Vol.LXVI No. 08 February- 2024 Pages-40 Price: Rs.6

Indian Coconut Journal

Sensory Evaluation of Food
with Special Emphasis on Coconut Products

Coco Nectar: Transforming Lives and Redefining Sustainable Agriculture:
the journey of Global Coconut Farmers Producer Company Limited

RoboHarvest:
Pioneering Precision in Coconut Cultivation Through Robotics

INDIAN
COCONUT
JOURNAL
Vol. LXVI No.08
February- 2024
Kochi - 11

Publisher
COCONUT DEVELOPMENT BOARD
Ministry of Agriculture and Farmer's Welfare,
Department of Agriculture, Government of India
Kera Bhavan, Kochi - 682 011, India

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SUBSCRIPTION

Annual	Rs. 60.00
Single Copy	Rs. 6.00
Institutes / Libraries	
Annual	Rs. 200.00
Single Copy	Rs. 20.00

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,

As we all know, the coconut sector plays a crucial role in the livelihood of millions, serving as a source of income, employment, and nutrition. However, amidst the present circumstances, it becomes increasingly apparent that the coconut industry is beset by a multitude of challenges.

Climate change poses a formidable threat, with rising temperatures, erratic rainfall patterns, and extreme weather events impacting coconut productivity. Additionally, the old and senile palms demand rejuvenation efforts, highlighting the need for sustainable agricultural practices. Fluctuating market prices also pose a serious concern, affecting the income of coconut farmers.

Education plays a pivotal role in progress, particularly in the case of coconut farming. The Coconut Development Board is aware that, training programs that cover modern agricultural practices, sustainable farming methods, and the utilization of technology can bridge the gap between traditional wisdom and contemporary needs. Hence the Board frequently undertakes collaborations with agricultural universities, research institutions, and extension services which is instrumental in disseminating best practices and keeping farmers abreast of the latest developments.

Diversification emerges as a key theme for the future. Beyond traditional uses, exploring novel products derived from coconuts can open up new markets and revenue generation. Coconut-based cosmetics, health products, and biodegradable packaging materials are having great opportunities for expansion. Collaborations between the coconut industry and research institutions can facilitate the development of value-added products, contributing to the overall growth of the sector.

Furthermore, the promotion of Farmer Producer Organizations can empower small-scale coconut growers. Shared knowledge, collective bargaining power, and access to financial resources can uplift the farming community, making them more resilient to market fluctuations. The onging training programs on sustainable farming practices ensures that the knowledge is disseminated effectively, benefitting farmers across generations.

The global interconnectedness of agriculture presents an opportunity for Indian coconut farmers to learn from and collaborate with their counterparts worldwide. CDB facilitates the participation of entrepreneurs in international conferences, forums, and research collaborations which enables the exchange of knowledge, technology, and best practices. Understanding global market trends, quality standards, and consumer preferences positions Indian coconut products on the international stage.

International partnerships can contribute to research and development efforts, bringing in diverse perspectives and expertise. Collaborations with international organizations focused on sustainable agriculture, value addition and market development creates a shared platform for addressing common challenges and fostering innovation. CDB's collaboration with international organizations such as the International Coconut Community provides an expansive opportunity to familiarize oneself with the latest advancements and initiatives occurring within the sector across the globe.

Let us collectively commit to fostering a future for the sector providing sustenance, livelihood, and environmental benefits. Through collaborative efforts and a shared vision, we can ensure that the coconut industry remains a beacon of prosperity for generations to come.

Chairman,
Editorial Board

Sensory Evaluation of Food with Special Emphasis on Coconut Products

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Sensory evaluation is the examination of organoleptic attributes of food products by the sense organs. It is usually carried out to develop a product, determine the formulation changes in a product, detect the shelf life, and monitor consumer acceptability. Sensory evaluation not only includes 'likes and dislikes', 'okay or not okay' but also various aspects and acceptability rates for the consumer. It is done with the help of trained, untrained, and semi-trained panellists in industries. Since consumer reaction is perceived by the five senses, sense organs are considered a vital measure of food development. Because no instrument or technology can replace the senses in evaluating food, humans are used as the test subjects. All food products have a wide range of attributes and parameters that can be detected by various sense organs.

Human Senses

Ancient philosophers called the human senses "the windows of the soul," and Aristotle described at least five senses - sight, hearing, smell, taste and touch.

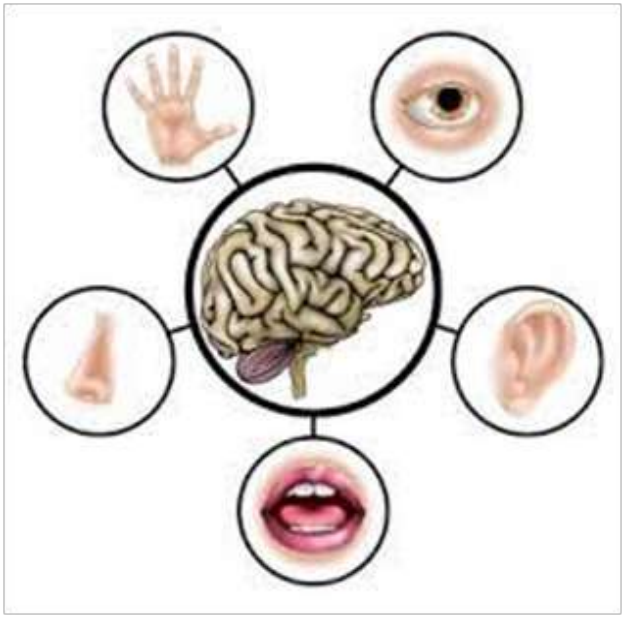
1. Visual or sight: The eyes perceive the initial quality of food and receive information such as color, size, shape, texture, consistency, and opacity. Visual appearance of a food product is an important factor that may determine the first opinion about that food.

2. Auditory or hearing: Sounds such as sizzling, popping, bubbling, crunching, slurping, munching, gulping, rustling, squeaking, dripping, exploding, and crackling describe more about the characteristics and quality of the food products. Sounds are vibrations that are received and detected by the cochlea in the ear. These sounds also indicate the freshness and ripeness of the product.

3. Olfactory or smell : Humans are microsmatic and can discriminate among 100,000 odors but cannot label them accurately. Volatile aromas are detected by smelling. These volatile aromas are related to temperature. Because only volatile molecules, in the form of gas, carry odor, it is easier to smell hot foods than iced ones.

4. Taste or gustatory: The tongue is the main taste receptor. It consists of approximately 10,000 taste buds, and each taste bud has a taste pore that detects tastes like sweet, salty, sour, bitter, and umami. Some of the other tastes are cool, zesty, warm, hot, tangy, sharp, rich, bland, rancid, tart, acidic, strong, citrus, mild, savoury, spicy, metallic, and weak.

5. Touch: The sense of touch delivers an impression of a food's texture mainly through the finger tips. Texture includes tactile feel properties like grainy, gritty, crystalline, and flaky. Some of the moisture properties, like wetness, oiliness, moistness, and dryness, can also be detected by the tactile nerves of the lips, tongue, or hands. Other textural properties are hardness, firmness, adhesiveness, cohesiveness, gumminess, springiness, /resilience, and viscosity. Mouth feel is detected by the teeth and the tactile nerve cells on the tongue and palate.



Sense organs

Types of Panelist for Sensory Evaluation

Sensory evaluation is carried out under proper condition with the help of trained or untrained or semi-trained panels. Panel members with different degree of training are required for different types of sensory analysis.

a. Trained panels : The trained panels consist of 5 to 12 members. They are carefully selected and trained, and need not be expert. They are given proper training to analyse every aspects of sensory character or the overall character of the food with their senses. Trained panels are also known as laboratory panels.

b. Semi-trained panels : They are also known as discriminative and communicative (D & C) panels. These panel members should be familiar with the food products and shall be capable of discriminating the differences and effectively communicate about the acceptability of the product. This panel generally consist of 25 to 30 members. These panel members are not given proper training but they are able to distinguish and evaluate the sensory aspects of the food product.

c. Untrained panels : Untrained panels are also known as consumer panels. These group of panel members are selected randomly from the target market area and they represent different age, sex, race, income groups. More than 80 members are included in this panel.

Conducting Sensory Tests

Particular attention should be paid while conducting the sensory tests so that they may provide a reliable result. Some of the techniques used before conducting the sensory tests are as follows

1. Sampling food for sensory testing: Samples taken for sensory testing represent the whole batch of the food. The foods prepared for testing will be safe to eat. If the food or the ingredient in it is unsafe to eat, then only the odour and appearance attributes of the food are evaluated.

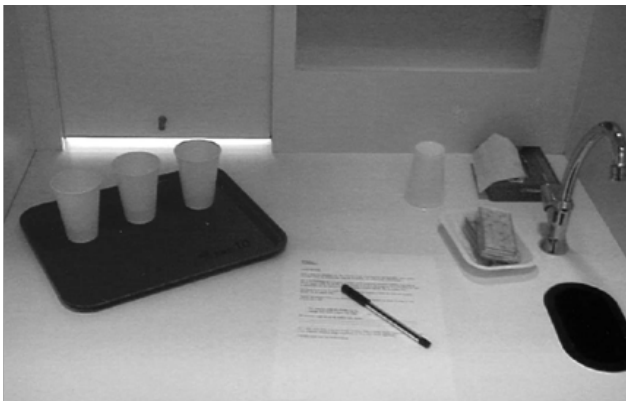
2. Preparing samples for sensory testing: Samples for sensory testing are prepared by standardized method so that it may eliminate all the possibility of preparation effects. Each step is standardized and documented to ensure uniformity in sensory testing. Keeping the samples for a prolonged period may drastically change their sensory attributes.

3. Presenting samples for testing: The method of sample presentation is also required to be standardised so that each panelist can be provided with a sufficient amount of samples to be tested. Fluid products should be stirred uniformly before portioning to ensure equal consistency. The food samples that are being tested can be swallowed or expectorated. Cups or lids are provided for expectoration. Room temperature water is generally provided to the panelist as a neutralizer to rinse their mouths during the sensory evaluation. If room temperature water will not clear the mouth, then a piece of bread, a slice of apple, or warm water can be used. It is also necessary to ensure that two or three samples are presented at a session. When sensory character other than colour is evaluated, then the samples should be masked so that the panelist can't judge the product based on the colour difference.

4. Using reference samples: The reference samples are used to compare with other samples, or they can be identified as samples used to mark the points on a measurement scale that discern the flavour, aroma, texture, and visual attributes that define the product quality. It is necessary to keep a reference sample to test the storage effects of the product when the time period is extended over several weeks or months or the testing is done at widely spaced intervals. The reference sample is the food product, which is of a similar type or sample to the actual food that is to be tested. The reference sample provided should be consistent so that the samples may serve their intended purpose.

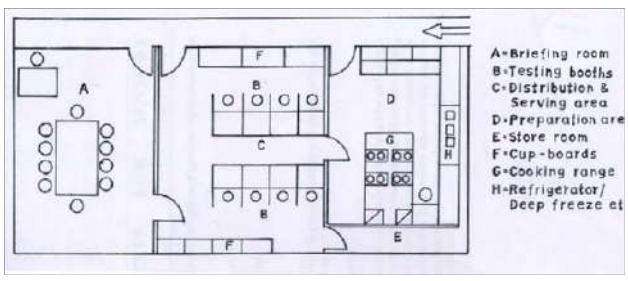
5. Sensory briefing: The briefing of panels involves providing concise information to panel members before they appear for sensory evaluation. In the briefing room, the panel members are assembled, given the evaluation cards and briefed about the sensory test. When a ranking test is to be conducted then the panelist are given a clear and precise idea of the scale used to help anchor judgements and detect quality attributes and grade specifications. These instructions provided to the panel members may provide a brief idea of how to conduct the sensory analysis and they do not provide any information regarding the sample or induce any errors of anticipation.

6. Test booth: These are the areas where sensory tests are performed by the panel members. Sophisticated sensory booths as per ASTM standards with controlled temperature (200°C–220°C) and RH at 40±5. Panel booths consist of an individual compartment where panelist can assess the samples



Sensory test booth

without the influence of other panel members. Each booth should be equipped with a counter, a stool or chair, a pass-through opening to the food preparation area, individual lighting, electrical outlets, and a neutralizer to clear the mouth



Layout of Sensory Evaluation Laboratory

Sensory Evaluation Booth
Source: Khamrui and Khetra (2013)

Sensory Tests

Sensory tests are used to evaluate the acceptability, liking, or preference of a food product. These tests are used to determine the differences among products or to measure the sensory characteristics of food products. The sensory tests are broadly classified into two major categories:

1. Analytical tests: These are based on the quality, clarity, and/or quantity of sensory characteristics of the product. There are two main analytical tests: descriptive and discriminative tests. These tests are used for laboratory evaluation and are hence done by trained and/or experienced panels.

