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Lakshadweep Halwa:
A Unique Coconut Based Value Added Food Product

Potential and prospects of coconut cultivation in Odisha

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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 six State Centres situated in the states of Orissa, West Bengal, Maharashtra, Andhra Pradesh, Gujrat 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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Dear friends,

The month of June is an important month for the coconut farmers across India. The prediction is that the South west Monsoon is going to start in the beginning of June itself, and it is expected that above-average rainfall will be received during this season. Hence, it is an ideal time for planting coconut seedlings especialy in areas receiving the south west monsoon To truly harness the potential of coconut farming, it is imperative to adopt scientific methods in cultivation and after care, ensuring that our practices align with modern agricultural advancements.

The cornerstone of a thriving coconut plantation lies in the selection and planting of high-quality seedlings. Ensure that the method of planting followed is correct to promote healthy growth and development of the coconut trees. The varieties chosen for planting must depend on the purpose of cultivation. Select appropriate varieties based on the final use - tender coconut / copra production / other products. Care should also be taken to purchase the seedlings from credible sources like public sector undertakings, development agencies, or approved nurseries to ensure the quality and authenticity of the seedlings. The Coconut Development Board emphasizes the importance of using genetically superior, disease-resistant, and high-yielding varieties. These seedlings form the backbone of a productive plantation, capable of withstanding the challenges posed by pests, diseases, and climate variations.

Scientific cultivation begins with the proper preparation of the land, followed by meticulous planting techniques. Ensuring adequate spacing for optimum plant density can significantly enhance the growth and health of the coconut palms. Regular monitoring for pests and diseases, coupled with integrated pest management strategies, form an essential part of the aftercare process. The proper and timely use of manures and fertilizers and soil health management practices also contribute to the long-term sustainability of the plantation.

Coconut farming extends beyond cultivation. Value addition through processing can significantly boost farmers' income and create employment opportunities. Apart from copra and coconut oil, products such as virgin coconut oil, desiccated coconut, coconut milk, and various other innovative coconut-based products are having an escalating market both domestically and internationally. By focusing on processing technologies, farmers can transform raw coconuts into high-value products, thus enhancing their profitability.

The Indian coconut sector stands at a pivotal juncture. While traditional farming practices continue to dominate, there is a growing recognition of the need for modernization. Challenges such as fluctuating market prices, pest infestations, and climate change impacts are persistent issues. However, with the right strategies, these challenges can be converted into opportunities.

Effective marketing strategies are crucial for the growth of the coconut sector. Diversifying the product range, enhancing packaging, and creating strong branding can help in capturing new markets. The growing global demand for organic and natural products provides an excellent opportunity for Indian coconut products. Emphasizing the health benefits and sustainability of coconut products can appeal to a broad consumer base.

Export prospects for Indian coconut products are promising. With proper certification and adherence to international quality standards, Indian coconut products can carve a niche in the global market. The Coconut Development Board is actively working on initiatives to promote exports, including participation in international trade fairs, exploring new markets, and facilitating export logistics.

Coconut Development Board has been at the forefront of promoting the coconut sector in India. Initiatives such as the distribution of quality planting materials, farmer training programs, and research on improved cultivation practices are aimed at empowering farmers. The Board's efforts in promoting value addition, providing market linkages, and facilitating export opportunities are crucial steps towards ensuring a sustainable and prosperous future for the Indian coconut industry.

In conclusion, as we step into the planting season, let us embrace scientific methods in coconut cultivation, focus on value addition, and explore innovative marketing strategies. Together, we can pave the way for a vibrant and resilient coconut sector that not only sustains our farmers but also elevates India’s position in the global coconut market.

Chairman,
Editorial Board

Effective strategies to manage bud rot disease of coconut palms during monsoon season

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Bud rot, caused by the pernicious fungus *Phytophthora palmivora*, poses a grave threat to palms of all ages, particularly the young trees. With its prevalence peaking during the monsoon season amidst low temperatures and high humidity, this disease strikes fear into the hearts of coconut growers during and after monsoon showers.

Field view of a coconut garden affected with bud rot

Symptoms:

Early signs of bud rot disease include the yellowing and drooping of one or two younger leaves surrounding the spindle, followed by turning brown and eventual detachment of the affected spindle leaf.Subsequently, inner leaves fall away, leaving only the outer whorl of matured leaves in the crown. Ultimately, the palm succumbs to the disease with the death of the growing bud.

Management Strategy: A highly effective strategy for managing bud rot is only possible through a community-wide approach, where farmers in the same locality can collaborate to implement comprehensive management techniques collectively.

1. **Preventive Measures:**

- Removal of all diseased and dead palms in the advanced stage of bud rot disease from the orchard, with the subsequent destruction of the crown.
- All disease-affected tissues should be promptly burned to prevent further spread.

First stage | Mid stage | Final stage

2. Prophylactic measures:

- Prophylactic treatment involves crown cleaning and the application of Bordeaux mixture (1%) to palms in disease-endemic areas before the onset of monsoon, preferably in the last week of May or the first week of June.

Prophylactic placement of fungicide sachets in the innermost leaf axils

Prophylactic placement of TCPC cake on either of the spindle leaf

• Additionally, 300 ml of Bordeaux mixture (1%) or Chlorothalonil solution (3 g in 300 ml water) should be poured into the base of the spindle. In heavy rainfall endemic areas, an additional application may be required after 45 days. Alternatively, two perforated plastic sachets containing fungicide Chlorothalonil (3 g) can be placed in the innermost leaf axil at bi-monthly intervals until the end of December.

• Two *Trichoderma* coirpiths cake can be placed on either side of the growing bud of coconut at bimonthly interval from June to December for the prophylactic management of bud rot disease.

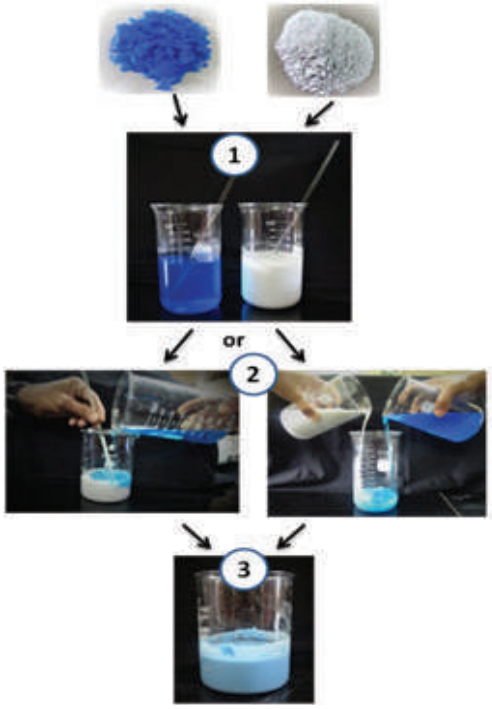
3. Curative Treatment:

• In the early stage of the disease, affected spindle leaves should be removed by pulling them out, followed by the complete removal of infected tissues. If necessary, two or three healthy leaves adjacent to the spindle may also need to be removed for thorough cleaning.

• The wound should be treated with Bordeaux paste (10%) or chlorothalonil solution (3 g in 300 ml water/palm), and covered with polythene to prevent rainwater entry until normal shoot emergence.

Prevention of Rhinoceros Beetle Infestation:

• Given that Rhinoceros beetle attacks predispose palms to bud rot infection, prophylactic measures should be undertaken in bud rot endemic areas to prevent beetle infestation.



Preparation of 1% Bordeaux mixture

Copper sulphate- 10 gm
Hydrated lime- 10 gm
Water- 1 Liter

1.Dissolve 10 gms of copper sulphate and lime separately in ½ liters of water each. Utilize glass or plastic utensils, preferably a bucket, for this purpose. Avoid using utensils made up of iron or copper to prevent contamination or formation of any unwanted reactions.

2.Pour the thoroughly dissolved copper sulphate into a bucket containing lime while continuously mixing. Alternatively, pour both the solutions into a third utensil, maintaining continuous mixing. For stirring, it is advisable to use a wooden stick to ensure proper blending of the solutions. Avoid using metal implements to prevent any unwanted reactions.

3.After preparing the Bordeaux mixture solution, immerse a sharp blade or knife in it for 3-5 seconds. Upon removal, inspect for any rust deposits. If rust is present, indicating an excess copper content, additional lime should be added. Repeat the process of dipping the blade into the solution until a clean blade emerges, signifying the optimum balance of ingredients.

Note: For preparation of 10% Bordeaux paste, follow the same procedure for preparation with 10 gram copper sulphate, 10 gram hydrated lime and 100ml water.

Potential and prospects of coconut cultivation in Odisha

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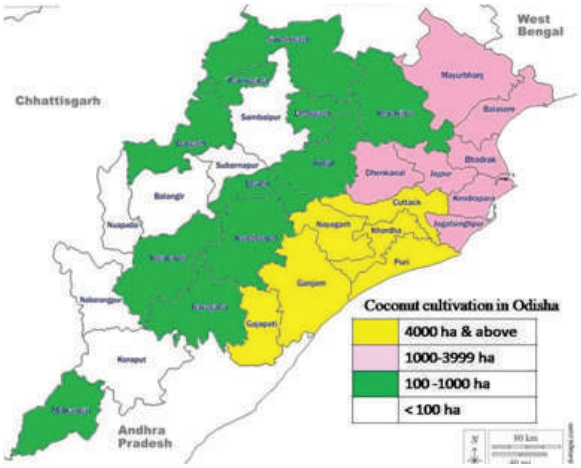

Coconut (*Cocos nucifera L.*) is one of the important plantation crops which occupies more than 30% of the total cropped area in costal districts of Odisha i.e., Puri, Cuttack, Ganjam, Nayagarh and Khurda (CDB 2020). Coconut palms are categorized under two distinct group of cultivars namely talls and dwarfs. Tall palms, sometimes referred as var. typica are the most cultivated in all the coconut growing areas in the world. It generally grow to a height of 25- 30 m and have a comparatively long pre bearing age of 6-10 years and is normally cross pollinated.Fruits are generally medium to large and nuts mature within a period of 12 months. The copra content is usually over 150 g/nut and oil percentage varies from 66-70. The common tall varieties found in India are West Coast Tall, East Coast Tall, Tiptur Tall, Orissa Tall, Lakshadweep Ordinary, Andaman Ordinary. Dwarf palms are sometimes referred to as var. nana are characterized by their short stature. They are quicker to come to bearing (3-4 years) and short lived when compared to tall cultivars. Dwarfs are identified by the colour of the fruits also.Tall cultivars are mainly grown for copra and oil purpose while dwarfs are preferred for tender nut production. Coconut production and productivity in Odisha is very low compared to the national average. The reasons for this are cultivation of poorly selected local varieties in most parts of the state, lesser availability of quality planting material of suitable high yielding varieties and hybrids, cultivation of coconut as a backyard plantation and lack of proper care and management, little or no attention to disease and pest management practices etc.

Area, production and Productivity of coconut in Odisha state

Sl .No	Districts	Area (Ha)	Production (Lakh nuts)	Productivity (Nuts/ha)
1	Angul	434.29	30.33	6984
2	Balasore	1415.24	98.39	6952
3	Bargarh	678.26	62.02	9144
4	Bhadrak	1376.78	84.53	6140
5	Bolangir	06.58	00.37	5623
6	Boudh	151.85	11.03	7264
7	Cuttack	5583.03	341.25	6112
8	Deogarh	117.43	17.45	14860
9	Dhenkanal	2145.14	60.38	2815
10	Gajapati	4344.94	173.07	3983
11	Ganjam	5452.44	936.80	17181
12	Jagat Singh Pur	2876.04	240.14	8350
13	Jajpur	3574.55	72.03	2015
14	Jharsuguda	177.16	10.85	6124
15	Kalahandi	416.07	36.10	8676
16	Kandhamal	530.46	26.95	5080
17	Kendrapara	3849.82	188.43	4895
18	Keonjhar	121.48	02.56	2107
19	Khurda	5544.26	192.69	3475
20	Koraput	157.92	12.89	8162
21	Malkangiri	217.65	32.18	14785
22	Mayurbhanj	1078.14	99.15	9196
24	Nayagarh	5285.40	150.29	2843
25	Nuapada	35.43	02.26	6379
26	Puri	5365.37	355.65	6629
27	Rayagada	455.55	451.45	99100
28	Sambalpur	67.83	35.16	51835
29	Sonepur	330.02	200.15	60648
30	Sundargarh	553.97	45.27	8172

Source: Coconut Development Board 2020-21

In Odisha, East Coast Tall is the dominant variety under cultivation with an average yield of 80 nuts palm year. To increase the production and productivity of coconuts, priority should be given to using high-yielding varieties and hybrids. The seedlings of the hybrids are vigorous and produce a larger number of leaves within 12 months. They have larger leaf area and higher dry weight, indicating precocity in growth and development. The floral, morphological and fruit component characteristics of the hybrids prove to be superior compared to the parent palms. The characteristics of these hybrids and their performance suggested the potential to increase productivity and overall coconut production. Identifying suitable coconut hybrids to a particular agro-climatic region plays an important role in achieving higher and sustained yield. The AICRP on Palms Centre at Bhubaneswar aims to conduct location-specific research in Odisha which started functioning from 1977 at Konark. In 2000, programmes of Konark centre were shifted to Bhubaneswar due to damage of palms by the Super cyclone. Some of the traditionally grown Talls types in Odisha are East Coast Tall and Sakhi Gopal Tall.

