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Development of Coconut Milk Paneer and evaluation of its quality characteristics

Goat Farming in **Coconut Gardens**

Holistic package to mitigate **Exotic Whiteflies on Coconut**

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

Coconut Development Board

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

Functions

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

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

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

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Message from the Chairperson's desk

Dear Readers,

As you are aware, the agriculture sector plays a pivotal role in the economy of our country by contributing 17% to the total GDP and providing employment to 60% of the population. The Indian food sector is also poised to a huge growth thereby increasing its potential for investment. Value addition in coconut is also expected to be on the rise especially in the wake of the growing awareness about the health benefits of coconut. Resultantly this has widened the already existing gap between demand and supply. To meet this increasing demand, we need to increase the production and productivity of the crop.

Coconut Development Board through its various programmes and schemes is aiming at increasing the area under coconut and also increasing productivity through rejuvenation of existing gardens. The Board under its existing scheme, Area Expansion Programme, is targeting to increase coconut cultivation in addition to an area of 7193 ha. during 2020-21. With a view to replant and rejuvenate the existing gardens by removing the old, senile and unproductive palms, Board under its Replanting and Rejuvenation programme is also planning to additionally cover an area of 7392 ha. during the year. Area expansion efforts has to be closely coordinated with the production of quality seedlings. During this year, Board is targeting the production of five lakh coconut seedlings through its 11 Demonstration cum Seed Production Farms of the Board and also the production of 26.25 lakh seedlings in association with various state governments. It is expected that with these concerted efforts, the coconut sector of the country will tap its potential. I solicit the wholehearted support and cooperation of all in bringing in a new era in the agriculture sector of the country.

G Jayalakshmi IAS

Chairperson

Food security through intercropping of tuber crops in coconut gardens- Opportunities under 'Subhiksha Keralam' initiative

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Background

Agriculture sector has suffered huge loss due to the COVID-19 pandemic induced lock down and subsequent disruptions in the agricultural supply chain. Taking into cognizance the problems experienced by farmers and other stakeholders due to the lock down, the Government of Kerala has been implementing various measures to overcome the crisis in farm sector. Kerala State has been traditionally food insecure due to its unique agro-ecological features favouring cultivation of perennial commercial crops and it heavily depends on other States to meet its basic food requirement. Of course, there has been an impressive gain in vegetable production in the State during the last few years due to implementation of specific schemes. In spite of this, the State produces only 60 per cent of its vegetable requirement. Further, Kerala depends on other States for 85 per cent of the total quantity of its total food grain requirement. It is a risk in the long run for the State to depend heavily on other States for the supply of food commodities especially considering the continuing COVID 19 pandemic scenario.

Under these circumstances, Kerala government has initiated a comprehensive programme viz., 'Subhiksha Keralam' with the aim to increase food production and attain food self-reliance to the extent possible. Effective utilization of available land; fallow land, homesteads or terraces of houses, to increase food production is the basic approach of the initiative. Besides enhancing food production, interventions for processing and value addition to enhance income and employment opportunities are also envisaged under the initiative.

It is envisaged to implement the initiative ensuring large scale people's participation and through the coordinated efforts of various government departments viz., Agriculture, Animal Husbandry, Dairy Development, Fisheries, Water

Resources, Cooperative, Industries and various LSG institutions. It is also proposed to link the initiative to the activities under Haritha Keralam Mission, Kudumbasree Mission and MGNREGA, ensure involvement of Agriculture, Veterinary and Fisheries universities in the State and seek cooperation of educational institutions, public sector institutions, cooperatives, youth clubs, mass organizations and residents associations for effectively implementing the interventions under 'Subhiksha Keralam'. Reports from various districts about the implementation of 'Subhiksha Keralam' initiative clearly indicate that it is quite possible to achieve the objectives of the project.

Food security through intercropping of tuber crops in coconut gardens

The scope for expanding the land area for enhancing food production is very much limited in Kerala and hence, efforts are needed to increase food and nutritional security and income per unit area per unit time through intercropping and integration of livestock and related enterprises. Moreover, area under food crops is declining and the general trend in the state depicts a shift in the cropping pattern from food crops to cash crops. Under these circumstances, utilisation of the potential for multiple cropping in coconut gardens to enhance food production in the state assumes much significance. Coconut plays a vital role in the agrarian economy of Kerala state and it occupies about 37.4 % of the net area sown in the state. It is highly amenable for multiple cropping and hence it is highly relevant that strategies for promoting cultivation of food crops as intercrops in coconut gardens are implemented to enhance food security in the state. Details of area under coconut cultivation in different districts in Kerala state is given in table 1.

Table1. District wise area under coconut in Kerala state (2018-19)

Sl. No.	District	Area (ha)
1	Kasaragod	65999
2	Kannur	83663
3	Wayanad	10121
4	Kozhikode	115706
5	Malappuram	104685
6	Palakkad	55502
7	Thrissur	79776
8	Ernakulam	39275
9	Kottayam	25514
10	Idukky	14514
11	Pathanamthitta	15816
12	Alappuzha	33755
13	Kollam	45473
14	Thiruvananthapuram	71158
	Total	7,60,946

(Source: Agricultural Statistics 2018-19, Department of Economics and Statistics, Thiruvananthapuram)

Agronomic feasibility of coconut based multiple cropping

Coconut as a monocrop does not fully utilize the basic resources such as soil and sunlight available in the garden. 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. The orientation of leaves in the coconut crown helps penetration of sunlight into the soil and provides opportunities for exploitation of land and solar energy for inter/mixed cropping. Coconut offers scope for intercropping in the initial stages of the growth of palms and mixed cropping in the later part of life of palms. The light incident on the interspaces in coconut decreases with the increase in the age of the plantation, and very little light reaches the ground when the palms are around 8-10 years because of short stature of palms and greater foliage. This intensely shaded situation lasts up to the age of 20 years. Thereafter, increasing amount of slant light and filtered light reaches the lower profile of the coconut canopy due to the leaf orientation and at about 30 years of age 30% of the total light incident in the area reaches the ground. The amount of light penetrating the canopy, thereafter increases with the age of the palm as the tree height increases.

Arrowroot

Cassava

Dioscorea

This characteristic feature of coconut offers scope for crop intensification in coconut gardens. In a coconut plantation, maximum solar energy is received for intercropping during the early stages (<8 years), minimum quantity is received at the early production stages (8-25 years), during which shade tolerant/loving crops can be intercropped and again it increases with the age of the trees.

Different tuber crops which can be raised along with coconut as intercrops depending on the availability of solar energy are listed in Table 2.

Table 2. Options of tuber crops for intercropping in coconut at various stages

Age of coconut palms	Tuber crops
< 8 years	Cassava, Elephant foot yam, Yams
8-25 years	Elephant foot yam, Taro, Tannia, Arrowroot
> 25 years	Cassava, Elephant foot yam, Taro, Tannia, Yams, Arrow-root and Chinese potato

Desirable traits of roots and tubers as intercrops

• They have higher biological efficiency and ability to produce higher dry matter per unit area per unit time.

• They are adapted to marginal environments, poor soil and adverse climatic conditions and have great flexibility to adapt to mixed farming systems.

• Tropical tuber crops especially arrowroot, yams and aroids are shade tolerant or shade loving.

• They are shorter in stature than coconut and will hence never over-grow the main crop.

• Tuber crops such as cassava and yams are resilient to climate change and can withstand drought and heat to a certain extent and are less water demanding crops.

• These crops can be grown with less external chemical inputs and instead help to recycle the organic wastes available in the coconut garden.

• The harvested tubers of arrowroot, yams and aroids have good shelf life under well aerated storage and great market demand.

Tuber crops as intercrops in coconut

Experimental evidences indicates that yield was promoted by 5-15% in coconut under intercropping with tuber crops. In general, indigenous yams (greater yam and lesser yam), edible aroids (especially tannia and elephant foot yam) as well as arrowroot were suitable for intercropping. Of the various tuber crops, arrowroot produced higher rhizome yield (7%) under intercropping.

Crop management practices for tuber crops intercropped in coconut gardens

A brief summary of the management practices to be followed for intercropping tuber crops in mature coconut gardens of more than 25 years under rainfed conditions is given in Table 3.

The tuber crops partially meet the food requirements of a farm family and have always found a place in the homestead gardens in Kerala state. The agronomic feasibility and economic viability of coconut based multiple cropping, which involves growing a large number of crops including tuber crops, has been demonstrated under various research projects implemented by ICAR-Central Plantation Crops Research Institute in farmers' field. Growing tuber crops as intercrop is one of the options to increase the productivity and economics of the coconut based cropping system. Elephant foot yam, cassava and dioscorea were intercropped in selected coconut gardens under the NAIP project on 'Value chain in coconut'. These tuber crops are cheap source of food and energy and are capable enough

Table 3. Management practices for tuber crops intercropped in coconut gardens						
Intercrop	**Time of planting**	**Suitable variety**	**Method of planting, spacing and plant population per ha**	**Manures**		**Duration (months)**
				FYM t ha-1	NPK kg ha-1	
Cassava	May-June	Sree Pavithra Sree Reksha Sree Vijaya Kalpaka	Mounds 90x90 cm (9,000 plants)	9	50:50:100	8-10
Elephant foot yam	March-April	Sree Athira Sree Padma Gajendra	Pits 90x90 cm (9,000 plants)	20	26:20:33	8-9
Greater yam	April-May	Sree Keerthi Sree Swathy Indu	Pits 90x90cm (9,000 plants)	9	80:60:80	8-9
Lesser yam	April-May	Sree Latha	Pits 75x75cm (12,000 plants)	8	60:30:60	7
White yam	April-May	Sree Priya Sree Haritha	Pits 90x90cm (9,000 plants)	9	80:60:80	8-9
Arrowroot	May-June	Local selection	Raised beds 30x15cm (1,30,000 plants)	10	50:25:75	9-10

to withstand biotic and abiotic stresses. The yield of tuber crops as intercrops in coconut garden in farmers' field varied between locations and mostly influenced by the level of crop management and planting density of coconut palms. Analysis of interventions carried out by CPCRI in farmers' field under the IPGRI – COGENT project on 'Developing sustainable coconut based income generating technologies in poor rural communities in India' also revealed the feasibility of intercropping tuber crops in coconut gardens. There is huge potential for growing tuber crops profitably as intercrops in coconut gardens and hence, 'Subhiksha Keralam' initiative needs to have specific strategies for promoting intercropping of suitable tuber crops in coconut gardens to attain food self-reliance to the extent possible as envisaged.