2. Affective tests: These are tests based on the acceptance or preference of the product and are evaluated by scoring, ranking, and selecting samples.

A. ANALYTICAL TESTS	
Discriminative test : Difference test: Measures the difference among the sample.	• Paired- comparison • Duo-Trio • Triangle • Ranking • Rating difference
Sensitivity test : Measures the ability of the individuals to detect the sensory characteristics.	• Threshold • Dilution • Rating difference
Descriptive test : Measures the quantitative and/or qualitative characteristics.	**Attribute rating** • Category scaling • Ratio scaling • Flavour profile analysis • Texture profile analysis • Quantitative descriptive analysis

B. AFFECTIVE TESTS	
i. Acceptance test : Measures the rate of degree of liking.	• Paired- performance • Ranking • Rating
ii. Preference test: Identifies the product which is liked more.	• Hedonic scale • Food action scale

1. Triangle test: This test determines whether any sensory differences exist between two products. To conduct this test, three samples are presented before the panelists, of which two are alike. They are asked to indicate the odd one out of the three samples.

2. Duo-trio test: This test is an alternative to the triangle test. As in the triangle test, three samples are presented to the panellists, of which one is the reference. Assessors may identify the most similar sample to the reference.

3. Paired comparison test: Two coded samples are evaluated and asked to find out which has the greatest intensity of sensory attributes.

4. Ranking test: In the ranking test, samples are analyzed based on a particular attribute and ranked according to their evaluation. Two or more samples of the same or a different product are provided for the panelist to accomplish the test.

5. Rating difference test: A specific criterion is used to rate or evaluate the food product. Among multiple samples, a rating scale, such as a score card, is used to figure out the sensory attributes.

6. Dilution test: determines or measures the smallest amount of sample that can be detected when it is mixed with a standard material. A sample of food is presented to the panellists, and they are asked to taste the sample to determine whether they can identify the presence of the product.

7. Threshold test: It can be measured using a stimulus scale, and the difference is detected. The panellists are asked to identify how sensitive the flavours of the food are and how well they can identify different levels of flavour.

8. Flavour profile analysis (FPA): Flavour denotes both the taste and aroma of the food product. Known quantities of taste- and odour-causing chemicals are detected by trained panels on an intensity scale.

9. Texture profile analysis: The texture profile analysis uses a standardised method to describe the textural characteristics of the product sample. These are usually measured by trained sensory panels or with specialised equipment. Texture that includes hardness, cohesiveness, tenderness, and crunchiness is analysed.

SENSORY EVALUATION OF COCONUT PRODUCTS

Product name	Tests followed	Sensory attributes	Remarks	Reference
Coconut milk	Acceptability test using hedonic scale	Color, Flavor, Taste, Overall acceptability	Addition of 15% skim milk powder to the coconut milk blend improved the sensory and nutritional qualities.	Rehman et al., (2004)
Coconut water	9-point hedonic scale	Aroma, Off-flavor Freshness,Sweetness, Burnt, Color,Overall acceptability		Pandiselvam et al.,(2022)
Neera	Acceptability test using 9-point hedonic scale	Colour, Flavour Taste, Consistency, Overall acceptability	All sensory characters showed a decreasing trend during storage.	Priya Ramaswamy and Lalitha Ramaswamy (2017)
Coconut milk powder	Acceptability test using 9-point hedonic scale	Taste, Aroma	Irradiation enhances the sensory attributes	Umakanthan et al., (2024)
Dark chocolate	9-point hedonic scale	Appearance, Texture Mouth feel, Taste, Overall acceptability		Beegum et al., (2022)
Ice cream	Affective test	Flavour & taste Melt down, Iciness, Appearance Color, Fat feel	Positive attributes were good appearance, better flavor & taste	Beegum et al., (2022) Beegum et al., (2021)
Coconut chips	9-point hedonic scale	Appearance, Crispiness Taste,Overall acceptability	Jaggery treated or coconut sugar treated chips are more appealing than the conventional one.	Pravitha et al., (2022)
Coconut sugar	Descriptive test	Appearance,Smell, Taste, Consistency	Smell was described as caramel, malty, sweet, and roasty. Taste was mainly sweet.	Wrage et al.,(2019)
Virgin coconut oil	Descriptive test	Appearance, Aroma, Taste Flavour	Results indicate that samples significantly differ in most of the attributes except for turbidity, saltiness and margarine flavor.	Villarino et al., (2007)

10. Quantitative descriptive analysis is a total system that includes sample selection, panellist screening, vocabulary development, testing, and data analysis. It is used to evaluate the sensory characteristics of a single food product, usually in an isolation booth.

11. Hedonic scale: It is used to analyse the acceptance of the food product. The 9-point hedonic scale ranges from "extremely dislike" to "extremely like." It is mainly applied to testing the presence or acceptance. The data from the hedonic scale ratings are evaluated by rank sum analysis, t-test, or chi square test.

12. Food action scale rating: A test may be used to measure the acceptance of the food product by a population. Nine successive rating categories ranging from "I would eat this every time if I had the opportunity" to "I would eat this only if I were forced to" are represented. The scale ratings are converted to a numerical score and analyzed.

REFERENCES

1. P.P. Shameena Beegum, Jwala P.Nair, M.R. Manikantan, R. Pandiselvam, Sandip Shill, S. Neenu, K. B. Hebbar (2021).Effect of coconut milk, tender coconut and coconut sugar on the physico-chemical and sensory attributes in ice cream. Springer. https://doi.org/10.1007/s13197-021-05279-y.

2. M. Pravitha, M.R. Manikantan,V.Ajesh Kumar, P.P. Shameena Beegum, R. Pandiselvam (2022). Comparison of drying behavior and product quality of coconut chips treated with different osmotic agents.Elsevier. https://doi.org/10.1016/j.lwt.2022.113432.

3. P.P.Shameena Beegum, Ravi Pandiselvam, S.V.Ramesh, P.Sugatha (2022). Sensorial, textural and nutritional attributes of coconut sugar and cocoa solids based 'bean to bar' dark chocolate. https://doi.org/10.1111/jtxs.12698.

4. Saleem-ur-Rehman, M. Mushtaq Ahmad, Amna Yameen, Kausar Almas, Sidra-til-Muntaha(2004). Sensory and nutritional evaluation of coconut-natural milk blend. Pakistan Journal of Life and Social Sciences.pp:104-108.

5. R.Pandiselvam, V.Prithviraj, M. R. Manikantan, P. P. Shameena Beegum, S. V. Ramesh, Anjineyulu Kothakota, A. C. Mathew, K. B. Hebbar, Cristina Maria Maerescu, Florin Leontin Criste, Claudia Terezia Socol(2022).Dynamics of biochemical attributes and enzymatic activities of pasteurized and bio-preserved tender coconut water during storage.Frontiers.https://doi.org/10.3389/fnut.2022.977655

6. Priya Ramaswamy and Lalitha Ramaswamy (2017). Organoleptic acceptability, selected nutrient content and physicochemical characteristics of coconut neera on storage. David publishing. pp:192-201.https://doi.org/10.17265/2159-5828/2017.04.003

7. Umakanthan T,Madhu Mathi, Umadevi U (2024).Sensory attributes improvement of coconut milk powder by employing mid-infrared wave.Juniper publisher.https://doi.org/10.19080/NFSIJ.2024.12.555846.

8. Jasmin Wrage, Stephanie Burmester, Jurgen Kuballa, Sascha Rohn(2019). Coconut sugar (cocos nucifera L.): production process, chemical characterization, and sensory properties. Elsevier.https://doi.org/10.1016/j.lwt.2019.05.125

9. Blanca J. Villarino, Lianne Marsha Dy, Ma. Concepcion C. Lizada(2007). Descriptive sensory evaluation of virgin coconut oil and refined, bleached and deodorized coconut oil.https://doi.org/10.1016/j.lwt.2005.11.007

10. Khamrui K, Khetra Y. 2013. Practical Sensory evaluation of milk and milk products. ICAR-NDRI, 105p

Kisan Kalyan Mela 2024

CDB, Regional Office, Patna participated in Kisan Kalyan Mela 2024 held from 10th to 12th February 2024 at KVK Piprakothi, East Champaran. Board displayed various value added products viz. virgin coconut oil, neera, coconut chips, coconut oil, coconut milk powder, coconut based handicraft items and different varieties of coconut bunches. Informative charts on coconut cultivation and coconut food products, leaflets and publications of the Board were also displayed in the Board's stall.

Occurrence and Distribution of Coconut Leaf Blight Disease in Tamil Nadu and its Management

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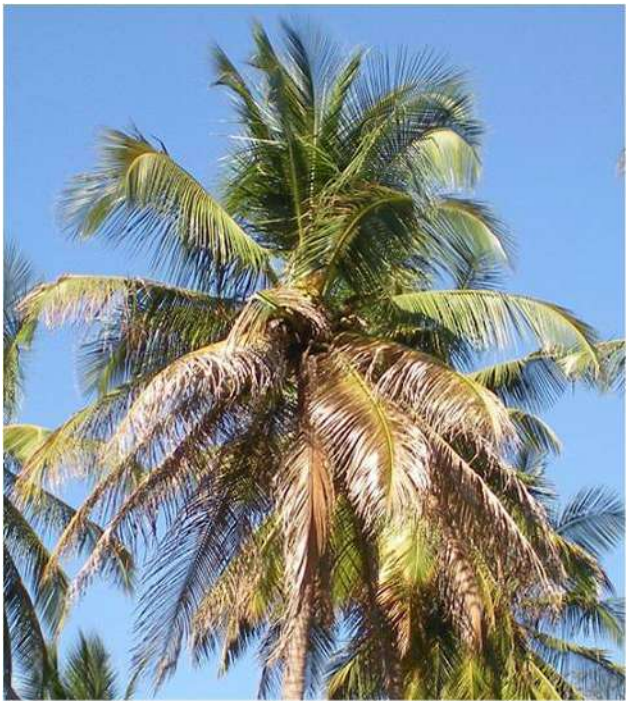
Introduction

Coconut *(Cocos nucifera L.)* palm is an important oil yielding, plantation crop grown in most coastal states and few interior states of India, and the country ranks first in the world (19,309.90 million nuts) in coconut production. Among the coconut producing states of India, Andhra Pradesh, Kerala, Karnataka and Tamil Nadu states contribute to nearly 91 per cent of country's coconut production. Though coconut palm is hardy in nature and adaptable to varied climatic conditions is affected by many diseases at various phases of its growth starting from seedlings to bearing stage. Among the diseases bud rot *(Phytophthora palmivora),* Thanjore Wilt (or) basal stem rot (*Ganoderma lucidum*), stem bleeding disease (*Thielaviopsisparadoxa*) leaf blight (*Lasiodiplodiatheobromae*) and root wilt (*Candidatus phytoplasma*) are the major diseases of coconut in India. To address the research needs of the coconut growers of the states in terms of development of new varieties, cutting edge production technologies to scale-up on farm productivity and to circumvent pest and disease incidence, under the aegis of ICAR-All India Coordinated Research Project on Palms. Integrated Disease Management modules were developed for leaf blight. Intense surveys are conducted to document the micro-meteorological parameters towards the occurrence of the disease and an alloy of approaches comprising of nutrient management, intercultivation has been developed to contain the disease. In this article, various strategies for effectively managing leaf blight in coconut trees in Tamil Nadu are discussed.

Coconut palms are affected by many diseases; the occurrence of these diseases is mostly restricted to specific locations in different growing regions. For instance, in Tamil Nadu, the basal stem rot disease is more prevalent in eastern parts of the state viz., Thanjavur district, while the leaf blight disease of coconut is restricted to certain pockets in western



parts viz., Coimbatore, Tirupur, Krishnagiri and Dindigul districts. The leaf blight disease was first noticed in 1994 in South India, especially in Coimbatore district of Tamil Nadu. Leaf blight, caused by the fungus *Lasiodiplodiatheobromae*, can negatively impact coconut yields and overall tree health if left unmanaged. Leaf blight disease of coconut remains a problem especially in aged palms. The pathogen persists between seasons on infected leaflets and dead palm debris. The symptoms initially appear on the leaflets of matured outer/lower fronds and subsequently spread to other fronds leaving topmost leaves including the spindle, unaffected. The disease progression starts from the distal end of the leaflets and spreads towards the midrib then ends. As the disease becomes severe, most of the fronds would be affected and ultimately resulted in reduction of nuts. The leaf blight disease inflicts yield loss ranging from 10- 25%.