Sakhi Gopal Tall: Sakhi Gopal Tall, popularly known as Orissa Tall, is indigenous to Orissa. Palms grow to about 8-9 m, with a stem girth of 77 cm at 1 m from the ground level. The number of leaf scars measured from 1 to 2 m above ground level is 32. The leaves are long with a strong petiole which is about 113 cm long. The inflorescence is short, about 88 cm long. Fruits are oval and mostly yellowish red in colour. The husk is thick, constituting 40% of the whole fruit. The husked nut is oval. The kernel is thick. The palms start fruiting nine years after planting. The palm produces 11 inflorescences per year with a range of 8 to 12. The fruits are big-sized, and the palm yields 88 fruits per palm and the fruits are big, yielding 234 g of copra.

East Coast Tall : East Coast Tall is a tall cultivar type originating from the East Coast Region of Tamil Nadu, Andhra Pradesh, Bihar, Pondicherry, Orissa, Madhya Pradesh, Andamans and West Bengal. The nuts are smaller than West Coast Tall and starts yielding from 6 to 8 years after planting. Average yield is 100 nuts per palm per year. The expected copra content is 125 grams per nut ranging between 100 gram and 140 grams with 64 % oil content.

As the development of new varieties is a long-term process, the immediate step is to evaluate already released hybrids to assess their suitability for yield and tender water. Hybrids no doubt produce more yield as compared to local and high yielding varieties. Hence, evaluation of different hybrids and varieties are important to know their performance in a particular environment or locality. Such an evaluation is lacking in Odisha and hence, a study was conducted to evaluate the performance of different hybrids for their various growth and nut characters contributing to the productivity under Odisha condition. Based on the performance the following hybrids were recommended for commercial cultivation for Odisha during the XXXI Annual Group Meeting of AICRP on Palms.

Godavari Ganga: The Horticultural Research Station, Ambajipeta started hybridization work in coconut in early 1960's. In the year 1993, Godavari Ganga, a Tall x Dwarf hybrid (Selection from East Coast Tall as female parent and Ganga bondam's male parent) was released and gained much attention among coconut farmers which was having high yielding potential of 120-140 nuts/palm/year and with precocity in bearing of four years after planting. The hybrid contains high copra content (150 g/nut) and Oil content (68 %). It can also be used for tender nut

purpose as it contains higher quantity of tender nut water.

VCH 2: This hybrid released by Tamil Nadu Agricultural University in 1987 under the name 'Veppankulam Hybrid Combination – 2' (VHC-2) - selection from East Coast Tall as female parent and Malayan Yellow Dwarf as male parent was released and gained much attention among coconut farmers which was having high yielding potential of 120-140 nuts/palm/year. The other features of this variety medium tall, thick trunk, semicircular to circular crown, 43 months for first flowering, oil content 70.2% and copra content 146g/nut.

In India, the coconut based agro forestry systems are generally found in tropical and sub-tropical areas and are characterized by high species diversity and usually with three to four vertical canopy strata. Coconut-based farming system is a common practice in the coastal districts of Odisha. The advent of population pressure, less lands to cultivate and the worsening marginal conditions of farmlands has prompted the need to go into intensification of farming systems in the form of agro forestry. In the Odisha state the coconut is grown mainly as a mono crop which has indirectly resulted in lower productivity of coconut. Hence, the stress has to be given for adoption of mixed farming system, and hi-density multi species cropping system to increase the return from unit area and thereby improving the economic status of the farmer.

A number of common annual and seasonal crops were found to be grown in coconut-based farming system in various districts of Odisha. In very small size holdings like 0.1 acre and 0.2-acre commonly grown annual crops were yam and turmeric. In holding size of 0.3 acre to 1.2 acre the common annual crops were yam, arrowroot, turmeric, colocasia and pineapple. With regards to common seasonal crops, all holding sizes possessed crops in all the three seasons such as kharif, rabi and summer along with coconut trees. In kharif, the common intercrops were brinjal, okra, bitter gourd, chilli and greens in holding size of 0.1 acre to 1.2 acre with additional crop of cowpea in relatively higher size plot. Beyond 1.2 acre, paddy was mostly grown in kharif with coconut. In rabi the common crops grown were tomato, brinjal and beans up to 0.3 acre size where as additional crops like cauliflower, onion and greens were found in relatively higher size holding up to 1.2 acre. Beyond 1.2 acre, no rabi crops were grown under coconut plantations.

In summer, the common crops were brinjal, chilli, beans up to 0.3 acre and additional crop of pumpkin in higher size plots. No seasonal crop were found to be grown beyond 1.2 acre in summer. It was observed that crop diversity is more up to 1.2 acre size holdings because these holdings were mostly the homesteads and there is water source where people grow the food crops essential for them and mostly managed by the family labour. On the other hand in relatively higher holding sizes which are more than 1.2 acre, paddy is grown in kharif with the coconut trees which are located in the bunds of paddy field.

Livestock in coconut-based agroforestry/farming system

The livestock comprising animals and birds was found to be an integral part in most of the holding sizes in coconut-based farming system of Odisha. The animals included cattle, buffalo and goat among which cattle was common in all size holding. The cattle number varied from 2 to 4 per holding with a higher number in higher holdings. Keeping cattle is quite common in rural areas of Odisha for milk and draught purpose. The goats found in holding size of 0.1 acre to 0.9 acre having less land are preferring goat and the number varies 2-4 per holding. The total number of animals per holding varied from 4-9 with more between 0.4 and 1.0 acre. This may be because the middle size holdings prefer all three types of livestock. With regards to birds, poultry and ducks

were found to be reared in varied sizes of holding, 4-6 numbers of poultry birds were found up to the holding size of 0.8 acre. This signifies that the small farmers having relatively small area are integrating

the poultry bird to enhance their income. Ducks were found to be reared in 2 to 5 numbers in the holding size varying from 0.1 acre to 1.2 acre. This is because ponds are available in the backyards and ducks are reared easily for egg and meat. Beyond 1.2 acre holding sizes which are mostly paddy fields ducks are not found because of absence of pond. The total numbers of birds in terms of poultry and duck varied from 2 to 10 in holding size of 0.1 acre to 1.2 acre. Significantly, higher numbers of birds were found in relatively smaller size holding because people try to enhance their income by integrating more number of birds in their small size holdings.

In costal district like Puri, the presence of farm pond is a common feature in the homestead which provides scope for pisciculture in coconut-based farming system. Two to three fish species are found to be cultivated by people and they were mostly rohu (*Labeo Rohita L.*), silver carp and grass carp (*Ctenopharyngodon idella*). People grow these species for home consumption in the case of small size pond and some extend for sale in higher size pond.

Mushroom cultivation in coconut-based farming system

Integration of paddy straw mushroom (*Volvariella volvacea*) during March to October and oyster mushroom (*Pleurotus sajor-caju*) during November to February is increasing in the coconut-based farming system in Puri district. It was observed that holding size of 0.4 acre to 1.00 acre are accommodating mushroom cultivation under the canopy of coconut. This indicates that farmers having medium size holding around their homestead are preferring mushroom cultivation. The reason is that the micro climate under canopy of coconut is suitable for paddy straw mushroom and there is a good market for the mushroom due to presence of nearby cities like Bhubaneswar, Cuttack and Puri.

Role of coconut-based farming system on livelihood

The agro-climatic condition of Puri district of Odisha is very suitable for growing coconut. In addition to this, coconut has been a very sacred place in this part of Odisha for a long time due to the presence of enormous number of religious institutions and communities which give importance to coconut. Coconut based farming systems are playing multiple roles like various productive, protective and ameliorative, recreational and educational as well as developmental role. The common productive role is supply of various kinds of products like food, fodder, fuel, oil, shading material, broom material, timber, etc.

Status analysis of coconut in Odisha state:

Following SWOT analysis has been carried out regarding coconut cultivation in Odisha.

A. Strengths:

1. High demand for coconut:

- There is much scope of coconut in Odisha especially in some of the districts where in suitable weather condition exists; the crop can be exploited at a commercial level.
- Demand is very high for tender coconut during the months from March to August and for matured nuts demand is very high during Jagannath Rath Yatra during month of Aashaadha and Dussehra and in the month of October- November.

2. Suitable climate in some of the districts:

- Coconut is one of the important plantation crops in Odisha and the major area is confined to five districts i.e., Puri, Cuttack, Ganjam, Nayagarh and Khurda and their climate is suitable for cultivation.

3. Suitable for bund planting:

- Coconut can be planted on bunds of the field crops in the suitable area for getting additional income.

4. Demonstration cum Seed Production (DSP) Farm:

One of the Centre of Coconut Development Board (CDB), a statutory body established under the Ministry of Agriculture and Farmers Welfare, Government of India has established a Demonstration cum Seed Production (DSP) Farm in Pitapally, Kumarbasta PO, District Khurda with the following thrust area:

- Increasing the production of quality planting material.
- Creating future production potential by bringing more area under coconut.
- Improving the productivity of existing coconut holdings.
- Integrated management of major pests and diseases.
- Strengthening coconut industry by promoting product diversification and by-product utilization.

The farm has a sizable number of mother palms of promising tall and dwarf cultivars and a good capacity to provide an enormous number of locally produced quality planting materials. Suitable policy interventions for optimum utilization of these facilities would bring additional areas under coconut cultivation in the region.

B. Weaknesses

1. Lack of awareness about health benefits and potential of coconut.

2. Lack of awareness on coconut production technology:

- People are not much aware of the technology know how for successful cultivation of coconut even in area where coconut can be grown successfully.

3. Lack of recommended suitable varieties:

- There are no recommended varieties for this region. Experiments are under progress to identify the suitable variety of coconut under AICRP on Palms (Coconut) and Bhubaneswar centre to identify the varieties suitable for this region.

4. The agronomic and plant protection practices for the crop demands special type of skilled labour.

C. Opportunity

1. Scope of multi-storey cropping system: On knowing the success of multi-storied cropping

system in other parts of India, coconut based high density multispecies cropping system model established under AICRP, Palms which aims at developing a system which is self-sustaining and produces maximum biomass and returns with least inputs.

Coconut + Banana + Turmeric + Elephant Foot Yam+ Cowpea + Pineapple (integrated cropping system can be followed in this region)

2. Exploitation of value-added products for improvement of human health and wellness

3. Involvement of community level approach for augmenting farm income

4. Favorable policy environment for production and marketing of neera and coconut sugar

5. Alternative utilization of wood for furniture and support for handicrafts artisans

D. Threats:

- Climate change and deteriorating natural resources in crop growing areas and consequent drought and elevated temperature affecting cultivation.
- Extremely vulnerable to cyclones, storm surges, floods, and drought due to its peculiar geographical location
- Lack of interest among the farmers in growing coconut as it is perennial, and damages cause big losses and also not being considered as a commercial crop.
- Insufficient availability of quality planting material.
- The possibility of frequent price shocks due to the change in demand supply chain.