Strategies for promoting intercropping of tuber crops in coconut gardens under 'Subhiksha Keralam' initiative

Farmer Producer Organisations (FPOs) in coconut sector and women SHGs under Kudumbasree Mission can be facilitated to take up interventions on intercropping of tuber crops in coconut gardens under 'Subhiksha Keralam' initiative. Apart from the coconut gardens owned by farmers who are willing to take up intercropping of tuber crops, coconut gardens neglected by land owners due to various socio-economic factors also need to be utilised for promoting tuber crops under 'Subhiksha Keralam'. Appropriate institutional arrangements are to be made for utilising such coconut gardens for intercropping. LSGIs and State Department of Agriculture Development & Farmers' Welfare can formulate and implement suitable schemes to incentivise intercropping of tuber crops in coconut gardens. Timely availability of quality planting materials of tuber crops is to be ensured for effective implementation of such interventions besides providing support for marketing. Awareness creation among farmers about the benefits of intercropping needs to be emphasized and interventions for promoting intercropping of tuber crops in coconut gardens need to be implemented in a campaign mode with active participation of farmers, FPOs and women SHGs. ■

Holistic Package to Mitigate Exotic Whiteflies on Coconut

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Exotic pests have become a real threat and a bio-security risk to agricultural production mainly reflected by biodiversity decline and in the absence of specific natural enemies the introduced pest outnumber considerably. Coconut being an excellent ecological service provider fostering livelihood security to more than 12 million farm families, is currently subjected to incursion by non-native pests, especially the invasive whiteflies. Though the primary exotic spiralling whitefly, Aleurodicus dispersus was reported as a minor pest on coconut during 1996, it never assumed a pest status due to non-preference and fortuitous introduction of aphelinid parasitoids, Encarsia spp. from Minicoy Island probably migrated from Maldives. This followed the introduction of the devastating and invasive coconut eriophyid mite (A*ceria guerreronis*) during 1998 and ICAR-CPCRI had evolved a holistic package and subdued the damage potential of *A. guerreronis*. A wide array of predatory mites (*Neoseiulus baraki, Amblyseius sp.*), acaropathogenic fungus (*Hirsutella thompsonii*), neem formulation in synergy with nutritional and soil-health management strategies suppressed the invasive potential of mite.

Exotic whiteflies

In a span of four years (2016-2019), four exotic whiteflies from Neotropical region had emerged in to Peninsular India, impeding the production potential of palms. Increased trade and transport by globalization could be one of the major reasons for this sudden entry. The non-native rugose spiralling whitefly (*Aleurodicus rugioperculatus*) (Fig 1 a,b) was reported first on coconut from Palakkad (Kerala) and Pollachi (Tamil Nadu) during 2016 still remains as a key pest on coconut in isolated pockets causing national concern. It is also found as a major pest on oil palm and a minor pest on banana in certain coconut growing belts. Rugose spiralling whitefly (RSW) has reached Maharashtra, Assam, West Bengal, Gujarat and Lakshadweep Islands in a very short period. RSW is confined on the under surface of palm leaflets, desap profusely and release out honey dew excrements and get deposited on the upper surface of palm leaflets, which subsequently aid in the sooty mould fungus (*Leptoxyphium sp.*) turning black in colour affecting photosynthetic efficiency. This is one of the characteristic symptoms of pest attack. In general dwarf cultivars (Chowghat

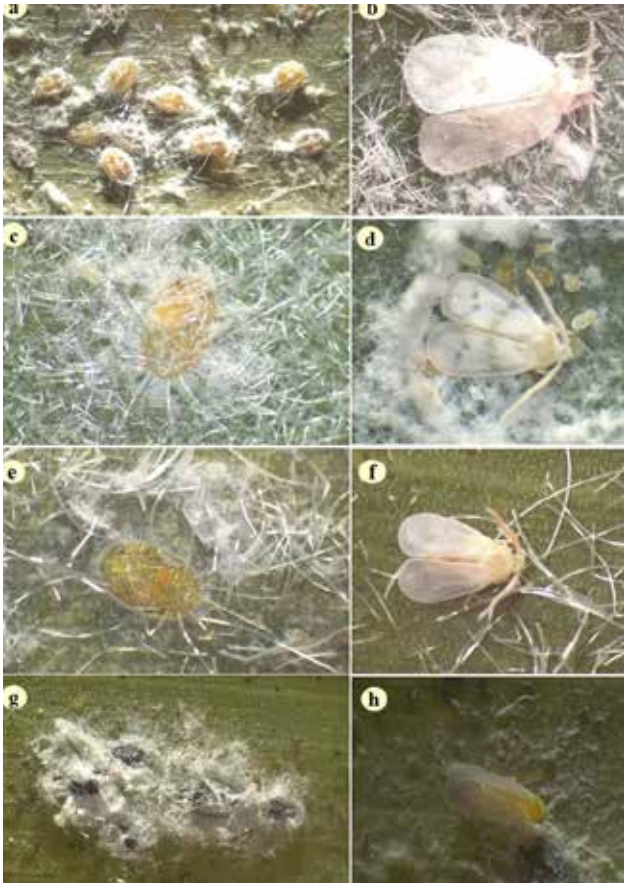

Fig 1. Diversity of exotic whiteflies.
a,b - Nymphs and adult of Aleurodicus rugioperculatus
c,d, - Nymph and adult of Paraleyrodes bondari
e,f - Nymph and adult of Paraleyrodes minei
g,h - Nymphs and adult of Aleurotrachelus atratus.

Orange Dwarf, Malayan Green Dwarf and Malayan Yellow Dwarf) are found susceptible whereas the Tall cultivars (West Coast Tall) are relatively tolerant.

During 2019 two nesting whiteflies viz., Bondar's nesting whitefly *(Paraleyrodes bondari*) (Fig 1c,d) and Non-native nesting whitefly (*Paraleyrodes minei)* (Fig 1 e,f) co-existed in the colonies of RSW and regulated their population to greater extent was reported from Kerala, Tamil Nadu and Andhra Pradesh. Nesting whiteflies were relatively smaller (1.00 mm) whereas RSW is about 2.20 mm size with conspicuous brown mottling on wings. Nymphal stages of nesting whiteflies are flat whereas it is convex for RSW. In addition, a new non-native palm whitefly (*Aleurotrachelus atratus*) (Fig 1g,h) was recently reported on coconut from Mandya and Mysuru district of Karnataka. The nesting whitefly, *P. minei* was closely associated with *A. atratus* in most cases reducing the incursion potential of palm whitefly which otherwise causes damage including necrotic lesions on palm leaflets as reported from other countries. Adult palm whiteflies are smaller than RSW, longer than wide and the wings are held roof like upon rest unlike the nesting whiteflies which are absolutely flat. Eggs of palm whitefly are blackish with characteristic eight puffs on emerging nymphs and conspicuous blackish puparium clothed by dense white covering along the sides. The quantum of honey dew produced by RSW was found to be higher than other whiteflies reported so far. RSW was also found to be cosmopolitan and reached all over the country in a short period calling for a holistic package to hold down the severity.

Holistic package

a) Conservation biological control

Pesticide holiday approach aiding in the conservation biological control using the aphelinid parasitoid, *Encarsia guadeloupae* (Fig 2c,d) and the chrysopid predator, *Dichochrysa astur* (Fig 2a.b) as well as in situ preservation of the sooty mould scavenger beetle, *Leiochrinus nilgirianus* (Fig 2e.f) were found pivotal in the bio-suppression of the exotic whiteflies. This strategy was mainly preferred to avoid indiscriminate use of insecticide in coconut system to conserve the pollinators, aforesaid natural defenders and the bio-scavenger beetles which were actively involved in the regulation of *A. rugioperculatus*. The predator, *D. astur* and the parasitoid, *E. guadeloupae* co-occurred along with the pest and in a period of four to five months of pest introduction, these natural enemies subdued the pestilence potential of RSW, which is normally observed in coconut belts experiencing less precipitation, humidity as well as high temperature coinciding summer period. In addition, during the monsoon phase the sooty mould scavenger beetle, *L. nilgirianus* devoured the sooty mould encrusted on palm leaflets and completely cleaned the palms reviving back the photosynthetic efficacy in toto. This warranted the pesticide holiday approach which later proved quite successful in reducing the invasive potential of RSW coordinated by the natural enemies (*D. astur, E. guadeloupae*) and bio-scavenger beetle (*L. nilgirianus*) restoring the natural ecosystem and the dynamic pollinators involved in ecological services. In this conservation agriculture approach, the RSW population got reduced by 80% and parasitism reached as high as 85% in a period of five to six months.

Fig 2: Conservation Biological control of Rugose Spiralling Whitefly
a,b - Eggs and grub of Dichochrysa astur
c,d - Parasitized pupa of Aleurodicus rugioperculatus and the aphelinid parasitoid, Encarsia guadeloupae;
e,f - Eggs and adult sooty mould scavenger beetle (Leiochrinus nilgirianus)

b) Mechanical control

All species of whiteflies preferred yellow colour than other colours including green, red, black, white etc. Since the whiteflies are active and mobile during crepuscular phase (Early morning and late evening), installation of yellow sticky traps (Fig 3c) all over the garden and affixing on palm trunk trapped the floating whitefly population and reduced the migratory potential of the pest. Even a yellow plastic sheet coated with white grease or castor oil could also serve the purpose in the non-availability of sticky traps. This method was quite easy to adopt and formed an essential strategy in the sustainable management of the pest. More than five to six adult whiteflies could be trapped in an area of 1 cm2 on the yellow sticky trap installed in the pest-inflicted garden.

c) Water or botanical spraying

Whiteflies are susceptible to wetness and well distributed rainfall could suppress the pest population significantly. RSW population is very low during monsoon season. Simulating this approach, jet spray of water (Fig 3d) was found effective in dislodging the whitefly colony and this habitat modulation strategy could temporarily disperse the seriousness of the pest and encourage parasitism as well. If the colony exceeds 20 per leaflet, application of 0.5% neem oil admixed with Tween 80 (0.005%) is quite effective to reduce the pest population instantaneously. Dosage is very critical because any increase in neem oil concentration could also invariably affect natural defenders and ever sustaining pollinators. This water spray and neem oil spray is warranted only if the pest population exceeded the threshold level of >20 live colonies per leaflet. At low pest population, conservation biological control alone would be sufficient to counter the pest attack and check the population below the threshold level.

d) Nutrition management

Palm health management comprising adequate nutrition, optimising soil physico-chemical and biological properties, judicious water usage, and pest and disease management are very important to sustain income from palms which in fact justifies the commemoration of International Year of Plant Health in 2020. RSW normally de-saps from older leaves which had completed the nut production stage, however, the impact need to be corrected by supplementation of primary, secondary and micro nutrients on soil test basis (Fig 3a) to accelerate production of new fronds and inflorescence. Copious delivery of water through drip mode along with nutrients could withstand the health deterioration and make up the brunt of pest damage. Soil moisture conservation (Fig 3b) and basin management through mulches (Fallen leaves and petioles) is a long-term approach in palm health management for sustained conservation of microbes involved in nutrient recycling and other ecological benefits providing continuous farm income.

e) Ecological intensification

Mono-cropping in coconut is slowly replaced with crop pluralism to infuse diversity and multitude of volatile cues to disorient pests. In the classical experiment of ecological engineering (Fig 4) comprising Kalpa sankara (CGD x WCT) with diverse intercrops viz., nut meg, rambuttan, curry leaf, banana, lemon, jack, eco-feast crops like coral vine, flowering crops (marigold, cosmos etc) demonstrated at ICAR-CPCRI, Regional Station, Kayamkulam in 60 cents encouraged the defender (predators, parasitoids) and pollinator (bees, flies, wasps and butterflies) population and subdued pest (rhinoceros beetle, red palm weevil, rugose spiralling whitefly) population. There was about two

Fig 3. Bio-suppression of rugose spiralling whitefly

a) Fertilizer application, b) In situ basin mulching, c) Yellow sticky tap in coconut garden, d) Jet water spray

to three fold reduction in pest population including RSW in the diversified garden compared to coconut mono-cropping. While RSW damage was 4.3% in ecological engineered coconut garden, it was 24.8% in mono-cropped garden. This ecological agriculture approach encompasses species richness and diversity due to insect hotel (Indigenous trees) and crop cafeteria (diversification). A continuous income cum employment is being ensured in this stimulo-deterrancy model, where an inch of land is effectively utilized with the bunch of crops to become climate smart and lead to an environmentally responsible farming. Radiation from sun will not strike the soil surface directly in diversified garden and so is the rain droplets primarily fall on plant leaves rather than smacking on soil. From about 39 hybrid palms yielding more than 160 nuts per palm per year could realize more than 1.3 lakh rupees besides making the system self reliant even in COVID-19 pandemic period delivering consumables (fruits, curry leaf etc) on a regular basis.

