced by ICC for World Coconut 2019 is 'Coconut for Family Wellness'.

Around 500 coconut farmers from all coconut growing states and senior officials from the Department of Agriculture/ Horticulture and Agricultural Universities will attend the programme at Bhubaneshwar. A technical session will also be held as part of the programme. Coconut Development Board is organising programmes across the country in all coconut growing states to celebrate the coconut day. An exhibition of value added products and coconut handicrafts will also be held as part of the programme.

Genetic Resource Management and Improved Varieties of Coconut

Niral, V., Samsudeen, K., Sudha, R., and Ranjini, T.N.
ICAR- CPCRI, Kasargod

Hybrid varieties

Among the five hybrids developed and released for commercial cultivation by CPCRI, the hybrid Kalpa Samrudhi is relatively tolerant to drought and is recommended as a dual purpose variety for copra and tender nut purpose. The hybrid Kalpa Sankara is tolerant to coconut root (wilt) disease and recommended for cultivation in the root (wilt) affected tracts.

Chandra Sankara:

Chandra Sankara was the first hybrid developed at the institute to be recommended for commercial cultivation in the year 1985 and is the most popular Dwarf x Tall hybrid in the country. This hybrid was produced by crossing Chowghat Orange Dwarf palms (female parent) with pollen from elite West Coast

In India, heterosis breeding has been employed for development of hybrid coconut varieties through hybridization between indigenous and exotic selections of Talls and Dwarfs. The first coconut hybrid in the country was produced at the erstwhile Coconut Research Station, in 1934 by Dr. J.S. Patel using West Coast Tall as female parent and Chowghat Green Dwarf as male parent.

Chandra Laksha is the first Tall x Dwarf hybrid recommended for commercial cultivation by CPCRI and is a cross between Lakshadweep Ordinary Tall as female parent and Chowghat Orange Dwarf as male parent. The palms of this variety are tall in habit, with circular canopy. The hybrid comes to bearing in about 4-5 years after planting.

Tall palms (male parent). The palms come to bearing early when compared to tall WCT parent. The palms of this variety are semi tall in habit, with circular canopy. The average time taken for flowering is about 3- 4 years, under favourable growth conditions. The fruits are round in shape and brown in colour. It is a heavy yielder and produces, on an average, 110-123 nuts/palm/year, with an estimated copra yield of 25-28 kg copra/palm/year or 4.40-4.82 t copra/ha and 2.99 t oil/ha. The hybrid progenies can easily be identified in the nursery, since the hybrid seedlings exhibit vigorous growth coupled with bronze-coloured petioles.

The fruits are medium-sized and the mean copra content is around 208-225 g and the oil content in copra is 64-68 per cent. Chandra Sankara is susceptible to drought and hence irrigation is required during the summer months. The hybrid performs better under good management conditions and is not recommended for cultivation in rainfed plantations. Chandra Sankara developed by CPCRI was also found superior to the local check, WCT in the AICRP on Palms centres and hence the VII Biennial Workshop of the All India Coordinated Research Project on Palms, in the year 1985, has recommended this hybrid variety, Chandra Sankara, for large scale commercial cultivation in the states of Kerala, Karnataka and Tamil Nadu

Chandra Laksha:

This is the first Tall x Dwarf hybrid recommended for commercial cultivation by CPCRI and is a cross between Lakshadweep Ordinary Tall as female parent and Chowghat Orange Dwarf as male parent. The palms of this variety are tall in habit, with circular canopy. The hybrid comes to bearing in about 4-5 years after planting. The mean annual yield is 109 nuts per palm with an estimated copra yield of 21.3 kg copra/palm/year. Under irrigated conditions and good management, the hybrid variety Chandra Laksha produces higher average yield of 175 nuts per palm per year with estimated yield of 30.10 kg copra/palm/year (5.26 t copra/palm/year) and 3.37 t oil/palm/year.

The fruits are oval in shape and medium-sized with a copra content of 195 g per nut and copra oil content of 69 per cent. This hybrid performs better than Chandra Sankara and Kera Sankara under moisture stress situation.

This hybrid has been released by CPCRI VII Biennial Workshop of the All India Coordinated Research Project on Palms, in the year 1985, for cultivation in Kerala, Karnataka and Tamil Nadu, based on the superior performance of this hybrid under evaluation at CPCRI Kasaragod and coordinating research centres at Arsikere in Karnataka and Veppankulam in Tamil Nadu.

Kera Sankara:

This is a popular Tall x Dwarf hybrid between West Coast Tall as female parent and Chowghat Orange Dwarf as male parent. The hybrid palms are precocious and exhibit higher productivity than the parents. The palms of this variety are tall in habit, with circular canopy. The palm comes to bearing by the 4th year of planting. The mean annual yield of nuts is 108 with an estimated copra yield of 20.2 kg copra/palm/year. The fruits are oval in shape.

The fruits are medium-sized and the average copra content is 187 g/nut with 68 per cent oil in the copra.

This hybrid gives higher yields under good management and irrigation. However, Kera Sankara, unlike Chandra Sankara, can also perform well under rainfed conditions. This hybrid proposed by CPCRI was recommended by the X Biennial Workshop of the All India Coordinated Research Project on Palms, in the year 1991, for large scale commercial cultivation in Kerala, coastal Andhra Pradesh and coastal Maharashtra based on the superior performance at CPCRI and the AICRP on Palm centres.

Kalpa Samrudhi:

Kalpa Samrudhi is a high yielding, drought tolerant, semi tall Dwarf x Tall (DxT) hybrid involving MYD as the female parent and WCT as the male/ pollen parent. It is a dual-purpose variety, suitable for cultivation as copra and tender nut variety. The palms of this variety are semi-tall with compact spherical canopy. The palms are regular bearers and commence flowering 5 years after planting, under rain fed conditions. However, under irrigated conditions, the palms commence flowering within 4 years after planting. The colour of the leaf petiole and fruits is green. The fruits are oval in shape, while the dehusked fruits are round in shape. The average annual nut yield of this variety is 117 nuts/palm/ annum, under rain fed conditions, with an estimated annual copra yield of 4.5 tons/ha and oil yield of

3.04 tons/ha. The variety is superior to Chandra Sankara, the earlier released D x T hybrid, and the annual average nut, copra and oil yield per hectare is 30.27%, 66.05% and 73.71% higher than Chandra Sankara, respectively. The seed nuts germinate early and produce vigorous seedlings.

The average weight of the fruits of this variety is 1032.33 g with average copra content of 219.46 g and copra oil content of 67.5%. The oil extracted from the copra of this hybrid has 45.4% lauric acid. The quantity of tender nut water is around 346 ml/ nut with good tender nut quality (TSS - 6.0 Brix). The nutritive value of tender nut water is as follows: total sugars - 4.17 g/100ml; free amino acids -2.08 mg/100ml; Potassium - 2370 ppm; Sodium - 35.1 ppm.

Kalpa Samrudhi has distinguishable characters of green petiole colour, high collar girth, presence of split leaves, broad leaflet, thick inflorescence stalk girth, green coloured fruits, thick fresh endosperm and high shell weight. Kalpa Samrudhi is also relatively drought tolerant when compared to Chandra Sankara, based on physiological parameters. Further, the seedlings of this variety recorded higher nitrogen use efficiency when compared to Chandra Sankara. Considering the superior performance of the variety at CPCRI, Kasaragod in Coastal Kerala and AICRPP Centre, Kahikuchi, Assam, Kalpa Samrudhi was recommended for cultivation in the states of Kerala and Assam by XIX Biennial Workshop of the All India Coordinated Research Project on Palms in 2009. The variety has been approved for release by the Central Sub-committee on Crop Standards, Notification and Release in 2012, for cultivation in

the states of Assam and Kerala and notification of Ministry Agriculture (Department of Agriculture and Co-operation) is awaited.

Kalpa Sankara:

Kalpa Sankara coconut hybrid was produced in 'hotspots' of root (wilt) disease by crossing root

(wilt) disease-free Chowghat Green Dwarf female parents with pollen of root (wilt) disease-free West Coast Tall male parents and was found to be a high yielding root (wilt) disease tolerant variety suitable for cultivation in the root (wilt) affected tracts in the country. The palms of this variety are semi-tall in nature with precocious bearing habit. The palms attain a height of around 4.98 m at 18 years of age and come to flowering 3-4 years after planting. The agronomic features of this variety are its high yield, early bearing nature and tolerance to root (wilt) disease. The quantity of tender nut water is 373 ml and sweet in taste.

Kalpa Sankara requires adequate plant protection measures against major pests particularly red palm weevil when large scale plantings are adopted. Drought tolerance studies using different coconut hybrids reveals that tolerance to moisture stress was significant in CGD x WCT. The hybrid gives better yield under rain fed conditions in farmer's plots in the root (wilt) disease prevalent tract. Considering the superior performance of the hybrid coconut variety Kalpa Sankara at CPCRI Regional Station, Kayamkulam, located in the root (wilt) diseased tract, the variety was proposed for release by CPCRI and recommended by XIX Biennial Workshop of the All India Coordinated Research Project on Palms in the year 2009 for release for cultivation in the root (wilt) affected tracts in the country. Kalpa Sankara was released and notified for cultivation in the root (wilt) affected tracts of the country by the Central Sub-committee on Crop Standards, Notification and Release vide Notification of Ministry of Agriculture (Department of Agriculture and Co-operation) S.O. 456 (E) dated March 16, 2012.

Kalpa Sreshta:

Kalpa Sreshta is a high yielding, Dwarf x Tall (DxT) hybrid involving selections from MYD as the female parent and selections from WCT as the male/pollen parent. The female parent palms are dwarf, takes 38 months for flowering, bears bright yellow fruits and has yellow petiole colour. The male parent palms are tall, bearing green fruits and takes about 87 months for flowering. Kalpa Sreshta is a dual-purpose variety, suitable for cultivation as copra and tender nut variety. The palms of this variety are vigorous in growth, tall in plant habit and attain an average height of 10.05m 23 years after planting. The palms are without prominent bole. The colour of the petiole is green. The variety Kalpa Sreshta is characterized by vigorous growth habit, higher rate of spathe production, high nut yield; green coloured fruits; more female flowers/inflorescence and tender nuts having more water with good taste. The fruits of this variety are oval shaped, with the dehusked fruits being round in shape. The palms of the variety Kalpa Sreshta are regular bearers and commence flowering in 6-7 years after planting. However, under irrigated conditions, the palms are expected to commence flowering within 4 years after planting. The average annual nut yield of this variety is 167 nuts/palm/annum, under irrigated conditions, with an estimated annual high copra out turn of 35.9 kg/palm/year (6.28t/ha copra). The variety Kalpa Sreshta is superior to Chandra Sankara, the earlier released D x T hybrid (COD X WCT), and gives 35.75% more nut yield and 30.29% more copra yield over Chandra Sankara.