Lakshadweep Halwa: Unique Coconut Based Value Added Food Product

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Lakshadweep halwa (locally known as 'aluva') is a traditional food product of Lakshadweep islands made with coconut gratings and concentrated neera (locally known as "katti," prepared by concentrating neera into a semi-solid form, similar to jaggery). Katti was mentioned in the historical descriptions, including one of the oldest literatures about Lakshadweep (Ellis, 1924). However, the name was mentioned as coconut jaggery, though technically it is in semisolid form, which is obtained just before the jaggery stage.

The word "halwa" refers to a kind of confectionary that originated in Persia and is extensively distributed throughout South Asia and the Middle East. Most types of halwa are dense confections sweetened with sugar or honey. It is a popular dessert prepared in Indian households that resembles a very thick pudding. It is usually associated in some way with auspicious celebrations. It is made from different sources including refined wheat flour, semolina, green gram, chickpeas, carrots, etc. Halwa is described as yellow-brownish, opaque, soft, and smooth in texture in North India (such as carrot halwa) whereas it is a translucent, lustrous, jelly-like substance in Southern India (such as Kozhikodan halwa). Generally, refined wheat flour is used as the major ingredient in halwa in addition to refined sugar and fat. India has a wide variety of halwa, unique to particular regions of the country. On the other hand, Lakshadweep halwa is entirely different and unique from the popular varieties of halwas of India and south East Asia because of its choice of ingredients. Preparation and use of halwa has been known to the islanders since time immemorial. The knowledge and skill for halwa preparation has been handed over to generations and many of the women of present generation in Lakshadweep islands also actively follow the traditional methods of halwa preparation.

Traditional coconut climbing

Ingredients used in halwa preparation

Grated coconuts and concentrated neera (katti) are the two exclusive ingredients used for making halwa. The product is unique since all of the

ingredients are derived entirely from coconut. The maturity of the kernel is very critical which influence the quality of the final product. Less fibre content in coconut kernel is desirable for halwa preparation since it enhances the consistency of the product. Hence, 9-10 months old nuts are used for preparing halwa. The nuts are harvested by skilled climbers following traditional method.

Traditional coconut climbing

Women of the neighborhood prepare the halwa as a community activity. In every island, women groups are actively involved in preparation and marketing of halwa. Usually, the quantity of halwa prepared and frequency of preparation depend on demand from the local community. However, in islands like Agatti where there is more visitors from the mainland, some of the women groups are involved in preparation and marketing of halwa on a continuous basis. There are more number of women groups in such islands who pursue halwa related income generating activities. Furthermore, in islands like Agatti the availability of katti is comparatively high due to the larger number of tappers. In the past, Department of Agriculture was implementing a scheme for promoting neera tapping in the islands. As part of the scheme, neera tappers were engaged by Village Dweep Panchayath and the Department used to pay them the wages. Neera thus collected was sold to the public which was either converted to katti or fermented for making coconut vinegar. However, the availability of neera is on the decline as the scheme for promoting neera tapping by the Department was discontinued since 2021.

Katti is made by concentrating freshly extracted neera (locally called meera) in an open pan (locally known as Kaychemb) using dried coconut residues such as spathe, rachelle, petiole, pedicel etc as fuel. During the initial heating time, much fuel will be used to bring the meera to boiling stage, thereafter, once it starts thickening, heat will be reduced by removing some of the fuel material, continuing the concentrating process until it reaches a semi solid form. Since, the pH of meera extracted from the islands is slightly acidic or partially fermented (pH below 6.8), further crystallization does not happen and katti (semi solid form of concentrate or spread) is the end product. There is a traditional practice of putting coral stone (calcium carbonate) during boiling of meera for adjusting the acidity level. The katti thus obtained is packaged in glass or plastic bottles and stored for further use.

Katti

Method of preparation of halwa

The women group prepares halwa in the backyard of the house of one of the members. The members find the convenient time for halwa preparation setting apart enough time for household routine activities. Usually it is done during evening hours. The first step in the preparation of halwa is grating of the kernel, which is done manually using traditional graters. In a group, 3-4 women sit together for grating the kernels.

Grating of coconuts using traditional graters

Traditional graters

Grated coconuts

Gadgets used for halwa making

Melting katti in coconut water

Dissolving katti in coconut water

Addition of coconut gratings with continuous stirring

Concentrating

Final stage in halwa making

Freshly made halwa before packaging

Required amount of water is taken in the pan and heated. While heating, katti is added to the water in order to dilute the katti. Instead of water, coconut water obtained while splitting the nuts is also for halwa preparation by some of the women groups. They believe that use of coconut water enhances the taste of halwa. The diluted katti (locally known as katti thanni) will be further concentrated until it reaches one-string consistency.

The gratings are added once the liquid reaches one string in consistency and are mixed well to get the kernel uniformly coated with the liquid katti. The ratio of coconut gratings, coconut water and katti is about 1.5: 1.5: 0.5 respectively. Fresh coconut petiole is shaped and used as ladle for stirring the concentrate. The rationale for using the coconut petiole ladle is the belief that the stirring of the mix would be easier especially at the finishing stage of halwa making, when the mix would come closer to the petiole. The whole process is carried out under low flame. The process is stopped when the grating adheres to the ladle without sticking to the vessel. By the end of the process, the greenish petiole turns to brownish in colour.

Halwa packaged with dried banana leaf

The halwa thus made will be made into ball shape when it is still hot and packaged with dried banana leaves. The two tips of the packet will be tied with banana leaf fibre. Halwa yield obtained will be about 40% of the total quantity of ingredients used. One packaged halwa will weigh approximately 35-40 g.

Nutritional quality and shelf life

The halwa is an intermediate moisture food as the moisture content of the ingredients is reduced to nearly 15% by concentration through heating during its preparation. In a study conducted by ICAR-CPCRI, it was found that the moisture content of the halwa prepared by one of the women Self Help Groups (Dweepasree Women Group facilitated by Department of Rural Development) at Kadmat island ranged from 9% to 13%. Crude fat, crude protein, carbohydrates and total minerals of the laksadweep halwa have also been analysed. Since, the sweetness is completely contributed by the neera concentrate (katti), halwa can be recommended as diebetic friendly product with lower glycemic index (GI).

Systematic studies on the shelf life of Lakshadweep halwa is scanty. However, its long shelf stability is evident from the experiences of the islanders. The reminiscences of elderly people of the islands reveal that halwa was prepared in large quantity for the Haj Pilgrims during olden days when it was long travel days in Indian-style boom boats (odam or paykappal) (which take 45–60 days to Mecca and to return to the islands) and the leftover halwa packaged in dried banana leaves brought back by the pilgrims tasted as fresh as the newly prepared halwa.

Constraints and opportunities

Presently the halwa preparation is done manually which involves lot of drudgery for the women folk. The process of preparation of halwa involving grating the coconut, preparing katti, and concentrating the ingredients through continuous stirring is quiet lengthy. It would take 2-2.5 hours to process 3 kg of raw materials. Besides, the workforce has to bear the high temperature from the pan while preparing halwa. Hence, it would be quiet beneficial if the process is mechanized through the use of an open pan kettle with electrical stirrers, (similar to VCO cooker or khoa kettle) to reduce the drudgery. In addition, making halwa balls is done when the halwa is hot which is a cumbersome activity. Use of suitable moulding equipments can ease the job.

Halwa is a unique value added product of coconut with high nutritional value exclusive to Lakshadweep islands with vast potential to become a Lakshadweep GI (Geographical indication) product. Though it has a great potential for marketing, the cost of halwa is higher due to the high cost of the katti (presently Katti costs about Rs. 800-1000 per kg). As a result, a wide variety of comparable items with a suggested retail price of Rs. 5 per piece are available in the mainland market that is prepared using jaggery or refined sugar. In the mainland such items are sold as Lakshadweep halwa or island halwa which actually lack the unique quality of the original product. As a result, it is getting difficult to market the original Lakshadweep product which has to be sold at the rate of Rs. 35 to 50 per halwa piece to make it remunerative. Hence, it is imperative that some meaningful interventions are implemented to exploit the market potential of Lakshadweep halwa by the concerned agencies. It is learnt that Lakshadweep administration has initiated steps for obtaining GI tag for Lakshadweep halwa. It is also necessary to document the unique properties of halwa including method of preparation, nutritional facts and nutraceutical potential. Once GI tagged, the vast potential of Laksadweep halwa for production and domestic as well as international marketing can be better exploited which would enhance the income and employment opportunities of the islanders. The added advantage of branding the halwa prepared by ingredients collected from coconut grown under the natural farming situation in Lakshadweep islands can also be effectively utilized. Needless to say, the coordination of efforts of various research and developmental agencies with active participation of islanders, especially women, is essential to effectively implement interventions to exploit the potential of Lakshadweep halwa.

Gradient outbreak of Coconut Slug Caterpillar, *Macroplectra nararia* in Tiruppur, Tamil Nadu

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Severerly affected coconut garden by slug caterpillar

Coconut, *Cocosnucifera L. (Arecaceae)* is an important plantation crop grown mainly in the tropical and subtropical regions of the world, and millions of people depend on coconut either directly or indirectly for their livelihood. India is one of theleaders in coconut farming and is the largest coconut producing country in theworld. Coconut is grown in an area of 22.77 lakh hectares in 19 states and 4 union territories in India with an annual production of 20,535 million nuts. An area of 4.73 lakh hectares is under coconut cultivation in Tamil Nadu, with productivityof 11,470 nuts per hectare, which is higher than the national average of 9,018 nuts per hectare. Besides, Tamil Nadu isa leading exporter of coconut by products such as activated carbon, coconut oiland coconut shell charcoal. Coimbatore and Tiruppur districts are the leading producers of coconut with an area of 91,809 hectares and 73,311 hectares, respectively.

Pest problem is one of the major constraints for achieving higher production and productivity of coconut. The coconut palm is attacked by several insects and mite pests all around the year and more than 900 species of pests are associated with cultivated and wild coconut. Coconut Eriophid mite, *Aceria guerreronis Keifer* (*Eriophyidae: Acari*), rhinoceros beetle, *Oryctes rhinoceros L* (*Coleoptera: Scarabaieidae*), red palm weevil, *Rhynchophorus ferrugineus Olivier (Coleoptera: Curculionidae),* black headed caterpillar, *Opisina arenosella Walker (Lepidoptera: Oecophoridae*) and white-grub, *Leucopholis coneophora Burmeister (Coleoptera: Scarabaieidae*) are considered as the major pests of coconut. Besides, recently four invasive whiteflies viz., rugose spiraling whitefly, *Aleurodicus rugioperculatus* during 2016, Bondar's nesting whitefly, *Paraleyrodes bondari* and nesting whitefly, *Paraleyrodes minei* during 2018 and palm infesting whitefly, *Aleurotrachelus atratus* invaded into coconut which lead to change in pest dynamics at large extent (Sundararaj et al., 2021).

Outbreaks are thought to be triggered by several successive years of weather conditions favourable to population growth. In general, population dynamics of insects recognizes two major kinds of insect outbreaks that are "gradient outbreaks" and "eruptive outbreaks". Outbreaks can be of eruptive in nature driven by intrinsic population processes and trophic-level factors. It can also be gradient in nature as a consequence of changing environmental

factors favouring population growth. Clearly, gradient outbreaks are very likely to be caused directly by climate change, whereas eruptive outbreaks are much less likely to be affected by it.

Gradient outbreak of coconut slug caterpillar, *Macroplectra nararia Moore (Limacodidae: Lepidoptera)* in Udumalpet taluk of Tiruppur district, Tamil Nadu was noticed during January 2024 -February 2024 to the extent of 60-70% crop damage. Severity of infestation was very high in coconut garden which are adjoining to water bodies. The pest incidence was observed in sole coconut gardens, coconut palms on lakes and paddy field bunds. Outbreaks of slug caterpillar on coconut garden adjoin to water canal also reported in Karur district of Tamil nadu during 2012. Further, it was noticed that slug caterpillar infestation co-exists with invasive whiteflies in coconut. They avoid the whitefly colonies and ate away healthy leaf areas. Large scale explosion of pest population leading to widespread damage in coconut plantations was reported in Andhra Pradesh which was closely interlinked with rise in ambient temperature and humidity along the water bodies (Rajan et al., 2022).