Nuts on leaf blight affected coconut tree

Leaf blight symptom on fronds

Symptomatology

The pathogen caused severe damage in adult palms (above 30 years old) and mild damage in young palms. Heavily infected coconut palms exhibited delayed flowering when compared to healthy palms and the incidence was severe in older/matured fronds and the younger fronds were mostly free from disease. The affected leaflets showed minute yellow dots initially and started drying from the tip towards middle rachis. Drying spread to entire leaf let and shows a charred or burnt appearance from distance. In the fronds, irregular necrotic spots with dark brown margins appeared on leaflets of older fronds and turned into dark brown in color on maturation with black powdery mass. Under severe conditions, symptoms of dark grey to brown lesions with wavy or undulated margins appear on nuts from the apex. Infected seedlings showed to reduction in photosynthetic activity leading to poor growth while nut infection showed to decay of endosperm completely, reducing the marketable value. The affected nut was desiccated, shrunken, deformed and dropped prematurely. The pathogen penetrated the kernel through mesocarp, resulting in decaying of endosperm.

Roving survey

This survey includes assessment of disease incidence or damage from randomly selected spots in a short period of time over a large area. It provides information on disease levels which helps in determining the timing of adopting appropriate control measures. Periodical survey on disease incidence helps to assess the general health of the palm, identification of hotspot area for a particular disease, developing forewarning disease models and to devise suitable management strategy. Roving survey has been taken up in major six coconut growing districts of Tamil Nadu namely Coimbatore, Tirupur, Dindigul, Theni, Tirunelveli and Kanyakumari to ascertain the damage due to various diseases afflicting coconut. The survey was taken up from March to September every year and observations have been recorded pertaining to major diseases of coconut (Fig 1). Even though the leaf blight

Leaf blight - leaflets

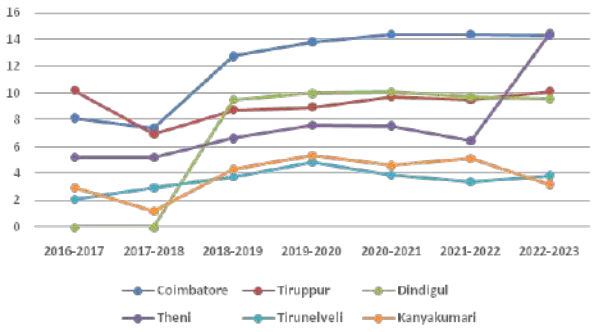


Fig 1. Incidence of Leaf Blight across Districts over the years

Blocks	Leaf blight
(Per cent Disease Index)	
COIMBATORE DISTRICT	
Pollachi South	14.13
Pollachi North	12.615
Anamalai	15.00
Kinathukadavu	15.82
Mean	14.39
TIRUPUR DISTRICT	
Gudimangaalm	9.635
Udumalaipet	10.64
Tirupur	8.295
Avinashi	10.42
Mean	9.748
DINDIGUL DISTRICT	
Palani	13.38
Ottenchithiram	10.16
Reddiyarchathiram	7.97
Nilakottai	7.57
Mean	9.77
THENI DISTRICT	
Cumbum	10.055
Uthamapalayam	9.12
Periyakulam	12.29
Bodinayakanur	10.48
Mean	10.486
TIRUNELVELI DISTRICT	
Thenkasi	1.955
Kadayanellur	5.385
Vasudeavnellur	4.81
Shenkottai	3.03
Mean	3.795
KANYAKUMARI DISTRICT	
Rajakkamangalam	6.15
Thuckalay	2.51
Kurunthancode	2.165
Thovalai	3.06
Mean	3.471

Table 1. Status of leaf blight disease in surveyed districts of Tamil Nadu during 2022-23

incidence was observed in almost all districts during the survey (March to September 2022) the severity was considerably high in four districts namely, Coimbatore, Theni, Dindigul and Tirupur districts. The intensity of leaf blight was maximum (16.48 PDI) in Lakshmipuram village of Periyakulam block and Kombai (16.29 PDI) village of Cumbum block, Theni district followed by Kappalankarai village (16.19 PDI) of Kinathukadavu block, Coimbatore district. In Coimbatore district, the leaf blight incidence was maximum in Kinathukadavu block (15.82 PDI) and Anamalai block (15.00 PDI). The maximum district average (14.39 PDI) was recorded in Coimbatore followed by Theni (10.48 PDI) districts (Table 1)

Epidemiology of leaf blight disease in coconut was studied in Aliyarnagar

The observations on symptoms of leaf blight disease in coconut were taken on weekly intervals from January 2022 to December 2022 to understand the pattern of incidence in correlation with weather parameters prevailing in different seasons. The weather parameters namely Temperature, Rainfall, Relative Humidity (Morning and Evening) and Evaporation prevailed in Standard Meteorological Weeks (SMW) were recorded and the respective incidence of leaf blight during these weeks were also recorded.

The results revealed that nevertheless, the leaf blight symptoms were exhibited all through the year or in all months of the year, the incidence was maximum during hot months of March, April and May months of the year 2022 it got decelerated during October, November, December months of 2022. The correlation results given in table 2 revealed that there existed a positive correlation between temperature (Maximum and Minimum) and leaf blight incidence. It could be inferred as a rise in every degree of temperature there is every

	Weather parameters	Correlation coefficient
Leaf blight incidence	Temperature (Maximum)	0.626
	Temperature (Minimum)	0.593
	RH (Morning)	-0.079
	RH (Evening)	0.393
	Rainfall	-0.545
	Evaporation	2.01

Table 2. Correlation between leaf blight incidence and weather parameters

likelihood that there will be increase in the infection of leaf blight disease in coconut. Similarly, there existed a negative correlation between RH and leaf blight incidence as shown in table 2. This could be inferred as the increase in RH resulted in decrease in the incidence of the leaf blight disease which could be corroborated from the observations that the months coinciding the increased RH experienced lesser incidence of leaf blight.

Yield loss assessment in coconut due to leaf blight disease

Twenty-five healthy and 25 leaf blight infected palms were selected in Puliyankandi village, Anamalai block, Coimbatore district and nut yield were recorded from January 2022 to December 2022. From the results it was found that the percent reduction in nut yield due to leaf blight disease in coconut ranged from 6.07 to 21.74 per cent with an average nut yield loss of 10.36 per cent. In addition to leaf blight, occurrence of rugose spiralling white fly infestation was also observed on the palms to an extent of 10 per cent. (Fig. 2)

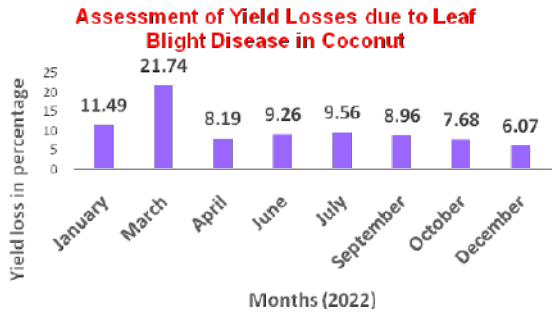


Fig. 2. Yield loss assessment in coconut due to leaf blight disease

Management of leaf blight Disease in coconut

Management of leaf blight disease using chemicals has been one of the pragmatic options and to arrive at the best option among the recent fungicides available, a field experiment has been contemplated with seven treatments. The fungicides namely propiconozole and tebuconozole have been selected for this experiment. The study was undertaken in the coconut garden of farmers in Puliyankandi village. The observations have been made in coconut trees before the start of the treatment and 36 months after the treatment. The results clearly revealed that the treatment of root feeding of propiconazole @ 5ml +100 ml water was found to be very effective in controlling leaf blight disease when compared to all the other treatments. The effect of the treatment was such that the disease incidence reduced from the PDI of 30.01 to 2.98 which was calculated to be 27.03 percent reduction. In terms of severity of the disease, the treatment was reported to effect 67.8 percent reduction in the severity of the disease. Nut yield was also found to be significantly increased when compared to other treatments. It was reported that 132 nuts have been harvested with a benefit cost ratio of 1:1.24. Next best treatment was root feeding of tebuconazole @ 5ml + 100 ml water which has resulted in 19.75 percent reduction in the leaf blight disease and the severity was reduced to the level of 55.58 percent with the nut yield of 123/tree/year and benefit cost ratio of 1:1.19.

Demonstration on integrated management of leaf blight disease

An Integrated Disease Management protocol was demonstrated in one acre coconut farm which consisted of 72 palms located in Aliyarnagar village of Anaimalai block in Coimbatore district.

The following four components were demonstrated as integrated disease management strategy.

- Removal and destruction of severely affected fronds (once in 3 months)
- Spraying of Bordeaux mixture 0.5% or copper oxychloride 0.3% two times at 45 intervals during summer months (Feb /April).
- Root feeding of Propiconazole @ 2ml + 100 ml water (Root feeding to be done at three months interval during Jan, April, July and October)
- Basal application of *Bacillus subtilis* @ 200g along with 50 kg FYM per year.

S. No.	Treatment details	Percent Disease Index				Nut Yield
		Before Initiation	January 2022	July 2022	Difference (% reduction / increase)	
1.	Treated as per Schedule (IDM module)	13.01	9.27	6.15	6.86	80
2.	Untreated Control	12.35	13.01	14.52	(52.73% disease reduction)	67
Average of 72 palms; PDI – Per cent Disease Index; Values are mean ± Standard error.						

Table 3. Intensity of leaf blight disease in demonstration plot

The observations were made pretreatment of this IDM module and post treatment after six months. From table 3 it could be inferred that the incidence of leaf blight disease which was an average of six months got reduced significantly from 13.01PDI (initial) to 9.27PDI respectively. The average intensity of leaf blight disease reduced from 9.27 PDI to 6.15 PDI after 6 months of application accounted for the disease reduction of 3.74 per cent. In control plot the disease incidence slightly increased from 12.35 PDI (initial) to 14.52 PDI after 6 months of application. Clear difference was observed between control and the treated palms as there was increase in the incidence of leaf blight in control plot. By adopting the IDM packages the leaf blight disease can be effectively managed.

Here are some tips for managing coconut leaf blight disease:

1. Identify the symptoms: The first step in managing coconut leaf disease is to identify the symptoms. The affected leaflets showed minute yellow dots initially and started drying from the tip towards middle rachis. Drying spread to entire leaf let and shows a charred or burnt appearance from distance. In the fronds, irregular necrotic spots with dark brown margins appeared on leaflets of older fronds and turned into dark brown in color on maturation with black powdery mass.

2. Remove infected leaves: To prevent the spread of the disease, it's important to remove infected leaves as soon as possible. This can be done by cutting off the affected leaves and burning them or burying them deep in the soil. It's important to sanitize the cutting tool with alcohol or bleach between cuts to prevent the disease from spreading to healthy leaves.

3. Use fungicides: In addition to removing infected leaves, fungicides can also be used to manage coconut leaf disease. However, it's important to use the right fungicide at the right time to maximize effectiveness. Fungicides should be applied preventatively, before the disease appears, or early in the infection cycle. Copper-based fungicides are effective against Leaf blight pathogen; However, fungicides should be used sparingly and according to label instructions to avoid resistance and reduce environmental impact.

4. Improve tree health: Healthy coconut trees are less vulnerable to disease, so it's important to improve overall tree health. This can be done by fertilizing the trees with balanced fertilizer, providing adequate water and nutrients, and controlling pest infestations. In addition, it's important to ensure good soil drainage and avoid over watering, which can create conditions favorable for fungal growth.

Conclusion

L. theobromae, causing leaf blight in coconut is a serious disease in southern India especially Tamil Nadu, which has limited the production and productivity under severe conditions. It is observed that the moist condition favors the initial establishment of *L. theobromae* and the existence of favorable temperature and high humidity during February-March and August-September aggravates the disease development. But in coconut palm, this pathogen is not lethal restricting its severity to reduced photosynthetic activity causing indirect loss in terms of productivity under extreme intensity. Based on the observation, any wound or any injury to the fronds/leaflets is needed for the initial establishment of plant pathogen for further establishment and development of the disease. Although the pathogen developed symptoms on the matured fronds and nuts, the level of infection is not at critical stage. As the pathogenicity proved that, wound/injuries to leaf lets are the main predisposing factor for initial establishment, avoiding injuries to plant parts can go a long way in reducing the incidence and spread of the disease.