No major pest attacks and disease out breaks have been observed under field conditions at Kasaragod, Kerala and Arsikere, Karnataka. However, the Kalpa Sreshta variety, with a disease score of about 11% is categorized as moderately susceptible to grey leaf blight caused by *Lasiodiplodia theobromae* and stem bleeding caused by *Thielaviopsis paradoxa*.

The average quantity of tender nut water in the variety Kalpa Sreshta is 368 ml. Based on the organoleptic test; the tender nut water is classified as "good" in taste with a TSS of 5.890 Brix, with total sugar content of 5.81g/100ml and amino acid content of 1.34g/100ml. The tender nut water has Na content of about 33.3 ppm and K content of 2081 ppm. The average weight of the fruits of this variety is 940.09 g with weight of husked fruit being 610g. The average copra content is around 215 g and copra oil content is about 64.1%.

The hybrid Kalpa Sreshta is found to be high yielding under irrigated conditions both at CPCRI Kasaragod and at AICRPP Centre, Arsikere and hence is recommended for cultivation in the coconut growing tracts of Kerala and Karnataka by the XXIII Workshop of the All India Coordinated Research Project on Palms during July 2013. Kalpa Sreshta will help in enhancing the coconut productivity as this hybrid gives an average yield of 29227 nuts per ha which will provide 6.28 tons copra per ha.

References

Chowdappa P., Niral V., Jerard B.A. and Samsudeen K. (Eds.) (2017) Coconut. Daya Publishing House, A Division of Astral International Pvt. Ltd. New Delhi, India. 440p.

Coconut Development Board (2016-17). Area, Production & Productivity of Coconut in India. http://www.coconutboard.nic.in/stat.htm

Patel, J.S. (1937) Coconut breeding. Proc. Assoc. Econ. Biol.5: 1-16. ■

Management of Coconut Gardens in Flood Affected Areas

Thamban C, Subramanian P, Murali Gopal, Vinayaka Hegde and Mathew A C
ICAR- Central Plantation Crops Research Institute, Kasaragod

Introduction

Agriculture sector in Kerala state has been badly hit by the recently occurred flood and huge crop loss has been reported. The preliminary assessment of loss by the State Department of Agriculture has indicated an economic loss of more than Rupees 5600 crores due to the damage of crops in about four lakh farm holdings covering about 146000 ha. Coconut also suffered loss due to the heavy rain and flood situation prevailed in the state. The preliminary assessment report indicated that about 12 lakh coconut trees were damaged in about 7000 ha of area causing an economic loss of about 63 crores of rupees. Concerted efforts are being made for the revival of agriculture sector in the state and farmers need all support for the same. The need of the hour is to enable farmers to adopt appropriate crop management practices in the post flood scenario to protect the crops and to avoid further loss. Effective strategies are to be formulated for implementing suitable location specific interventions for promoting adoption of scientific practices for improving soil and crop health.

Nature of damage

In many localities, especially in the sloppy terrains, the fertile top soil has been washed off from coconut gardens due to the heavy rain resulting in extensive leaching of nutrients which would adversely affect crop health. Landslides occurred in some localities in the hilly areas caused widespread destruction of farm land and coconut gardens have been wiped out. Incidence of fungal diseases like bud rot and nut fall got flared up due to the continuous heavy

rainfall. Coconut gardens remained waterlogged for a long period in many localities due to the heavy rain and flood and coconut palms have shown yellowing of leaves since the feeder roots were affected resulting in restricted or impaired nutrient uptake. In such waterlogged areas the physical, chemical and biological properties of soil in the coconut gardens have been adversely affected. Intercrops such as pepper, nutmeg and cocoa are also damaged to the heavy rain and water logging. Nutmeg trees and pepper vines have dried in many places mostly because of the damage to roots and subsequent fungal infection. In cocoa crop loss due to fungal diseases viz., black pod disease and die back disease have been observed in many localities across the state. Arecanut palms grown as mixed crop along with coconut also suffered crop loss due to the incidence of fungal disease; fruit rot disease and nut fall due to the heavy rainfall and water logging condition in the garden. Farmers could not adopt timely spraying of fungicides due to the continuous rain. Similarly crops like banana, cassava, elephant foot yam, etc intercropped in coconut gardens also were damaged due to flood. In many localities, large scale deposition of silt has occurred in coconut gardens. Coconut gardens located adjacent to river bed are deposited mostly with sand and in far off places with silt and clay particles. Gardens deposited with sand may show decreased soil fertility whereas in other orchards where silt and clay are deposited can increase soil fertility and thus crop productivity. However, it is also necessary to analyse whether heavy metal toxicity is caused to palms due to the silting through flood water from contaminated rivers. After flood water recede from the field the silt and clay deposits form into a hard pan on soil surface adversely affecting the structure of the soil. Aeration in the soil and movement of water into and out of the soil are adversely affected by the formation of hard pan.

Crop management practices

The following measures are suggested to improve the soil/crop health in coconut gardens:

▶ *Field/crop sanitation*

- Sanitation drive has to be taken up to clear fallen coconut trees and completely damaged and dried up inter/mixed crops and other accumulated biomass to prevent insect pest breeding and fungal spore multiplication in the garden
- Remove the fallen and fungal infected immature nuts in coconut garden and spray the bunches with 1% Bordeaux mixture.

▶ *Crop health management*

- In the bud rot affected coconut palms, remove the infected tissues of the spindle completely. Two or three healthy leaves adjacent to the spindle may have to be removed, if necessary, for easy removal of all rotten portions and thorough cleaning. After removing the affected tissues apply 10% Bordeaux paste and cover the wound with a polythene sheet to prevent entry of rain water. The protective covering has to be retained till normal shoot emerges. Destroy the infected tissues removed by burning or deep burying in the soil and spray 1% Bordeaux mixture to the surrounding palms.

▶ *Soil health management*

Wherever top soil loss have taken place in coconut gardens due to flooding/washing off soil, addition of organic manures and application of nutrients must be carried out.

- Compost/FYM/green leaves @ 50 kg/palm may be applied
- 1 kg Mureate of potash may be applied per palm
- Application of 500g common salt/palm also will be beneficial

Improving aeration in the soil

Wherever compaction has occurred due to prolonged water stagnation and silt deposition

- Liming for loosening of the soil have to be undertaken. 1 kg lime and 500 g Magnesium sulphate or 1 kg dolomite must be applied in the basin.
- Apply 5 kg neem cake enriched with Trichoderma in the basins of coconut palms.

Drainage

- Importance must be given to provide adequate drainage in coconut gardens where water stagnation has taken place.

▶ *Stabilisation of land slide sites*

Wherever complete land mass have been destroyed and crops including coconut have been washed off due to landslide interventions for stabilisation of the area have to be undertaken including the following:

- Maintain the naturally formed water course after the land slide
- Convert the steep bed slope into a series of near level slope by making check dams using boulders

available nearby

- Convert the water course to a vegetative waterway; by seeding with close, fast growing grass species to check further erosion in the erosion prone area within the land mass subjected to land slide
- Wherever possible retaining wall for side protection ; coir geotextiles ideal for immediate protection.

Management of inter/mixed crops

▶ *Pepper:*

- Provide adequate drainage in the field.
- Drench Potassium Phosphate 0.3 % or Copper oxy chloride 0.2% at the baseoif the vine
- Spray Bordeaux mixture 1% on the foliage as a protective measure
- In cases where feeder root damage is suspected, foliar nutrition may be attempted by spraying foliar application of 1 Per cent solution of 19:19:19

▶ *Nutmeg and clove:*

- Provide proper drainage facility in the field
- Ensure field sanitation by removing dead and decaying branches and other debris from the field
- In trees with severe leaf fall and or drying cut and remove the completely affected branches and apply Bordeaux paste
- Spray 1% Bordeaux mixture on the foliage
- Drench the tree basin with Copper oxy chloride 0.2 per cent
- Observe the tree trunk and branches for symptoms of shot hole borer infestation and apply insecticides if necessary to control the pest

Cocoa

- Remove completely dried and damaged trees
- Collect and destroy fallen and black pod disease affected pods
- Cut and remove dried-up branches affected by die-back disease and apply 10% Bordeaux paste for wound dressing and spray the treated trees and remaining healthy plants with 1% Bordeaux mixture
- Drench the tree basin with 1% Bordeaux mixture

▶ *Arecanut*

- Collect and destroy the fallen nuts, dried bunches and inflorescences affected by fungal infection
- Spray 1% Bordeaux mixture to the bunches
- Provide proper drainage facility in the field

Soil analysis

A detailed soil analysis for physical, chemical and biological properties must be carried out and suitable soil health improvement interventions must be worked out.

Quantification/characterization of crop loss

Efforts should be made for proper quantification/ characterization of crop loss and to implement schemes to provide compensation for the farmers accordingly and also schemes to facilitate adoption of technological interventions to solve the field problems and revive coconut farming in flood affected areas.

Location specific interventions and community action

Location specific interventions for soil/plant health in coconut gardens in the flood affected areas must be implemented with the active involvement of farming community. FPOs in coconut sector including the three-tier system of Coconut Producer Society-Coconut Producer Federation-Coconut Producer Company facilitated by Coconut Development Board (CDB) and FPOs promoted by State Department of Agriculture under the ongoing 'Keragramam' project can play a significant role in mobilising coconut farmers for community action to implement interventions related to crop management practices in flood affected areas with the support of LSGs through decentralised planning and development agencies like CDB and Department of Agriculture through their schemes implemented for coconut development. ■

Nursery Practices and Seedling Selection in Coconut

Samsudeen, K., Niral, V., Ranjini, T. N. and Sudha, R.
ICAR- CPCRI, Kasargod

Introduction

Best quality coconut seedlings should be selected to start a plantation since the crop will be in the field for many years. The long life span and large capital outlay involved in establishing a coconut plantation, necessitates the selection of good quality seed nuts and seedlings, as a first step for the successful cultivation of the crop. If poor quality planting materials are used for planting, the new plantation can prove to be uneconomic, causing considerable loss of time and money to the grower. Therefore, selection of good quality seed nuts and seedlings is of great importance in the establishment of coconut plantations. Further, as coconut is cross pollinated, the palms do not breed true making the selection of seed nuts and seedlings more difficult and at the same time, important. It is possible to improve the quality of the planting materials through a series of selections at the various stages of seed and seedling production. The various aspects of nursery techniques and selection procedures are discussed in the this article.