Symptoms of slug caterpillar in coconut and their coexistence with invasive whiteflies

Coconut palms that are located near to permanent water bodies are found to be highly susceptible due to the prevalence of higher humidity coupled with high ambient temperature. Slug caterpillar earlier considered as a sporadic pest is at present becoming regular and endemic on coconut and oil palm in Godavari districts of Andhra Pradesh during summer months causing serious loss to the plantation crops (Chalapathi Rao et al., 2020). Further, they also observed to cause feeding damage to the intercrops banana, cocoa and surrounding hedge plants like *Pithecellobium dulce*, agave, weed plants (Sujatha et al., 2008) and in oil palm from West Godavari district of Andhra Pradesh by Kalidas (2002).

The caterpillar is greenish brown in colour, covered with tiny spines that cause severe irritation on contact to the skin. The young larvae feed on the epidermis on lower side of the leaflet, scrapping the surface tissue giving a glistening appearance in the feeding area and later leaf spot-like black halo markings develop on the feeding areas which later coalesce and form bigger lesions. The later instar caterpillars feed voraciously on entire laminar portion of the leaflets leaving only mid ribs. In severe outbreaks, the caterpillar feeds even on the leaf stalks and nuts surface of coconut resulting in gum ooze symptoms. The affected leaf fronds show a burnt appearance and in case of severe attack the whole palm loses all green chlorophyll area and bores a dried appearance.

Life stages of slug caterpillar

When larval population is high, green petioles, spathes and nuts are also damaged in addition to leaves (Fig.1). Further, it was reported during severe out breaks, all the functional leaves get dried up leaving only the spindle leaves, which results in pre-mature drooping of leaves and shedding of nuts, delayed spathe emergence and reduction in yield (Sujatha et al., 2008; Rajan et al., 2011). The adult moths are brown coloured, sluggish and rest in inverted position mostly in the crown region during day time and have a longevity of five days.

Due to suddent outbreak, most of farmers resorted to chemical pesticides such foliar application of *Flubendiamide* 20% WG, *Lambda Cyhalothrin*

Interacting farmers for effctuive management of slug caterpillar in Tiruppur district

5% EC and root feeding with monocrotophos 20 EC which brought down the pest population significantly. Scientists of ICAR-NBAIR, Bengaluru and CDB, CoE for Coconut, DSP Farm, Dhali visited pest outbreak gardens and interacted with farmers and advised to follow preventive and curative strategies for arresting the further spread of the outbreak of pest. Although, parasitoid, *Pediobius imbreus* was reported a potential parasitoid on slug caterpillar, however, during our survey its occurrence was not noticed. A close examination of dead caterpillars in the surveyed garden revealed the presence of small exit holes of parasitoids on the body of the slug caterpillar. However, no parasitoids / predators could be collected from the field during the survey. Therefore, inoculative or augmentative release of this parasitoid during early stage of infestation play major role and also reduce the chemical pesticides usage in coconut garden.

Management strategies

- Establishment of light traps in endemic tracts proved effective in monitoring the pest incidence well in advance. Such an indicator could forewarn the outbreak of pest.
- Monitor the adult moth emergence in hot spot areas using light trap @ 5 per hectare, at 1 ½ feet above the ground level and water pan is kept below the light trap from 9 pm to midnight for three hours to attract and kill the moths.
- Mechanical removal and destroying larval and pupal stages present in two to three heavily infested dried leaves in outer whorls of the coconut palm.
- Timely initiation of management strategies to avoid severe outbreak situation.
- Community based approach provided desirable results as it contains migration of pest to neighbouring garden.
- Timely release of specific parasitoid, Pediobius imbreus @ 60 per palm at fortnight intervals give desirable results.
- Farmers advised not to apply proad spectrum chemical pesticides for this pest instead select green label pesticides to conserve the natural enemies in coconut ecosystem.

Interacting farmers for effctuive management of slug caterpillar in Tiruppur district

References

Chalapathi Rao, N.B.V., Chakkani Priya, K., Ramanandam, G, Bhagavan, B.V.K and Maheswarappa, H.P (2020). Successful management of slug caterpillar outbreak in Andhra Pradesh through IPM. Indian Coconut Journal, June 2020: 24-26.

Rajan P., Josephrajkumar, A. and Sujatha, A. (2011). Gradient Outbreak of Coconut Slug Caterpillar, *Macroplectra nararia Moore* in East Coast of India. CORD, 27 (1): 61-69.

Sujatha, A., Chalam, M.S.V., Vijayalakshmi, P. and Gautam, B. 2008. Coconut slug caterpillar Macroplectra nararia Moore-Outbreak in Godavari district of Andhra Pradesh. Indian Coconut Journal 38(11):2-4.

Sundararaj, R., Selvaraj, K and Sumalatha, B.V (2021). Invasion and expansion of exotic whiteflies *(Hemiptera: Aleyrodidae)* in India and their economic importance. Phytoparasitica, 49:851 863, DOI: 10.1007/s12600-021-00919-7

An Overview of Natural Vinegar with a Special Focus on Coconut Vinegar

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Vinegar is a familiar product found in every household. It is technically an acidic liquid that is primarily composed of acetic acid and is produced from fermentable carbohydrates through the processes of acetification and alcoholic fermentation (Adams, 1988). The word "vinegar" comes from the French word "vinaigre," which means sour wine. Traditionally, vinegar has been applied as a food preservative as it inhibits microbial growth and contributes to the sensory properties of a number of foods, such as sauces, mayonnaise, etc. In the kitchen, it's a staple for marinades, pickles, salad dressings, and sauces, giving food more flavour and acidity. Because of its acidic qualities, it is also a powerful surface cleanser, natural disinfectant and deodorizer. It is commercially used as a condiment for cleaning, food preservation, and cooking in restaurants. There are two types of vinegar: synthetic and natural. While synthetic vinegar is made through chemical synthesis processes (a controlled and standardised process) and does not involve fermentation, natural vinegar is made through fermentation processes using ingredients like fruits (apples, grapes, etc.), grains (rice, barley, etc.), and other sugar-rich raw materials. The sour flavour of vinegar is caused by the fermentation process, which turns carbohydrates into acetic acid. There are numerous varieties of vinegar, each with a distinct flavour and application, including rice vinegar, apple vinegar, cider vinegar, balsamic vinegar, and white vinegar. While both vinegars have similar uses in cooking, natural vinegar is healthier than manufactured vinegar.

Vinegar Production

Vinegar is produced through a two-step fermentation process.

1. **Alcoholic fermentation**
2. **Acetic acid fermentation**

1. Alcoholic fermentation: This process involves the conversion of sugars into ethanol and carbon dioxide by yeast, generally at a temperature

of 30-32° C. It is an anaerobic process that occurs in the absence of oxygen.

In alcoholic fermentation, yeast consumes sugar and breaks it into two pyruvate molecules. Later the pyruvate is converted into ethanol and carbon dioxide through fermentation, producing a small amount of energy in the form of ATP. The rate of alcoholic fermentation can be influenced by several factors, including temperature, pH, oxygen availability, and the concentration of yeast and sugar.

Glucose → 2 Ethanol + 2 Carbon Dioxide + Energy (ATP)

($C_6H_{12}O_6 \rightarrow 2\ C_2H_5OH + 2\ CO_2$)

2. Acetic acid fermentation: This involves the conversion of alcohol into acetic acid and water. It is an aerobic process where a group of bacteria (Acetobacter) converts the alcohol portion to acid.

Ethanol + Oxygen → Acetic Acid + Water

($C_2H_5OH + O_2 \rightarrow CH_3COOH + H_2O$)

Types/ Varities Of Vinegar

There are several types of vinegar, each with its own distinct flavour profile and uses, that are classified based on their raw materials and fermentation process.

i. Balsamic vinegar:

- It is a dark, syrupy vinegar with a complex, sweet-tart flavour originating from Italy.
- It is made from the white Trebbiano grape and aged in barrels of various woods.
- Some gourmet balsamic vinegars are over 100 years old.

Definition and Standards of Vinegar

Sl. No.	Authority	Definition & Standards
1.	Codex Alimentarius Commission (Codex)	• A liquid that is fit for human consumption and produced exclusively from suitable products containing starch or sugars by double fermentation processes, alcoholic and acetous. • Shall not contain less than 50 g per litre(w/v) of acetic acid. • Vinegar shall not contain more than 0.5% alcohol, and stabiliser is not permitted for use in fermented vinegars
2.	United State Food and Drug Administration (USFDA)	• No standards of identity for vinegar established under the Federal Food, Drug and Cosmetic Act. • However, FDA considers that natural vinegar must contain in excess of 4 g of acetic acid per 100mL.
3.	International Coconut Community (ICC)	• The product obtained by acetic acid fermentation of alcohol containing solutions and is used as an acidulant in foods. • Must contain at least 4% acetic acid.
4.	Food and Safety Standards Authority of India (FSSAI)	• Products obtained by the alcoholic and acetic acid fermentation of any suitable medium such as fruit, malt, or molasses, with or without the addition of caramel and spices. • They shall not be fortified with acetic acid. • Acetic acid content, shall not be less than 3.75% (m/v) the total solids (m/v) shall not less than 1.5%, and the total ash content shall not be less than 0.18%.
5.	European Union	• Defines vinegar as a product that is produced by the double fermentation, i.e., alcoholic and acetic, of substances of agricultural origin. • Raw materials such as wine, cider,malt, rice mash, whey, concentrated grape and various kinds of spirits are utilised.
6.	World Health Organization (WHO)	• A liquid produced by means of a process of double fermentation from suitable products containing starch and/or sugar. • Acetic acid level, shall not be less than 4% (w/v).
7.	Coconut Development Board (CDB)	• Coconut vinegar is made from fermented coconut water and also from the sap of coconut • Acidity as acetic acid (g/100m1): 5.26 - 5.76 • Total solids (%) :1.83 - 1.92 • Total ash (%) :0.38 - 0.42 • Specific gravity: 1.012 - 1.008
8.	Philippines Food & Drug Administration	• A liquid produced by the alcoholic and acetic acid fermentation of one or more of the different crops rich in starch or carbohydrates.

- It is commonly used as a condiment in salad dressings, marinades, sauces, and as a flavourful drizzle over dishes like grilled meats, vegetables, fruits, and even desserts.

ii. Rice Wine vinegar:

- It is a sweet alcoholic beverage enjoyed in cooking and drinking
- It has been made by the Chinese for over 5,000 years.
- There are three kinds of rice wine vinegar: red (used as a dip for foods and as a condiment in soups), white (used mostly in sweet and sour dishes), and black (common in stir-fries and dressings).

iii. Rice vinegar:

- Popular in Asian cuisine, rice vinegar is made from fermented rice.
- It has a mild, slightly sweet flavour and is often used in sushi rice, marinades, and salad dressings.

iv. Cane vinegar:

- It is made from fermented sugarcane and has a very mild, rich-sweet flavour.
- It is most commonly used in Philippine cooking.

v. Palm vinegar:

- Can be made from palms including coconut, Palmyra, dates etc.
- It is low in acidity, with a musty flavour and a unique aftertaste.
- It is used in many Thai dishes.

vi. Bamboo vinegar:

- A brown – red transparent liquid
- Composed of nearly 90% water and more than 200 kinds of chemical compounds.
- It has a special smoky odour
- Widely used in Japan

vii. Champagne vinegar:

- A type of vinegar made in Champagne, the sparkling wine produced in the Champagne region of France.
- It has a delicate and light flavour profile.
- It is commonly used in salad dressings, marinades, sauces, and vinaigrettes, where it adds a touch of acidity and brightness without overpowering other flavours.

viii. Cider vinegar:

- It is made from fermented apple juices.
- Most popular vinegar used for cooking in the United States.

ix. Distilled vinegar (White vinegar):

- It is made from distilled grain alcohol and has a sharp, acidic taste.
- It's commonly used in pickling, cleaning, and as a staple in many recipes.

x. Black vinegar:

- It is a type of vinegar originating from China.
- It is made from various grains like rice, wheat, barley, or sorghum, and sometimes also includes glutinous rice or millet.
- It has a slightly sweet and malty taste with a mild acidity.

xi. Fruit vinegar:

- It is made from the fermentation of fruit juices or fruit wines.
- Fruit vinegars typically retain some of the fruit's natural sweetness and flavour, resulting in a mild, fruity taste.
- They are often used in salad dressings, marinades, sauces, and beverages.

xii. Vegetable vinegar:

- It is made from the fermentation of vegetable juices or extracts.
- Vegetable vinegars may have a unique flavour profile depending on the vegetables used, ranging from earthy and savoury to slightly sweet or tangy.
- They can be used in various culinary applications, including dressings, sauces, and pickling solutions.