The holistic package evolved in the bio-suppression of invasive whiteflies is very practical and eco-friendly resulting in doubling farm income, enhancing ecological benefits and sustainable pest management. This approach of ecological intensification would fit in with the conservation of biological control making it self-reliant coconut-based inclusive farming and hold down invasive whiteflies in the most efficient manner.

These strategies augment sustainable nut production accomplished through biological and organic pest management solutions. Lastly, strengthening quarantine and regulatory interception of alien invasive species at sea and airports is critical to prevent entry of transboundary pests and diseases in the near future. Prevention is indeed better than cure! ■ *Author for correspondence: joecpcri@gmail.com*

Goat Farming in Coconut Gardens – A Pivot of Confidence for Rural Unemployed during COVID era

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Today, the world is suffering an extra-ordinary looming panic of the deadly viral pandemic and is at cross–roads to move ahead sustainably. The corona viral pandemic in India has been largely disruptive affecting all walks of life, encompassing Agriculture, Energy, Employment and Economy. A vast majority of the world's poor live in rural areas and agriculture remains the prominent source of livelihood for 86 per cent of them. Their livelihood is characterized by small holdings or landlessness, illiteracy, unemployment and malnutrition. As per the report of the Centre for Monitoring of Indian Economy, the unemployment rate had shot upto 26 % across India and many rural households suffered an income dip during April 2020. Food and Agriculture Organization of the United Nations underlines that rural youth are 40 per cent more likely to be in casual work than their urban counterpart and many earn their income only on a daily or weekly basis, with little access to social security. Small scale enterprises in the rural regions are highly vulnerable to the fluctuations in supply-chain together with depression of demand, leaving ripple effects on their households. Thus encouraging agrobased ventures in the rural areas is the way out to revive the rural economy from financial crunch and from emotional setbacks.

Coconut Farming – A Determinant of Rural Economy

Coconut plantations turned out to be a sensitive victim to receive the catastrophes of the impacts of COVID scenario. Coconut plantations hold great promise on the rural economy of many countries across the globe. It provides livelihood security to 64

million farm families and 12 million Indians accrue direct / indirect benefits from coconut industry. In India, coconut is a crop of small and marginal farmers, spreading over an area of 2.15 million hectares yielding a production of 21,288 million nuts (Source: Horticulture Division, Department of Agriculture and Co-Operation, Ministry of Agriculture and Farmers' Welfare, Government of India). More than 98 % of the coconut holdings in the country is less than 2.0 ha in size and more than 90 % of them are lesser than 1.0 ha. Export earnings derived from coconut is around Rs.3000 million and is mainly vested with the export of coir and coir goods. Processing and associated activities generate employment opportunities to nearly three million people in India. Coconut farming, providing a platform for the production of array of kernel based, shell based, inflorescence based and coconut wood based products offer excellent prop up to the rural economy.

Goat Rearing – A Profitable Venture

Ever fluctuating price chart of copra together with resurgence of pests and diseases draws roadmap for the farming community to integrate animal component in coconut plantation. Integrated Farming System in coconut is economically rewarding, ecologically sustainable and emotionally complacent for the rural farmers. Crop and animal enterprise are the two major segments of the Integrated Farming System.

Crop component

Coconut palms especially tall palms with a spacing of (7.5 x 7.5) m2 to accommodate fodder crops is the pre requisite of Integrated Farming System. Fodder crops should not compete with the main crop for natural resource and for foraging nutrients. They should possess the ability to withstand shade and should respond to fertilizer application to a great deal.

Glyricidia plants along the borders of coconut garden

Monkey Pod Tree







1.Telicherry breed
2. Jamunapari breed
3. Barbari breed
4. Kanni Aadu
5. Osmanapadi
6. Black Bengal
7. Boer Goat

Fodder crops should be relished by cattle. Commonly employed fodder crops in coconut ecosystem include graminaceous fodders like guinea grass, Cumbu napier hybrid and leguminous fodder crops viz., Desmanthus, Subabul and Stylosanthes. Glyricidia, Moringa, Kadamba, Sesbania, Cotton candy berry and Indian Tulip tree can also be accommodated along the borders. Goats have special preference towards monkey pods (Pethecellobium dulce), which can be raised in the field borders without offering hindrance to coconut.

Animal Component

Goat is often celebrated as "Poor man's cow" or "Moveable Wealth" and is highly suitable for semi-intensive and extensive systems of management. Although an array of goat breeds is available, Jamunapari, Beetal, Barbari, Telicherry, Kanni Aadu, Kodi Aadu, Boer goat and Osamanapadi are commonly employed for rearing. The characteristic features of the common breeds are furnished below. Depending upon the local situation, economy, fodder availability and purpose, the goats can be selected for rearing.

Characteristic features of Common Indian Goat Breeds

1.Telicherry breed

Also called "Malabari goat" is the well recognized breed of Kerala and Tamil Nadu. Mainly reared for meat and milk. This is medium in size with colours ranging from black, white and brown. Known for exhibiting multiple birth rate compared to other breeds of South India. An adult female (10 - 12 months old) weighs from 30 to 40 kgs whilst an adult male between 40 and 50 kgs. Female goats (Does) can give birth to three to four kids per year and the milk yield is one to two litres per day.

2. Jamunapari breed

"Jamunapari" breed is mainly found in Uttar Pradesh and takes its name from the river Yamuna. Skin colour is white with patches of tan on the neck and head. They have a convex nose imparting parrot like appearance. Long drooping ears is the special feature of this breed, with beard and horns in both the sexes. They are the elegant and long legged goats of India. An adult female weighs between 45 to 60 kgs and an that of an adult male ranges from 65 to 80 kgs. Meat is reported to be low in cholesterol. Milk yield is around 2 litres per day and the average age of first conception of this breed is 18 months.

3. Barbari breed

Barbari goat is mainly found in the states of Haryana, Punjab and Uttar Pradesh. It derives its name from Berbera, located on the Indian Ocean.

Goats are multi purpose, versatile animals which produce milk, meat, fiber and skin together, which can be reared easily with less space, less demand of housing and other management with relatively low initial investment.

It is a medium sized animal with compact body. It is a seasonal breeder and is employed in intensive farming, bred mainly for milk and meat. The milk yield is approximately 107 litres in a lactation of about 150 days. Colour of this breed is white with light brown patches. Weight of adult female goat varies from 25 to 35 kgs while that of adult male goat from 35 to 45 kgs. Average milk yield ranges from 1.5 to 2.0 litres per day.

4. Kanni Aadu

These goats are mostly found in Tirunelveli and Ramnad districts of Tamil Nadu. They are characterised by black or white spots over a dark tanned skin. The weight of adult female ranges from 25 – 30 kgs and that of adult male from 35 – 40 kgs. It gives birth to 2 to 3 kids per delivery. They have the ability to adapt themselves to drought conditions.

5. Osmanapadi

Osamanapadi goat is known for its high kidding ability, disease resistance and adaptability to diverse rearing systems. Goat is predominantly black, white and brown with spots. Average birth weight is 2.4 kgs. It gives kids once a year. Average age at first kidding is 19 – 20 months. Good quality meat is the characteristic of this goat. Average milk yield is 170 – 180 litres per lactation.

6. Black Bengal

Black Bengal is a Bangladeshi, dwarf meat–type, highly prolific breed of goat. They breed round the year and have resistance to a wide array of diseases. Average live weight of buck is 15 kgs and doe is 12 kgs. It is most prolific among the Indian breeds. Average age at first delivery is 9-10 months. Length of the lactation period is 90 to 120 days. Reports reveal that birth weight, growth rate and milk yield of these goats is low in the order of 800 – 900 g, 40 – 45 g per day and 400 – 700 ml per day.

7. Boer Goat

Boer goat is a South African breed but suitable for farming in India. Boer goat has a fast growth rate with excellent carcass qualities, making it one of the most popular breeds of meat goat in the world. They have white bodies and brown heads. Boer goats have high resistance to diseases and adapt to hot, dry semi deserts. An adult male goat weighs about 110-115 kgs and a female goat weighs about 90-100 kgs.

- ***Ventilation***

Shed should be well aerated and ventilated to maintain goats in a hygienic atmosphere. It is also essential for maintaining the temperature for air flow. Slatted Goat Shed is recently gaining momentum because goats enjoy a very salubrious atmosphere in the shed, as urine and faecal pellets are drained down, paving way for their better breeding ability. Added advantage of this shed is the presence of compartments which helps isolate the sick, weak and pregnant goats. Goat shed can be disinfected with 3- 4 % $KMnO_4$ solution at fortnightly intervals to prevent the spread of diseases.

- ***Orientation***

To facilitate intrusion of solar radiation, East–West orientation of goat shed is considered as the best. Elevated goat shed offers protection for goats from damp conditions, crawlers and reptiles. Shed should be 20 feet wide of any convenient length.

- ***Feeding***

Goats respond very well to well balanced and nutritious feed. For successful growth and reproduction, it requires 12-18 % protein. A perfect blend of proteinaceous and non-proteinaceous feed and fodder facilitates the goats in weight gain, disease resistance and in parturition.

Prospects of Goat Farming

• Goats are multi purpose, versatile animals which produce milk, meat, fiber and skin together, which can be reared easily with less space, less demand of housing and other management with relatively low initial investment.

• Production costs like infrastructure, feeding and treatment are less.

• Goats can adapt themselves to diverse agro-climatic conditions and to changing weather scenario.

• Goats are prolific breeders and achieve sexual maturity at the age of 10-12 months. Gestation period of goats is short and at the age of 16-17 months they start yielding milk.

• Diseases are less common in goats and doesnot require expensive veterinary aid.

• Goat products have wide acceptance throughout the world without any social taboos.

Economics of Goat Farming (Per year for a flock of (6+1) goats)

One acre of coconut garden can support 15-20 goats. Initially the venture can be started with (6+1) goats and as the flock reaches a threshold of 15-20, surplus can be sold. Cumbu Napier hybrid cultivated over one acre can yield a green fodder of 17 - 20 tonnes per annum. Fodder yield of Desmanthus over one acre is 15- 18 tonnes per annum. Besides, a good amount of feed can be generated from Glyricidia, Agathi, Moringa, Cotton Candy Berry and Monkey Pod Tree raised on the borders and edges. Economics of rearing a flock of (6+1) goats is furnished below:

S.No.	Particulars	Amount (Rs.) per year
Fixed Cost		
1.	Flock size (6+1)	10500
2.	Goat Shed (27 x 27 ft)	150000
Variable Cost		
1.	Labour wages	70000
2.	Green fodder @ 30 kgs per day	35000
3.	Concentrate	25000
3,	Vaccination & Veterinary Aid	3000
4.	Associated Expenses	2000
		135000
Gross Revenue		
1.	Sale of kids, does and bucks (24 no.s @ Rs.500 per kg)	288000
2.	Manurial value of 7000 kgs	10000
		298000
	Net Revenue	163000

As one acre of coconut garden can support 20 goats, it is possible to generate a net annual revenue of Rs. 4.89 lakhs through goat farming alone.