Managing leaf blight disease in coconut palms requires a holistic approach, integrating preventive, cultural, and chemical control measures. Early detection, regular monitoring, and pruning infected leaves are crucial steps to help minimize the spread of the disease. Cultural practices, such as adequate spacing, good ventilation, sanitation, and proper nutrient management, play a significant role in preventing leaf blight. Incorporating fungicides, as recommended, can provide additional protection. Long-term strategies involving the cultivation of resistant or resilient coconut varieties contribute to the sustainable management of leaf blight and secure the productivity of coconut plantations. By implementing these strategies, farmers can effectively combat leaf blight and secure the health and productivity of their coconut trees.

Status of Coconut Root Wilt Disease in Tiruppur District

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Yellowing of Leaves

Survey of the root wilt infected coconut gardens

Coconut palm (*Cocos nucifera, L.*) is an important plantation crop of India and often described as 'Kalpavriksha' because of the multifarious uses of every part of it in the commercial sector. Coconut palms are normally affected by various diseases resulting into reduction in yields. Among them, root (wilt) a systemic disease caused by phytoplasma is one of the most devastating diseases of coconut palms. Root (wilt) disease, a non-lethal but debilitating malady of coconut palm was first reported from Kerala State, India about a century and quarter years ago. Sparse and sporadic occurrence of the disease was also reported from other six northern districts of Kerala and from adjoining areas of neighbouring states of Tamil Nadu.

Foliar yellowing and marginal necrosis of the older leaves were observed in association with disease, and in advanced stages of the disease, yellowing of younger leaves occurred. The important diagnostic symptom is "flaccidity" of leaves. Such affected leaflets were curved along the entire length and forms a structure resembling the ribs of mammals. Shedding of buttons and immature nuts occur. The sizes of mature nuts are small with thin kernel. The crown size also gets reduced in advanced stages and trees remain unproductive.

Flowering is delayed when palms are affected by root (wilt) disease in pre bearing period and the vitality of the reproductive system is very much affected. The spadices become small, weak, and do not open normally, and drying of spathe and necrosis of spikelets from tip to downwards occurs. Shedding of immature nuts and poor quality of nuts/copra is often attributed to yet another character of the disease.

The secondary infection of Root wilt disease is leaf rot disease caused by *Exerohilum rostratum* and *Colletotrichum gloeosporioides*, which occur as superimposed on the root (wilt) affected palms. Leaf rot causes a reduction in photosynthetic area, disfiguration of the palms, and reduction in yield.

The pathogen is transmitted by insect vectors such as lace bug (*Stephanitis typica*) and plant hopper

Leaf rot

Marginal Necrosis

(*Proutista moesta*). Recently, root wilt disease is slowly spreading in Tiruppur district of Tamil Nadu. In Tamil Nadu, root wilt disease was observed in Theni, Tenkasi, Kanyakumari and Coimbatore districts.

In this regard, the survey was conducted in Tiruppur district of Tamil Nadu to monitor the incidences of root (wilt) disease in coconut. Wherever the disease incidence was noticed, garden to garden survey was undertaken and individual trees infected with root (wilt) disease were identified and eradication was recommended as per the procedure. Disease index was calculated to quantify the disease intensity, by adding the weighted average grade points of the different symptoms in all the leaves of a palm (George and Radha, 1973).

$$\text{Disease Index} = \frac{\text{Sum (F+Y+N)} \times 10}{\text{L}}$$

where F - Grade points assigned to flaccidity (0-5)
Y - Yellowing (0-3)
N - Necrosis (0-2)
L - Total number of leaves

From the survey conducted on the occurrence of root (wilt) disease of coconut in Tiruppur district of Tamil Nadu, Kosavampalayam and Mungiltholuvu villages, belonging to Gudimangalam block of Tiruppur District were found to be infected with root wilt disease. In Kosavampalayam and Mungiltholuvu villages, Gudimangalam block root (wilt) disease incidence of 7.8% and 8.2% respectively were observed. Mid-whorl yellowing was noticed in several gardens. Leaf rot disease symptom was also observed in several palms. In Udumalpet block, root (wilt) disease was observed up to 6.4% and in Gudimangalam block, root (wilt) disease was recorded up to 7.5%. In Udumalpet block, root wilt disease was observed in villages viz., Manupatti (5.5%) and Deepalapatti (7.3%). In Gudimangalam block, root wilt disease was observed in villages viz., Virugalpatti (6.5%), Kosavampalayam (7.8%) and Mungiltholuvu (8.2%).

Wherever the disease incidence was noticed, garden to garden survey was undertaken and individual trees infected with root (wilt) disease were identified and eradication was recommended as per the procedure. A comprehensive recommendation involving application of balanced dose of chemical fertilizers (split into two times) were given to farmers.

Chemical fertilizers	Dosage
Urea	1.3 kg/palm/year
Superphosphate	2.0 kg /palm/year
Muriate of Potash	3.5 kg/palm/year
Magnesium sulphate	500 g/palm/year

Besides, the farmers were advised to adopt soil application of bioagents namely *Bacillus subtilis* and *Trichoderma asperellum* @ 100 g/palm along with neem cake @ 5.0 kg/palm/year (split into two times). Further, root feeding of coconut tonic – 200 ml/tree along with TNAU COCOCON – 2 litres/tree are advised to farmers for the management of coconut root wilt.

References

1. George.M.V. and Radha. 1973. Computation of disease index of root (wilt) disease of coconut. Indian.J. Agric. Sci., 43:366-370.

Coco Nectar: Transforming Lives and Redefining Sustainable Agriculture:

the journey of Global Coconut Farmers Producer Company Limited

Dr. Prabhat Kumar, Dr. B Hanumanthe Gowda and Vincy Varghese
Coconut Development Board, Kochi- 11

In pursuit of a vision to enhance the prosperity and sustainability of coconut farmers' lives, a collective effort by 1200 progressive coconut farmers materialized in the formation of GCFPCL (Global Coconut Farmers Producer Company Limited) in Palladam, Tiruppur District of Tamil Nadu. Global Coconut Farmers Producer Company Limited (GCFPCL) is a registered entity operating under the Farmer Producer Organisations (FPO) Act, with 1200 farmers as share holders. The company has an authorised capital of 50 lakhs with a paid capital of Rs 22.66 lakhs. The Company is producing 1000 ltr neera per day and product is being sold in around 600 outlets in Tamil Nadu of which 200 outlets are organic stores. The product is available in online platform like Flipkart and Amazon.

At the core of GCFPCL's mission lies a commitment to uplifting the livelihoods of its member farmers, aiming to elevate their income and overall well-being. To achieve this noble objective, GCFPCL operates on a foundation of five guiding principles viz: adding Standardized Value to Farm Products, Integrating Farmers with Consumers, Assisting in Processing, Advertising, and Marketing, Providing Necessary Training and Technical Assistance and Arranging Equal Distribution of Profits to Shareholders. These principles collectively form a holistic approach aimed at uplifting the socio-economic status of the participating farmers.

Addressing the Plight of Coconut Farmers

GCFPCL's management conducted a thorough analysis of the challenges faced by coconut farmers and found a grim reality: while a coconut is being sold for mere Rs 10-12/-, the cost has remained stagnant for a decade, contrasting sharply with urban markets where coconuts fetch Rs 45-50/- depending on the season. This disparity has left ordinary farmers with meager or no income from coconut farming, highlighting an urgent need for change.

Innovation in Neera Tapping and Processing

Recognizing the critical need for change, GCFPCL turned its attention to coconut neera tapping as a potential value addition. In a groundbreaking move, the company tapped into the untapped potential of coconut neera, realizing its ability to significantly enhance value. Leveraging cutting-edge Ice Box technology obtained from CPCRI and guided by the Coconut Development Board, GCFPCL initiated the process of tapping and selling raw neera in its natural form. While the raw neera market showed promise, challenges arose in bulk sales due to the necessity of maintaining a cold chain until it reached the consumer.

Neera is a wholesome natural drink, rich in vitamins (A, B & C) and minerals like Iron, Zinc, potassium and calcium. This makes it a healthy and a nutraceutical product. Neera is a natural, nutritious and healthy drink without any additives. Apart of being sweet and nutritious it has low calorific value which helps in weight loss. It is very good for the digestive system.

Undeterred by challenges, the company invested considerable resources in research and development, exploring various packing methods. The pivotal breakthrough came with the development of a Tetra Pack packaging solution, allowing the storage of coconut neera at ambient temperatures with a guaranteed shelf life of 12 months. This innovation marked a milestone, positioning GCFPCL as pioneers in the industry.

CoCo Nectar: A Healthful Innovation

GCFPCL had placed their products in various leading hospitals. Many doctors, having tasted / tested the same for months, started prescribing Thenneera to their patients based on their ailments. As per the trails, Thenneera-Coco Nectar is a health supplement alternative to machine made electrolytes and other beverages. After covid, scenario in food sector has experienced dramatic changes. Many started towards consuming local and native drinks. THENNEERA finds a good place in organic shops and among sports enthusiasts and health conscious people. During covid there were many cases of Thenneera helping them to enhance immunity and people affected with Covid felt fast recovery from its infection.

The product was commercially launched in January 2022 in the SKU (Stock Keeping Units) of 200 ml tetrapak. They are able to generate revenue near to Rs. 2 crores from sale of around 70,000 litres. They ensure a payback of Rs. 30/litre to the farmer and Rs. 20 to the tappers. The company has an average turnover of Rs. 2.00 crores from the retail sales and export of the product. This industry could be classified as sunrise sector.

GCFPCL is receiving bundle of appreciations from various segments of the society. Padma Shri Dr V

Team Global CFPCL with Director, CPCRI and CCDO, CDB

S Natarajan, a Geriatric Specialist from Chennai made an extensive study on this nature drink and recommends to all senior citizens for improving digestion, sleeping and get away from constipation. The company is working to produce coconut nectar honey, coconut nectar sugar, coconut chips etc and with an expectation of good market demand .

As most other nature health drinks are acceptable as alternate to modern beverages by all people, Kalparasa (life essence) or Coconut Neera is also going to be in the same way. The company is working on improving the livelihood of coconut farmers and ensures the sustainability of the coconut farming. Coconut Neera and its byproducts are found to have huge potential in the world market. If the potential of this unique beverage is effectively tapped in the domestic and international market, it will be a great opportunity for the FPOs .

Unlocking Global Potential: Coconut Neera and its Byproducts

GCFPCL had put all efforts to make this product all over and tried all the leading supermarkets and organic stores. Since Neera can be tapped only by Farmer Producer Organisations with valid Neera licence, company had very limited finance resources for branding, promotion marketing. GCFPCL's Board of Directors has marketed the product by investing funds in their own capacity. Coconut Development Board's support in market – opening access to world market is imminent and this constant support is very helpful to place this brand in International Expos in India and abroad. GCFPCL participated in number of International Exhibitions like Aahar Food and Hospitality Show in Delhi, Gulf Food in Dubai and this year's Summer Food Fancy Show in New York

Attending those events helped GCFPCL a lot from packing to product improvement and also to

understand the present trends in world market to meet the International standards. To meet the international quality standards and assurance, GCFPCL is having Quality certificates like FSSC 22000; Halal Certificate; KOSHER Certificate; 100% Vegan; GMO Free certificate for their product.

Awards Recognizing Excellence

The Global Coconut Farmers Producer Company has garnered prestigious awards, including the National Award presented by Hon'ble Shri. Narendra Singh Tomar, Union Minister for Agriculture. Another notable recognition is the Award for the promotion of Coconut Enterprise, conferred by Hon'ble Sushree Shobha Karandlaje, Minister of State for Ministry of Agriculture and Farmers Welfare. Additionally, the company has received the Startup Tamil Nadu

Grant and Indo-U.S. Business Excellence Awards from the Indo-American Chamber of Commerce and Industries.

A Beacon of Inspiration

K. Balasubramanian, Managing Director, Global Coconut Farmers Producer Company

GCFPCL's journey, is not just a success story but a beacon of inspiration for the agricultural community and beyond. The transformation of coconut farming from a stagnant venture to a thriving enterprise is a testament to the resilience and ingenuity of the 1200 progressive coconut farmers The challenges faced, innovations achieved, and markets conquered has proved that GCFPCL's impact extends far beyond the coconut groves of Tiruppur District. It serves as a motivational narrative, reminding us that grassroot initiatives, fueled by collective vision and unwavering commitment, can alter the course of an entire industry.