Production Methods

Vinegar production methods can range from traditional methods (Orleans Process) surface culture (Generator Process) and submerged method.

Orleans Method/Batch Culture/Slow Method

It is the oldest method of vinegar production, in which wine left in open vats is converted to vinegar by acetic acid bacteria. Initially, fermented fruit juice

is placed in a vessel with a high diameter/height ratio. After approximately a week, during which acetous fermentation is triggered, the liquid is passed to another vessel. Acetous fermentation is slow, taking effect only at the surface of the liquid, where there is sufficient dissolved oxygen,which ensures the conversion of alcohol to acetic acid. Fermentation lasts between 8 and 14 weeks, depending on various factors, such as the fermentation temperature, the initial composition of the alcoholic solution, the nature of the microorganisms, and the sufficiency of the oxygen supplied. The main advantage of this method was that it produced good-quality vinegar.

Generator Method/ Continuous method/ Quick Method

The generator process is one of the rapid processes for producing vinegars. Fermentation proceeds in this process in a container that consists of two chambers. The larger (upper) chamber is packed with solid materials almost to the top, and this is separated from the lower chamber by a screen. Air is injected and blown upward through the screen and through the solid materials, and the air escapes through the top. The process takes approximately 3–7 days to complete the vinegar production. Two-thirds of the final vinegar product is withdrawn from the tank, and a new batch of mash is added slowly to the tank.Conditions within the chamber, such as temperature, humidity, and airflow, are carefully controlled to optimize the activity of the acetic acid bacteria and the efficiency of the oxidation reaction. The generator process offers advantages such as continuous production and efficient utilization of space, making it suitable for industrial-scale vinegar production (Tan, 2005).

Submerged method

The submerged method involves the suspension of acetic acid bacteria in the acetifying culture with the application of strong aeration to meet the required oxygen demand in the system. This method consists of stainless steel fermentation tanks with a capacity of 10,000 to 40,000 L, an air supply system, a cooling system, a foam controlling system, and loading and unloading valves. This method consists of three main steps, which are the loading of raw materials and inocula into the fermentation medium, fermentation and the complete unloading of the fermented medium with the biotransformed product. Part of the finished product is unloaded, and the other part is left in the vessel for the next cycle (Tesfaye et al., 2002).

Factors Affecting Fermentation

1. Yeast Strains: Different strains of yeast can produce different amounts of volatile compounds and alcohol contents. This indicates that different kinds of vinegars in terms of aroma, alcohol content and acetic acid content will be produced according to the types of strains used.

2. pH: The optimum pH for the growth of acetic acid bacteria is from pH 5.5 to pH 6.3. However, several studies have found that acetic acid bacteria can still survive at pH 3.0, and some strains have been isolated from aerated media with a pH as low as 2.0.

3. Temperature: The optimum temperature for the growth of acetic acid bacteria is 25°C to 30°C. Thermo tolerant acetic acid bacteria are able to grow up to 40° C. These bacteria may oxidise ethanol at 38°C to 40°C, and the rate of ethanol oxidation could be more rapid compared to that of mesophilic strains in this temperature range. However, another study has shown that acetic acid bacteria are still active at 10° C but have a slower growth rate.

4. Production Methods: The use of different methods will affect the quality of vinegars. Because the Orleans method requires the longest amount of time for vinegar production compared to the submerged and generator methods, it ensures that the substrates are almost fully used up to maximise the ethanol and acetic acid content in the final product (Ho et al., 2017).

Health Benefits Of Vinegar

Vinegar has been used as a food preservative, seasoning condiment, and therapeutic agent since ancient times. It possesses many pharmacological properties that can be beneficial to human health by functioning as an antibacterial, antifungal, and

anti-inflammatory agent. Its nature as weak acid has many effects. Some of the Health benefits (as per many clinical reports and publications) are:

- **Weight Management:** Vinegar consumption may help with weight loss by increasing feelings of fullness and reducing calorie intake.
- **Blood Sugar Control:** Vinegar has been shown to improve insulin sensitivity and lower blood sugar levels after meals, which may benefit individuals with diabetes or insulin resistance.
- **Heart Health:** Vinegar has beneficial effects on heart health by lowering cholesterol and triglyceride levels, as well as reducing blood pressure.
- **Antimicrobial Properties:** Vinegar has antimicrobial properties, which may help inhibit the growth of harmful bacteria and pathogens, both internally and externally.
- **Digestive Health:** Consuming vinegar, particularly with the "mother" (a colony of beneficial bacteria), may support digestive health by promoting the growth of healthy gut bacteria and aiding digestion.
- **Antioxidant Effects:** Some types of vinegar contain antioxidants that help combat oxidative stress and reduce inflammation in the body.
- **Skin and Hair Care:** Diluted vinegar solutions can be used topically for various skin and hair benefits, such as treating acne, soothing sunburn, or improving hair shine and texture.

Vinegar, while enhancing physiological functions such as lipid metabolism, blood glucose level control, and body weight management, also possesses anticancer, antibacterial, antioxidant, and anti-infection properties. It is considered as a good source material for many bioactive compounds including organic acids, melanoidins, polyphenols, ligustrazine, and tryptophol. The pharmacological and metabolic benefits of vinegar are believed to be due to these bioactive compounds present in vinegar. Regular consumption of vinegar-containing foods is considered important for keeping many life-style related diseases like diabetes, hypertension, hyperlipidaemia, cancers, and obesity in check and also has been used as a cure for stomach aches, wounds, burns, rashes, and oedema conditions (Perumpuli et al., 2022).

Coconut Vinegar

Commercial coconut vinegar is made from coconut sap or coconut water. Coconut water, the liquid endosperm, is a common byproduct of the coconut industry, whereas coconut inflorescence sap, locally known as neera, obtained by tapping the unopened spadix of coconut palm.

1. Coconut water vinegar

One-third of the annual coconut production is used by the processing industry for coconut oil production, while the rest is processed into desiccated coconut and other products. During the processing of mature coconuts for oil, virgin coconut oil, coconut chips, etc., coconut water is wasted indiscriminately into the environment. Tonnes of coconut water are wasted each year in India, and the amount is increasing due to the increasing demand for coconut oil, coconut milk, virgin coconut oil, etc. (Prades et al., 2012). This coconut water is utilised for the production of products like bottled water, vinegar etc. The production process of vinegar from mature coconut water includes increasing the total soluble solids (TSS) to more than 10°Brix with the addition of sucrose, which acts as a nutrient source for yeast. Generally, 10-15% sugar is added to mature coconut water as its TSS would be around 1-4°Brix, which will be pasteurized at 90ºC for 10–15 min. Once it reaches lukewarm temperature, dry yeast (0.15-0.3%) will be added to initiate the alcoholic fermentation, which lasts for 4-6 days. Inversion of sugars occurs during fermentation. Studies have reported that half of the total sugars are fermented during the first 24 hours. The concentration of sugars has a linear relationship with the reading of TSS. Sucrose is converted into fructose and glucose during initial fermentation, and the reducing sugar is consumed by microorganisms at a later stage. The alcoholic fermentation needs anaerobic conditions. When the TSS reaches 0–1°Brix and produces maximum alcohol, mother vinegar is added (at 10–20% of the alcoholic mix) to start the second phase of aerobic acetic acid fermentation which lasts about 30-40 days depending on the storage conditions (Beegum et al., 2018)

Anaerobic and aerobic fermentation process in coconut water vinegar production

Stages of coconut water vinegar production during 30 days of fermentation

2. Coconut sap vinegar

Coconut inflorescence sap is utilised as a fresh or unfermented drink. Once the pH of the sap falls below 6, it will not be suitable for consumption as a fresh drink. In that stage, it can be utilised for vinegar production. Converting partially fermented neera into vinegar is a traditional practice in Lakshadweep islands, and sap vinegar is an essential component of traditional fish gravies (Beegum et al., 2021b). The traditional way of producing sap vinegar is mentioned by Beegum et al. (2018). Partially fermented sap is kept in suitable porcelain containers, amber glass bottles filling three-fourths capacity, which will be loosely capped for 48 hours for the lactic acid fermentation, followed by tightly capping the bottle for inducing anaerobic fermentation for alcoholic production. Acetic fermentation will be started when the sugars completely ferment and produce maximum alcoholic content. Within 30-45 days (varies depending on the temperature and humidity conditions), it will be converted to vinegar.

Parameters	Mature coconut water based vinegar	Partially fermented sap based vinegar	Market available synthetic vinegar
Ingredients	Mature coconut water, sugar, yeast, mother vinegar	Coconut inflorescence sap	Water, acetic acid
Colour	Dark yellow	Light yellow	Colourless (Water clear)
Flavour	Harsh	Sweeter	No distinct flavour
Titratable acidity (% acetic acid) within 30 days	4.2	5.87	4-5
Grain strength	42	58.7	-

(Source: Beegum et al., 2018)

Table 2 Qualitative comparison of vinegar produced from mature coconut water, coconut inflorescence sap and market available synthetic vinegar

Both coconut inflorescence sap and mature coconut water are excellent natural vinegar substrates, and the resulting vinegar is on par with cider apple vinegar. The resulted vinegar is higher in mineral content and has antioxidant potential. Additionally, the cost of producing coconut vinegar is low (Beegum et al., 2021b)

Applications Of Coconut Vinegar

Coconut vinegar has several health benefits, including weight loss, improved digestion, a stronger immune system, and a healthier heart. It is excellent for supporting a healthy balance of gut bacteria. Coconut vinegar, especially the mother of vinegar, is excellent for nutritional support. As well as being rich in probiotics, it is known to be good for heart health by lowering cholesterol and triglycerides. It's rich in minerals, potassium, vitamin C, manganese, zinc, and B vitamins, as it comes from the coconut sap. The pharmacological and metabolic benefits of vinegar are believed to be due to the bioactive compounds present in coconut vinegar. Coconut vinegar has various culinary and non-culinary applications due to its unique flavour profile and potential health benefits. Some common applications include:

1. Culinary Uses: Coconut vinegar is often used as a condiment or ingredient in cooking and food preparation. It adds a tangy flavour to salads, marinades, dressings, and sauces. It can also be used as a substitute for other types of vinegar in recipes.

2. Pickling and Preserving: Coconut vinegar can be used as a pickling agent for vegetables, fruits, and other foods. Its acidity helps preserve food by inhibiting the growth of spoilage-causing microorganisms.

3. Beverages: Coconut vinegar can be diluted with water and sweetened to create a refreshing beverage. Some people enjoy drinking it as a health tonic or as an alternative to sugary drinks.

4. Health Tonic: In some cultures, coconut vinegar is believed to have health-promoting properties. It is often consumed as a tonic or used in traditional remedies for various ailments, although scientific evidence supporting these claims is limited.

5. Beauty and Personal Care: Coconut vinegar may be used topically as a natural beauty product. Some people use it as a hair rinse to improve shine and manageability or as a facial toner to cleanse and balance the skin.

6. Household Cleaning: Due to its acidic nature, coconut vinegar can be used as a natural cleaning agent for household surfaces. It can help remove stains, grease, and odours from countertops, floors, and other surfaces. Overall, coconut vinegar offers a versatile and flavourful alternative to other types of vinegar, with a range of potential culinary, health, and household applications.

Conclusion

Vinegar is a versatile, sour-tasting liquid containing acetic acid obtained by fermenting alcoholic liquids, typically wine. It is now mainly used in cooking, cleaning, and even some medical applications. Its antimicrobial properties make it useful for disinfection and food preservation. Different types of vinegar are being developed worldwide, using different ingredients and different production technologies. Different countries have established their own national standards to ensure consumer safety. Vinegar promotes digestion, stimulates the appetite, exhibits antioxidant activity, has antidiabetic effects, and presents antimicrobial properties. It can also contribute to blood glucose control, cardiovascular health, lipid metabolism, weight management, digestive tract problems, and renal health. These benefits are attributed to the bioactive compounds present in vinegar, such as polyphenols, melanoidins, ligustrazine, and organic acids. By default, vinegar is considered a safe product for human consumption because it has the minimum toxicity. Therefore, people are encouraged to consume vinegar regularly for the benefit of their health.