Mother palm selection

For production of quality planting material, it is essential to have good quality mother palms of the desired varieties. In the absence of commercially viable vegetative propagation techniques, only seed propagation is possible. Therefore, mother palm selection is a key factor in planting material production of coconut. Trees growing near cattle sheds, wells and other favored conditions should be avoided, as their true genetic potential may be masked because of favorable environment.

Mother palms should be aged 22 years or more since it will be necessary to observe their yield for at least 10 years after stabilization of yield. From young seed gardens, seed nuts can be collected irrespective of the age of the mother palms, since only high yielding palms with known genetic potential are maintained in the seed gardens. (Patel, 1938).

Collection and Storage of nuts

Seed nuts can be collected throughout the year.

However, it is preferable to collect seed nuts during the period from January to May in the West Coast region, so that sowing can be taken up with the onset of south west monsoon. In the East Coast, seed nuts are collected during the period from May to September and are sown during October–November with the onset of north east monsoon. Fully matured nuts i.e. about 12 months old should be harvested. Care should be taken not to damage the seed nuts while harvesting. Nuts which are too big or too small in the bunch and also the nuts of irregular shape and size should be discarded. Seed nuts of tall varieties are to be sown 2-3 months after collection, whereas dwarfs should be sown within 15-30 days after harvest (Liyanage, 1950). For storing, arrange the seed nuts with the stalk-end up over an 8 cm layer of sand in a shed and cover with sand to prevent drying of nut water. The nuts can also be stored in plots, provided the soil is sandy and the ground is sufficiently shaded. (John and Narayana, 1942).

The important feature of a good motherpalm
a) Regular bearer,
b) Straight stout trunk with even growth and closely spaced leaf scars,
c) Spherical or semi-spherical crown with short fronds,
d) Short and stout inflorescence stalk with bunches, preferably resting on the leaf petioles of the lower whorl,
e) More than 30 leaves and 12 inflorescences carried evenly on the crown,
f) Inflorescence with 25 or more female flowers,
g) Consistent high nut yield (about 70 to 80 nuts/annum under rainfed conditions or 100-120 nuts under irrigated conditions),
g) More than 150g copra per nut,
h) Absence of disease and pest incidence.

Nursery site selection

A good nursery should be open, level and well-drained have loose or slightly textured soil to facilitate nursery operations. It should have a good source of water for irrigation, proper shade and accessible to transportation. It should be far from potential sources of coconut insect pests and diseases. A fence for security, a shed for implements and supplies and trained manpower are the other requirements for a coconut nursery.

a. Soil: Coconut is adapted to a wide range of soil types from coarse sand to deep soils. However, well-drained friable sandy, sandy loam/loam soils are best suited for coconut nursery due to the relative ease in removing the seedlings from the nursery. In laterite soils, sand has to be applied to the nursery beds. Heavy/clayey soils and waterlogged soils are to be avoided. The ideal soil pH ranges from 5.5 to 7.0 and the seedlings are tolerant to a pH range from 4.5 to 8.5. Under irrigation, coconut seedlings tolerate saline and alkaline soils.

b. Climate: Coconut palms are cultivated in humid regions lying between latitude 27^{o}N and 27^{o}S. They are well adapted to full sunlight. However, the nursery area is to be preferably shaded to get good quality seedlings without sun scorch. The optimum temperature range for better growth of seedlings is from 21^{o}C to 35^{o}C. Though coconut can withstand temperatures beyond this range, the growth, development and yield will be affected. Coconut palms are well adapted to areas receiving an annual rainfall ranging from 600mm to 4000mm. Seedlings can be produced at an altitude ranging from sea level to an elevation 800m above mean sea level.

c. Water Source: A perennial source of water is required for maintenance of coconut palms and irrigation is essential for obtaining good coconut yield. Further, the nursery has to be irrigated regularly for production of planting material. Sprinkler/ micro jet sprinkler/hose irrigation systems are well suited for irrigating coconut nurseries.

d. Nursery Structures: Nursery can be raised in the interspaces of the coconut plantation. The nursery area is to be provided with shade using 50-75% shade net if the nursery area is in an open space. About 120m^2 area would be required to sow 1000 nuts in flat or raised beds whereas larger area of 200m^2 would be required to maintain 1000 poly bag coconut seedlings.

Seedling Production:

a. Time of sowing: The time of sowing seed nuts in the nursery will vary depending on the location (agro-climatic zone) and the monsoon. The most appropriate time for sowing seed nuts in the West Coast region is May-June. However, seed nuts can be sown all round the year under favorable climatic conditions and good irrigation facilities.

b. Nursery bed preparation: Seedbeds should be prepared in an area having loose and well-drained soil. Raised beds of 10-20 cm height are made to provide good drainage. Seedbeds are generally of 1m width and convenient length with 75cm space between beds. The seedbeds should be drenched with Chlorpyriphos @ 0.05% before sowing of seed

nuts, in areas having termite problem. To prevent bud rot in seedlings, the nursery can be drenched with 1% Bordeaux mixture, in bud rot endemic areas.

c. Sowing of nuts: Plant the seed nuts at a spacing of 30 cm (between rows) x 30 cm (between nuts) with four or five rows per bed. The nuts may be planted either horizontally with the widest of the segments at the top or vertically with stalk-end up. While sowing vertically, set the nuts firmly in either upright or slightly tilted position with the germ end at the top. Then cover them with soil, with about 2/3 of their size buried or plant the seed nuts in the beds in trenches 25-30 cm deep and cover with soil so that top portion of husk alone is visible. Keep a record file and a sign board placed in front of each bed indicating the: name of variety/type sown, date of sowing, number of nuts sown, seedbed number and date of harvest.

d. Irrigation: The seed beds should be irrigated regularly to ensure that the soil is moist. After sowing, the seed beds should be irrigated thoroughly to saturation levels and repeated as frequently as necessary. During summer months, the beds may be irrigated on alternate days. Irrigation can be provided through hose/micro sprinklers.

e. Mulching: The seed beds can be covered with suitable mulch (coconut leaves, straw or green leaves etc.) to conserve moisture and check the weed growth.

f. Weeding: The nursery should be kept free of weeds to allow good growth of the seedlings.

g. Management: A record should be maintained indicating the name of variety sown, date of sowing, number of nuts sown, seedbed number and date of seed nut harvest. A signboard should be placed preferably in front of each bed indicating the name of variety sown along with the date of sowing.

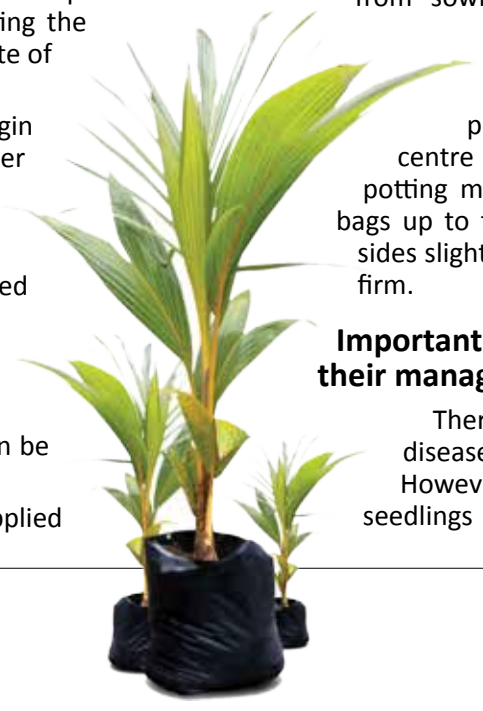
Seed nuts of tall varieties begin germination within 60-130 days after sowing and seed nuts of dwarf varieties germinate 30-95 days after sowing. Generally, germination is recorded till the fifth month of sowing and a good seed lot will give 80 to 90% germination. Seed nuts that do not germinate within 5 months after sowing as well as those with dead sprouts can be removed from the nursery. Such rejected seed nuts can be used for production of copra.

Chemical fertilizers need not be applied to the seedlings in the nursery since the seedlings are usually nourished by the endosperm. Moreover, application of chemical fertilizers can mask the true genetic potential of seedlings, making the selection of genetically superior seedlings difficult.

Poly bag seedling production

Poly bag nursery can be adopted for producing more vigorous seedlings with better root system. Compared to the nursery in the field, watering, weeding and roguing operations for the elimination of unwanted seedlings are easier in poly bag nursery. The seedlings can be raised in black polythene bags (500-gauge thickness) of 60 cm x 45 cm size for bigger nuts and 45 cm x 45 cm for smaller nuts. The bottom of the bags is to be provided with 8-10 holes for draining the excess water. To fill 100 bags, around 2-2.5m^3 of potting mixture will be required. The commonly recommended potting media are top soil mixed with sand in 3:1 ratio or fertile top soil, sand and well rotten and powdered cattle manure/ vermicompost in the ratio of 3:1:1. Red earth, well rotten and powdered cattle manure/vermicompost and sand in 1:1:1 ratio can also be used. Fertilizers can be applied in the poly bags @ 20g ammonium sulphate and 25g muriate of potash per bag after two months of germination and 45g of ammonium sulphate and 45g of muriate of potash per bag after four months of germination. Seedlings are to be watered after application of fertilizers.

In order to produce poly bag seedlings, the seed nuts are initially sown very closely and allowed to germinate in a pre nursery bed. The germinated nuts are picked out from nursery once in a week, until 80% of nuts have germinated or up to 5 months from sowing, whichever is earlier. The germinated nuts are placed in half filled poly bags with the sprout positioned upwards in the centre of the bag and sufficient potting mixture is added to fill the bags up to two-third portion and the sides slightly pressed to keep the nut firm.



Important diseases/pests and their management

There are no serious pest and diseases in coconut nurseries. However, bud rot affected seedlings are to be avoided for

planting.