Continued Commitment to Innovation

Looking forward, the visionaries at GCFPCL continue to pioneer new frontiers. Their commitment to introducing coconut nectar honey, coconut nectar sugar, and other innovative products underscores their dedication to constant improvement and meeting evolving consumer needs. In doing so, they not only secure a prosperous future for coconut farmers but also contribute to the global demand for sustainable, natural alternatives.

"The inspirational journey of Global Coconut Farmers Producer Company Limited serves as a testament to the transformative potential within the agricultural sector. Through innovation, dedication, and a commitment to sustainability, GCFPCL not only improved the livelihoods of coconut farmers but also created a unique and valuable product with global market potential. Their story encourages other Farmer Producer Organisations to explore untapped opportunities, contributing to the growth of the agricultural sector and the well-being of farming communities."¬

First Consignment of Neera - Coco Nectar flagged off to US from Cochin Port.

The fisrt consignment of Coco Nectar – ready to drink Neera produced by Global Coconut Farmers Producer Company Limited (GCFPCL) Tiruppur, Tamil Nadu was flagged off from Kochi Port to US by Dr. K. B. Hebbar, Director, CPCRI and Vice Chairman, Coconut Development Board at the premises of CFSM IV Logistics Pvt Ltd, Vallarppadam, Kochi on 17th February 2024. While speaking during the occasion Dr. Hebbar congratulated Global CPC for making an entry in to the global market and further told that this is the result of the efforts of 1200 member farmers of the Company. Mr. Balasubramanian, Director, Global CPC said that the company will work more for exporting one container every month. Dr. Hanumanantha Gowda, Chief Coconut Development Officer spoke during the occasion. Regent North America LLC is the importer of the product in the USA. The programme was attended by Shri. Jayachandran IRS, Customs Deputy Commissioner; Shri. Ajay Kumar, Customs Superintendent; Shri. Sushant Awathi, Director DP World; Shri. R. Madhu, Secretary, Coconut Development Board and representatives of Global Coconut Farmers Producer Company Limited.

Empowering Entrepreneurs in the Coconut Processing Industry: Inspiring stories from CDB Institute of Technology

Dr. Prabhat Kumar, Dr. B Hanumanthe Gowda and Resmi D. S
CDB, Kochi- 11

CDB Institute of Technology (CIT) established at South Vazhakulam, in Ernakulum district, Kerala aims at the overall development and promotion of the coconut processing Industry through a set of focused activities. CIT has been offering various services and training programs to Individuals, Farmer Producer Organizations/SHGs/Women groups, private entrepreneurs and VHSE, UG & PG students (Food Science/Food Technology/ Food Engineering/ agriculture). From offering comprehensive training programs to individuals, Farmer Producer Organizations, and students specializing in food science and agriculture, to pioneering novel value-added coconut products, CIT stands as a testament to unwavering dedication and commitment.

Empowering Entrepreneurs: CIT's impact resonates through the success stories of numerous individuals who have undergone its training programs. With an average of around 500 trainees per year, CIT has been instrumental in equipping aspiring entrepreneurs with the necessary skills and knowledge to thrive in the competitive market. Remarkably, approximately 30% of these trainees have gone on to establish their own thriving business ventures, serving as beacons of inspiration for others.

A Journey of Entrepreneurial Success: Mr. Asharaf K.M's Venture in Food Processing

Mr. Asharaf K.M, a native of Thrissur, Kerala returned to his home town after a successful career as a TV anchor in the Middle East. Inspired by his experiences and with an interest in food processing, he embarked on a journey to establish his own venture. His exposure to a plethora of value-added food products during his time abroad fueled his passion to bring innovation. In 2017, with insights

from the District Industries Centre (DIC), Mr. Asharaf laid the foundation for his business. In 2018 when he underwent intensive training at the Coconut Development Board (CDB) Institute of Technology, equipping him with the technical expertise needed to realize his dreams.

Venture Highlights: In a modest space spanning 2500 sq. ft., Mr. Asharaf commenced his operations, focusing on an array of coconut-based products such as Virgin Coconut Oil (VCO), Avalose powder, Coconut pickle, Coconut Curry powder, and Shell-based tooth powder. Moreover, diversifying his offerings, he ventured into processing other food products including arrowroot powder and steam wheat puttu powder. He is the recipient of State-level farm award for post-harvest intervention in 2021, conferred by the Agricultural Department, Government of Kerala.

According to Asharaf, entrepreneurs often overlook the immense potential of the coconut. Through his journey, he discovered the untapped opportunities in coconut value addition, which he believes to be a highly lucrative business endeavour.

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Abdulla's Journey of Coconut Innovation

Mr. Abdulla M., hailing from Kannur, Kerala, took over his father's Copra and Coconut Oil business with a desire to innovate. Intrigued by the untapped potential of coconut water, he sought guidance from the CDB Institute of Technology (CIT) to explore new avenues. Inspired by his training, Abdulla envisioned establishing a unit dedicated to producing Coconut Vinegar and Nata De Coco. Despite encountering setbacks, his unwavering commitment propelled him to succeed as an entrepreneur.

In 2017, 'NataNutrico Food Products' was founded with an initial investment of Rs. 75 Lakhs. Today, it stands with a 10,000 sq. ft. factory located in Kannur, Kinfrapark, with a substantial investment of Rs. 2.5 Crores. The company is having diverse range of coconut-based products including Nata De Coco soft drinks (offered in 14 flavors), Coconut Water Vinegar, Dietary Food Supplements, Vegetable Wash infused with Coconut Vinegar, Leather crafted from Nata and banana leaf fiber, Nata-based facemasks, Virgin Coconut Oil, etc.

Abdulla highlights the soaring demand for Nata De Coco, primarily imported from Thailand and the Philippines. With the rising popularity of Nata in the ice cream and fruit juice industries, meeting demand has become a challenge. Abdulla underscores the importance of proper training and expertise for the successful operation of any Nata-based unit.

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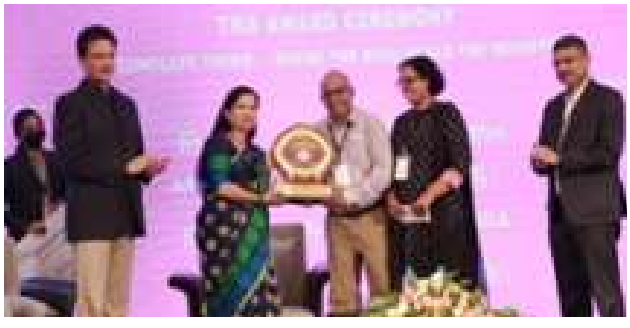
Green Aura International: Pioneering Innovation in Coconut-Based Products

Smt. Sumila Jayaraj, fueled by her passion for entrepreneurship and with her extensive experience as an Assistant Manager in a Virgin Coconut Oil manufacturing company, embarked on her journey to establish her own venture. In 2012, she started an integrated coconut processing unit in Thrissur, Kerala, originally named "Greennut International," later rebranded as "Green Aura International" with "Greennut" as its flagship brand. She attended special training from CIT in manufacturing coconut based vinegar.

Under her leadership, Green Aura International has introduced a diverse range of eight coconut-based products to the market. These include coconut milk, cold-pressed Extra Virgin Coconut Oil, Desiccated Coconut Powder, coconut chutney, coconut water vinegar, hair cream, low-fat desiccated coconut, and coconut pickle. With a project worth Rs. 1.8 crores and a workforce of 13 employees, the enterprise boasts a quality control lab ensuring adherence to the highest standards, accredited by FSSAI & ISO HACCP.

Initially targeting the domestic market, Sumila's



enterprise rapidly expanded its reach, venturing into international trade in 2016. Key exports include coconut milk, extra virgin coconut oil, coconut water vinegar, and desiccated coconut, fortified with Kosher Passover certification. Embracing digital platforms like Amazon and Indiamart, the company has leveraged digital marketing to amplify its presence.

Recognized for her entrepreneurial acumen, Sumila has received prestigious accolades including 'The Best Entrepreneur Award' from the Kerala Gazetted Officers Association, 'The Best Enterprise in Food Processing Award' by Hues of Life magazine, and the 'Best Enterprise in Manufacturing Award' from METRO MSME, bestowed by the Kerala State Industrial Development Corporation (KSIDC) in 2022. Moreover, her remarkable leadership earned her the 'Best Woman Managed Enterprise Award' from the Thrissur Management Association (TMA).

In her vision for the coconut industry, Sunila emphasizes the need for continuous innovation and value addition beyond conventional products. She believes that entrepreneurship in this sector not only generates revenue but also serves as a crucial support for coconut farmers across the nation.

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TJ Products: A Testament to Dedication and Legacy in Coconut-based Enterprise

TJProducts stands as a successful coconut-based small-scale enterprise in Thrissur, a testament to the dedication of Shri. Jose & late Smt. Tessy. The journey began with Smt. Tessy's initiative to craft organic Virgin Coconut Oil (VCO) for her grandchild.

Recognizing the remarkable benefits of VCO, she ventured into a small business, aiming to offer high-quality coconut products to new mothers and grandmothers. The couple underwent training from the CDB Institute of Technology and participated in MSME programs.

Under the brand, bearing the initials of the husband-wife duo, TJProducts offers a diverse range of coconut-based value-added products. These include Virgin Coconut Oil, Coconut chutney powder, Coconut Lemonade, Dandhapaala oil with VCO, Pain relief oil, Roasted Coconut products (such as Sambar powder, meat masala, etc.), Dry banana powder (kannankaayappodi), and VCO-based charcoal soap, all free from preservatives.

The sudden demise of Smt. Tessy in 2021 was a profound hardship for the family. Jose recalls Tessy's commitment and hard work as a driving force behind TJ Products. Despite this loss, Jose, with the support of their elder daughter, has taken charge of the business, determined to fulfill his late wife's dreams. Today, the brand boasts a portfolio of over 18 varieties of coconut-based products.

Looking ahead, TJProducts is on the path of expansion, with plans to introduce more products, aiming to provide pure and quality offerings to the public.

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Contact No.: 8547470333

Aashan & Co.: Cultivating Coconut Goodness, Crafting Quality

Aashan & Co., a business venture owned by Shri. Sreenesh, stands as a beacon of quality and commitment in the realm of coconut processing. Founded in 2019 with a vision to bring the goodness of coconut to the masses, this enterprise has quickly garnered acclaim for its dedication to delivering superior products to the public.

With an installed capacity of 10,000 nuts per day, Aashan & Co. operates at 35% capacity, showcasing its efficient utilization of resources. The unit is equipped with sophisticated infrastructure, housing approximately 10 processing machineries specialized in Cold Processed Virgin Coconut Oil and Desiccated Coconut, made possible through financial assistance from NABARD.

Aashan's diverse product portfolio includes Baby oil, Haircare oil, Skincare oil, and cooking oil, each crafted meticulously to meet the highest standards of quality and purity. Sreenesh's expertise in coconut processing is framed through the specialized training he attended from CDB Institute of Technology. He is very careful in ensuring that only the finest raw materials, carefully sourced from renowned Kuttiyady & Perambra farms in the Malabar region, are utilized in production.

While Aashan & Co. primarily caters to the domestic market, supplying cold processed VCO to industrialists like Mosons Group (Indulekha products), the brand is poised to make its mark on the international stage. With a steadfast commitment to excellence and a passion for promoting the virtues of coconut, Aashan & Co. is set to make their presence in the global market.

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Koko Neer/Koko Scoop: Crafting Coconut Delights

Koko Neer/Koko Scoop, founded by Mr. Anuj Divekar and his wife Dnyanada Anuj Divekar, is a good example of success in the coconut-based industry in Pune. The journey began with the inception of Kokoneer in August 2018, fueled by the couple's vision to provide natural and healthy products to the public. Armed with technical expertise gained from

the CDB Institute of Technology, they embarked on their mission to introduce minimally processed tender coconuts under the brand name 'Koko Neer,' aiming to bring coconut water to every household in Pune on a daily basis.

With a production capacity of around 3000 coconuts per day, Kokoneer initially offered home deliveries on a subscription model throughout Pune at an affordable price of just Rs. 38 per piece. As their popularity soared, they expanded into the retail sector, attracting major clients such as Reliance, Star Bazar, Dorabjee's, Hyatt Hotels, and Conrad Hotels.