Reference

1. Adams, M.R. 1998. Vinegar. In: Microbiology of Fermented Foods volume I, (Ed.). Brian, J.B.W. Springer, USA, pp.1-44.

2. Beegum, P.P.S, Manikantan, M.R., Pandiselvam, R., Arivalagan, M., and Hebbar, K.B. 2018. Comparative evaluation of natural vinegar produced from mature coconut water and coconut inflorescence sap. International Journal of Innovative Horticulture 7(2): 123-127.

3. Beegum, P.P.S, Mazna V.P., Ramesh S.V., Sugatha P., Neenu S., Pandiselvam R., Manikantan M.R. and K.B. Hebbar. 2021a. Quality parameters of coconut vinegar and cider apple: A comparative analysis. In Book of Abstracts "Indian Horticultural Congress-2021". 18-21 November, 2021, Chandra Shekhar Azad University of Agriculture and Technology. Kanpur, Uttar Pradesh

4. Beegum, P.P.S C. Thamban, and K. Samsudeen. 2021b. A Critical Appraisal on the Present Status of Coconut Cultivation in Lakshadweep Islands and Strategies for Enhancing Sustainability. In: Transforming Coastal Zone for Sustainable Food and Income Security. Proceedings of the International Symposium of ISCAR on Coastal Agriculture, March 16–19, 2021.Springer. 341-360p

5. Prades, A., Dornier, M., Diop, N. and Pain, J.P. 2012. Coconut water preservationand processing: a review. Fruits, 67:157-171.

6. Tan, S. C. (2005). Vinegar fermentation [master of science thesis]. Department of Food Science, Baton Rouge: Louisiana State University

7. Tesfaye, W., Morales, M. L., Garcı´a-Parrilla, M. C., & Troncoso, A. M. (2002). Wine vinegar: Technology, authenticity and quality evaluation. Trends in Food Science & Technology, 13, 12–21.

8. Perumpuli, P. A. B. N. and Dilrukshi, D. M. N. 2022. Vinegar: A functional ingredient for human health, pp 2-10

9. Ho CW, Lazim AM, Fazry S, Zaki UKHH, Lim SJ. Varieties, production, composition and health benefits of vinegars: A review. Food Chem. 2017 Apr 15;221:1621-1630.

Coconut oil - A healthier path in the making for the healthier oil

Coconut oil is one of the traditional edible oils used for centuries by coconut growing countries across the globe. Inscriptions of trade of coconut oil from the Malabar coast with major monarchies in the West are available in plenty. The nutritional and health attributes of coconut oil have been conclusively proven through innumerable clinical studies within and outside India; and yet consumers are in a dilemma – is consumption of coconut oil good for health? The culprit is always searched amongst the houses behind the negative propaganda against coconut oil in the West or the pharma houses playing to increase the market for drugs for treating cholesterol and the list continues. But as the stakeholders in the coconut oil industry including manufacturers of coconut oil, processors, exporters etc – don't we too have a role to play? The seminar on the prospects and challenges in the coconut oil sector was organized by the Coconut Development Board in Kochi on 21st May 2024 to deliberate and evolve solutions to the challenges faced by the industry.

The discussion primarily centered around the most critical issue that the industry faces currently – adulteration of coconut oil. The processors expressed their inability to compete in the domestic and export markets with quality coconut oil, when mixing of coconut oil with a variety of products was in vogue helping them offer reduced prices. If palm oil and palm kernel oil were used for adulteration of coconut oil in the last decade, it is solvent extracted coconut oil, testa oil or refined coconut oil are used currently in adulteration. The participants comprising of representatives from processing industry, scientists,

food safety and food standards officials, food testing officials etc discussed and deliberated on the various means by which such practices could be curbed. The forum paved the way for the collaborated working of various institutions in unison to fight a noble cause – providing the consumers with quality coconut oil. The need for introduction of stringent regulations and better parameters and standards was tabled which should be followed by appropriate recommendations for policy decisions in this regard. The forum was also concerned about the consumer's right to be aware of the details of the coconut oil a person consumes including process of production, ingredients and product characteristics.

It was clear from the discussions that the rivals for coconut oil were present within the industry itself. The participants agreed for a coordinated action by all stakeholders to be on the guard and take stringent action for addressing the issue of adulteration. The manufacturers were also advised to act as whistle blowers and inform the food safety authorities of malpractices. The trust of the consumers in coconut oil as an edible oil has to be regained. The need for a continued promotion of coconut oil as a healthy oil was also stressed by the stakeholders. The need for advances in technology for the quality production of copra and coconut oil also formed part of the discussion. The stakeholders were unanimous regarding the need for integrating modern technology for production of quality copra.

Sophisticated testing methods to identify parameters beyond the fatty acid profile would be helpful in differentiating coconut oil, testa oil, refined oil etc. Such test methods need to be developed and further tested and validated for inclusion among the standard protocols for testing of quality of products which need to be developed.

The region wise difference in quality parameters for coconut oil was also discussed by the entrepreneurs. The coconut oil from the islands of Lakshadweep and the Andaman and Nicobar had slightly different values for the parameters like iodine value which were beyond the standards. There is need for studies to investigate on the same and revise the standards accordingly as per the test results. The seminar was very effective in addressing the issues faced by the coconut oil industry. The deliberations not only helped in tabling the major issues but also provided options for solving the same. The participation of all major stakeholders involved in the industry made it more effective and created collaborations for addressing the various issues raised. Shri. Thalath Mahmood, President, Cochin Oil Merchant Association (COMA) inaugurated the seminar who emphasized the need for quality standards in coconut oil production and requested the support of the Board in preventing adulteration of coconut oil. Dr. B. Hanumanthe Gowda, Chief Coconut Development Officer spoke on the need for concentrating on processing, value addition, marketing and export of coconut products for the inclusive growth and sustainable development of the coconut sector. Officials from Food Safety and Standards Authority of India (FSSAI), Bureau of Indian Standards, Bureaus Veritas, National Institute for Interdisciplinary Science and Technology (NIIST), Regional Analytical Laboratory (RAL) and officials of Coconut Development Board led the seminar. Dr. Soban Kumar, Senior Technical Officer, NIIST, Shri. Fairooz Jazzack, Technical Officer, FSSAI and Shri. Thomas Kiran, Research Officer, RAL were the panelists of the interactive session. Smt. Leenamol M. A, Assistant Director (Marketing), CDB briefed on the support given by CDB for the promotion of various coconut products. Smt. Resmi D.S, Deputy Director CDB Institute of Technology briefed the participants on quality testing undertaken by the Board. Collaboration of CDB CIT with BIS and FSSAI in quality testing were also part of the discussion. Smt. Deepthi S. Nair, Director (Marketing), CDB delivered the welcome address and Smt. Mridula K, Development Officer (Marketing), CDB proposed vote of thanks.

Indcarb Activated Carbon Private limited launched inline water filters

Indcarb Activated Carbon Private limited, Palakkad, Kerala, an activated carbon unit assisted by Coconut Development Board launched inline filters for water purifier manufactured with export quality coconut shell based Activated Carbon at Kochi on 21st May 2024. Mr. Gokul Thottikkamath, Chairman and Managing Director, Indcarb officially launched the product. Dr. Hanumanthe Gowda B, Chief Coconut Development Officer, Coconut Development Board was the chief guest of the programme.

Training on Recent Advances in GAP for Management of Emerging Insect Pests in Coconut

Indian Council of Agricultural Research – National Bureau of Agricultural Insect Resources (ICAR-NBAIR) conducted five days Training on "Recent Advances in Good Agricultural Practices for Management of Emerging Insect pests in Coconut" at ICAR-NBAIR, Bengaluru from 29th May to 3rd May, 2024 for Subject Matter Specialists (Plant Protection) of ICAR- Krishi Vigyan Kendra, Plant Protection Officers (Entomology) of Central Integrated Pest Management Centres, Directorate of Plant Protection, Quarantine and Storage, Horticultural Extension Officers of Department of Horticulture and Development Officers of Coconut Development Board to disseminate the bio-control technologies developed at ICAR-NBAIR to curtail the recent emerging insect pests in coconut.

The training focused on diagnosis and identification of emerging pests viz., Invasive Whiteflies, Black Headed Caterpillar, Eriophid mite and Slug Caterpillar in coconut, their potential natural enemies, hands on training on mass production protocol for potential parasitoids, predators and entomopathogens including entomopathogenic fungi, bacteria and nematodes for management of emerging pests in coconut. Various augmentative and conservation strategies for these bio-control agents and bio-control compatible approaches such as behaviour approaches for coconut pest management was covered in the training.

In addition to crop protection practices, crop production practices including coconut based multiple and integrated farming systems and conservation of pollinators in coconut and INDGAP Certification Scheme for Good Agricultural Practices were also covered for the optimum use of resources such as pesticides, fertilizers, water and eco-friendly agriculture. Further, release of natural enemies and foliar application of entomopathogens including agri-drone in coconut ecosystem was also demonstrated.

Dr. S.N. Sushil, Director, ICAR-NBAIR interacted with trainees and sensitized about the biological control of recent invasive insect pests through bio-control agents. He also urged the trainees to disseminate these technologies to growers for the sustainable management of these emerging pests in coconut and their bio-control strategies.

20 trainees from Odisha, Andhra Pradesh, Karnataka, Kerala, Tamil Nadu and Puducherry attended the training programme. In house resource persons from ICAR-NBAIR, ICAR-IIHR, Bengaluru, ICAR-ATARI, Bengaluru and Horticultural Research Station of YSRHU, Ambajipeta were the technical experts. Trainees were exposed to research facilities available at ICAR-NBAIR such as Live Insect Repository, mass production unit of parasitoid, *Encarsia guadeloupae*, Bee home, Black Soldier fly mass production laboratory.

The training was conducted as part of the project activities of Coconut Development Board funded project on "Generation of toxicological data for registration of *Isaria fumosorosea* in CIBRC and demonstration of bio-control agents for management of Invasive Whiteflies in Coconut".

Shri G. Ragothuman, Assistant Director, CDB, DSP Farm, Dhali, Shri Rabi Narayana Das, Development Officer, CDB, DSP Farm, Pitapalli and Shri Babu Varkey, Sr. Field Officer, CDB, DSP Farm, Neriamangalam participated in the training programme.

Coconut Laddoo

Laddoo is a spherical shaped sweet which comes in different varieties and flavours. It is the most ancient Indian sweet which is often served in celebrations and religious festivals. Mostly laddoos are prepared out of Besan, Semolina etc. Coconut Laddoo is a sweet ball which is prepared out of the healthy coconut kernel gratings and Jaggery. It is loaded with unique tropical flavour of coconut which is enhanced by addition of flavourings like cardamom. Coconut kernel being the major ingredient in coconut ladoo having its unique health benefits like antioxidant properties, anti-microbial effects etc. Jaggery being an excellent sweetener alternative to table sugar contains several minerals and vitamins that boosts metabolism and improves digestion. The snack Coconut ladoo with Jaggery thus provides beneficial nutrients like minerals, vitamins and dietary fibre, boosts haemoglobin and improves immunity, makes coconut ladoo a part of healthy diet.

Ingredients	Quantity
Grated Desiccated Coconut	650 g
Jaggery	650 g
Rice flour	14 g
Cardamom powder	10 g

Method of preparation

• Jaggery is melted in twice amount of water. The syrup is strained well.

• The Jaggery syrup is then heated to a thick consistency (around 60o Brix). When the syrup reaches the required consistency, grated coconut is added followed by rice flour and cardamom powder.

• The mixture is then heated under low flame. Keep on stirring continuously until all the moisture is evaporated and the mixture leaves the sides of the pan and forms a mass. Turn off the heat.

• Allow to cool slightly and make balls of required size.

• If required, the laddoo can be garnished using cashew, badam, cherry, raisins etc. and preservatives can be added for improving the shelf life.