Bud rot: The fungus, Phytopthora palmivora, causes this disease. The symptoms are yellowing and withering of the spindle leaf followed by drying and death of the seedlings. The spindle of the affected seedlings will easily come out with a gentle pull and rotting can be seen in the lower end of the detached leaf. The affected portion emits a foul smell. Though it is not a major problem in coconut nurseries, the affected seedlings are to be removed and the surrounding seedlings treated with 1% Bordeaux mixture**.**

Scale insect (Aspidiotus destructor): The characteristic symptom is yellowing of leaves and presence of scale insect underneath the leaves. Though the insects do not pose serious threat to the seedlings, this can be controlled by drenching the nursery with Dimethoate @ 0.05% to ensure good quality and healthy foliage of seedlings.

Termite: Drying of the sprouts and leaves are the symptoms of termite damage in the nursery. Drenching the nursery with Chlorpyriphos @ 0.05% will control the termites.

White grub *(Leucopholis coneophora)*: This occurs mainly in sandy soils. The characteristic symptom is yellowing of leaves followed by drying of leaves and death of the seedlings due to severe root damage. This can be controlled by application of Phorate 10 G @ 15g/seedling.

Selection of seedlings

Remove seed nuts, which do not germinate within 6 months after sowing as well as those with dead sprouts. Select only good quality seedlings (9-12 months old) by a rigorous selection based on the following characteristics.

1. Early germination, rapid growth and seedling vigour.
2. Six to eight leaves for 10-12 month old seedlings and at least four leaves for 9-month-old seedlings.
3. Collar girth of 10-12 cm.
4. Early splitting of leaves. 1.(Jack and Sands, 1929 and Liyanage, 1955)

Since early germination is one of the criteria for the selection of seedlings, the storing and sowing of seed nuts should be in lots according to the harvest and should not be bulked.

Removal and transportation of seedlings

Seedlings should be removed from the nursery by lifting with a spade. Seedlings should never be lifted from the soil by pulling the leaves or petiole. The seedlings should be planted as early as possible after removal from the nursery. The seedlings can be kept for about four weeks under careful storage after removal from the nursery. In such cases, the seedlings should be kept under shade and also watered.

Poly bag nursery can be adopted for producing more vigorous seedlings with better root system. Compared to the nursery in the field, watering, weeding and roguing operations for the elimination of unwanted seedlings are easier in poly bag nursery.

Seedlings can be compactly packed and transported. For very long distance transportation, special care should be taken to pack the seedlings in moss/coir pith/other moisture retaining material. Poly bag seedlings can be transported as such and planted directly in the field, after cutting and removal of the base of the poly bag to facilitate growth of roots.

References

Chowdappa P., Niral V., Jerard B.A. and Samsudeen K. (Eds.) (2017) Coconut. Daya Publishing House, A Division of Astral International Pvt. Ltd. New Delhi, India. 440p.

Chowdappa, P., K. Samsudeen, C. Thamban and M.K. Rajesh (Eds.) (2016). Planting material production in coconut. Today and Tomorrows Printers and Publishers, New Delhi, India. 130p.

Jack, H.W and Sands, W.N. (1929). Observations of the dwarf coconut palm in Malaya. Malay Agric J, 17:140-170.

John, C. M and Narayana, G-V.1942. Asimple method of preserving seed coconuts. Madras Agric. J.30: 148-49.

Liyanage D.V. (1950). Sex life of the coconut palm. Ceylon Coconut Quarterly 11(2): 33 - 35.

Liyanage, D.V. (1955). Planting material for coconuts. Paper presented at the coconut conference, 29th August Bandirippuwa Estate, Lunuwila Coconut Research Institute, Ceylon.

Patel, J.S. (1938) The coconut: a monograph. Government Press, Madras, p 311

Blends of coconut oil

Dr. Surjit Kumar Saha
Chartered Engineer & Oil Technologist
3-AF, Green Park, Tagore Road, Civil Lines, Nagpur - 440 001

Coconut oil is an edible oil extracted from the kernel of mature coconuts harvested from the coconut palm. India produces about 3.5 million tons of Coconut Oil each year. Coconut oil contains 91 percent of saturated fatty acids, 6 percent of monounsaturated fatty acids and 2 percent of Polyunsaturated fatty acids. This makes coconut oil highly resistant to oxidation at high heats. For this reason, it is the perfect oil for high-heat cooking methods like frying.

Coconut oil consists almost entirely of Medium Chain Triglycerides which have an entirely different metabolism process as compared to long chain Triglycerides. These medium chain fatty acids go straight from the digestive tract to the liver, where they are turned into ketone bodies and provide a quick source of energy. The most abundant fatty acid in coconut oil is lauric Acid, which is broken down into a compound called monolaurin in the body. Lauric acid and monolaurin are both very interesting substances due to their inherent antibiotic properties by virtue of which they can kill microbes like bacteria, fungi and viruses in the human body. For this reason, coconut oil can also act as a protective agent against various infections..

Unrefined coconut oil actually improves blood lipid profiles. In two separate rat studies conducted in Kerala, India, consumption of virgin coconut oil was compared against refined coconut oil and corn oil. The virgin coconut oil significantly reduced Total and LDL cholesterol, oxidized LDL, triglycerides and increased HDL cholesterol. It also had favorable effects on blood coagulation factors and antioxidant status. In a further study of women with abdominal obesity, coconut oil increased HDL and lowered the LDL:HDL ratio, while soybean oil increased Total and LDL cholesterol and decreased HDL. The medium chain triglycerides in coconut oil have also been shown to reduce blood triglycerides compared to long chain fats. Coconut oil is therefore protective against heart disease and not the other way around as per the negative myths associated with this oil.

Further, there is considerable evidence that coconut oil can help in losing weight. Animal and human studies have shown that the fast rate of oxidation of medium chain fatty acids leads to greater energy expenditure. Most animal studies have also demonstrated that the greater energy expenditure with medium chain fatty acids relative to long-chain fatty acids results in less body weight gain and decreased size of fat depots after several months of consumption. In a study conducted in Brazil on 40

Coconut oil can be blended with conventional edible oils such as groundnut, soybean, safflower, sesame and mustard oil. The approximate contents of saturated, monounsaturated and polyunsaturated fatty acids of different oils and their corresponding S:M:P ratios of the individual oils and their blends with equal amounts of the other conventional oils are presented in Table-1 and Table-2.

women with abdominal obesity, coconut oil reduced waist circumference compared to soybean oil while also improving other health markers. Medium chain triglycerides have also been consistently shown to promote weight loss in both animal and human studies.

Despite the aforesaid multiple benefits of consuming coconut oil, it is often looked upon by an element of fear by the general public mainly due to historical myths and unwarranted adverse publicity. Coconut Oil has a typical taste and odour which restricts its consumption and it is here that the phenomenon of blending Coconut Oil with other conventional oils comes into the picture. Blending of Coconut Oil with other conventional oils will not only increase the consumption of indigenous Coconut Oil but also tend to bridge the gap between demand and supply of edible oils resulting in lower imports and conservation of foreign exchange.

Coconut Oil can be blended with conventional edible oils such as groundnut, soybean, safflower, sesame and mustard oil. The approximate contents of saturated, monounsaturated and polyunsaturated fatty acids of different oils and their corresponding S:M:P ratios of the individual oils and their blends with equal amounts of the other conventional oils are presented in Table-1 and Table-2 respectively.

Table-1: Saturated, Monounsaturated and Polyunsaturated Fatty Acid Content of Rice Bran Oil and Some Conventional Oils

OIL	SAFA	MUFA	PUFA	S : M : P
Coconut Oil	91	06	03	30.3:2.0:1.0
Groundnut Oil	21	43	36	1.0:2.0:1.7
Soybean Oil	17	25	58	1.0:1.5:3.4
Safflower Oil		07	15	78
Sesame Oil	20	40	40	1.0:2.0:2.0
Mustard Oil	07	63	30	1.0:9.0:4.3

TAable-2 : Saturated, Monounsaturated and Polyunsaturated Fatty Acid Content of Blends of Coconut Oil with some Conventional Oils

No.	Oils in Blend	Content in Blend	S:M:P of Blend
1.	Coconut Oil	50%	2.9:1.3:1.0
	Groundnut Oil	50%	
2.	Coconut Oil	50%	3.5:1.0:2.0
	Soybean Oil	50%	
3.	Coconut Oil	50%	4.7:1.0:3.9
	Safflower Oil	50%	
4.	Coconut Oil	50%	2.6:1.1:1.0
	Sesame Oil	50%	
5.	Coconut Oil	50%	3.0:2.1:1.0
	Mustard Oil	50%	

Blending of Coconut Oil with other conventional oils increases the saturated fatty acid content and decreases the polyunsaturated content of the blends resulting in better antioxidant activity and enhancing the keeping quality of the blend. Increase in the quantum of lauric acid in the blend would not only improve the S:M:P ratio of the blends but also improves the antibiotic activity of the blends. Moreover, the saturated fatty acids in the blends are the medium chain acids from coconut oil which are converted into energy faster, are easier to digest and also help to boost body metabolism thereby contributing to alleviation of obesity. They also increase the body's absorption of antioxidants to promote health. Apart from this, blending of Coconut Oil with conventional oils according to regional preferences would also tend to improve the organoleptic properties of Coconut Oil as per regional preferences. However, much work is needed in this direction to educate the general public about the potential benefits of consumption of coconut oil as such or in blends with other conventional oils to dispel the negative myths and unwarranted adverse publicity associated with consumption of coconut oil. ■

Banana cv. Ney poovan Potential Intercrop in Coconut Plantation

G. Panjavarnam, S. Parthiban *, P. Subramanian and Ravi Bhatt,
Division of Crop Production, ICAR-Central Plantation Crops Research Institute, Kasaragod
*Department of Fruit Science, Horticultural College and Research Institute for Women, TNAU, Trichy -24

Coconut is one of the commercially important plantation crops cultivated in India. Coconut being widely spaced owing to its morphological features provide ample opportunities for cropping in the interspaces. Sahasranamam and Pillai (1976) observed that only 23 per cent of the soil on area basis is effectively utilised by the coconut roots in a coconut plantation planted at 7.5m spacing. The effective root zone of an adult bearing palm growing under normal management is confined laterally within a radius of 2m around the base of the palm. About 74 per cent of roots do not extend beyond this distance. On depth basis, the top 30 cm layer is practically devoid of functional roots and 80 per cent of the roots are found between 30 cm and 120 cm depth from surface. It was further confirmed that more than 80 per cent of the root activity was confined to a lateral distance of 2m from the trunk. This shows that on an area basis of total available land in a pure palm stand is not effectively utilised by coconut roots and can support many more crops. Thus, the active root zone of coconut is confined to 25 per cent of the available land area and the remaining area could be profitably exploited for raising subsidiary crops (Reddy and Biddappa, 2000).