Building on their success, Koko Neer/Koko Scoop diversified its offerings with the launch of 'Koko Scoop' in 2017, an ice cream and dessert outlet inspired by the flavors of Thailand. Koko Scoop, with three outlets in Pune and one in Bangalore, serves a variety of coconut-based ice creams, each presented in a coconut shell and topped with fresh Malai and different toppings. Complementing their delectable treats, they offer a complimentary serving of coconut water, adding to the authentic experience.

Their dedication to excellence has not gone unnoticed, as Koko Scoop was felicitated at the Times Hospitality Icons as an Iconic Ice Cream Parlor and recognized as 'Pune's Unique Ice Cream Brand - 2021' by the Nationwide Restaurant & Hospitality Awards.

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(To be continued)

RoboHarvest: Pioneering Precision in Coconut Cultivation through Robotics

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Introduction

In the ever-evolving landscape of agriculture, the incorporation of cutting-edge technologies has become imperative for enhancing efficiency, productivity, and sustainability. One such revolutionizing frontier is found in the realm of coconut cultivation, where traditional practices are being seamlessly integrated with robotics to usher in a new era of precision farming. This comprehensive guide delves into the transformative potential of implementing robotics in coconut cultivation, exploring the intricate synergy between automation and traditional farming methods. From addressing labor challenges to optimizing resource utilization, this guide aims to illuminate the path towards a more resilient and technologically advanced future for coconut farmers.

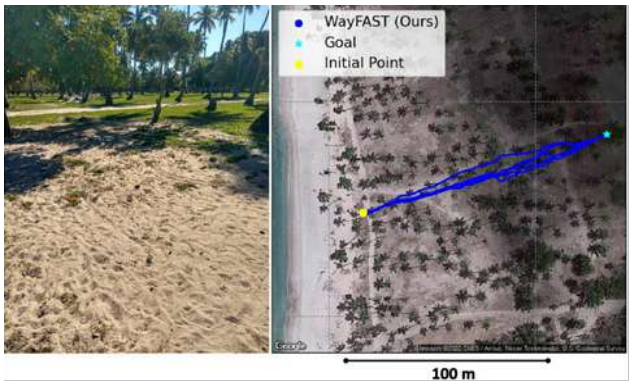
Robotics in Coconut Plantation: An Overview

The integration of robotics in coconut plantations represents a transformative leap into the future of agriculture, transcending traditional cultivation methods. Harnessing the power of automation, robotics in coconut plantations promises to revolutionize the way we nurture and harvest this iconic crop. Automated processes, from planting and irrigation to harvesting and maintenance, not only alleviate the challenges associated with labor shortages but also enhance efficiency and precision. Drones equipped with advanced imaging technologies can monitor the health of coconut palms, detecting diseases and nutritional deficiencies early on. Harvesting bots, programmed with precision, delicately pluck ripe coconuts with minimal damage to the trees. The synergy between technology and nature in coconut plantations unveils a sustainable approach, maximizing yield while minimizing environmental impact. As we embark on this robotic journey within the lush expanse of

coconut groves, the promise of increased productivity and a harmonious coexistence between technology and tradition unfolds (Divyanth *et al.*, 2022).

Mapping and Surveying Technologies

In the dynamic landscape of coconut cultivation, the integration of mapping and surveying technologies with robotics represents a groundbreaking approach towards precision agriculture. Robots equipped with advanced mapping tools are revolutionizing the way coconut plantations are monitored and managed. Drones, armed with high-resolution cameras and LiDAR sensors, soar over vast coconut groves, capturing detailed imagery and generating accurate 3D maps. These maps provide invaluable insights into the topography, health, and distribution of coconut palms, allowing farmers to make informed decisions on irrigation, fertilization, and pest control. The synergy between robotics and mapping technologies not only streamlines the surveying process but also ensures a more targeted and resource-efficient approach to coconut cultivation. This transformative integration not only enhances the overall productivity of coconut plantations but also ushers in an era of sustainable and data-driven farming practices (Abraham *et al.*, 2014).

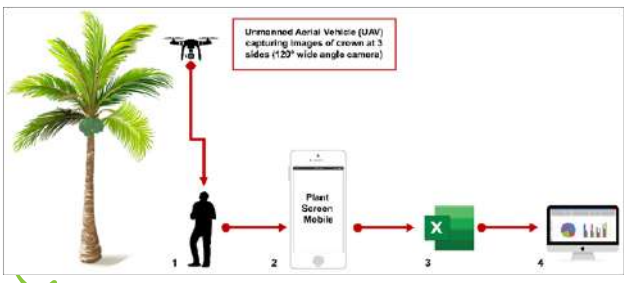


Data Analytics for Coconut Farms

The convergence of data analytics and robotics in coconut farming represents a paradigm shift in agricultural management, ushering in a new era of precision and informed decision-making. Robotics equipped with advanced sensors traverse coconut farms, collecting an extensive array of data on soil conditions, weather patterns, crop health, and growth rates. This wealth of information is then processed and analyzed using sophisticated data analytics tools, providing farmers with actionable insights into the optimal cultivation practices. From predicting disease outbreaks to recommending precise irrigation schedules, this synergistic approach empowers coconut farmers to make data-driven decisions that enhance productivity and resource efficiency. By harnessing the power of data analytics through robotic assistance, coconut farms can not only maximize yields but also contribute to sustainable farming practices by minimizing environmental impact. The marriage of robotics and data analytics offers a transformative avenue for coconut cultivation, marking a step towards a more efficient, resilient, and technologically-driven agricultural landscape (Megalingam *et al.*, 2015).

Automation in Planting and Transplanting

The application of automation in planting and transplanting within the realm of coconut cultivation marks a significant leap towards precision farming. Robots designed for planting and transplanting operations bring unprecedented efficiency and accuracy to the process. These specialized machines are equipped with sophisticated sensors and robotic arms, enabling them to navigate through coconut groves with precision. From digging holes to placing saplings at optimal distances, these robotic systems ensure uniformity in planting, thereby enhancing crop density and overall yield. By automating these labor-intensive tasks, farmers can overcome challenges related to workforce shortages and time constraints, leading to more streamlined and cost-effective coconut cultivation practices. The marriage of automation and coconut planting not only addresses practical concerns but also represents a futuristic approach that holds the potential to redefine the landscape of agriculture with enhanced productivity and sustainability (Pawar *et al.*, 2019).



Robotic Pruning and Trimming

The advent of robotic pruning and trimming has ushered in a new era of precision and efficiency in coconut cultivation. These robotic marvels, equipped with advanced sensors and cutting-edge technology, undertake the meticulous task of pruning and trimming coconut palms with unparalleled accuracy. Guided by algorithms and real-time data, these robots navigate through the dense foliage, identifying and selectively removing unwanted fronds and branches. This automated approach not only ensures a more controlled and uniform canopy structure but also promotes optimal sunlight penetration and air circulation, contributing to the overall health and productivity of coconut palms. Robotic pruning and trimming alleviate the physical strain on farm laborers while enhancing the precision of these crucial horticultural practices. As coconut cultivation embraces the era of automation, the marriage of technology and tradition promises to redefine the standards of efficiency and sustainability in the cultivation of this iconic crop (Maheswaran *et al.*, 2017).

Implementing Precision Irrigation with Robotics

Implementing precision irrigation through robotics in coconut cultivation marks a significant advancement in sustainable agricultural practices. Robotic systems equipped with sophisticated sensors

and real-time data analysis capabilities are deployed to precisely monitor soil moisture levels, climatic conditions, and the specific water needs of coconut palms. By dynamically adjusting irrigation schedules and precisely delivering water where it is needed, these robotic solutions optimize water usage and minimize wastage. This precision approach not only conserves water resources but also contributes to improved coconut yield and overall crop health. The marriage of robotics and precision irrigation in coconut cultivation not only enhances efficiency but also aligns with the broader goals of resource conservation and environmental sustainability. As the agricultural landscape embraces technological innovations, the implementation of precision irrigation with robotics emerges as a promising pathway toward a more resilient and environmentally conscious future for coconut farming (Parvathi and Selvi, 2017).

Harvesting with Robotics

Robotic coconut harvesting technologies have emerged as a game-changer in the agricultural landscape, offering a sophisticated solution to the labor-intensive process of gathering coconuts. These innovative machines, equipped with advanced sensors, computer vision, and robotic arms, autonomously navigate through coconut plantations. Employing algorithms that distinguish ripe from unripe coconuts, these robots delicately harvest the mature fruits without causing damage to the trees. This transformative approach not only addresses the perennial challenge of labor shortages but also significantly expedites the harvesting process, ensuring a more timely and efficient yield. The precision and reliability of robotic coconut harvesting technologies not only enhance productivity but also contribute to sustainable farming practices by minimizing wastage and optimizing resource utilization. As agriculture embraces the era of automation, these technologies stand at the forefront, reshaping the future of coconut harvesting with a perfect blend of technological prowess and environmental stewardship (Sakthiprasad and Megalingam, 2019).

Coconut tree tapping

A labour-intensive and intricate process is poised for a transformative evolution with the integration of robotic technology. Robotic systems designed for coconut tree tapping bring precision and efficiency to this traditional practice. Equipped with advanced sensors and precise control mechanisms, these robots can navigate through the canopy, identifying optimal spots for tapping coconuts without causing damage to the tree. Automated tapping ensures consistency in the collection process, reducing the dependency on manual labor and minimizing the physical strain on workers. The use of robotic technology in coconut tree tapping not only streamlines the harvesting operation but also enhances overall productivity by ensuring a more controlled and systematic approach. As coconut cultivation embraces the era of automation, the introduction of robots in tree tapping promises to revolutionize this age-old practice, making it more sustainable, efficient, and technologically advanced (Manochithra and Karthika, 2019).

Robot-Assisted Pest and Disease Management

In the ever-evolving landscape of coconut cultivation, the integration of robotic technology has become a crucial asset in the battle against

pests and diseases. Robotic systems, armed with advanced sensors and imaging technologies, play a pivotal role in monitoring and managing the health of coconut palms. These robots navigate through plantations, scanning for signs of pests, diseases, or nutritional deficiencies. By providing real-time data and early detection capabilities, they enable farmers to take proactive measures, such as targeted pesticide application or precision nutrient delivery. The automation of pest and disease management not only mitigates the risks associated with manual inspection but also facilitates a more precise and efficient response to potential threats. As coconut cultivation embraces the era of robotics, the integration of these technologies becomes a key strategy in ensuring the health and resilience of coconut palms, ultimately contributing to sustained agricultural productivity and the preservation of this vital crop (Li *et al.*, 2022).

Identification of Pests and Diseases

The identification of pests and diseases in coconut cultivation is a critical aspect of ensuring the health and productivity of coconut palms. Traditional methods of visual inspection have been complemented and enhanced by modern technologies to provide more accurate and timely detection. Utilizing advanced tools such as imaging devices, sensors, and data analytics, farmers can now identify subtle signs of pests, diseases, or nutritional imbalances early on. This proactive approach allows for swift intervention, minimizing the potential damage to coconut crops. By leveraging technology in the identification process, coconut farmers can make informed decisions regarding targeted treatments, reducing the reliance on broad-spectrum pesticides and promoting more sustainable pest and disease management practices. The integration of cutting-edge identification methods not only safeguards the well-being of coconut palms but also contributes to the overall resilience and sustainability of coconut cultivation in the face of evolving agricultural challenges (Li *et al.*, 2022).

Robotic Applications for Pest Control

Robotic applications for pest control have emerged as a transformative solution in the realm of coconut cultivation, offering a sophisticated and efficient means of safeguarding crops. Equipped with advanced sensors, imaging technology, and precision spraying mechanisms, robotic systems navigate through coconut plantations, identifying and targeting specific areas affected by pests. These automated solutions enable precise and controlled application of pesticides, minimizing environmental impact and reducing the need for widespread chemical treatments. The real-time data collected by these robotic applications aids in assessing the extent of pest infestations, allowing farmers to tailor their pest control strategies with unparalleled accuracy. By embracing robotic technology for pest control, coconut cultivation not only benefits from increased effectiveness but also contributes to sustainable agricultural practices by optimizing resource usage and minimizing the ecological footprint associated with traditional pest management methods. This innovative approach marks a significant step towards a more efficient, environmental friendly, and economically viable future for coconut farmers (Li *et al.*, 2022).