Nutritional Value of Coconut Jaggery Laddoo	
Parameter	**Value (per 100 g)**
Moisture	3.03 g
Carbohydrate	75.44 g
Protein	1.88g
Fat	13.90 g
Total ash	1.77g
Crude Fibre	4.02g

(Product standardized by CDB Institute of Technology)

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Cultivation practices for coconut-June

Sowing of seednuts in nursery

Well-drained, coarse-textured soil near dependable irrigation water source should be selected for raising the nursery. The seed nuts can be sown in flat beds if there is no drainage problem. The seeds are to be sown in raised beds, if water stagnation is a problem. Nursery can be raised either in the open with artificial shade or in gardens where the palms are tall and the ground is not completely shaded. The seed nuts should be sown in long and narrow beds at a spacing of 40 cm x 30 cm either vertically or horizontally in 20-25 cm deep trenches. Advantage of vertical planting cause less damage during transit of seedling. However, in delayed planting, when the nut water goes down considerably, adopt horizontal sowing. It is better to go for horizontal sowing of seed nuts for better germination.

Seedling selection for planting

Only good quality seedlings are to be selected from the nursery for field planting. In tall varieties, vigorous seedlings which are one year old, more than 100 cm in height with 5-6 leaves and girth of 10 cm at the collar should be selected for planting. In dwarf varieties, the girth and height of good quality seedlings should be more than 8 cm and 80 cm, respectively. Early splitting of leaves is another character preferred for selecting good seedlings. Generally, one year old seedlings are preferable for planting. However, for planting in water-logged areas, 1½ to 2 year old seedlings are to be preferred.

Seedlings raised in poly bags perform better. The advantage of polybag seedlings is that, there is no transplanting shock since the entire ball of earth with the root system can be placed in the pits and the seedlings establish early and more vigorously. But the disadvantages include difficulty for transportation and higher cost of seedling production.

Planting

In well drained soils, seedlings can be transplanted with the onset of south-west monsoon during June. A spacing of 7.5 m x 7.5 m to 8.0 m x 8.0 m in the square system is generally recommended for coconut. This will accommodate 177 and 156 palms per ha, respectively. If the triangular system is adopted, additional 25 palms can be planted. Hedge system can also be adopted giving a spacing of 6.5 m along the rows and 9.5 m between rows. For facilitating multiple cropping in coconut gardens, it is advisable to go for wider spacing of 10 m x 10 m so as to provide ample opportunity to accommodate a number of perennial and annual crops in the interspaces.

The depth of planting pits will depend upon the type of soil. In laterite soil with rocky substratum, deeper and wider pits, 1.5 m length x 1.5 m breadth x 1.2 m depth may be dug and filled up with loose soil, powdered cow dung and ash up to a depth of 60 cm before planting. In case of laterite soil, application of 2 kg of common salt will help in loosening the soil. In loamy soils with low water table, planting in pits of 1 m x 1 m x 1 m filled with top soil to height of 50 cm is generally recommended. The coconut seedlings are planted in the centre of the pit by making small hole within the pits and the soil around the seedlings must be firmly pressed, but soil should not be allowed

to bury the collar region of the seedling or enter into the leaf axils. However, when the water table is high, planting at the surface or even on mounds may be necessary. While planting on the surface or mounds also, digging pits and soil filling has to be done. While filling the pits with soil, it is advisable to use top soil. Two layers of coconut husk (with concave surface facing up) can be arranged at the bottom of the pit before filling up. This will help in conserving the moisture. The seedlings, after field planting, are to be protected from heavy wind by staking and from sunlight by proper shading using plaited coconut leaves or palmyrah leaves or any other suitable shading materials. If there is no rain after planting, seedlings are to be adequately irrigated.

Further, if continuous heavy rain occurs after planting, care should be taken to avoid water stagnation in the pit by providing drainage. Bund should be made around the planting pit using bottom soil to avoid run-off water entering the pit.

Application of fertilizers

Under rainfed conditions one third of the recommended dose of chemical fertilizers can be applied to the coconut palms with the onset of south west monsoon. Application of 500 g N, 320 g P2O5 and 1200 g K2O per palm per year is generally recommended for adult plantations. To supply one-third of the above nutrients it is necessary to apply about 0.36 kg urea, 0.5 kg rock phosphate (in acidic soil) or 0.7 kg Super Phosphate (in other soils) and 0.7 kg of Muriate of potash (MOP). The recommended dose of fertilizers may be spread around the palms within the radius of 1.8 m and forked in. It is always advisable to test soil in the coconut garden periodically (once in 3 years) based on the results of which, type and dosage of chemical fertilizers can be decided. Skipping of phosphatic fertilizer application is recommended if the available soil phosphorus is above 20 ppm.

If the coconut palms are maintained under irrigation, one fourth of the recommended dose of chemical fertilizers should be applied to the coconut palms during June.

It is always advisable to analyse the soil and leaf once in three years and based on the results, fertilizer application should be done.

Application of soil amendments

If application of soil amendments has not been done during May because of non-receipt of summer showers 1 kg of dolomite or 1 kg of lime may be applied per palm during June at least 15 days prior to the application of chemical fertilizers.

Application of biofertilizers

Biofertilizer application should coincide with the onset of monsoon, especially when the palms are maintained under rainfed condition. Formulations containing *Azospirillum spp*. and Phosphate solubilising bacteria prepared in carriers such as talc or vermicompost each are to be applied @100 g per palm.

'Kera Probio' (a talc formulation of *Bacillus megaterium,* a phosphate solubilising bacteria) can be applied to coconut seedlings @ 25 g per seedling mixed with vermicompost or farm yard manure while planting. Similarly an Arbuscular Mycorrhizal Fungal (AMF) bioinoculant, '*KerAM*' can be applied @50 g per seedling.

Basin management with legume cover crops

Green manure legumes like *Pueraria phaseoloides*, *Calopogonium mucunoides*, cowpea (*Vigna unguiculata*), sunhemp (*Crotolaria juncea*), horse gram (*Macrotyloma uniflorum*), daincha (*Sesbania aculata)* and *Sesbania spinosa* can be raised in the coconut basin and incorporated into the soil as green manure at 50% flowering stage. Seeds of these crops @ 100 g per basin can be sown in the palm basin at a radius of 1.8 m during June.

Dismantling of drip irrigation system

After the monsoon sets in during June, laterals of the drip irrigation system should be dismantled and rolled back and kept tied on a pole or on a coconut tree trunk at the starting point of the irrigation system in the coconut garden.

Planting of intercrops

Planting of suitable inter/mixed crops can be taken up in coconut garden during June. Intercrops like banana, pineapple, ginger, turmeric, tapioca, sweet potato and perennials like, black pepper, nutmeg, clove, cinnamon, vanilla, cocoa etc. can be planted.

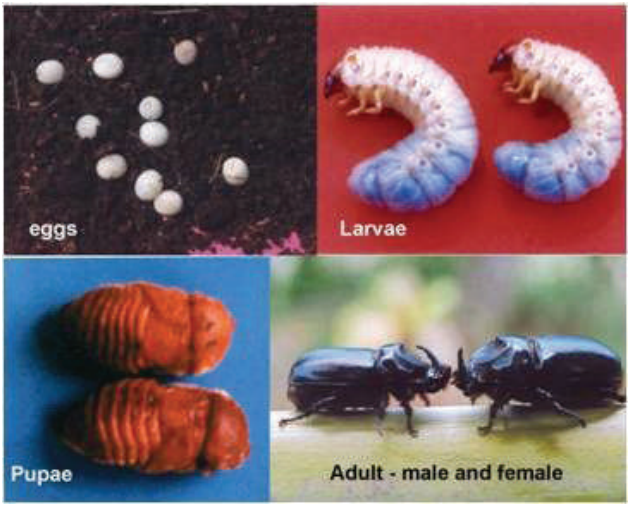
Plant protection

Peninsular India, the dominant coconut growing region in the country would receive South-West monsoon showers during the period of June. Palms therefore would re-adjust from dryness to wetness with the active formation of feeding roots in this period. Palm health need to be rejuvenated with soil-test based nutrition along with prophylactic management module and routine scouting to tackle pests and diseases. Heavy monsoon showers are likely to wipe away the sucking pest complex including coconut eriophyid mite and invasive whiteflies and also suppression of black headed caterpillar to a greater extent. Two major coconut pests, viz., coconut rhinoceros beetle and red palm weevil are a major concern in this period and the emergence of adult beetles of white grub would be quite prominent with receipt of monsoon showers which would be the right time for mechanical collection of beetles. Farmers should adopt all prophylactic measures such as leaf axil filling with neem cake admixed with sand and also application of 1% Bordeaux mixture in bud rot endemic zones. Timely prophylactic treatment in bud rot endemic zone is very critical to save the palm, as spotting the disease symptoms would be difficult in the initial stage of infection for which Unmanned Aerial Vehicle are smart tools in pest surveillance.

Pests

Rhinoceros beetle (*Oryctes rhinoceros*)

Being a ubiquitous pest, the incidence of rhinoceros beetle is quite common during all periods. However its damage is well pronounced during monsoon phase when seedlings are also planted. In seedlings just planted, the spear leaf gets damaged and distorted by beetle damage. Juvenile palms are also prone to pest attack and sometimes appearing as elephant tusk-like symptoms. Damaged juvenile palms are stunted and get delayed in flowering. Of late incidence of nut boring symptoms are also noticed. Moreover, the attack by rhinoceros beetle would invariably incite egg laying by red palm weevil as well as entry of bud rot pathogen in this period.



Life stages of the pest

▶ *Management*

- Prophylactic treatment of top most three leaf axils with either botanical cake [Neem cake /marotti cake / pungam cake (250 g)] admixed with equal quantity of sand or placement of 12 g naphthalene balls covered with sand.
- Routine palm scrutiny during morning hours along with brushing of teeth and hooking out the beetle from the infested site reduces the floating pest population. This strategy could reduce the pest population significantly.
- Shielding the spear leaf area of juvenile palms with

Nut damage

Elephant-tusk like symptom

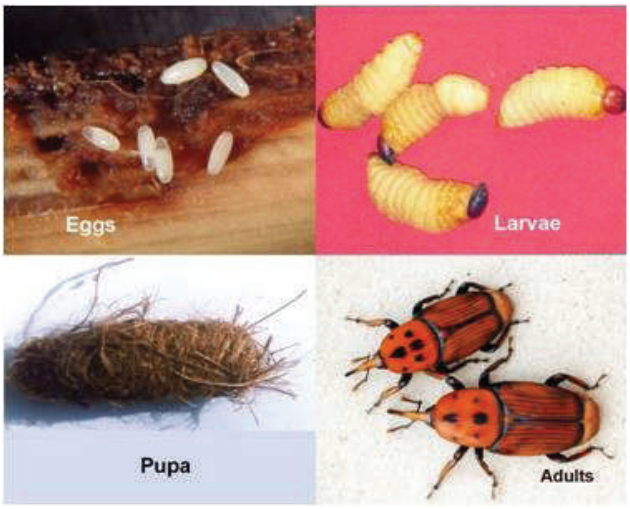
fish net could effectively entangle alighting rhinoceros beetles and placement of perforated sachets containing 3 g chlorantraniliprole / fipronil on top most three leaf axils evade pest incursion.

- Dairy farmers could treat the manure pits with green muscardine fungus, *Metarhizium anisopliae* @ 5 x 1011spores /m3 to induce epizootics on the developing grubs of rhinoceros beetle. Area-wide farmer-participatory approach in technology adoption could reduce the pest incidence very effectively and forms an eco-friendly approach in pest suppression.
- Incorporation of the weed plant, *Clerodendron infortunatumin* into the breeding pits caused hormonal irregularities resulting in morphogenetic transformational aberration in the immature stages of the pest.
- Crop diversity induced by intercropping and ecological engineering principles would disorient pests and provide continuous income and employment as well.

Metarhizium packets

Red palm weevil (*Rhynchophorus ferrugineus*)

This is the fatal enemy of coconut and any injury to palms will predispose pest invasion. Dwarf genotypes and palms aged between 5-15 years are relatively more susceptible. All life stages of the pest were noticed inside the infested palms. Leaf splitting at base, yellowing of middle leaves, presence of boreholes and oozing of brown fluid are some of the visible damage symptoms. Correct geometry is very crucial for accommodating



Life stages of the pest

intercrops as well as pest avoidance due to multiple odour cues.

▶ *Management*

- Field sanitation is very critical and all residual population in crown toppled palms should be destroyed
- Avoiding palm injury is very critical to disorient the gravid weevils away from the field and therefore leave out at least one metre from palm trunk when petioles are cut.