Banana (Musa sp.) is the second largest fruit crop grown in the world. In India, it is one of the most important commercial fruits which contain more carbohydrate and energy. Therefore it is mostly used in raw and cooked form. In India, banana is cultivated in an area of 830.5 thousand ha with an annual production of 29,779.91 thousand tons (NHB, 2018). Banana is originated from South East Asia, a region considered as the primary centre of diversification of the crop and where earlier domestication has occurred (Simmonds, 1966). Bananas and plantain are mostly grown not only for their nutritional value but also for their economic importance. Banana fruit is highly nutritious, easily digestible than many other fruits and it is popular for its aroma and texture. It is rich in K, Ca and low in Na and Fe content. It is an ideal food for weaning infant mother. The demand for banana is increasing day by day due to its nutritional value and high economic return realized by the farmers.

Performance of banana cv. Ney Poovan under coconut plantation

Coconut based cropping systems involving cultivation of compatible crops in the interspaces of coconut offer considerable scope for increasing productivity unit area, time and inputs by more efficient utilization of resources like sunlight, soil, water and labour (Bavappa and Jacob, 1982). Hence, the interspaces of coconut plantation can very well be utilized by introducing profitable fruit crops like banana. Banana cv. Ney Poovan is the choicest diploid (AB) cultivar (Syn: Kadali, Elakki bale, Njali Poovan) which is under commercial cultivation on a large scale especially in Karnataka and Tamil Nadu. The pseudostem of Ney Poovan is slender and bears bunch of 15-25 kg in crop duration of 12-14 months. The dark green fruit turn into golden yellow colour on ripening and the pulp is consistent, firm, fragrant and tasty with good keeping quality. Moreover, many earlier studies showed that banana cultivars are found to be shade tolerant. Further, it was clearly indicated that banana cultivation as suitable intercrops under coconut plantation was highly productive and profitable. In this context, an experiment was conducted for two years to study the comparative efficiency of planting system and

nutrient management in banana cv. Ney Poovan under coconut plantation at Department of Fruit Crops, TNAU, Coimbatore. The results revealed that there was a positive response in terms of plant growth, reduced the number of days taken from planting to shooting, shooting to harvest, reduce the total crop duration and highest yield (11.50 kg per bunch) obtained in the treatment combination of application of 100 per cent RDF (As per TNAU Recommended fertilizer for banana-110g :35g :330 g N P K / plant / year) along with Azospirillum @ 100g plant-1 + Phosphobacteria @ 100g plant-1+ AM fungi @ 100g plant-1 in single row planting system. The highest yield was attributed to more number of hands per bunch, finger per hands and as well to the higher average weight of fingers. Benefit cost ratio (2.52) is also highest in the same treatment and found that it will boost the farmer income (Fig .1).

Fig 1 View of single row planting system under coconut plantation

The research at CPCRI clearly indicated the scope for integration of Coconut with other component crops. Coconut based HDMSCS, initially conceptualized and developed in the eighties and further refined in the succeeding years, is a highly versatile, sustainable, profitable system, optimizing the use of available resources. Different models tailor-made for various agro-ecological zones and suiting different requirements of households have also been evolved over the years. By the latest projections, a coconut based cropping system using multi species cropping of coconut with pepper, banana, nutmeg, pineapple, ginger, turmeric and elephant foot yam generated a net income of Rs. 3.7 lakhs per ha, which is 150% higher than that of coconut monocrop (1.4 lakhs)

Multi species cropping system has further evolved into mixed farming system by integrating livestock enterprises in to it. It is a classic case of the society demanding it and the research institution answering the distress call. Off late, the coconut growers are exposed to economic risks and uncertainties owing to the frequent price f1uctuations for the produce. In this context, it is needless to emphasize the importance of crop/ enterprise diversification in coconut gardens. The research at CPCRI clearly indicated the scope for integration of crops and animals in the coconut garden for enhancing income and providing employment throughout the year. The system, thus developed, is a closed one, requiring less off- farm inputs, and gives importance to recycling of produces / wastes among the components in the system. It facilitates high input use efficiency and energy-efficient practices through proper linking/ integration of different components and intelligent management of available resources. Besides enhancing coconut yield, there was substantial improvement in soil and plant health status, soil physical properties and soil biology, thereby making CBIFS more economically feasible and ecologically sustainable. Added attraction is that subsidiary income is also realized from all the component units. As per the recent investigations, a coconut based mixed farming system (CMFS) comprising coconut, pepper, banana, fodder grass, crossbred cows, poultry birds, goat, and pisciculture generated a net return of ` 5.5 lakhs, which is 288% higher than that of coconut monocrop (Chowdappa et al., 2016).

CPCRI, Kasaragod also conducted experiment during the year 2011 in order to utilize the available land resource effectively and generate more income from the system banana was chosen as a component crop and it was planted around the periphery during 2011. In one hectare area of coconut plantation approximately 195 banana suckers were planted in an interval of 2m under single row system.

Fig 2. View of double row planting system under coconut plantation

Cultural practices were adopted as per the package of practices. From this crop component, 728 kg of biomass on dry weight basis was produced per annum, which was recycled into the system (Subramanian et al., 2016).

Cultivation of banana cv. Ney Poovan under coconut plantation.

Trim the roots and decayed portion of the corm, cut the pseudostem leaving 20 cm from the corm and grade the suckers to size to avoid wilt diseases, infected portion of the corm may be pared and dipped for 5 minutes in 0.1% emisan solution (1 gram in 1 litre of water), pralinage is done with 40 g of carbofuran 3 G granules per suckers (dip the corm in slurry solution containing 4 parts clay with 5 parts water and sprinkle carbofuran to control nematodes). Alternatively, dip the corm with 0.75% monocrotophos, shade dry for atleast 24 hours before taking plantings. The treated corms are planted in a pit size of 45 cm x 45 cm x 45 cm in single row system and double row system interspaces between the coconut garden. The recommended spacing for banana 1.8 m x 1.8 m was adapted. As per TNAU Recommended doses of fertilizers (RDF) for banana 110g :35g :330 g NPK per plant per year was applied as per treatment schedule. The treatment consisting of two factors, one is planting density (single row planting system and double row planting system) and another one is nutrient management (75 % RDF alone , 100% RDF alone,125% RDF alone, 150% RDF alone, 75% RDF along with Azospirillum @ 100g plant-1 + Phosphobacteria @ 100g plant-1+ AM fungi @ 100g plant-1 , 100% RDF along with Azospirillum @ 100g plant-1 + Phosphobacteria @ 100g plant-1+ AM fungi @ 100g plant-1, 125 % RDF along with Azospirillum @ 100g plant-1 + Phosphobacteria @ 100g plant-1+ AM fungi @ 100g plant-1 and 150% RDF along with Azospirillum @ 100g plant-1 + Phosphobacteria @ 100g plant-1+ AM fungi @ 100g plant-1). The biofertilizers were applied to the plant twice, one at the time of planting and another at 60 days after planting. Application of inorganic fertilizers as per the treatment schedule was applied at the time of planting, 3rd months after planting, 5th months after planting, 7th months after planting and shooting stage at different split doses. Ten plants of uniform size were selected at random in each treatment for recording the observations. The yield attributes were taken after the harvesting of bunches. Yield attributing characters viz., days taken for shooting, number of hands bunch-1, number of fingers bunch-1, pulp weight, peel weight and pulp peel ratio were recorded and are subjected to statistical scrutiny.

Other cultural operations like watering, weeding, desuckering, propping, removal of withered styles and perianth, pruning of leaves, mattacking, earthing up and denavelling should be carried out as and when required. Harvest the bunch and give a top cut to the plant leaving the pseudostem as such so that the nutrients in it leach down and are available to young plant left for first ratoon (if to be taken). Don't cut the pseudostem from base as it is a common practice of the farmers.

Conclusion

In the present scenario, coconut intercropping is gaining importance. This system will help farmers to get additional income from coconut garden. Growing of intercrops in coconut gardens produces more food and agricultural products, ensuring food security of the people in rural and urban areas. At same time, it generates more employment opportunities and livelihood, enhancing farm income and the purchasing power. Moreover, successful intercropping technology is more useful to the farming community to increase farm income when compared to mono cropping system.

References

Sahasranaman, K. N. and N.G. Pillai. 1976. Mixed farmimg in coconut garden. Intensitve Agric., 14(9): 6-10.

Bavappa, K. V. A. and V. J. Jacob.1982. High Intensity Multispecies Cropping - A new approach to small scale farming in the tropics. World Crops 34 (2): 47-50. ■

Papaya Intercropping - an Income Source for Newly Planted Coconut Gardens

K.Nihad[1], V.Krishnakumar[2] ,M. Rajkumar[3], A.Abdul Haris[4], and Ravi Bhat[5]

[1,3,4] ICAR-Central Plantation Crops Research Institute, Regional station, Kayamkulam, Kerala,India

[3,5] ICAR-Central Plantation Crops Research Institute, Kasaragod, Kerala,India

Coconut is the main plantation crop in coastal India and coconut based cropping system is the major integrated farming method where the families depend on the base crop and other subsequent enterprises for their nutrition and livelihood security. Large number of senile and old palms, lack of proper spacing and non adoption of scientific management practices are some of the major reasons for the low productivity of the palms. Unlike other plantation crops, the unique canopy structure and root distribution of coconut palms provide ample scope for accommodating other crops in the interspaces. During its initial growth phase light is not a limiting factor in the coconut gardens where we can include light demanding crops as well. Coconut plantations as a sole crop are not remunerative during their initial growth phases. Depending on the varieties cultivated, it has a longer juvenile phase of three to six years where planting suitable intercrops is the only way for income generation, food and nutritional security. In this regard, papaya (*Carica papaya L.*) is an ideal fruit crop that can be intercropped which can generate sufficient income to the farmer from

During its initial growth phase light is not a limiting factor in the coconut gardens where we can include light demanding crops as well. Coconut plantations as a sole crop are not remunerative during their initial growth phases. Depending on the varieties cultivated, it has a longer juvenile phase of three to six years where planting suitable intercrops is the only way for income generation, food and nutritional security.

very early stage of coconut cultivation. Around fourty percent of the area in juvenile plantations can be utilized for planting papaya. It has a rapid vegetative growth and starts bearing fruits within three to four months of its growth with an economic life span of two to three years. The fruit has gained higher commercial value due to its high nutritive and medicinal properties. The ripe fruits are rich sources of vitamin A and C. Papain extracted from the dried latex of immature fruits has many industrial uses such as meat tenderiser, chewing gum additive, for degumming natural silk and to give shrink resistance to wool. Unripe fruits are also processed and canned for bakery products such as tuti-fruti. Papaya fruits are a preferred ingredient from cosmetics to pharmaceutical industries. By understanding its market potential, many farmers have now started growing papaya as a commercial horticulture crop which is evident from the substantial increase in the area under the crop during the past decade with a compound annual growth rate of 6.2%.It is an ideal intercrop in juvenile coconut plantation because of its early and continuous fruiting till the coconut palms come to bearing stage.