Integration of Artificial Intelligence (AI) in Coconut Farming

The integration of Artificial Intelligence (AI) in coconut farming represents a ground breaking frontier, where cutting-edge technology converges with traditional agricultural practices. AI applications, powered by machine learning algorithms and data analytics, bring in an unprecedented level of intelligence to the management of coconut plantations. These systems analyze vast datasets, including weather patterns, soil conditions, and crop health, to provide actionable insights for farmers. AI algorithms can predict optimal irrigation schedules, identify potential pest outbreaks, and even optimize the overall farm management strategy. By harnessing the power of AI, coconut farmers can make informed decisions that enhance productivity, reduce resource wastage, and promote sustainable agricultural practices. The seamless integration of AI in coconut farming not only boosts efficiency but also paves the way for a more resilient and technologically advanced future, ensuring the continued prosperity of this iconic crop in the face of evolving challenges (Parvathi and Selvi, 2017).

Future Prospects of AI in Coconut Cultivation

The future prospects of Artificial Intelligence (AI) in coconut cultivation hold immense promise for revolutionizing the way we approach and enhance agricultural practices. As AI continues to evolve, its applications in coconut farming are anticipated to become even more sophisticated and tailored to the unique challenges faced by coconut growers. Predictive analytics, machine learning algorithms, and autonomous robotic systems powered by AI could play pivotal roles in optimizing resource management, precision farming, and crop health monitoring. The potential for AI to adapt and learn from real-time data offers a dynamic approach to addressing emerging challenges, such as climate change impacts and evolving pest patterns. Furthermore, the integration of AI has the capacity to foster sustainability by minimizing environmental impact, optimizing resource usage, and ensuring a more resilient coconut cultivation industry. The future of AI in coconut farming not only holds the promise of increased productivity but also signifies a transformative shift towards a more efficient, technologically-driven, and sustainable agricultural landscape (Megalingam *et al.*, 2015).

References

Abraham, A., Girish, M., Vitala, H. R., & Praveen, M. P. (2014). Design of harvesting mechanism for advanced remote-controlled coconut harvesting robot (arch-1). Indian journal of Science and Technology, 7(10), 1465.

Divyanth, L. G., Soni, P., Pareek, C. M., Machavaram, R., Nadimi, M., & Paliwal, J. (2022). Detection of coconut clusters based on occlusion condition using attention-guided faster R-CNN for robotic harvesting. Foods, 11(23), 3903.

Li, Y., Feng, Q., Lin, J., Hu, Z., Lei, X., & Xiang, Y. (2022). 3D Locating System for Pests' Laser Control Based on Multi-Constraint Stereo Matching. Agriculture, 12(6), 766.

Maheswaran, S., Sathesh, S., Saran, G., & Vivek, B. (2017, June). Automated coconut tree climber. In 2017 International Conference on Intelligent Computing and Control (I2C2) (pp. 1-6). IEEE.

Manochithra, V., & Karthika, S. (2019). Design of Robot for Scrambling on Tree and Clutching Fruit Using Foundary Design. International Journal of Scientific Research in Computer Science, Engineering and Information Technology, 5(1), 307-311.

Megalingam, R. K., Pathmakumar, T., Venugopal, T., Maruthiyodan, G., & Philip, A. (2015, September). DTMF based robotic arm design and control for robotic coconut tree climber. In 2015 International Conference on Computer, Communication and Control (IC4) (pp. 1-6). IEEE.

Parvathi, S., & Selvi, S. T. (2017, June). Design and fabrication of a 4 Degree of Freedom (DOF) robot arm for coconut harvesting. In 2017 International Conference on Intelligent Computing and Control (I2C2) (pp. 1-5). IEEE.

Pawar, M. R., Jagadale, O. A., & Chakor, S. (2019). Design and Development of Coconut Tree Climbing Robot. International Journal of Innovations in Engineering Research and Technology, 1-3.

Sakthiprasad, K. M., & Megalingam, R. K. (2019, January). A Survey on Machine Learning in Agriculture-background work for an unmanned coconut tree harvester. In 2019 Third International Conference on Inventive Systems and Control (ICISC) (pp. 433-437). IEEE.

Wibowo, T. S., Sulistijono, I. A., &Risnumawan, A. (2016, September). End-to-end coconut harvesting robot. In 2016 International Electronics Symposium (IES) (pp. 444-449). IEEE.

Karshakashree Karshika Mela

Coconut Development Board participated in Karshakashree Karshika Mela held from 31st January to 4th February 2024 at MSP ground, Malappuram, Kerala. Shri. V. R. Vinod IAS, Malppuram District Collector inaugurated the exhibition. Board displayed various informative posters on Board's schemes and on the goodness of coconut and publications of the Board. Sale cum display of various value added products were also arranged in CDB's stall.

Coconut Snowball Cookies

(Developed by CDB Institute of Technology)

Coconut snow ball cookies are fibre rich snacks prepared by incorporating desiccated coconut flour into refined wheat flour. Desiccated coconut flour is coconut meat that has been disintegrated/grated and dried. It is rich in healthy unsaturated fats with no cholesterol and is also a good source of dietary fibre and protein.

Ingredients	Quantity
Maida	115.2 g
Desiccated coconut powder	57.6 g
Sugar powder	80.4 g
Butter	34.4 g
Vanaspathy	51.6 g
Cashew nut roughly chopped	57.6 g
Salt	0.68 g
Vanilla extract	2.52 g

Method of preparation

(All the ingredients needs to be selected and weighed properly.)

1. Mix butter and vanaspathy on medium speed until soft and creamy with an electric hand mixer.

2. Add powdered sugar, salt, vanilla extract and mix well.

3. Add desiccated coconut and roughly chopped cashew nuts.

4. Continue mixing on low speed by gradually adding flour and mix until evenly combined.

5. Roll dough into a small ball and place balls one inch apart on a baking sheet.

6. Coat the balls in powdered sugar before baking.

7. Bake cookies until firm but tender in a pre-heated oven at 180° C for about 30 minutes (until bottom get light golden -brown colour).

8. Remove from the oven, cool for few minutes and while cookies are still warm, roll them in powdered sugar.

9. Allow it to cool completely and then roll in powdered sugar once again, to coat it well.

Storage instructions

Storage The snow ball cookies need to be packed in airtight containers.

Nutritional Value of Coconut Snowball cookies

Parameter	Value (per 100 g)
Moisture	2.48 g
Carbohydrate	40.08 g
Protein	7.81 g
Fat	34.85 g
Total ash	0.55 g
Crude Fibre	14.22 g

Cultivation practices for coconut -March

Collection and storage of seed nuts

Continue seed nut collection from the identified mother palms. Seed nuts should be carefully harvested and properly stored to prevent drying of nut water. Wherever the ground surface is hard, harvested bunch should be lowered to the ground using a rope.

Nursery management

Continue irrigation for the seedlings in the nursery. Weeding has to be done wherever necessary. If termite infestation is noted in the nursery drenching with chlorpyriphos (2ml chlorpyriphos in one litre of water) should be done. Spiralling white fly infestation is observed in coconut nurseries in many localities. Spraying of water on the lower surface of leaves of seedlings can be done against spiralling white fly attack.

Fertilizer application

In irrigated coconut gardens, apply one fourth of the recommended dose of chemical fertilizers to the coconut palms.

Irrigation

Irrigation has to be continued in coconut gardens. If basin irrigation method is adopted, provide irrigation once in four days @ 200 litres per palm. Drip irrigation is the ideal method of irrigation for coconut. The number of dripping points should be six for sandy soils and four for other soil types.

Moisture conservation

Scarcity of water for irrigation during the peak summer days is a major problem in some of the

coconut growing areas. Hence, it is imperative that coconut growers judiciously use water for irrigation. Drip irrigation has to be adopted to save water. Mulching and other soil and moisture conservation practices should be adopted if not done earlier. In water scarce areas, wherever feasible, life saving/ protective irrigation has to be provided to coconut palms. Mulched materials are to be removed in the basin before giving such life saving/protective irrigation and immediately after providing irrigation the basin should be covered again with the mulching materials.

Shading

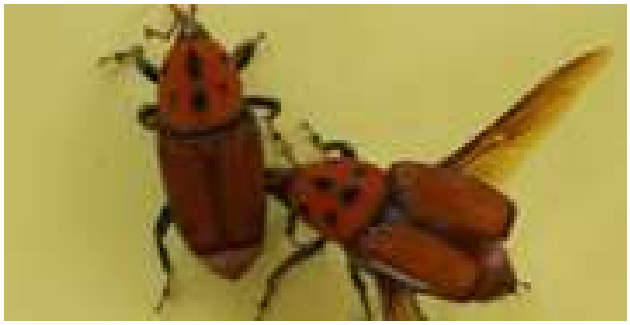
Shade has to be provided for the newly planted seedlings, if not already provided.

Management of pests and diseases

The month of March remains dry throughout, however, some summer showers at random could reduce the heat intensity and accelerate some humidity favouring outbreak of pests. The sucking pests such as whiteflies as well as coconut eriophyid mite could increase during the period. The slug caterpillar endemic regions should be strictly monitored and precautions should be carried out to prevent expansive spread by destroying pest-laden older leaves. Rugose spiralling whiteflies will find weather conditions very conducive and therefore suitable health management approaches such as nutrition and watering is very critical to upkeep proper health so as to put forward extra foliage to counter pest attack. Coconut seedlings in nurseries should be strictly monitored for rugose spiralling whitefly and nesting whiteflies. The odour plumes of deteriorating palm residues in the cyclone affected areas of Andhra Pradesh and Tamil Nadu could orient the red palm weevil for egg laying in the standalone palms for which strict monitoring is warranted. Crop residue burning on the palm basin should be avoided or it may soften trunk issues paving entry of stem bleeding and basal stem rot pathogens. March is thus known for strict monitoring days for maintaining good palm health and evading pest attack.

Red palm weevil *(Rhynchophorus ferrugineus)*

Incidences of rhinoceros beetle, would subsequently induce the invasive potential of the killer native pest, viz., the red palm weevil, which needs an injury for the weevils to orient towards the palm cue and lay eggs. Yellowing of leaves in mid whorl region, oozing of brown fluid, presence of bore holes, choking of spindle region and gnawing sound of grubs heard along the trunk are some early symptoms for timely diagnosis of pest damage. Farmers fail to detect the pest damage at an early stage due to concealed habitat of the pest. 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. Being a fatal enemy of palms, 1% action threshold has been fixed.



Adults weevils

Crown entry

Toppling of palm

▶ *Management*

- 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.

- Complete destruction of pest affected palms / crown toppled palms immediately
- 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 reduced pest incidence than mono-cropping.

Coconut eriophyid mite, *Aceria guerreronis*

Coconut eriophyid mite is the invasive pest reported from our country during 1998 and has been on the rise during post-winter season. It belongs to the spider family with two pairs of legs, sub-microscopic (200-250 microns size), lays about 100-150 eggs and the life cycle completed in 7-10 days. Mites infests the developng nuts immediately after pollination and are confined within the floral bracts (tepals) and feeds on the meristematic tissues beneath the perianth. Appearance of elongated white streak below the perianth is the first visible symptom. Within few days, yellow halo appears round the perianth, which turns as warts and finally develops as cracks, cuts and gummosis. Shedding of buttons, immature nuts, malformation of nuts are other indications of mite damage.

Mite damaged nuts

Mite colony

Progression of mite damage

▶ *Management*

a) Removal and destruction of dried spathes, inflorescence parts and fallen nuts to subdue the pest population

b) Spraying 2% neem-garlic emulsion or azadirachtin 10000 ppm @0.004% or root feeding with neem formulation containing azadirachtin 10000 ppm at 10 ml with equal volume of water three times during March-April, October-November and December –January is recommended.

c) Application of talc-based preparation of acaropathogen, *Hirsutella thompsonii*@ 20 g / litre/ palm containing 1.6 x 108cfu three times in synergy with neem formulation.

d) Kalpaharitha (a selection from Kulasekharam Tall) was found field tolerant to mite damage.

e) Application of recommended dose of fertilizers, recycling of biomass, raising of green manure crops in palm basin and incorporation during flowering, summer irrigation including soil and water conservation measures improve the palm health and reduce the pest attack.