Red palm weevil infestation on palms

- Crop geometry and correct spacing is very crucial to reduce pest attack.
- Timely and targeted spot application of imidacloprid 0.002% (1 ml per litre of water) or indoxocarb 0.04% (2.5 ml per litre of water) on infested palms would kill the feeding grubs and induces recovery of palms by putting forth new spear leaf.
- Crop-habitat diversification (Ecological Bio-engineering) through coconut based cropping system strategy inciting defenders and pollinators would diffuse the palm-linked volatile cues and encouraged pest suppression. Diversified cropping system reduces pest incidence than mono-cropping.

Summer ploughing

White grub (*Leucopholis coneophora)*

This subterranean pest feeds on the roots of coconut and cause yellowing of leaves, premature nut fall, delayed flowering, retardation of growth and reduction in yield. Since grubs are hidden in soil, symptom diagnosis is very crucial in the identification of pest damage. Grubs initially feed on organic materials, roots of grasses and intercrops before feeding on the palm roots. Adults emerge from the soil during the month of June. The pest is very severe in certain sandy belts of Kasaragod, Kerala and parts of Karnataka.

White grubs

Adult beetles

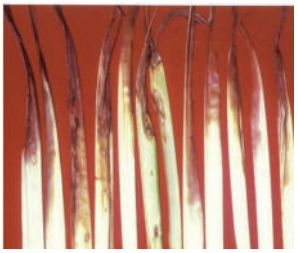
▶ *Management*

- Repeated summer ploughing to expose the immature stages for predation
- Handpicking of adult beetles during evening of two weeks commencing from the onset of monsoon.
- Application of neem cake in the palms basin @ 5 kg /palm for regeneration of roots.
- Soil application of aqua suspension of entomopathogenic nematode, *Steinernema carpocapsae* @ 1.5 billion Infective Juveniles /ha and need based repeated application.

Diseases

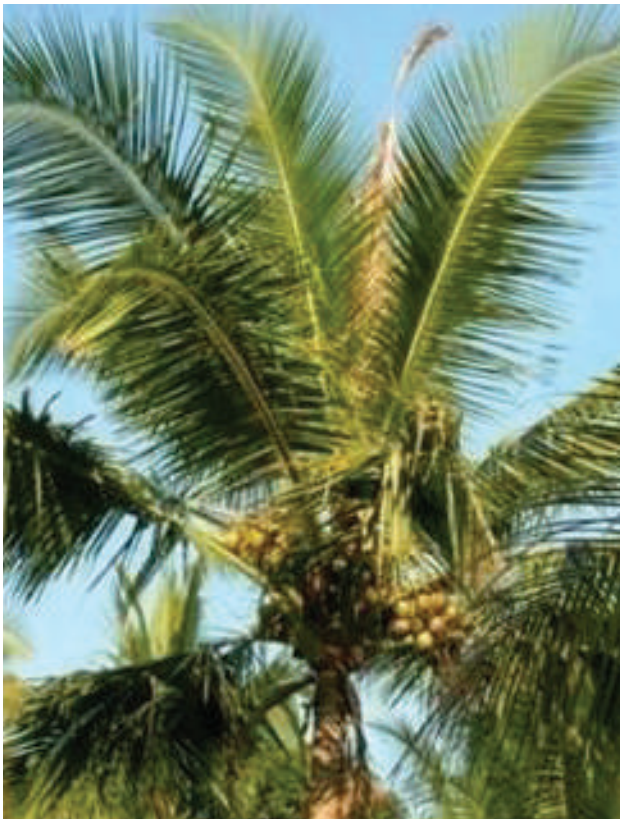
1) Leaf rot disease (*Colletotrichum gloeosporioides, Exserohilum rostratum*)

It is commonly observed on palms affected by root (wilt) disease wherein foliar necrosis of terminal spear leaf and adjacent leaves are registered. The disease is prominently noticed in the post-monsoon phase during the month of December. Affected leaves turn necrotic and are not detachable from the palm and remain intact. This disease could be initially observed as minute lesions which later enlarge, coalesce and cause extensive rotting affecting the photosynthetic efficiency of palms. The disease is endemic to root (wilt) affected regions of Southern Kerala



▶ *Management*

- Need based pruning and destruction of disease affected regions of spear leaf and other adjacent leaves in the terminal region
- Spot application of hexaconazole 5 EC 2 ml in 300 ml water on the affected spear leaf region .In disease endemic areas prophylactic fungicide treatment can also be given.



Bud rot or immature nut fall (*Phytophthora palmivora*)

In certain humid locations bud rot occurred regularly killing hundreds of trees.In India, bud rot incidenceis recorded as less than one per cent. Pathogen attacks the bud region leading to rotting of bud and death of palms. The first visible symptom is withering of the spindle marked by pale colour. The spear leaf or spindle turns brown and bends down. The affected spear leaf can easily be pulled out as the basal portion of the spindle is completely rotten emitting a foul smell. Temperature range of 20- 24ºC and relative humidity of 98% - 100% were found optimum for the development of the bud rot disease. Contiguous occurrence of such "favourable days" during rainy seasons determines the development of the disease and the intensity of infection. As Phytophthora diseases are known to be extremely fatal, a close scrutiny is mandatory during monsoon period to assess the health of the palm especially the spear leaf zone.

▶ *Management*

- Regular cleaning of the crown and prophylactic spraying of Bordeaux mixture (1%) to the crown just before the onset of monsoon and one more spray after 35-40 days help in reducing the bud rot incidence.
- Field sanitation and provide proper drainage during rainy season.
- Placement of two Trichoderma (*Trichoderma harzianum* CPTD28 isolate) enriched coir pith cakes in the inner most leaf axils just before the onset of monsoon and again after every two months as prophylactic measure.
- In disease affected palms, remove the entire rotten

portion of the spindle by cutting with a sharp knife and apply 10% Bordeaux paste to the wound and cover with polythene sheet to prevent entry of rain water. The protective covering has to be retained till normal shoot emerges.

Area wide and farmer-participatory adoption of prophylactic management practices could reduce the inoculum pressure of pest /disease even in favourable weather condition. Greater emphasis should be given for correct diagnosis and timely adoption of pest management practices. The concept of ecological engineering should be given due importance to obtain regular income from the farm and induce pest regression as well. Soil test based nutrition is also very crucial for improving palm health and endure biotic stresses. ■

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Market Review – April 2024

Domestic Price

Coconut Oil

During the month of April 2024, the price of coconut oil opened at Rs. 15100 per quintal at Kochi market, Rs.15200 per quintal at Alappuzha market and Rs.16200 per quintal at Kozhikode market.

The price of coconut oil closed at Rs.16000 per quintal at Kochi, Rs.16200 per quintal at Alappuzha market and Rs.16500 per quintal at Kozhikode market with a net gain of Rs. 900 per quintal at Kochi market, Rs.1000 per quintal at Alappuzha market and Rs. 300 per quintal at Kozhikode market respectively. During the month, the price of coconut oil in Kerala, showed an upward trend.

During the month, the price of coconut oil at Kangayam market opened at Rs. 12000 per quintal and closed at Rs. 13467 per quintal with a net gain of Rs. 1467 per quintal.

Weekly price of coconut oil at major markets Rs/Quintal)				
	Kochi	Alappuzha	Kozhikode	Kangayam
01-04-2024	15100	15200	16200	12000
06-04-2024	15400	15600	16000	12467
13-04-2024	15400	15600	16000	12600
20-04-2024	15700	15800	16000	12867
27-04-2024	16000	16200	16400	13667
30-04-2024	16000	16200	16500	13467

Milling copra

During the month, the price of milling copra opened at Rs.9900 per quintal at Kochi, Rs.9750 per quintal at Alappuzha and Rs.9900 per quintal at Kozhikode market.

The prices of milling copra closed at Rs. 10450 per quintal at Kochi market, Rs. 10150 per quintal at Alappuzha market and Rs. 10400 per quintal at Kozhikode market with a net gain of Rs.550 per quintal at Kochi, Rs. 400 per quintal at Alappuzha market and Rs. 500 per quintal at Kozhikode market respectively.

The price of milling copra at Kangayam market opened at Rs.8700 per quintal and closed at Rs.9700 with a net gain of Rs.1000 per quintal.

During the month, the price of milling copra showed an upward trend.

Weekly price of Milling Copra at major markets (Rs/Quintal)				
	Kochi	Alappuzha	Kozhikode	Kangayam
01-04-2024	9900	9750	9900	8700
06-04-2024	10100	9950	9900	8800
13-04-2024	10100	9950	9900	9000
20-04-2024	10200	10050	9950	9100
27-04-2024	10450	10200	10300	9600
30-04-2024	10450	10150	10400	9700

Edible copra

During the month the price of Rajpur copra at Kozhikode market opened at Rs. 10600 per quintal expressed an upward trend during the month and closed at Rs. 10700 per quintal with a net gain of Rs. 100 per quintal.

Weekly price of edible copra at Kozhikode market (Rs/Quintal)	
01-04-2024	10600
06-04-2024	10700
13-04-2024	10500
20-04-2024	10350
27-04-2024	10750
30-04-2024	10700

Ball copra

The price of ball copra at Tiptur market opened at Rs. 8000 per quintal and closed at Rs.9400 per quintal with a net gain of Rs.1400 per quintal.

Weekly price of Ball copra at major markets in Karnataka (Rs/Quintal) (Sorce: Krishimarata vahini)	
01-04-2024	8000
06-04-2024	9350
13-04-2024	9000
20-04-2024	8500
27-04-2024	9000
30-04-2024	9400

Dry coconut

At Kozhikode market, the price of dry coconut opened at Rs. 11000 per quintal and closed at the same price during the month.

Weekly price of Dry Coconut at Kozhikode market (Rs/Quintal)	
01-04-2024	11000
06-04-2024	11000
13-04-2024	11000
20-04-2024	11000
27-04-2024	11000
30-04-2024	11000

Coconut

At Nedumangad market in Kerala, the price of coconut opened at Rs. 16000 per thousand nuts and the price was almost steady during the month.

At Pollachi market in Tamil Nadu, the price of coconut opened Rs. 28500 per ton and closed at Rs.30000 per ton with a net gain of Rs.1500 during the month.

At Bangalore market in Karnataka, the price of coconut opened at Rs. 20000 per thousand nuts and the price was almost steady during the month.

At Mangalore market in Karnataka, the price of coconut opened Rs. 33000 per ton and closed at Rs. 34000 per ton with a net gain of Rs.1000 during the month.

Weekly price of coconut at major markets				
	Nedumangad (Rs./1000 coconuts)[#]	Pollachi (Rs./ MT) [##]	Bangalore Grade-1 coconut, (Rs./ 1000 coconuts) [##]	Mangalore Black coconut (1 tonne) [##]
01-04-2024	16000	28500	20000	33000
06-04-2024	16000	28500	20000	34000
13-04-2024	16000	29000	20000	34000
20-04-2024	16000	29500	20000	32000
27-04-2024	16000	30000	20000	34000
30-04-2024	16000	30000	20000	34000

International price

Coconut

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

Weekly price of dehusked coconut with water				
Date	Domestic Price (US$/MT)			
	Philippines	Indonesia	Sri Lanka	India*
06-04-2024	146	195	218	341
13-04-2024	161	202	NR	347
20-04-2024	160	197	212	353
27-04-2024	158	191	213	359
				*Pollachi market

Coconut Oil

International price and domestic price of coconut oil at different international/ domestic markets are given below.

Weekly price of coconut oil in major coconut oil producing countries					
	International Price(US$/ MT)	Domestic Price(US$/MT)			
	Philippines/ Indonesia (CIF Europe)	Philippines	Indonesia	Sri Lanka	India*
06-04-2024	1426	1258	NR	2004	1493
13-04-2024	1439	1306	NR	NR	1509
20-04-2024	1411	1302	NR	1970	1541
27-04-2024	1406	1316	NR	1985	1637
					*Kangayam

Copra

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

Weekly International price of copra in major copra producing countries				
Date	Domestic Price (US$/MT)			
	Philippines	Indonesia	Sri Lanka	India* * Kangayam
06-04-2024	678	722	1119	1054
13-04-2024	679	734	NR	1078
20-04-2024	689	715	1159	1090
27-04-2024	681	715	1144	1150
				* Kangayam

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

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