Unemployed Turned Entrepreneur

(i) Case Study 1

Mr. Subramanian of Aliyarnagar, Coimbatore district, Tamil Nadu is overwhelmed to narrate the transformation made by goats in his life and the tangible and intangible benefits accrued through goat rearing. He had been leading a drifting life without permanent employment. Having derived hint from the Integrated Farming System model of AICRP (Palms) scheme of Coconut Research Station, Aliyarnagar, he purchased a pair (1+1) of Jamunapari breed of goats a year back and started rearing in the one acre coconut garden owned by him. Within six months, the goat gave birth to two kids which provoked confidence in him to expand goat rearing to a business venture. He celebrates the kids as new additions to his family. He spells with all hope that goat rearing will scrap his worries and negativities and reframe his life towards prosperity.

(ii) Case Study 2

Mr. Aruchamy, a coconut grower of a village of Pollachi taluk of Coimbatore District owns (7+2) flock of Boer goats. He tells that goats give consistent income to him through kids and manure and he is regardless of the fluctuating price chart of copra.

138th Meeting of Coconut Development Board

138th Meeting of Coconut Development Board was held on 28th July 2020 under the Chairmanship of Smt. G Jayalakshmi IAS, Chairperson, Coconut Development Board. Hon'ble MPs and Members of the Board, Smt. Chinta Anuradha, Shri K.K. Ragesh and Shri Gangasandra Siddappa Basavaraj and other Members of the Board, Dr.B.N. Srinivasa Murthy, Horticulture Commissioner, Dr. Anitha Karun, Director, Central Plantation Crops Research Institute, Shri. Sudhir Garg, Joint Secretary, ARI, Ministry of MSME, and Chairman, Coir Board, Shri Gagandeep Singh Bedi IAS,. Agricultural Production Commissioner & Secretary to the Government of Tamil Nadu and Shri B. Pradhan IAS, Special Secretary to the Govt. of India & Financial Advisor attended the meeting. Shri. Saradindu Das, Chief Coconut Development Officer and Shri R. Madhu, Secretary CDB attended the meeting.

Slatted Goat Shed at Coconut Research Station, Aliyarnagar

Soil fertility of his one acre farm is enriched with the droppings and urine of goat. He has planted trees of cotton candy berry, Thespesia populnea and Manila Tamarind in his farm which supplies abundant leaves for the goats. In his perspective, rearing goats renders eustress to him. He obtained a net profit of Rs. 1.42 lakhs during 2019 through the sale of goats. Besides economic benefits, he says goat rearing is a therapeutic activity for his body and soul.

Conclusion

Goat farming which remained as a traditional occupation of India has underwent a major set back in the interim period because of urbanization. Goats are very agile and independent animals with high level of resistance to diseases and are amenable for rearing without drudgery. COVID -19 has left special imprints in the rural economy of the nation. Reverse migration of workers who could not be absorbed per se in farm holdings, disruption of distribution channels, shattered business cycles and informal economy inched up rural unemployment during the COVID period. In the backdrop of the dreadful pandemic, Goat Farming has turned out to be a viable endeavor and a pivot of confidence for rural unemployed youth towards economic prosperity, emotional well being and to transform them as a profitable entrepreneur. ■

Coconut Milk Coffee

Courtesy

Ingredients

Coffee Powder	**1/2 cup**
Coconut Water	**4 cup**
Coconut Milk	**1/2 cup**
Honey & Sugar	**5 tea spoon**

Preparation Method

Grind coffee bean with its pod. Pour the coffee powder into a jar and mix well with coconut water and keep in the refrigerator for around 8 hours. Then filter the coffee grounds through a fine sieve or a thin muslin cloth. Add half cup coconut milk to the filtered coffee powder. Add enough sugar and honey as sweetner.

It can also be prepared by adding 3 teaspoons of coffee powder instead of coffee beans.

Occurrence of bizarre/freakish inflorescence in coconut palm

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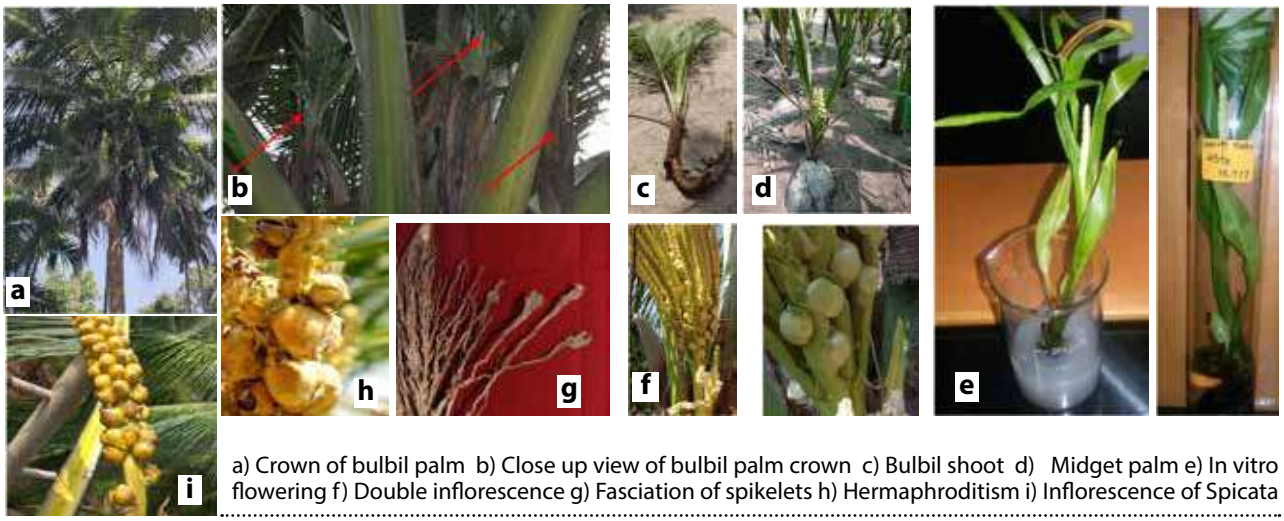
The coconut is one of the most useful plants to the humans and every part of the palm was being useful from very ancient times. The palm is monoecious with distinct male and female flowers borne on the same inflorescence.

The coconut, *Cocos nucifera L.* is one of the most useful plants to the humans and every part of the palm was being useful from very ancient times. The palm is monoecious with distinct male and female flowers borne on the same inflorescence. The coconut inflorescence is known as a 'spadix' which is borne singly in the axil of each leaf. The male flowers are borne on the top portion of spikelets and female flowers are situated at the base of the spikelets.

The production of inflorescence commences as a vegetative meristem that later gets converted into floral primordia. The transition of vegetative meristem to the flowering state has been considered to be controlled by genetic factors combined with environmental factors like temperature, daylight and the developmental state of the plant. In most flowering plants, there is a clear differentiation of vegetative and reproductive growth phases, whereas in palms like coconut, these phases are continued even after the first flowering, throughout its life time, wherein a single terminal bud continues to produce leaves whereas the axillary buds regularly get converted into inflorescence, which subsequently produce flowers and fruits.

In coconut, the inflorescence primordium is reported to develop in the leaf axils about 32 months before the opening of the inflorescence. The primordia of the branches of inflorescence develop in about 16 months and male and female flowers in about 11 and 12 months, respectively before the opening of the inflorescence. The ovary normally differentiates 6-7 months before the opening of the inflorescence. Various environmental factors including nutrition during the 32 months period before the opening of inflorescence affects the yield of coconut. In coconut, the spathe (inflorescence) opens at the 32nd month and fertilization takes



a) Crown of bulbil palm b) Close up view of bulbil palm crown c) Bulbil shoot d) Midget palm e) In vitro flowering f) Double inflorescence g) Fasciation of spikelets h) Hermaphroditism i) Inflorescence of Spicata

place during the 33rd month after initiation of the floral primordium. The nut development process takes 10-12 months after female flower fertilization depending upon the season. In exceptional cases, the inflorescences of coconut show some abnormalities in the development creating curiosity. Such variations could be due to genetic/epigenetic/ physiological reasons. Some of the abnormal/rare traits observed in inflorescences are reported in this article.

1. Bulbils

Usually the leaf axil of a normal bearing coconut palm subtends to an inflorescence. In bulbil forming palms, these spadices, spikes, female flowers and male flowers gets transformed into vegetative shoots either in part or fully due to genetic and environmental factors. These are known as bulbil-shoots on account of their similarity to bulbils seen in certain members of Agavaceae and Liliaceae families. The term 'bulbil' denotes small, young plant that is reproduced vegetatively from axillary buds on the parent plant's stem or in place of a flower on an inflorescence. The palm resembles normal coconut palms in its morphological appearance, except that they produce only bulbil shoots in place of normal inflorescence and hence do not produce nuts. At the time of emergence from the leaf axil, the shoot like structure just resembles a normal inflorescence with a green spathe covering the growth. In the bulbil shoots, the emerging spathe was observed to split vertically to expose spathes with leaf sheath and the top as leaflets. The transformation of reproductive structures into vegetative shoots may be due to certain genetic and environmental factors. The phenomenon is also known as pseudo vivipary as it is akin to development of seedlings still attached to the mother palm. In bulbiferous palms, the terminal bud continues to produce leaves and the axillary buds grew into spathe like inflorescence and then get converted into bulbil shoots making the palms completely vegetative. However, the root formation of such bulbil shoots was not observed in these palms.

2. 'Midget' coconut palm

In coconut nursery, rarely certain coconut seedlings flower at the early infant stage and are referred as "midget" palms. The inflorescence produced is terminal and they soon die after producing the first inflorescence. Such inflorescence is conspicuous for the absence of the spathe. They bear only female flowers and these ranged upto eleven in an inflorescence. These palms are normal in their habit with adventitious root system. The inflorescence appeared at the terminal portion of the short regular stem. Presence of unsplit leaflets in midget palm is a remarkable feature and the leaves of this palm have narrow stipular sheaths. Decrease in size of leaves was noticed and the last two leaves appeared at the base of the inflorescence resembles bracts which enclose the young spadix. This decreasing size of leaves and terminal inflorescence are rare occurrence among coconut palms which bear axillary inflorescence. However this is generally observed in some members of monocot family where the terminal bud transformed into an inflorescence or flower.

In midget palms the inflorescence is a simple spadix without a regular spathe but

the two bracts found just below this terminal inflorescence serves the function of spathes. Midget palm dies or wither after flowering and this palm is monocarpic according to Morris (1892) instead of polycarpic normal palms. Hence this phenomenon of early flowering in seedling stage has no significant utility to the farmers since the palm dies before producing any nut. Immature or infant flowering in midget palm may be due to some photoperiodic induction occurred in the unsplit immature leaves of the palm because these partially matured leaves are highly sensitive and capable of initiating flowering through photoperiodic response. The midget palms are usually noticed in progenies of dwarf palms.

3. In vitro flowering

A case of in vitro flowering was noticed at ICAR-CPCRI Regional Station, Kayamkulam in tissue culture plantlets of West Coast Tall (WCT) cultivar. Immature inflorescence was used as the explants. The transition of vegetative shoot to reproductive state was accompanied by some morphological changes in the in vitro raised plantlets which include rapid emergence of long and thin leaves before the appearance of pearly white inflorescence. As in midgets, the emergence of inflorescence was terminal and the inflorescence was devoid of spathe. Usually the conversion from vegetative to reproductive growth in vitro is regulated by various external and internal factors, which include plant growth regulators, nutrients, pH of the medium and light conditions. Prolonged sub-culture in the same media might have resulted in changes in pH and reduction in organic and inorganic constituents of the media and the resulting chemical stress might have induced in vitro flowering.