Var. CO.8

Selection of varieties

Papaya, native of Central and South America belongs to Caricaceae family in which the plants are either dioecious (male and female flowers produced in different plants)or gyneocious (female plants) or gynodioecious (both male and female flowers produced in same plants). Since many papaya varieties are dioecious in nature, selection of a variety is the most important step in starting its commercial cultivation as gyneocious and gynodioecious varieties alone produce fruits. Red Lady (Taiwan 786) is a suitable gynodioecious variety for starting commercial cultivation of papaya in juvenile coconut plantations. The variety Co 8 (variety released from TNAU) also has preferred fruit qualities and comes up well in the interspaces of coconut gardens, but its dioecious nature makes it a less profit crop as its bearing nature will be exhibited only during its fruit bearing stage.

Planting

Around one month old healthy seedlings are used as planting material. For this quality seeds from approved agencies are procured and sown in polybags (15cm x 20cm size) or protrays filled with potting mixture (soil, sand and dried compost or cowdung in 1:1:1 ratio). It can also be sown in raised seedbeds of 2m x 1m and 15 cm height. Seeds start germinating in two weeks time. Soaking of seeds for 8 to 10 hours in 100ppm giberrelic acid solution (100mg in 1 litre water) ensures better germination. Vegetative propagation by mound layering can also be adopted in papaya for multiplication of planting materials from productive plants.

Single row of papaya seedlings can be planted in pits taken at a distance of 3.5m away from the basin of coconut palms. It can be planted in pits (30 cm x 30 cm x 30 cm) which are taken 2 m apart. Pits are filled with top soil along with vermicompost (2.5 kg) and neemcake (0.5kg) and seedlings are planted. For dioecious varieties such as CO 8, three to four seedlings are planted in a pit and once starts flowering, all the plants except a single healthy female plant is retained in the pit. Retention of male plants in 1:10 ratio is recommended for higher fruit yield in dioecious varieties.

Manuring

Papaya can be grown with organic inputs or integrated nutrient management practices. Under integrated nutrient management, apart from basal inputs, inorganic fertilizers such as urea (90g), rock phosphate (200g) and MOP (130g) can be given per plant at bimonthly interval. Additional dose of

Papaya ring spot virus is one of the major threats in papaya cultivation. The symptoms include cholorotic mottling of the leaves with water soaked spots on leaf, stem and fruits. It is a viral disease transmitted by aphids (Myzus persicae, Aphis craccivora and Aphis gossypii). Early detection and removal of affected plants is the only method of controlling the wide spread of the disease.

Var Red Lady

10 to 15 kg/plant dried cowdung can be given after one year of planting. Under organic cultivation, in addition to basal dose of organics, vermicompost (2.5 kg/plant), bone meal (100g/plant) and sulphate of potash (150 g/plant) can be supplied at bimonthly interval. Growing papaya plants in the interspaces through organics enhances the soil organic matter content thus helping in better soil aeration, root development and establishment of the coconut garden.

Disease management

Papaya ring spot virus is one of the major threats in papaya cultivation. The symptoms include cholorotic mottling of the leaves with water soaked spots on leaf, stem and fruits. It is a viral disease transmitted by aphids (Myzus persicae, Aphis craccivora and Aphis gossypii). Early detection and removal of affected plants is the only method of controlling the wide spread of the disease. Selection of healthy seedlings raised in insect proof net house is advisable in disease endemic areas.

Organic nutrient management for Nematodes- a major threat for papaya intercropping

Plant-parasitic nematodes of Meloidogyne species (root knot nematode) are the most economically damaging pests of horticultural crops causing an estimated loss of US$100 billion globally on an annual basis. Root-knot nematode (Meloidogyne incognita) causes serious damage to the crop growth affecting vigour and premature death of plant. Nematode attacked plants are vulnerable to secondary infections by soil borne fungi and bacteria. It also results in the breakdown of resistance against plant pathogenic fungi. During the experiment conducted at Regional Station of Indian Council of Agricultural Research- - CPCRI, Kayamkulam, Kerala, it was observed that the plants grown under organic nutrient management showed lower disease incidence of root knot nematodes (25-40%) with lesser gall index (1.8). The plants supplied with only chemical fertilizers recorded higher incidence (35 -80%) of root knot nematode infestation with more gall index (3.5). The reduction in disease incidence of Meloidogyne incognita in organic papaya may be due to the presence of higher number of free living nematodes and nematicidal properties of organic matter.

Economics of cultivation

In one hectare of juvenile coconut plantation, approximately one acre area can be utilized for intercropping papaya. This will accommodate on an average of thousand plants. Papaya starts flowering in three months and harvesting of fruits can be commenced from four to five months after planting. We could harvest a minimum of 22 fruits per plant in the first year of fruiting. The total cost of cultivation in the first year includes cost of seeds, sowing, nursery management, land preparation, application of inputs and planting of seedlings in the interspaces of coconut gardens. These activities incurred Rs.1,26,000/- . Total fruit yield from 1000 plants was about 30,000 kg per year. At an average price of Rs.12/kg, the gross income from the system comes to Rs.3,60,000/- . The net return was about Rs. 2,34,000/- per hectare basis. ■

CDB conducted exporters seminar at Coimbatore and Kochi

Coconut Development Board held its 1st Exporters Meet for the year 2019-20 at Coimbatore on 24th July 2019. The meet was inaugurated by Shri Saradindu Das, Chief Coconut Development Officer, CDB. Speaking on the occasion, Shri. Das requested the participants to make this programme a meaningful event. He opined that the state of Tamil Nadu is the most potential state for promoting the export of coconut products and if exporters are interested, Board will arrange similar programmes in other major cities of Tamil Nadu. Thiru Mohanraj, Board Member spoke during the occasion.

The meet was designed to be interactive and to exchange information across participants. Six technical sessions were conducted and the participants could clarify their doubts and identify the next steps forward for furtherance of their international business.

The introductory session was handled by Dr. Gautam Dutta, Faculty, Indian Institute of Foreign Trade (IIFT), Kolkata. During the session he gave an overview of the export scenario, the HSN codes, etc. He also explained that the way of handling the business has changed and that the exporters have to look beyond the traditional products.

The post lunch session was handled by IIFT faculty Dr.Gautam Dutta. The session was on identification and selection of international markets. The session on "Foreign Trade Policy with special focus to Coconut industry" was handled by Shri Sraman ITS, Joint Director General of Foreign Trade, Coimbatore and the session on Trade finance solutions" was handled by Dr.Gautam Dutta from IIFT, Kolkata

A session on "Export incentives" by Dr.Gautam Dutta from IIFT, Kolkata and another on Export/ Market Promotion Schemes of CDB" by Smt. Deepthi Nair S., Deputy Director (Marketing), Coconut Dev. Board was also held.

Mrs.V.Usharani IAS, Chairperson, CDB participated in the interactive session and clarified the doubts raised by the participants and assured support for settling the outstanding issues. The interaction helped to instill confidence in exporters to do international business with more vigour and focus.

Important issues raised by the exporters in the meeting were: the non availability of quality packing material, the issue of unbridled duty free import of Desiccated Coconut from Srilanka under SAFTA agreement, the issue of zero export incentive to Virgin Coconut Oil, the heavy duty impact @4.8 per cent on clearance of Indian cargo at USA in the aftermath of new General System of Preference (GSP) policy of USA , the request to consider transportation subsidy to the exporters of fresh as well as tender coconut etc.

Smt.T.Balasudhahari, Director, CDB Regional Office, Chennai delivered welcome address and Smt. Deepthi Nair S, Deputy Director, CDB proposed vote of thanks. Shri. Sebastian K.S., Asst. Director, CDB and around 70 coconut product exporters took part in the programme.

Coconut Development Board conducted its 2nd Exporters Meet for the year 2019-20 at Kochi on 26th July 2019. The meet was inaugurated by Chairperson Mrs.V. Usha Rani IAS. Speaking on the occasion, Chairperson informed that CDB has made an all time high allocation of Rs.40 Crores under Technology Mission on Coconut(TMoC) to support coconut based entrepreneurs and urged the exporters to utilize the opportunity to produce world class products and expand their overseas business. She reminded that the previous year allocation under TMoC was only Rs.5 crores. She also informed the meeting that within a short span of four months, CDB has taken up major issues of exporters viz. lack of separate HS code for virgin coconut oil, inverted export incentive structure in the case of shell charcoal and Activated carbon, indiscriminate import of Desiccated Coconut from India under SAFTA agreement etc. with the Ministry of Commerce & Industry and Director General of Foreign Trade. She told that the Board has already taken note of the problems being faced by the shell charcoal manufacturers in view of the difficulty in obtaining no objection certificate from Pollution Control Boards concerned. She urged the exporters to establish direct backward linkage with the FPOs and try to avoid middlemen and offered Board's support in this regard. She suggested the exporters to utilize the training opportunities provided by organizations like CFTRI Mysuru, CPCRI, and Agricultural Universities for technological improvements and Indian Institute of Packaging for innovative packaging technologies.

Members of the Board, Shri. Mohanan Master and Shri. Muralidharan spoke during the occasion. Shri Saradindu Das, Chief Coconut Development Officer, CDB attended the meeting.