Rugose Spiralling Whitefly (*Aleurodicus rugioperculatus)*

This period could also witness the establishment of the invasive rugose spiralling whitefly (*Aleurodicus rugioperculatus*) in new areas as well as re-emergence in already reported areas. The pest population is increasing very high due to favourable weather factors of high day temperature and fall in relative humidity. Presence of whitefly colonies on the under surface of palm leaflets and appearance of black coloured sooty mould deposits on the upper surface of palm leaflets are characteristic visual symptoms of pest attack. In severe cases, advancement in senescence and drying of old leaflets was observed. Leaflets, petioles and nuts were also attacked by the whitefly pest and a wide array of host plants including banana, bird of paradise, *Heliconia sp.* were also reported. Continuous feeding by whiteflies cause health deterioration in palms for which agronomic care is very critical.

▶ *Management*

- In juvenile palms, spraying of water with jet speed could dislodge the whitefly and reduce the feeding as well as breeding potential of the pest.
- Ensure good nutrition based on soil-test recommendations and adequate watering to improve the health of juvenile and adult palms. Agronomic

health management of palms is very crucial including planting of intercrops wherever possible to diversify volatile cues and improve microclimate disfavouring flare up of whitefly.

- No insecticide should be used as this causes resurgence of the pest and complete kill of the natural aphelinid parasitoid, *Encarsia guadeloupae.* A pesticide holiday approach is advocated for the build up of the parasitoid.
- Installation of yellow sticky traps and conservatory biological control using *E. guadeloupae* could reduce the pest incidence by 70% and enhance parasitism by 80%.
- Habitat preservation of the sooty mould scavenger beetle, *Leiochrinus nilgirianus* could eat away all the sooty moulds deposited on palm leaflets and cleanse them reviving the photosynthetic efficiency of palms.
- A close scrutiny should be made for the presence of other whiteflies including the nesting whiteflies on coconut system.

Nesting whiteflies *(Paraleyrodes bondari and Paraleyrodesminei)*

In addition to the rugose spiralling whitefly, two more nesting whiteflies (*Paraleyrodes bondari* and *Paraleyrodes minei*) are found associated with palm leaflets. Nesting whiteflies are smaller in size (1.1 mm) than rugose spiralling whitefly (2.5 mm). The nymphs are flatter with fibreglass like strands emerging form dorsum whereas the nymphs of rugose spiralling whitefly are convex in shape. Adult nesting whiteflies construct bird's nest like brooding chamber and sustains in the chamber. *P. bondari* had X-shaped oblique black marking on wings with two minute projections on rod shaped male genitalia whereas *P.minei* is devoid of black markings on wings and possesses cock-head like genitalia. Nesting whiteflies compete with rugose spiralling whitefly and reduce the aggressiveness of rugose spiralling whitefly in many cases.

▶ *Management*

- In juvenile palms, spraying of water with jet speed could dislodge the whitefly and reduce the feeding as well as breeding potential of the pest.
- Ensure good nutrition and adequate watering to improve the health of juvenile and adult palms
- Effective nitidulid predators belonging to *Cybocephalus sp.* were observed on the palm system and pesticide holiday is advised for conservation biological control.

Slug caterpillars *(Darna nararia)*

Emergence of slug caterpillar, *Darna nararia* is East Godavari district, Andhra Pradesh and Tumkur, Karnataka could happen as this period is quite conducive for the population build up especially on coconut palms planted along the river beds and brackish water zones. Several hundreds of caterpillars would congregate and feed from under surface of palm leaflets, causing glistening spots and in synergy with grey leaf blight disease complete scorching of leaflets could be observed. In severe cases, complete defoliation was realized and only midribs will be spared. High temperature and cool weather could be one of the triggering factors.

Slug caterpillar infested field

Mature caterpillars on palm leaflet

Management

- Complete destruction of affected palm leaflets with caterpillar at early stages of infestation should be made immediately so that the pest build up is suppressed. Care should be taken as the caterpillars cause extreme itching when contacted

with human skin due to the presence of poisonous scoli.

- Establishment of light traps and spraying *Bacillus thuringiensis* 5 g/litre was found effective along with inundative biological control using the eulophid larval parasitoid, Pediobius imbrues.

Stem bleeding *(Thielaviopsis (Ceratocystis) paradoxa)*

This disease is mostly confined in the acid soils of Kerala and becomes quite explicit during the period. Conspicuous exudation of reddish-brown gummy fluid is visible on the trunk which turns black on drying. It could be observed initially as small bleeding patch along the longitudinal crack, which later coalesce and form extensive lesion. The tissues underneath show tremendous discoloration and decay subsequently. In advanced stage of infection, outer whorls of leaves turns yellow, dry and shed prematurely affecting the overall health of the palm. Invasion by scolytid beetles such as Diocalandra and Xyleborus would further weaken the stem.

Management

- Avoid burning of trash and palm residues near the trunk to avoid trunk/root injury
- Adequate irrigation and adoption of soil and water conservation measures is advised.
- Application of 5 kg of neem cake enriched with Trichoderma harzianum and soil test based nutrition.
- Application of paste of Trichoderma harzianum talc formulation on the bleeding patches on the trunk was also found effective in preventing the spread of stem bleeding.

Basal stem rot disease *(Ganoderma spp.)*

It is a destructive disease observed in all coconut growing regions and found very severe in soils with higher pH and moisture stress condition. The pathogen invades the root system during early stages of infection that are not visibly noticed. The disease is very severe in areas of Thanjavur, Tamil Nadu, parts of East Godavari, Andhra Pradesh and Arsikara, Karanataka. The outer whorl of leaves turn yellowish, then gradually become brown and droop from their point of attachment and hang vertically downwards to form a skirt around the trunk apex. In course of time, the apex of the trunk shows tapering with the advancement of the disease, and bleeding symptoms may appear on the bole region. At the base of the stem a characteristic reddish brown discoloration develops, accompanied by the exudation of a brown viscous gummy substance. These brownish patches may extend up to one metre from ground level and at times bark pealing was also observed. Sometimes fruiting bodies (basidiocarp) of the pathogen develop from the affected trunk.

Basal stem rot disease

Bracket fungus

Management

- Avoid burning of trash and palm residues near the trunk to avoid trunk/root injury
- Removal of dead palms and palms in advanced stage of the disease as well as destruction of the boles and root bits of the diseased palms to remove disease inoculums.
- Isolation of neighboring healthy palms, by digging isolation trenches (60 cm deep and 30 cm wide) around the affected palm (1.2 m away from the base of the trunk).
- Application of neem cake (5 kg) fortified with *Trichoderma harzianum* (CPTD 28) talc formulation (50 g) per palm per year at six monthly intervals reduced the disease intensity.
- Root feeding of hexaconazole @ 2% (100 ml solution per palm) and soil drenching with 0.2 % hexaconazole or with 40 l of 1% Bordeaux mixture in the coconut basin are recommended

Hence, sustained monitoring and prophylactic treatments would suppress the damage potential of pest and disease and suitable health management strategies need to be adopted at the appropriate time. Timely pest management strategies has to be implemented in March to upkeep sound palm health for ensuring sustained production and keep away from pest and disease infections.

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Market Review – January 2024

Domestic Price

Coconut Oil

During the month of January 2024, the price of coconut oil opened at Rs. 13900 per quintal at Kochi market, Rs.14100 per quintal at Alappuzha market and Rs.15800 per quintal at Kozhikode market. The price of coconut oil closed at Rs.14400 per quintal at Kochi, Rs.14500 per quintal at Alappuzha market and Rs.16600 per quintal at Kozhikode market with a net gain of Rs. 500 per quintal at Kochi market, Rs. 400 per quintal at Alappuzha market and Rs. 800 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. 11467 per quintal and closed at Rs. 11333 per quintal with a net loss of Rs. 134 per quintal.

Weekly price of coconut oil at major markets Rs/Quintal)				
	Kochi	Alappuzha	Kozhikode	Kangayam
01.01.2024	13900	14100	15800	11467
06.01.2024	13900	14100	15900	11400
13.01.2024	14000	14200	16100	11333
20.01.2024	14000	14200	16400	11067
27.01.2024	14200	14300	16600	11067
31.01.2024	14400	14500	16600	11333

Milling copra

During the month, the price of milling copra opened at Rs.9000 per quintal at Kochi, Rs.9200 per quintal at Alappuzha and Rs.9850 per quintal at Kozhikode market.

The prices of milling copra closed at Rs. 9600 per quintal at Kochi market, Rs. 9550 per quintal at Alappuzha market and Rs. 10550 per quintal at Kozhikode market with a net gain of Rs.600 per quintal at Kochi, Rs. 350 per quintal at Alappuzha market and Rs. 700 per quintal at Kozhikode market respectively.

The price of milling copra at Kangayam market opened at Rs.8300 and closed at Rs.8500 with a net gain of Rs.200 per quintal.

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

**NR-Not reported*

Weekly price of Milling Copra at major markets (Rs/Quintal)				
	Kochi	Alappuzha	Kozhikode	Kangayam
01.01.2024	9000	9200	9850	8300
06.01.2024	9000	9200	10000	8200
13.01.2024	9100	9300	10200	8200
20.01.2024	9100	9300	10400	8200
27.01.2024	9400	9350	10550	8350
31.01.2024	9600	9550	10550	8500

Edible copra

During the month the price of Rajpur copra at Kozhikode market opened at Rs. 10800 per quintal expressed a downward trend during the month and closed at Rs. 10100 per quintal with a net loss of Rs. 700 per quintal.

Weekly price of edible copra at Kozhikode market (Rs/Quintal)	
01.01.2024	10800
06.01.2024	10400
13.01.2024	10500
20.01.2024	10400
27.01.2024	10100
31.01.2024	10100

Ball copra

The price of ball copra at Tiptur market opened at Rs. 9000 per quintal and closed at Rs.9800 per quintal with a net gain of Rs. 800 per quintal.

Weekly price of Ball copra at major markets in Karnataka (Rs/Quintal) (Sorce: Krishimarata vahini)	
01.01.2024	9000
06.01.2024	9000
13.01.2024	9600
20.01.2024	10000
27.01.2024	9600
31.01.2024	9800

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)	
01.01.2024	11000
06.01.2024	11000
13.01.2024	11000
20.01.2024	11000
27.01.2024	11000
31.01.2024	11000

Coconut

At Nedumangad market in Kerala, the price of coconut opened at Rs. 13000 per thousand nuts and closed at the same price during the month.

At Pollachi market in Tamilnadu, the price of coconut opened Rs. 27500 per ton and closed at Rs. 30000 per ton with a net gain of Rs.2500 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. 32000 per ton and closed at Rs. 36000 per ton with a net gain of Rs.4000 during the month.

Weekly price of coconut at major markets				
	Nedu-mangad (Rs./1000 coconuts)#	Pollachi (Rs./ MT) ##	Bangalore Grade-1 coco-nut,(Rs./ 1000 coconuts) ##	Mangalore Black coconut (1 tonne) ##
01.01.2024	13000	27500	20000	32000
06.01.2024	13000	28000	20000	32000
13.01.2024	13000	28500	20000	32000
20.01.2024	13000	28500	20000	34000
27.01.2024	13000	29250	20000	36000
31.01.2024	13000	30000	20000	36000

International price

Coconut

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

Weekly price of dehusked coconut with water				
Date	Domestic Price (US$/MT)			
	Philippines	Indonesia	Srilanka	India*
06.01.2024	129	200	217	337
13.01.2024	128	199	201	343
20.01.2024	129	198	207	343
27.01.2024	127	196	202	352
				*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)	Philip-pines	Indo-nesia	Sri lanka	India*
06.01.2024	1103	1129	NR	2079	1372
13.01.2024	1127	1123	NR	1857	1364
20.01.2024	1134	1120	NR	2137	1332
27.01.2024	1141	1123	NR	1856	1332
					*Kangayam

Copra

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

Weekly International price of copra in major copra producing countries				
Date	Domestic Price (US$/MT)			
	Philippines	Indonesia	Srilanka	India* * Kangayam
06.01.2024	625	647	1070	987
13.01.2024	621	655	1085	987
20.01.2024	629	655	998	987
27.01.2024	635	648	1034	1005
				* Kangayam

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

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February 2024
Vol. LXVI No.08
Price: Rs.6

Registered No.KL/EKM/721/2024-26
Licence No. KL/CR/EKM/WPP-9/2024-26
Licensed to Post Without Prepayment
RNI No. 3032/1957

INDIAN COCONUT JOURNAL
Date of Publication - 24/2/2024

Printed and Published by Mini Mathew on behalf of Coconut Development Board, Printed at M/s KBPS, Kakkanad, Kochi-30
and Published at Coconut Development Board, Govt. of India,
Ministry of Agriculture and Farmer's Welfare, Kera Bhavan, Kochi-11, Editor: Deepthi Nair S