4. Double inflorescence

A rare occurrence of double inflorescence in one leaf axil of Chowghat Green Dwarf variety of coconut was noticed. Each of the two spadices was independent with fully developed spathe with normal spikelets bearing male and female flowers. However, the size of one of the spadices was smaller with only seven spikelets and five female flowers. Outer spathe was common to both spadices and therefore external appearance before the opening of inflorescence was normal. The double inflorescence was observed in only one inflorescence of the palm indicating that this may not be due to genetic factors

5. Fasciation of spikelets

In fasciated spikelets, the proximal end of some of the spikelets is flattened. The spikelets bear normal male female flowers. The fasciation is not observed in all the spikes of the same palms and hence it is not genetic. It may be due to the insect attack or similar injury to the spikelet happened during the meristermatic stage. This injury induces a rapid growth in the meristem and thus enhancing the surface area.

6. Hermaphroditism

Coconut is normally monoecious, bearing male and female flowers separately in the same inflorescence. The male flowers are arranged at the distal end of the spikelet and female flowers at the basal portion. Occasionally some palms which bear hermaphrodite flowers along with male and female flowers. The hermaphrodite flowers are located in between female and male flowers. These flowers are bigger than male flowers and smaller than female flowers. Sectioning of hermaphrodite flowers revealed well developed anthers and ovary. It is reported that some of the hermaphrodite flowers develop into nuts and these nuts are smaller in size than the normal ones.

7. Spicata

Palms with unbranched inflorescences, is referred to as spicata and have rarely been reported from all coconut growing regions. Spicata type is believed to have arisen from Tall coconut types and is associated with meiotic abnormalities. They are tall palms with unbranched inflorescence or inflorescence with one or two small spikes, unlike the normal inflorescences that are branched with 30-35 spikelets. The inflorescences of the spicata palms bear a large number of female flowers (125-130) with very few male flowers (50), in stark contrast to the normal inflorescences, with innumerable male flowers and few female flowers at the base of each spikelet. One of the characteristic features of the unbranched type of spicata is that female flowers are attached throughout the main rachis of the inflorescence, resulting in closely set fruits compared to normal inflorescence. Based on color, three types of spicata have been identified i.e. green, brown and yellow. However, a complete documentation on the morphology, taxonomy and genetic control of the spicata character in coconut is lacking which in turn limits the potential of exploiting this character in the breeding programme. ■

Development of Coconut Milk Paneer and Evaluation of its Quality Characteristics

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Coconut is a versatile product and has multiple uses. Coconut milk is essentially composed of high amount of protein, sugars, fats, vitamins, minerals. Some benefits of coconut milk paneer include, it is a good substitute for people with lactose intolerance and helpful for people suffering from malnutrition and support the immune system. A study was undertaken to formulate the development of paneer using coconut milk which is a good alternative for dairy product. From the study, it is concluded that an acceptable paneer can be prepared by using soy milk and coconut milk blend. Paneer made with coconut milk had higher protein, calcium and iron as compared to normal paneer. The nutritional quality of coconut milk was increased by addition of soy milk for developing paneer. The developed product consists of 1.27% ash content, 9.43% protein, 12.20% fat, 56.2% moisture and 1.15% sugar. The microbial quality of paneer was also analyzed on total plate count, total coliform count, which is under permissible limit and *Escherichia coli*, *Salmonella* and *Staphylococcus aureus* were also analyzed. All these micro organisms are absent in 25g sample of the developed coconut milk paneer. The quality of coconut milk paneer was also compared with normal paneer in both biochemical and microbial parameters to understand the acceptability of the developed product. It was observed that, the fat content and moisture content in coconut milk paneer was under the standard limit of normal paneer on analysis. But, the protein content, ash and sugar is more in coconut milk paneer. Thus the study concluded that coconut milk paneer which is a value added food developed from coconut can be used for better therapeutic health and is a good protein substitute for people suffering from lactose intolerance. This in turn also increases the wealth of coconut industry.

Introduction

Coconut is a versatile and indispensable food item for millions of inhabitants of South and South-East Asia and Pacific islands. It is one of the most sought-after ingredients in kitchen since it is used in almost each and every recipe. Coconut is considered as food and also as oil seed crop. The various coconut products offer vast scope for further development, value addition and commercialization

Coconut crop has the advantage that it is suitable for small holdings as well as for large holdings. Coconut plays an important role in poverty alleviation as well as in employment generation.

Several decades ago processing sector was mostly confined to few traditional products such as copra, coconut oil, desiccated coconut and coir. Today the processing sector has gradually progressed into a producing vast array of new products from its products and by-products. Among other products, the modern coconut industry is capable of producing two basic types of valuable products from coconuts for food uses: the traditional coconut oil and the coconut protein. Traditionally, the majority of coconut protein is recovered and used in the form of coconut milk, both full fat and defatted (or skimmed). However, few published reports have indicated that coconut protein could be used, along with coconut fat, to prepare highly acceptable and relatively inexpensive new types of dairy-like foods such as custard-like products, various types of cheeses (soft, Cheddar and blue cheeses), yogurt, paneer and drinks. A balanced diet that includes coconut milk keep the heart healthy and protect against cardiovascular problems. Lauric acid, one of its key nutrients, has been found to reduce oxidative stress and blood pressure in hypertensive rats. This fatty acid also has antioxidant properties and aids in weight loss, which further enhances its cardio protective effects. It also support immune system and helps in weight loss. Coconut milk contains medium-chain triglycerides (MCTs), which researchers have linked with weight loss. MCTs stimulate energy through a process called thermogenesis, or heat production. MCTs work to reduce body weight and waist size. This also balances unstable gut micro biota. Findings of Wang Y, et.al; (2010) suggest that MCTs increase insulin sensitivity, and many researchers believe that this sensitivity promotes weight loss. Insulin is an essential hormone that breaks down glucose and controls blood sugar levels.

Coconut contain a lipid called lauric acid, and many researchers believe that lauric acid can support the immune system. Lauric acid has antimicrobial and anti- inflammatory properties and triggers apoptosis, cell death, in breast and endometrial cancer cells.

The present study helps in providing varieties in food preparation. Paneer recipes provide varieties in food preparation and a good source of calcium for most of the vegetarians. It also act as a protein source in vegan diet. It can be prepared either fried or in the form of curry. Different tasty dishes can be prepared from paneer using different flavours and preparation methods. Lastly, the product can also be taken by people who are allergic to dairy products. Coconut milk paneer can be provided to those who are suffering from lactose intolerance. Lactose intolerance is a condition that occurs when a person does not produce enough lactase to break down the lactose in food. This is because people vary in the amount of lactose they can tolerate. When milk products are eliminated from the diet because of lactose intolerance, an important source of calcium and other vitamins and minerals are eliminated. To prevent this condition, coconut milk paneer is a better option to be adopted by all consumers, which can provide a source of calcium and other vitamins and minerals. The main objective of the study was to develop paneer using coconut milk instead of replacing cow's milk, to evaluate the acceptability of the paneer by sensory evaluation, to study the chemical composition of coconut paneer, to determine the micro organisms present in coconut paneer and finally to compare biochemical and microbial parameters of paneer made from coconut milk viz. cow's milk.

Materials and methods

The samples for the study were collected from a local market at a reasonable price. After, the samples were collected, the product for the study was developed using these samples.

A standard and traditional procedure was followed for the preparation of coconut milk paneer. The total solid content (TS) of the extracted coconut milk was analyzed on each trial for balancing the milk solids for effective preparation of coconut milk paneer. There were two consecutive trials undertaken to determine the total solid content

(TS) of coconut milk in the preparation of coconut milk paneer. In the first trial, the TS of coconut milk was 20.7 percent and in the second trial, the TS was 24.7 percent. The consistency of the paneer was almost similar in both trials. The standard TS value of coconut milk was maintained for the preparation of coconut milk paneer to improve the texture and quality of paneer. The TS of coconut milk paneer in trial 2 was approximately similar to TS of standard paneer.

Procedure

• The standardized milk was mixed with equal volume of soy milk in the ratio 50:50. • This standardized milk with soymilk was heated to 85^0C and was homogenized on continuous mechanical stirring. • Allow the homogenized milk to heat further at a temperature of 85^0 C for 5-10 minutes. Do not allow the milk to be boiled. Just below the boiling temperature, add 20 ml of vinegar to separate the curd and whey water. • Further stir and heat it for 2-3 minutes and allow the mixture for complete coagulation. • Now cool the mixture for about 5 minutes and drain the seperated curd from whey water using a muslin cloth • Drain out excess water. • Keep the paneer to set overnight by pressing with proper weights to attain its consistency. • Now cut the paneer into cubes and dip it in water for few seconds and remove. • Pack the paneer blocks air tight and store under refrigerator.

Biochemical Analysis

Biochemical analysis is an important step in the development of healthier, safer and tastier food products. The fact that a product contains a certain component does not necessarily indicate its health-promoting effects and safety. The present study was also conducted with biochemical analysis to evaluate the amount of various biochemical parameters like ash (In Muffle Furnace), protein (Kjeldahl's Method), fat (Soxhlet Extraction), moisture (Hot Air Oven) and sugar (Absorbance in Calorimeter) present in the food sample.

Microbial Analysis

Microbiological analysis is the use of biological, biochemical, molecular or chemical methods for the detection, identification or enumeration of micro organisms in a material. It is often applied to disease causing and spoilage microorganisms. It helps to keep under control the proliferation of viruses, bacteria, microorganism which may cause contamination, intoxication and analyze the shelf life of the food sample. The study also analyzed by microbial analysis on total plate count, *Staphylococcus aureus, E Coli, Salmonella* and Total Coliforms.

Results

▶ *1. Development of Coconut Milk Paneer*

The TS percent of trial 2 (24.7%) gives the maximum yield of paneer of about 25g. TS of trial 1 (20.7%) gives lowest amount of paneer of about 20.5g. The consistency of paneer on each trial was similar.

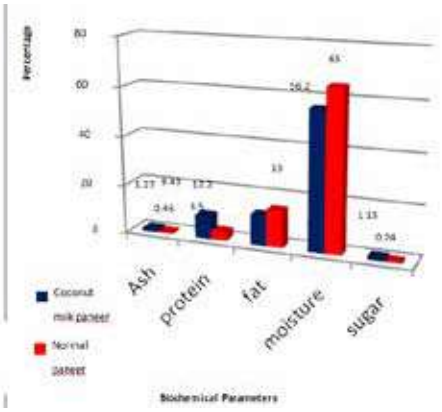
▶ *2. Sensory Evaluation of Coconut Milk Paneer over Normal Paneer*

Trial 1 Trial 2

Sensory evaluation was conducted on paneer, which was prepared in to a recipe and was carried out using 9- point Hedonic Scale method by the taste panel members for appearance, taste, flavor texture, odour and overall acceptability. The results of the evaluation revealed that appearance, taste and flavour of coconut milk paneer got a good score. The taste was liked extremely by the taste panel. Texture and odour also got good scores. The overall acceptability of the product was very good.