60 prospective exporters actively participated in the eight sessions conducted as part of the programme and the participants were encouraged to clarify their doubts and identify the next steps forward for furtherance of their international business.

The introductory session was by IIFT, handled by Dr. Gautam Dutta, Faculty, Indian Institute of Foreign Trade (IIFT), Kolkata. During the session he gave an overview of the export scenario, the HSN codes, etc. He also explained that the way of handling the business has changed and the exporters have to look beyond the traditional products.

The next session on "Foreign Trade Policy with special focus to Coconut industry was handled by Shri. Harilal ITS, Joint Director of Foreign Trade, Ernakulam. In his session he opined that the stumbling block for the exporters of value added coconut products is high price of raw materials prevailed in the domestic market. He was of the view that because of this, the sector is showing stunted growth. During discussion he favoured the suggestion of granting of advance authorization license to import dehusked coconut from other major coconut growing countries like Indonesia and Philippines

Shri.Anil Kumar, Appraiser, Office of the Customs Commissioner, Kochi handled the session on customs procedures and gave an overview of the customs procedure and interacted with the exporters. He informed that online filing of shipping bill will come into force soon, which will help the exports to file shipping bills within hours.

Shri.Prasad Chakravarthy, Asst. Agricultural Marketing Advisor, DMI, Govt. of India, took the session on DMI Schemes for Exporters.He spoke about the Agricultural Marketing Infrastructure (AMI) scheme specifically focusing on the needs of exporters. The scheme is aimed to develop Agricultural Marketing Infrastructure. The session on "Barriers (tariff and non-tariff) of trade in country specific situation" was handled by Dr.Gautam Dutta from IIFT, Kolkata. The session was on identification and selection of international markets. He explained that the core of every business is its buyers and the first and foremost step is to identify the right buyer for the products and elucidated the steps or identifying the markets and explained about the Revealed Comparative Advantage (RVA).

In the session on Trade finance solutions Dr.Gautam Dutta from IIFT, Kolkata briefly explained about various trade finance options available to

exporters. He explained about the terms of payment like Advance Payment, Letter of Credit etc. He also described about the export credit agencies (ECAs) which are public government-owned agencies and entities that provide government-backed loans, guarantees and insurance to corporate to do overseas business in developing countries and emerging markets.

Dr.Gautam Dutta from IIFT, Kolkata handled the session on Export incentives and spoke about the export incentive schemes available for coconut products. He apprehended about the export incentive scheme and explained about the Merchandise Exports from India Scheme (MEIS). In the session on "Export/Market Promotion Schemes of CDB" wherein Shri. Sebastian K.S, Assistant Director (Marketing), Coconut Development Board briefed about the new component schemes introduced by CDB during the financial year 2019-20 such as infrastructure support for setting up of sales outlets, assistance for quality certification, assistance to exporters for participation in international exhibitions / trade fairs / buyer seller meets, brand building support , brand publicity through digital marketing, brand publicity through mass media, assistance for printing publicity materials, assistance for outdoor advertising, manufacture of quality coconut products through development of skilled labour etc. He further briefed on each component schemes, the eligibility criteria, procedure for applying the scheme and motivated the exporters to utilize the opportunity.

CDB Board Member, Shri. P.R.Muraleedharan appreciated the resource persons for the sessions and thanked the exporters who attended the meeting. Smt. .Deepthi Nair S. Deputy Director, CDB proposed vote of thanks. In the Interactive Session which followed the exporters raised various issues of the sector.

District Level Seminar on Coconut Cultivation Technology, Bhadrak, Odisha

Coconut Development Board, State Centre, Odisha in association with the office of the Deputy Director of Horticulture, Bhadrak conducted a district level Seminar on Coconut Cultivation Technology on 24th July 2019 in Bhadrak district in Odisha.

Dr. Binod Kumar Jena, AHO, Bhadrak welcomed the gathering and discussed with the farmers about the prospects of coconut cultivation in the district. Dr. Aurobinda Das, Sr. Scientist & Head, KVK , Ranital spoke on "Scientific coconut cultivation technology like mother palm selection, seed nut selection, nursery management, scientific way of planting, intercultural operations etc. Smt. Urmila Mohapatra, ADH, Bhadrak briefed on the various schemes of State Government for coconut farmers. Dr. Shyam Sundar Mohapatra, Additional Director of Research, RRTS Bhadrak, spoke on Integrated Nutrient Management and Integrated Disease Management in coconut. Dr. Umasankar Nayak, Senior Scientist, Entomology, OUAT delivered spoke on Integrated Pest Management.

Dr. Rajat Kumar Pal, Deputy Director, CDB discussed on various schemes of Coconut Development Board. The importance of CPSs formation in the district for the benefit of coconut farmers was a major discussion

point during the technical session. Kum Sasmita Pallei, CDB briefed on Value addition in Coconut' and explained about various value added products of coconut like VCO, chips, vinegar, desiccated coconut, coconut milk, coir based products, husk based products etc.. Dr. Shyam Sundar Mohapatra, Additional Director of Research, RRTS, Bhadrak emphasized the necessity of formation of CPSs in Bhadrak district.

The district level training programme helped the farmers in gaining knowledge and farmers raised their queries during the interactive session. The resource persons in the training programme cleared the doubts of farmers. More than 100 farmers attended the programme. The programme ended with vote of thanks by Shri.Bijaya Kumar Mahunta, AHO, Bhadrak.

Block Level Workshop held at Minakhan, West Bengal

A Block Level Workshop on scientific coconut cultivation technologies and its value addition in coconut was conducted in association with the Malancha Coconut Farmers Welfare Society, Malancha at Minakhan BDO office, Minakhan block, North 24 Pgs on 7th August 2019.

Shri. Rajeev Bhushan Prasad, Director, RO, Patna welcomed guests and the farming community participated in the seminar. Shri. S. Mishra, Assistant Director of Agriculture, Barasat briefed on the importance of the adoption of cultivation technology by the farming community and sought all support from the Government of West Bengal for the overall development of coconut cultivation and industry and expressed that Board will extent maximum support for the betterment of small and marginal farmers of the state.

Shri. Santi Swarap Das, Fisheries Extension Office, Minakhan block briefed on the value addition of the coconut and Neera production which can enhance the income of the small and marginal farmers. Shri. Hazi Ayub Hossain, President, Minakhan block and Shri. Abul Kalam Mallick, Block Secretary, Minakhan block advised the farming community to take up coconut cultivation in the state and increase the area under coconut so that various coconut by-products units can be established in West Bengal in the upcoming years.

Shri. Rajeev Bhushan Prasad, Director, CDB RO, Patna advised the farming community to ensure planting of quality planting materials and adopting integrated farming practices in coconut garden so that they can obtain maximum income from their gardens. Shri. Ravindra Kumar, Development Officer, Regional Office, spoke on coconut cultivation and schemes of the Board for educating the farmers of the area. More than 50 farmers from local grama panchayats of the block attended the seminar.

Independence day celebrated

Shri. Saradindu Das, Chief Coconut Development Officer hoisitng the National Flag at CDB Head Quarter premises on 15th August 2019. Shri. Sreekumar Poduval, Deputy Director and other officers of the Board are also seen.

Cultivation practices in Coconut Garden - September

Planting

In low lying areas, planting of coconut seedlings can be undertaken in small sized pits or on mounts raised to one metre above water table. Prevent accumulation of rain water in the seedling pits by ensuring adequate drainage. In regions like Tamil Nadu field preparation should be done for new planting.

Manuring

Circular basins of 1.8m in radius and 25 cm depth may be dug and green leaf or compost or farm yard manure at the rate 50 kg per palm may be spread in the basin. Two third of the recommended dose of chemical fertilizers may be spread over the green leaf or compost and covered. Application of 500 g N, 320 g P_2O_5 and 1200 g K_2O per palm per year is generally recommended for adult plantations. To supply two-third of the above nutrients it is necessary to apply about 0.72 kg urea, 1 kg rock phosphate (in acidic soil) or 1.33 kg Super Phosphate (in other soils) and 1.33 kg of Muriate of potash (MOP). Under irrigated conditions, one fourth of the recommended dose of chemical fertilizers can be applied during September.

It is always recommended to apply chemical fertilizers based on the soil test results rather than going by the general recommendations.

Wherever Boron deficiency is noticed 100 g Borax may be applied in the basin. For coconut palms showing yellowing of leaves due to Magnesium deficiency, 0.5 kg of magnesium sulphate can be applied in the basins along with other fertilizers.

The above schedule of manuring is suitable for all the major coconut growing regions which are mostly benefitted by South-West monsoon during the season. In localities of Tamil Nadu, which are mostly benefitted by North- East monsoon the first dose (one third of recommended dose) of chemical fertilizers can be given during September. Under such situations, lime or dolomite or gypsum @ 1kg/ palm need to be applied two weeks before the first dose of chemical fertilizers are applied.

Green manuring

Wherever green manure crops are grown, plough in the green manure crop (after attaining 50 per cent flowering) and incorporate into the soil.

Intercultural operations

Ploughing/digging of interspace is to be undertaken to keep the plantation free of weeds. Care should be taken to avoid injury to coconut palm while ploughing.

Nursery management

Weeding should be done in the nursery. Five month old ungerminated nuts and dead sprouts should be removed from the nursery. In localities of Tamil Nadu, which are mostly benefitted by North-East monsoon, land preparation can be taken up for sowing seednuts.

Crown cleaning

Wherever crown cleaning has not undertaken during August the same may be done during this month.

Mulching

Mulching of palm basins can be undertaken during the second fortnight of September to conserve moisture

Plant protection

▶ *Integrated Pest Management*

▶ *Rhinoceros beetle*

Adopt mechanical method of control by extracting beetles with beetle hooks, without causing further injury to the growing point of the palm. The top most leaf axils may be filled with powdered neem cake/ marotti cake (*Hydrocarpus sp/ pongamia*) @ 250 g + fine sand (250g) per palm as a prophylactic measure. Filling the innermost three leaf axils with 4 g each of naphthalene balls covered with sand (12 g/palm) for juvenile palms. Placement of two perforated sachets containing *chlorantraniliprole a.i.* 0.4% (5 g) or fipronil (3 g) or one botanical cake (2 g) developed by ICAR-CPCRI and incorporation of the biomass of weed plant *Clerodendron infortunatum Linn.* in the cow dung/compost pit can also be done. The breeding sites may be treated with green muscardine fungus (*Metarhizium anisopliae*)

▶ *Red Palm Weevil*

Avoid causing injury to the palms, as they would attract the weevil to lay eggs. Mechanical injury if any, caused should be treated with coal tar. While cutting fronds, petiole to a length of 120 cm is to be left on the trunk to prevent the entry of weevils into the trunk. Removal and burning of palm at advanced stage of infestation would aid in destruction of various stages of the pest harboured in the trunk. Prophylactic leaf axil filling suggested for rhinoceros beetle is very essential as this pest pave way for red palm weevil.