▶ *3. Bio Chemical Analysis of Coconut Milk Paneer over Normal Paneer*

The moisture content and fat content of the coconut milk paneer is about 56.2% and 12.2% respectively in the sample. Thus, the shelf life of the paneer is low due to higher moisture content. The sugar content is very low at about 1.15%. The amount of protein is 9.43% in the sample. Ash content is about 1.27%.While, according to the FSSAI Standards the moisture content and fat content of the normal paneer is about 65% and 15% respectively and the moisture and fat content of coconut milk paneer was under these permissible limits. Thus, it is observed that a low fat paneer can be prepared from coconut milk.



Coconut is a versatile product and has multiple uses. Coconut milk is enormously rich in vitamins and minerals. It also contains a significant amount of vitamin C and E. Coconut milk is essentially composed of high amount of protein, amino acids, water, sugars, fats, vitamins, minerals.

▶ 4. *Microbial analysis of coconut milk paneer over normal paneer*

- Total Plate Count

Total Plate Count was analyzed after a series of five dilutions and the count was under the standard permissible limit of 2.5 x 104 to 4.1× 104 cfu/gm.

Coconut milk Paneer	2.9 x 10 - 4cfu/gm (25g Sample)
Normal Paneer (cow's milk)	2.2 x 10 - 4cfu/gm (25g Sample)

Total Coliform Count	
Coconut milk Paneer	4.1 x 101 cfu/gm (25g Sample)
Normal Paneer (cow's milk) (Standard Permissible limit)	3.9 x101 to 7.6 x 101 cfu/gm (25g Sample)

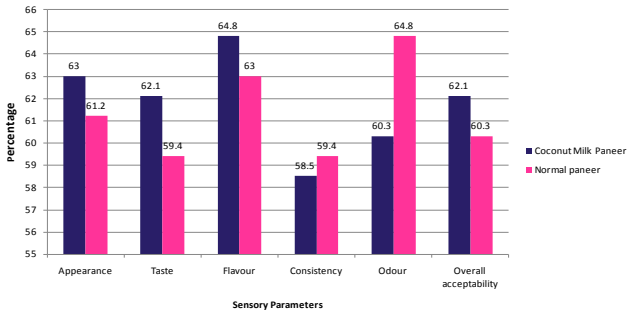
All other parameters, *E.coli, Salmonella and Staphylococcus aureus* are absent in 25g sample of both coconut milk paneer and normal paneer made from cow's milk.

The developed product consists of 1.27% ash content, 9.43% protein, 12.20% fat, 56.20% moisture and 1.15% sugar. The microbial quality of paneer was also analyzed on total plate count, total coliform count, *Escherichia coli,* and Salmonella and *Staphylococcus aureus.* The total plate count and total coliform count were under the permissible limits and hence have good market acceptability and is not hazardous. All other micro organisms are absent in 25g sample of the developed coconut milk paneer. The quality of coconut milk paneer was also compared with normal paneer in both biochemical and microbial parameters to understand the acceptability of the developed product.

It was observed that, the fat content and moisture content in coconut milk paneer is under the standard permissible limit of normal paneer. But, the protein content, ash and sugar is more in coconut milk paneer. The protein content of normal paneer was 3.5%, ash 0.46% and 0.24% sugar in 100g of sample.

Paneer usually has lower shelf life due to its moisture content. It is fresh in first 3-4 days and later the quality gets reduced. Since, coconut milk paneer has good protein source than standard normal paneer, it can be better acceptable than normal paneer. On sensory evaluation, coconut milk paneer was better acceptable by the panel members than standard normal paneer made from cow's milk. There are slight changes in the appearance and taste, but the flavour, consistency and odour of coconut milk paneer was almost similar to normal paneer. The cost of coconut milk paneer is slightly higher than normal paneer but the quality and nutritive composition of coconut milk paneer is higher than normal paneer. Therefore, the product has good market acceptability.

Coconut is a versatile product and has multiple



uses. Coconut milk is enormously rich in vitamins and minerals. It also contains a significant amount of vitamin C and E. Coconut milk is essentially composed of high amount of protein, amino acids, water, sugars, fats, vitamins, minerals etc . Several food products can be developed using coconut and its products. In the present study, a new product, paneer is developed using coconut milk and the acceptability of paneer was tested. Thus it can be concluded from the study that coconut milk paneer was found to be more acceptable than the standard paneer made from cow's milk. Coconut milk paneer is a good source of protein than standard normal paneer.

A low fat paneer can also be prepared from coconut milk. It consists of 1.27% ash content, 9.43% protein, 12.20% fat, 56.20% moisture and 1.15% sugar in which all the parameters were found to be under the standard limit given by FSSAI Standards and hence the scope of commercializing its production and marketing assumes its significance.

Acknowledgement: Dr. Anu Joseph, PhD, Associate Professor, St. Teresa's College (Autonomous), Ernakulam and Mrs. Aneeta Joy, Food Technologist, Coconut Development Board, Aluva.

Reference

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Hindi Fortnight

CDB observed Hindi Fortnight from 14th September to 25th September 2020. Shri. Saradindu Das, Chief Coconut Development Officer, CDB inaugurated the Hindi Fortnight celebrations of the Board on 14th September . Shri R. Madhu, Secretary CDB and Smt. S. Beena, Assistant Director, (OL) spoke during the occassion.

Ind- Carb Activated Carbon Unit

Shri. G Rajmohan, General Manager, District Industries Palakkad inaugurated Ind-Carb Activated Carbon Pvt. Ltd., an activated carbon unit based at Kanjikkode, Kerala. The plant with production capacity of 10 lakh Kg of activated carbon per annum is planning to procure 60000 kg of coconut shell from the coconut farmers of Palakkad, Thrissur, Malappuram and Pollachi areas.

Indian robot climbs trees to harvest coconuts

Researchers at Amrita Vishwa Vidyapeetham University have built a robot that can climb trees and cut down coconuts. The robot, known as Amaran, was created in response to a growing shortage in coconut harvesters in India. In a 15-minute process, users can manually assemble the robot's ring-shaped body around the base of a coconut tree. Utilizing its 8 inward-facing omnidirectional rubber wheels, Amaran then makes its way up to the top. A user wirelessly controls it from the ground, utilizing either a joystick unit or a smartphone app to move it up and down, and to rotate it around the trunk. Once the robot has reached the top, its arm is extended and positioned at the base of a bunch of ripe coconuts. Utilizing a circular saw blade on the end of the arm, Amaran then cuts through that base, allowing the coconuts to fall to the ground. In field tests conducted at a coconut farm, the robot successfully climbed trees up to 15.2 m in height, with trunk inclinations of up to 30 degrees. The device is designed by Rajesh Kannan Megalingam and team.

Coconut Seed Garden inaugurated in District Jail campus, Palakkad

Adoption of high yielding improved varieties is one of the important strategies for enhancing coconut productivity. However, the extent of adoption of improved varieties of coconut is very low and lack of availability of quality planting material of coconut is a major reason attributed for the low level of adoption of improved coconut varieties by the coconut growers. Limited number of mother palms available with the coconut research institutions, for developing new varieties has been the major cause of low spread of improved varieties. Raising mother palms and seed gardens in land under public sector institutions is a strategy to enhance availability of coconut seedlings. Major constraint in establishing seed gardens in public sector is the non-availability of land. Coconut planting material production requires large area for planting mother palms of improved varieties. Various departments under government have land that can be utilized for establishing mother

palms of improved varieties that will serve as source material for future.

With this approach, a coconut seed garden has been initiated by ICAR-CPCRI in the District Jail campus, Palakkad, Kerala State in collaboration with the State Department of Prisons and Correctional Services and State Dept. of Agriculture Development & Farmers' Welfare. A total of 100 seedlings; with 20 seedlings each of five coconut varieties released by CPCRI viz., Kera Chandra, Kalpatharu, Kalpa Prathibha, Kalpa Mithra and Kera Keralam have been planted in the seed garden.

Shri V. S. Sunilkumar, Minister for Agriculture, Government of Kerala inaugurated the seed garden on 16th July 2020 through video conferencing. Shri K. V. Vijayadas, M.L.A., Kongad, was the chief guest in the inaugural function. Dr. Anitha Karun Director, ICAR-CPCRI, Kasaragod and Smt K. Santhakumari, President, Palakkad District Panchayat were the Guests of Honour. Dr. C Thamban, Principal Scientist, ICAR-CPCRI presented the details of the project on coconut seed garden. Smt. Indira Ramachandran, President, Malampuzha grama panchayat, Shri. Sureshbabu V., Principal Agriculture Officer, Palakkad, Dr. P. Subramanian, Principal Scientist, ICAR-CPCRI and Shri Jose Mathews, District Secretary, Karshaka Sangham offered felicitations.

On line Interface programme on 'Enhancing productivity and income from coconut based farming systems'

On line Interface programme on 'Enhancing productivity and income from coconut based farming systems' was conducted on 16th June 2020 in collaboration with Haritha Keralam Mission, Government of Kerala. Dr. T N Seema, Executive Vice-Chairperson, Haritha Keralam Mission and Dr. Anitha Karun Director, ICAR-CPCRI, Kasaragod made the introductory remarks. Dr. C Thamban, Principal Scientist, ICAR-CPCRI presented the topic and Dr. P Subramanian, Principal Scientist, Dr. Prathibha P S, Scientist and Dr. Shameena Beegum, Scientist, participated as resource persons. Dr Jayasekhar S, Sr. Scientist, Mr. Sanjeev S.U., Consultant (Agriculture) and Mrs. Haripriya Devi, Technical officer (Agriculture), Harita Keralam Mission coordinated the programme. The programme was streamed through Facebook live.

'Thengum thanalum'- Radio series on coconut

Broadcasting of a radio series on coconut farming entitled 'Thengum thanalum' got underway through All India Radio Kannur station. The radio programme broadcast under 'Kisan vani' has been streamlined to create awareness among farmers and other stakeholders on various aspects of scientific coconut farming. The series included topics such as improved varieties of coconut, nursery practices for production of quality seedlings, planting and after care, integrated nutrient management, irrigation and water management, soil and water conservation in coconut gardens, coconut based multiple cropping and integrated farming systems, integrated pest and disease management, value addition of coconut, Farmer Producer Organisations for sustainable coconut development and experience sharing by successful coconut growers. The radio series 'Thengum thanalum' is a collaborative initiative of AIR Kannur and ICAR-CPCRI Kasaragod.

Online training programme for farmers on 'Coconut Production Technologies - Seed to Market'

Online training programme for farmers on 'Coconut Production Technologies - Seed to Market' was organised by ICAR-CPCRI Kasaragod in collaboration with Farmers Training Centre, State Dept. of Agriculture, Vengeri, Kozhikode during August 2020. Dr. Anitha Karun, Director, ICAR-CPCRI, Kasaragod inaugurated the training programme

on 4th August 2020. Introductory remarks were made by Dr. T.V.Rajendralal, Additional Director of Agriculture (Agrl. Extension), Dept. of Agriculture Development & Farmers' Welfare, Thiruvananthapuram in the inaugural session of the training programme. Dr. Thamban C, Principal Scientist presented the background, objectives and outline of the training programme. The online training programme covered 11 topics related to scientific coconut farming from seed to market and entrepreneurship development. The sessions were spread out during the period from 4th August 2020 to 27th August 2020. Dr. Thamban C, Principal Scientist, Dr. P. S. Prathibha, Scientist, Mrs. Rosly Mathew, Deputy Director of Agriculture, Farmers' Training Centre and Mrs. Remadevi P.R., Project Director i/c, ATMA Kozhikode were the coordinators of the online training programme. Coconut farmers from various districts in Kerala participated in the training programme and interacted with scientists on various topics on scientific coconut farming.

Scientist-Extension Personnel Interface Programme on Management of Coconut Gardens in Flood Affected Areas

A Scientist-Extension Personnel Interface Programme on Management of Coconut Gardens in Flood Affected Areas was conducted through video conferencing on 3rd July 2020 involving scientists from ICAR-CPCRI Kasaragod and officers of Department of Agriculture, Tamil Nadu. Dr. Anitha Karun, Director, ICAR-CPCRI, Kasaragod inaugurated the interface programme and Mr. A. Justin, Joint Director of Agriculture, Thanjavur, Tamil Nadu gave the introductory remarks. Dr. P Subramanian, Principal Scientist presented the topic.

Technologies recommended for the management of coconut gardens in flood affected areas and ways to enhancing efficiency of implementing various technological interventions for the same were discussed in the interface programme.

Dr. Thamban C, Principal Scientist, ICAR-CPCRI, Kasaragod and Mr. S. Eswar, Deputy Director of Agriculture (GoI scheme), Thanjavur were the coordinators of the interface programme. ■

World Coconut Day 2020

Shri Debasis Singh, IAS, Hon'ble Chairman and Chief Managing Director, West Bengal Housing Infrastructure Development Corporation Limited inaugurating the World Coconut Day programme.

West Bengal Housing Infrastructure Development Corporation Limited (WBHIDCO) celebrated 'World Coconut Day' on 2nd September by planting coconut seedlings. Shri Debasis Singh, IAS, Hon'ble Chairman and Chief Managing Director, West Bengal Housing Infrastructure Development Corporation Limited inaugurated the programme. Around 2000 saplings including coconut seedlings will be planted in New Town area of Kolkata as part of the programme. Shri Debasis Singh, IAS, Miss. Sritama Biswas, Technical Officer, Coconut Development Board, State Centre, Kolkata and other officials attended the programme conducted at Atharotola market, New Town, Kolkata. Coconut seedlings were planted by the dignitaries during the occassion.

World coconut day is celebrated on 2nd September every year across the country as well as globe. The day is celebrated to create awareness about the importance of the coconut and its potential benefits. The day is especially marked in countries under Asian and Pacific regions by the International Coconut Community (ICC) erstwhile Asian and Pacific Coconut Community (APCC) . The theme of coconut day of this year was "Invest in Coconut to save the world". India is one of the major coconut producing country while Kerala, Tamil Nadu, Karnataka and Andhra Pradesh are the major coconut producing states in India. World coconut day was celebrated by the AICRP centres with various training programmes and exhibitions.

Kahikuchi (Assam)

On the occasion of World Coconut Day on 2nd September 2020, a day long programme was organized in the Farmers' Field at Upar Hali, Bijoy Nagar under Kamrup district by All India Coordinated Research Project on Palms, Horticultural Research Station, Kahikuchi, Guwahati. The programme included seedling plantation, awareness generation, training and farmer-scientist interaction. As part of the programme, planting of coconut seedlings was done in the campus premises of the society. Addressing the gathering during the inaugural session of the programme, Dr. J.C. Nath, Principal Investigator deliberated on the significance and importance of observing 'World Coconut Day', industrial uses of coconut, post harvest management and product diversification of coconut in order to make its cultivation more remunerative for the farming community. In the training programme,

Ms Rinku Moni Phukon, Scientist, AICRP on Palms elaborated the procedure for selection of mother palms to get quality seed nut, method of planting of coconut seedling and fertilizer application in coconut and also briefed about other improved production technologies of coconut. Dr. S. Pathak, Principal Scientist, spoke on the various diseases and pest management in coconut. Various queries of the participants regarding coconut cultivation were elaborated by the scientists during the interaction session which included issues such as nursery management, planting method, neera production and disease and pest management. The meeting was ended with a vote of thanks offered by Sri Munin Das, President Gyan Vigyan Sammitee Kamrup district of Assam.

Veppankulam (Tamil Nadu)

The world coconut day was organized by Coconut Research Station, Veppankulam through video conference. About 150 farmers from different parts of Tamil Nadu, ADAs and AOs of Thanjavur district actively participated and the programme was facilitated by the Dept. of Agriculture, Thanjavur district and ICAR-KVKs (Vamban & Needamangalam). The welcome address was proposed by Dr. R. Marimuthu, Professor and Head, CRS, Veppankulam. Dr. L. Pugazhenthi, Dean (Horti.), Horticulture and Research Institute, TNAU, Coimbatore called upon the farmers to increase the productivity with adoption of new proven technologies to achieve better livelihood of coconut farmers. Dr. V. Ambethgar, Director, TRRI, Aduthurai briefed about the recent scenario of pest incidence in coconut and its management in Tamil Nadu. Th. A. Justin, Joint Director of Agriculture, Thanjavur district informed coconut farmers about the state welfare schemes and subsidies related to coconut crop and also declared the want of Geographical Indication for the Peravurani region coconut ecotype. Th. R.B. Shyam Sundar Ex. Member Coir Board explained about the role of coir and its value added products in the national economy and highlighted the latest invention of geo textiles for the soil erosion remedy and its usefulness in hi-tech road construction. Dr. R. Marimuthu, Professor and Head, CRS, Veppankulam spoke on trends in coconut cultivation practices and also facilitated the question answer session. The farmer's queries were clarified by the scientist's viz., Dr. M. Surulirajan, Asst. Prof. (Pl. Path.), Dr. R. Arun Kumar, Asst. Prof. (Hort.) and Dr. V. G. Mathirajan, Asst. Prof. (Ento.) in their respective fields.

Mondouri (West Bengal)

The world coconut day was celebrated on 30th August by arranging online National Seminar wherein Dr. Nirmal Babu, Former, PC, AICRP on Spices, Dr. Anitha Karun, Director, ICAR-CPCRI, Dr. K. B. Hebbar, HOD, CPCRI, Dr. Homey Cheriyan, Director, DASD, Kerala and Dr. Soudan Singh from CIMAP took part. Field visit cum training program of around 80 participants were also organized from Mondouri field.

Ambajipeta (Andhra Pradesh)

The World coconut day was celebrated through online Zoom webinar in Andhra Pradesh state as State programme on the theme Invest In Coconut to save the world by Horticultural Research Station, Ambajipeta, AICRP on Palms, Dr VSR Horticultural University in association with Department of Horticulture, Govt. of Andhra Pradesh. Webinar in vernacular language (Telugu) was conducted through Zoom Video conference. Dr. R.V.S.K. Reddy, Director of Research, Dr. YSR Horticultural University, Venkataramannagudem in his Inaugural address called upon the farmers to use the latest

technologies in coconut cultivation, to prepare value added products and to practice the coconut based cropping systems for higher and sustained yield. Dr. T. Janaki Ram, Honourable Vice chancellor, Dr. YSR Horticultural University, Venkataramannagudem in his presidential address spoke on the establishment of Dr. YSR Horticultural University, Salaha Kendras (Farmer advisory cell) for the benefit of farming community and appreciated Ryihu Bharosa Kendras (RBE'S) in implementing the farmer's programmes in Andhra Pradesh state. He also appreciated the Horticulture Research Station, Ambajipeta for the significant achievements in quality planting material production and development of biocontrol strategies for the management of pests and diseases. In his address, the Guest of Honour, Sri. Chiranjiv Choudary, IFS, Commissioner of Horticulture, Andhra Pradesh state called upon the farmers to follow latest management practices to increase the nut size and yield in Andhra Pradesh. Around 200 farmers participated in the World Coconut Day 2020 webinar from different coconut growing districts of Andhra Pradesh like East Godavari, West Godavari, Krishna, Visakhapatnam, Vizianagaram, Srikakulam, Chittoor, Nellore and Anantapur Districts. Later, Coconut entrepreneurs shared their success stories and feedback. Farmer-Scientists interaction session was held wherein the officers of Department and Scientists clarified the doubts raised by the farmers and the programme concluded with vote of thanks by Shri. A. Kireeti, Research Associate (Horticulture).

Ratnagiri (Maharashtra)

The world coconut day was celebrated at Regional Coconut Research Station, Bhatye, Ratnagiri on 2nd September 2020. Dr. Vaibhav Shinde highlighted the importance of coconut plantation as – "A best investment in life". Dr. Sunil Ghavale, Research Officer, spoke on 'Coconut orchard management-Problems and solutions to overcame'. Dr. Santosh Wankhede briefed on 'Insect pest management in coconut crops'. Publications of the Research Station 'Integrated Nutrient Management in Coconut Based Cropping System under Konkan Region of Maharashtra' and 'Coconut – Disease and pest management' were released during the occassion.

Navasari (Gujarat)

The online webinar on "Production Technology and Value Addition in Coconut" was organized by All India Coordinated Research Project (Palms), ASPEE College of Horticulture and Forestry, Navsari Agricultural University, Navsari through Google meet platform on 08th September 2020. Dr. S. R. Chaudhary, Hon'ble Vice Chancellor i/c and Directorate of Research and Dean PGS, Navsari Agricultural University, Navsari was the chief guest of this function. Dr. P. M. Vaghasiya, Director of Horticulture, GoG, Gandhinagar; Dr. K. A. Patel, ADR (Agriculture) and I/c Director of Extension Education, Navsari Agricultural University, Navsari and Dr. P. K. Shrivastava, I/c Principal and Dean, ASPEE College of Horticulture and Forestry, Navsari Agricultural University, Navsari were the guests of honour. In the beginning of programme, Dr. Pankaj P. Bhalerao,

Project In-charge, AICRP (Palms) welcomed the dignitaries and participants and briefed on the importance of celebration of World Coconut Day. Dr. S. R. Chaudhary, in his presidential address briefed the importance of coconut in human life and requested the coconut farmers to adopt scientific management practices to increase the production, productivity and income. He also focused on the mechanisation in harvesting of coconut and value addition in coconut for doubling farmer's income. Director of Horticulture, Dr. P. M. Vaghasiya advised the coconut growers of the state to utilize the assistance provided by the department of horticulture for increasing the area under coconut cultivation as well as improving the productivity of the existing plantations. He added that stringent measures should be taken during the procurement of seed nuts as well as during the selection of coconut saplings for providing best quality seedlings to the farming community. Dr. K. A. Patel spoke on the importance of integrated pest and disease management in coconut garden. The inaugural session was followed by a technical session on different topics related to production technology of coconut i.e. importance of crop, varieties, INM, irrigation management, cropping systems/multi-storeyed cropping system, IPDM, etc. by Dr. Pankaj P. Bhalerao. Dr. J. M. Mayani, Assistant Professor (PHT), ACHF, NAU, Navsari spoke on value addition in coconut, Mr. A. M. Dhetroja, Deputy Director of Horticulture, Gir Somnath spoke on the details of government policies/schemes which are related to coconut crop. More than 85 coconut growers and officials participated in the online webinar.

Arasikere (Karnataka)

The world coconut day was celebrated at Horticulture Research and Extension Centre, AICRP on Palms, Arsikere on 4th September 2020. The programme was inaugurated by Dr. Indrish K M, Honorable Vice chancellor, University of Horticultural Sciences, Bagalkot and in his inaugural address, he emphasised the importance of coconut cultivation for doubling the farmers income and suggested the farmers to adopt new technologies in coconut cultivation. Dr Basavaraju N, Director of Research, University of Horticultural Sciences, Bagalkot presided over the function and in his presidential remarks said that University and sate developmental department are functioning for the welfare of farming community, hence farmers should get first hand information on recent technologies from the Ressearch Station. Dr. Y K Kotical, Director of Extension University of Horticultural Sciences, Bagalkot spoke on the importance of virgin coconut oil in day to day life. Dr. Vishnuvardhan, ADRE, RHREC, Bangalore briefed the importance of integrated farming systems and suggested to adopt Mechanization in coconut cultivation. Shri. Yogesh H R, Deputy Director of Horticulture, Hassan explained about the state and central financial schemes to the farming communities and marketing of virgin coconut oil.