If damage occurs in the crown, the damaged tissue has to be removed and insecticide suspension, *imidacloprid* (0.02%) @1 ml/L of water may be poured in. In case of entry of weevil through the trunk, the hole in trunk may be plugged with cement/tar and the top most hole is made slanting with the aid of an auger and the insecticide solution is poured through this hole with funnel.

▶ *Eriophyid mite*

Spraying on the terminal five pollinated coconut bunches with neem oil garlic soap mixture @ 2 per cent concentration (neem oil 200 ml, soap 50 g and garlic 200 g mixed in 10 litres of water) or spraying neem formulations containing 1 per cent azadirachtin @ 4 ml per litre of water or spraying palm oil (200 ml) and sulphur (5g) emulsion in 800 ml of water and root feeding azadirachtin 10,000ppm @ 10 ml + 10 ml water is effective. Along with the recommended dose of manures and fertilizers, 5 kg neem cake should also be applied.

▶ *Coreid bug*

Spray neem oil-soap emulsion (0.5%) on the pollinated bunches. The emulsion can be prepared by adding 5 ml neem oil and 8 g bar soap in one litre water.

▶ *Rugose Spiralling Whitefly*

No chemical insecticide should be sprayed on leaves. Apply 1% starch solution on leaflets to flake out the sooty moulds.

In severe cases, spray neem oil 0.5% and no insecticide is recommended. Install yellow sticky

traps on the palm trunk to trap adult whiteflies. Encourage build up of parasitoids (*Encarsia guadeloupae*) and re-introduce parasitized pupae to emerging zones of whitefly outbreak.

In situ habitat conservation of the sooty mould scavenger beetle, Leiochrinus. nilgirianus

Integrated Disease Management

▶ *Bud rot*

Remove the infected tissues of the spindle completely. Two or three healthy leaves adjacent to the spindle may have to be removed, if necessary, for easy removal of all rotten portions and thorough cleaning. After removing the affected tissues apply 10% Bordeaux paste and cover the wound with a polythene sheet to prevent entry of rain water. The protective covering has to be retained till normal shoot emerges. Destroy the infected tissues removed by burning or deep burying in the soil. Spray 1% Bordeaux mixture to the surrounding palms

▶ *Stem bleeding*

Avoid burning of trashes near the tree trunk. Avoid injury to the tree trunk. The affected tissues should be completely removed using a chisel and smear the wound with 5% hexaconazole (5 ml in 100 ml of water) and drench the basins @ 25 lit. of 0.1% solution

Smearing paste of talc based formulation of *Trichoderma harzianum* on the bleeding patches on the stem (The paste can be prepared by adding 50 g of Trichoderma formulation in 25 ml of water)

Soil application of *Trichoderma harzianum* enriched neem cake @ 5kg per palm and adopt recommended irrigation/moisture conservation practices.

▶ *Leaf rot*

Remove rotten portion of the spindle leaf and 2-3 successive leaves and pour fungicide solution containing 2 ml hexaconazole 5 EC in 300 ml water/ palm or talc based formulation of *Pseudomonas fluorescens* or *Bacillus subtilis* @ 50 g in 500 ml water/palm into the well around the base of the spindle leaf

Undertake prophylactic measures to prevent rhinoceros beetle attack

▶ *Basal Stem Rot/ Ganoderma wilt*

Remove dead palms, palms in advanced stages of the disease and destruct the bole and root bits of these palms. Isolation of diseased palms from healthy palms by digging isolation trenches of 2 feet depth and one feet width around the basin can also be done. Avoid flood irrigation or ploughing in infected gardens to prevent spread of the inoculum.

Addition of 50 kg of farmyard manure or green leaves per palm per year and application of Trichoderma harzianum enriched neem cake@ 5 kg per palm and irrigating the palm once in 4 days and mulching around the basin is also useful.

Raising banana as intercrop wherever irrigation is possible Root feeding of hexaconazole @ 2% (100 ml solution per palm) or soil drenching with 0.2% hexaconazole / 1 % Bordeaux mixture @ 40 litre solution per palm can also be done.

Field sanitation

Special care should be taken to remove the organic debris/fallen trees etc in the coconut gardens in Kerala state affected by the recent heavy rainfall/ flood situation. ■

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

Market Review – July 2019

Domestic Price

Coconut Oil

During the month of July 2019 the price of coconut oil opened at Rs.14400 per quintal at Kochi, Rs.14500 per quintal at Alappuzha market and Rs.15000 per quintal at Kozhikode market. During the month, price of coconut oil at Kochi market expressed an upward trend whereas the price of coconut oil in Alappuzha and Kozhikode market expressed a slight fluctuating trend.

The price of coconut oil closed at Rs.14800 per quintal at Kochi and Alappuzha market and Rs.15100 per quintal at Kozhikode market with a net gain of Rs.400 per quintal at Kochi, Rs.300 per quintal at Alappuzha market and Rs.100 per quintal at Kozhikode market.

The price of coconut oil at Kangayam market in Tamilnadu, which opened at Rs.11467 per quintal, expressed an overall upward trend during the month and closed at Rs.12000 per quintal with a net gain of Rs.533 per quintal.

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

	Kochi	Alappuzha	Kozhikode	Kangayam
01/07/2019	14400	14500	15000	11467
07/07/2019	14400	14400	14850	11333
14/07/2019	14400	14400	14800	11267
21/07/2019	14500	14500	15000	11667
31/07/2019	14800	14800	15100	12000

Milling copra

During the month, the price of milling copra opened at Rs.8500 per quintal at Kochi, Rs.8900 per quintal at Alappuzha and Rs.9150 per quintal at Kozhikode market. The price of milling copra at Kochi market expressed a slight upward trend, whereas the price of milling copra at Alappuzha market and Kozhikode market expressed a slight downward trend during the first fortnight and thereafter expressed an upward trend.

The prices closed at Rs.9500 at Kochi market, Rs.9400 at Alappuzha market and Rs.9600 at Kozhikode market with a net gain of Rs.1000, Rs.500 and Rs.450 per quintal at Kochi, Alappuzha and Kozhikode market respectively.

At Kangayam market in Tamilnadu, the prices opened at Rs. 8200 per quintal and closed at Rs.8800 per quintal with a net gain of Rs.600 per quintal.

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

	Kochi	Alappuzha (Rasi Copra)	Kozhikode	Kan-gayam
01/07/2019	8500	8900	9150	8200
07/07/2019	8500	8800	9050	8200
14/07/2019	8950	8850	8950	8100
21/07/2019	9200	9050	9400	8300
31/07/2019	9500	9400	9600	8800

Edible copra

The price of Rajapur copra at Kozhikode market opened at Rs. 11400 per quintal expressed an overall upward trend during the month and closed at Rs.12500 per quintal with a net gain of Rs.1100 perquintal.

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

01/07/2019	11400
07/07/2019	11300
14/07/2019	11500
21/07/2019	12900
31/07/2019	12500

Ball copra

The price of ball copra at Tiptur market which opened at Rs.13000 per quintal expressed an upward trend during the month, though the price declined by the fag end of the month. The price closed at Rs.13800 per quintal with a net gain of Rs.800 per quintal.

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

01/07/2019	13000
07/07/2019	13500
14/07/2019	13700
21/07/2019	14000
31/07/2019	13800

Dry coconut

At Kozhikode market, the price of dry coconut opened at Rs.9500 per quintal expressed an overall downward trend during the month. The prices closed at Rs.9400 per quintal with a net loss of Rs.100 per quintal.

Weekly price of Dry Coconut at Kozhikode market (Rs/Quintal)	
01/07/2019	9500
07/07/2019	9300
14/07/2019	9300
21/07/2019	9200
31/07/2019	9400

Coconut

At Nedumangad market the price of partially dehusked coconut opened at Rs.12000 per thousand nuts and ruled at same price throughout the month. At Pollachi market in Tamil Nadu, the price of coconut opened at Rs.10000 per thousand nuts and closed at Rs.11000 per thousand nuts. At Bangalore APMC, the price of partially dehusked coconut opened at Rs.20500 and closed at Rs.18000 per thousand nuts. At Mangalore market the price of partially dehusked coconut opened at Rs.20000 ruled at same price throughout the month.

Weekly price of coconut at major markets (Rs /1000 coconuts)				
	Neduman-gad	Pollachi	Banglore	Mangalore (Grade -1)
01/07/2019	12000	10000	20500	20000
07/07/2019	12000	10000	20500	20000
14/07/2019	12000	10000	18000	20000
21/07/2019	12000	10000	18000	20000
31/07/2019	12000	11000	18000	20000

International price

Coconut

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

Weekly price of dehusked coconut with water					
Date	Domestic Price (US$/MT)				
	Philippines/ Indonesia (CIF Europe)	Philip-pines	Indone-sia	Sril-anka	India*
06.07.2019	105	108	136	320	1650
13.07.2019	104	105	128	313	1641
20.07.2019	103	105	126	320	1699
27.07.2019	101	105	130	349	1747
29.06.2019	100	n.q.	139	328	
*Pollachi market					

Coconut Oil

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

Weekly price of coconut oil in major coconut oil producing countries					
	International Price(US$/MT)	Domestic Price(US$/MT)			
	Philippines/ Indonesia (CIF Europe)	Philip-pines	Indone-sia	Sri lanka	India*
06.07.2019	634	621	628	1562	1650
13.07.2019	638	615	615	1596	1641
20.07.2019	651	609	615	1677	1699
27.07.2019	702	665	656	1729	1747
* Kangayam					

Copra

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

Weekly International price of copra in major copra producing countries				
Date	Domestic Price (US$/MT)			
	Philippines	Indonesia	Srilanka	India*
06.07.2019	399	390	931	1194
13.07.2019	398	386	832	1180
20.07.2019	397	387	832	1209
27.07.2019	398	400	828	1281
* Kangayam				