Report prepared by H. P. Maheswarappa and Balanagouda Patil, ICAR-AICRP on Palms, ICAR CPCRI, Kasaragod, Kerala-671124 ■

Cultivation practices in Coconut Garden - October

Planting

In low lying areas, planting of coconut seedlings can be taken up. Prevent accumulation of rain water in the seedling pits by ensuring adequate drainage. New planting can be undertaken in regions like Tamil Nadu with the commencement of north east monsoon.

Manuring

Under irrigated conditions, one fourth of the recommended dose of chemical fertilizers can be applied if not given during September. For the coconut seedlings planted during June, first application of chemical fertilizers (one tenth of general recommendation ie 100 g urea, 200 g MOP and 200g rock phosphate) can be given. 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.

Irrigation

In non-traditional areas of coconut cultivation in eastern and north eastern states, irrigation to coconut palms can be started when the minimum temperature goes below 20^{o}C as a protective irrigation. Before starting irrigation a thick mulch should be provided in the basin of coconut palm at 1.8 m radius to a height of minimum 15 cm. In the remaining parts of the coconut growing areas irrigation shall be started depending upon the soil moisture available and withdrawal of monsoon.

Green manuring

Regions benefitted by north east monsoon like Tamil Nadu, sowing of green manure crops like Sunhemp Crotalaria juncea or Daincha (Sesbania aculeate) or Cow pea (Vigna unguiculata) or Wild Indigo(Tephrosia purpurea) can be done. In the interspace of coconut gardens under monocropping the following seed rate of green manure seeds is recommended. Sunhemp – 20 kg/ha, Daincha – 30 kg/ha, Cow pea -25 kg/ha and Wild Indigo– 15 kg/ha.

If intercrops are grown, seeds of green manure crops can be sown in the coconut basin of 1.8 m radius. For Cow pea and Daincha seed rate per basin is 100g while for other green manure crops, 75 g seeds can be sown per basin.

Intercultural operations

Ploughing/digging of interspace is to be undertaken to keep the plantation free of weeds if not done during September. Care should be taken to avoid injury to coconut palm while ploughing.

Nursery managements

Weeding should be done in the nursery. Five month old ungerminated nuts and dead sprouts should be removed from the nursery. Mulching with coconut leaves or dried grass or live mulch by raising green manure crops can be done in the

nursery Irrigation has to be given for seedlings. In localities of Tamil Nadu, which are mostly benefitted by North- East monsoon, sowing of seednuts can be taken up.

Mulching

Mulching of palm basins can be undertaken if not done during September. Fallen dried coconut leaves available in the coconut garden can be used for mulching.

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. Fill 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 can be done. Incorporation of the biomass of weed plant Clerodendron infortunatum Linn. in the cow dung/compost pit can also be taken up. 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 can be undertaken. Root feeding azadirachtin 10,000ppm @ 10 ml + 10 ml water is also effective. Along with the recommended dose of manures and fertilizers, 5 kg neem cake should 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 case spray neem oil 0.5% and no insecticide is recommended. Installation of yellow sticky traps on the palm trunk to trap adult whiteflies can be done. Encourage build up of parasitoids (*Encarsia guadeloupae*) and re-introduce parasitized pupae to emerging zones of whitefly outbreak.

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 with @ 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) can be done. Soil application of Trichoderma harzianum enriched neem cake @ 5kg per palm and recommended irrigation/ moisture conservation practices can also be done.

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. Isolate of diseased palms from healthy palms by digging isolate trenches of 2 feet depth and one feet width around the basin. Avoid flood irrigation or ploughing in infected gardens to prevent spread of the inoculum. Additional application of 50 kg of farmyard manure or green leaves per palm per year can be done. Apply of Trichoderma harzianum enriched neem cake@ 5 kg per palm and irrigate the palm once in 4 days and mulching around the basin. Raise banana as intercrop wherever 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 be done.

Button shedding and immature nut fall

In the era of feast-famine mode of precipitation, several new pests and diseases emerge quite often. The recent button shedding and immature nut fall in coconut is a problem experienced by farmers. This was noticed immediately after the withdrawal of heavy downpour during August. In general button shedding and immature nut fall is equally associated with pest invasion and disease incidence. Though coconut eriophyid mite and coreid bug could induce button shedding and immature nut fall, the incidences of fungal pathogens (Phytophthora palmivora /Lasiodiplodia theobromae) have also been observed to be associated with button shedding of late. Fungal infection can be identified by the presence of water soaked lesion/ extensive rotting initiating from the soft white meristematic region below the tepal.

Phytophthora infections are severe in high humid time period. Lasiodiplodia attack is quite severe in mite and coreid bug endemic regions and expressed during post-monsoon phase and well pronounced during hot period. Attack by mite and coreid bug aggravate the problem to a greater extent and in combination with these pathogens make the problem quite troublesome in recent time.

Management

- Crown cleaning and removal of all residual sources of inoculums during the month of May
- Spraying of 1% Bordeaux mixture on bunches
- Application of 2% neem oil on all bunches after pollination and also on the leaf axils to repel off the resting stages of the pest. ■

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

Market Review – August 2020

Domestic Price

Coconut Oil

During the month of August 2020, the price of coconut oil opened at Rs. 16300 per quintal at Kochi and Alappuzha market and Rs. 17200 per quintal at Kozhikode market. The price of coconut oil at these three markets expressed an overall upward trend.

The price of coconut oil closed at Rs. 17000 per quintal at Kochi and Alappuzha market and Rs. 18500 per quintal at Kozhikode market with a net gain of Rs.500 at Kochi, Rs.700 at Alappuzha and Rs.1300 per quintal at Kozhikode market.

The prices of coconut oil at Kangayam market in Tamilnadu, which opened at Rs. 13667 per quintal, closed at Rs.14667 with a net gain of Rs.1000 per quintal.

Weekly price of coconut oil at major markets Rs/Quintal)				
	Kochi	Alappuzha	Kozhikode	Kangayam
01.08.2020	16300	16300	17200	13667
08.08.2020	16300	16300	17300	13667
15.08.2020	NQ	NQ	NQ	NQ
22.08.2020	16800	16800	18200	14667
29.08.2020	17000	17000	18500	14667

Milling copra

During the month, the price of milling copra opened at Rs.10400 per quintal at Kochi, Rs.10300 per quintal at Alappuzha and Rs.10800 per quintal at Kozhikode market. The price of Copra at Kochi, Alappuzha and Kozhikode market expressed an upward trend during the month.

The prices closed at Rs.11000 per quintal at Kochi and Alappuzha market, Rs. 11800 per quintal at Kozhikode market with a net gain of Rs.500, Rs.700 and Rs.1000 per quintal respectively.

At Kangayam market in Tamilnadu, the prices opened at Rs. 9700 per quintal and closed at Rs.9800 per quintal with a net gain of Rs.100 per quintal.

Weekly price of Milling Copra at major markets (Rs/Quintal)				
	Kochi	Alappuzha (Rasi Copra)	Kozhikode	Kan-gayam
01.08.2020	10400	10300	10800	9700
08.08.2020	10400	10300	10850	9600
15.08.2020	NQ	NQ	NQ	NQ
22.08.2020	10900	10800	11550	9500
29.08.2020	NT	11000	11800	9800

Edible copra

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

Weekly price of edible copra at Kozhikode market (Rs/Quintal)	
01.08.2020	12000
08.08.2020	11750
15.08.2020	NQ
22.08.2020	11700
29.08.2020	11800

Ball copra

The price of ball copra at Tiptur market which opened at Rs.9400 per quintal expressed an upward trend and closed at Rs.10100 per quintal with a net gain of Rs.700 per quintal during the month.

Weekly price of Ball copra at major markets in Karnataka (Rs/Quintal)	
01.08.2020	9400
08.08.2020	9500
15.08.2020	NR
22.08.2020	10000
29.08.2020	10100

Dry coconut

At Kozhikode market, the price of dry coconut opened at Rs.10500 per quintal and expressed an overall downward trend during the month. The prices closed at Rs.10150 per quintal with a net loss of Rs.350 per quintal during the month.

*NR-Not reported *NQ - Not Quoted *NT - Not Traded

Weekly price of Dry Coconut at Kozhikode market (Rs/Quintal)	
01.08.2020	10500
08.08.2020	10150
15.08.2020	NQ
22.08.2020	10150
29.08.2020	10150

Coconut

At Nedumangad market in Kerala, the price of coconut opened at Rs.15000 per thousand nuts and closed at Rs. 16000 during the month with a net gain of Rs 1000 per thousand nuts.

At Pollachi market in Tamil Nadu, the price of coconut opened at Rs.12670 per thousand nuts and closed at Rs.14710 during the month with a net gain of Rs.2040 per thousand nuts.

At Bengaluru market, the price of partially dehusked coconut opened at Rs.15000 and closed at Rs.11500 per thousand nuts, with a net loss of 3500 per thousand nuts.

The price of partially dehusked coconut was not reported during the month at Mangalore market.

Weekly price of coconut at major markets (Rs /1000 coconuts)				
	Neduman-gad	Pollachi	Banglore	Mangalore (Grade -1)
01.08.2020	15000	12670	15000	NR
08.08.2020	15000	13575	14000	NR
15.08.2020	NQ	NQ	NQ	NR
22.08.2020	15000	14030	13000	NR
29.08.2020	16000	14710	11500	NR

International price

Coconut

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

Weekly price of dehusked coconut with water				
Date	Domestic Price (US$/MT)			
	Philippines	Indonesia	Srilanka	India*
01.08.2020	172	143	294	408
08.08.2020	152	143	294	408
15.08.2020	153	154	302	NQ
22.08.2020	155	156	309	421
29.08.2020	NQ	164	293	442
				*Pollachi market

Coconut Oil

The domestic price of coconut oil in Sri Lanka expressed an overall downward trend during the month, whereas domestic price of coconut oil in Philippines and Indonesia expressed an increasing trend during the month. The international price of coconut oil opened at 906 USD/MT and closed at USD 1025 USD/MT during the month.

Weekly price of coconut oil in major coconut oil producing countries					
	International Price(US$/MT)	Domestic Price(US$/MT)			
	Philippines/ Indonesia (CIF Europe)	Philip-pines	Indone-sia	Sri lanka	India*
01.08.2020	906	835	835	2424	1857
08.08.2020	929	NQ	839	2413	1857
15.08.2020	957	NQ	850	2413	NQ
22.08.2020	1025	900	890	2417	1993
29.08.2020	NQ	NQ	890	2336	1993
					* Kangayam

Copra

The domestic price of copra in Indonesia, Philippines and Srilanka expressed an overall upward trend during the month. The price of copra quoted at different domestic markets are given below.

Weekly International price of copra in major copra producing countries				
Date	Domestic Price (US$/MT)			
	Philippines	Indonesia	Srilanka	India* * Kangayam
01.08.2020	595	560	1320	1278
08.08.2020	596	577	1321	1305
15.08.2020	600	566	1321	NQ
22.08.2020	607	568	1344	1291
29.08.2020	NQ	574	1369	1332

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