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Coconut cabbage: an underexploited value added coconut product

Outbreak of new fungal disease in coconut gardens of Northern Kerala

Enhancing planting material production in coconut through decentralised community nurseries

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Coconut Development Board

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

Functions

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

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

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

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Dr.N. VIjaya Lakshmi IAS assumes charge as Chairperson, Coconut Development Board

Dr. N. Vijaya Lakshmi IAS took additional charge of Chairperson, Coconut Development Board on 22nd June 2022. She is a 1995 batch IAS officer of Bihar Cadre , presently posted as Joint Secretary in the Department of Agriculture and Farmers Welfare, Government of India.

Dr. Vijaya Lakshmi has post graduation in Zoology and Anthropology and is a Ph.D holder in Management from IIT Delhi. She is also having Advanced Management Degree in Public Policy from Indian school of Business, Hyderabad.

In her 27 years of service, she has worked extensively for women's empowerment, equity, gender justice, empowerment of the marginalized sections of the society, human resources development, creating livelihood opportunities for millions of people, promotion of agriculture, horticulture and animal husbandry. Along with her four years of experience in heavy industry like steel sector, she has proven her expertise in policy, planning, designing and implementing large scale programmes for public good in various sectors. Dr. Vijaya Lakshmi is the recipient of various awards and honours instituted by prestigious Institutes, organizations and Ministries.

Message

Dear Readers,

The export of coconut and its value added products during the year 2021-22 was to the tune of Rs. 3236.83 crores which is 41.04% higher than the export figures of the previous year. This is excluding the export of coir products which is expected to reach around Rs. 4000 crores. This makes the total estimated export of coconut and coir products at over Rs.7200 crores in a financial year. Export values at over 900 million USD from a single crop, coconut which really is a remarkable achievement for the coconut sector.

The highest exported coconut product was coconut shell based activated carbon at RS. 2064.14 crores which constituted around 63.77% of the total export value. This was followed by coconut oil and fresh/frozen/grated coconut. The convergence of the international and domestic prices also contributed to the increase in competitiveness of food products from coconut. Coconut products, especially coconut water is experiencing a boom, both in the domestic and international markets. Increased demand for packed tender coconut water was experienced during the summer season in North India. Entrepreneurs with established processing lines are increasingly interested in value addition and processing of mature coconut water, which is otherwise unutilized in units producing desiccated coconut, virgin coconut oil, coconut milk etc. This will result in increased returns for coconut and a shift to the use of all parts of coconut – from the husk and shell through the kernel to the water inside which is a natural rehydrating and refreshing beverage. The post pandemic situation has also increased the demand for protective foods including coconut water. The global demand is increasing for various coconut products which was evidenced by increased enquiries on coconut products at the EXPO 2022 Floriade in Amsterdam-Almere NL where various coconut products were at display in the India Pavilion.

The domestic coconut market is experiencing a price fall on the other hand with farmers calling for procurement of milling and ball copra at MSP under the Price Support Scheme. It is important to undertake better post harvest handling and processing of coconut and its by-products thereby enhancing the returns and also reduce unprecedented price fall. With increasing awareness and demand for products made from nature which are biodegradable, there are start ups in the coconut sector which use materials like waste of tender coconut husk, coconut fronds, leaves etc for the production of environment friendly products like packaging materials, straws, cartons etc. The potential of this crop is enormous and we have to make use of this to lead the country to growth.

Let us work together to attain this vision of making Coconut a wonder crop.

Editor

Coconut cabbage:
An underexploited value added coconut product

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Palm cabbage, or heart of palm, is an underutilized, nutritious edible product of palm trees. It is also called palmito, or swamp cabbage. The coconut palm, called 'kalpavriksha", is known for its multipurpose uses from its root to the top. Though numerous value added products are obtained from coconut, one of the less well-known but underutilised edible products includes palm "cabbage" or "heart-of-palm". Coconut cabbage is locally known in Malayalam as' 'thengin kuruth 'or' 'thengin karimb' or 'thengin cabbage'. It is composed of the apical meristem of the palm along with part of the young or immature leaves emerging from the meristem. Generally, when the senile or old palms are cut down, the cabbage is extracted from the inner core by removing the leaf sheaths and fibers. It has a unique, mild, sweet taste and flavour when eaten fresh. With regard to its uses, it is used in its fresh form or as a component in salads, soups, and other gourmet dishes. It is sometimes referred to as the 'millionaire's salad' and is also used in vegetarian spreads. It is pickled and canned. Its use goes back to pre-Colombian times. In South Asia, palm cabbage is pounded and soaked to collect a starchy product that settles to the bottom upon standing. The starch is dried and used for bread making. In some countries, it is fermented and used as an alcoholic beverage. In countries like Brazil, it is considered a non-conventional vegetable and is even exported to many other countries. It is relatively rich in protein, low in fat and sugar, and an excellent diet.

If we deeply look into the parts of the cabbage, it can be observed to have three parts, the base, the cylinder, and the free top. The cylinder is a tube like leaf sheath enclosing the less developed petioles and leaflets. It is so called because it is shaped as an even cylinder until the point where it splits or opens and reveals the rachis and the free leaflets. The free top is the composite of the tender rachis and leaflets not enclosed or clasped by the cylinder. The base includes the enlarged bulbous mass of the tender portion up to the final curve at the beginning of the cylinder immediately after the last exposed heart base.

Extraction method: Palm hearts can be obtained from large mature trees as well as from juvenile palms. The palm is killed when the cabbage is extracted or harvested. It can be obtained from old palms and even younger palms with a minimum age of 3–4 years. When harvesting the cultivated young palms, the palm is cut and scrapped till the white fibres are visible. During processing, the fibres are

Fig.1 a. Canned form

b. Sticks as salad

c. As sea food substitute

removed, leaving the centre core, or heart of the palm. The centre core is attached to a slightly more fibrous cylindrical base with a larger diameter. The entire cylindrical centre core and the attached base are edible. The edible part usually has a length of 40 to 60 cm. The centre core is considered more of a delicacy because of its lower fibre content.

Major species used: Besides coconut, other palms have also been utilised for edible cabbage including *Phoenix Sylvester* (wild date palm), *Phoenix acaulis, Phoenix dactylifera* (date palm), *P. loureiroi, Euterpe olerace* (acai or Assai palm), *E. edulis. Bactris gasipaes* etc. Not all hearts of palm are edible. Some are very bitter, some are toxic (*Orania specis*). The three major palms used for the production of heart of palm are *Euterpe edulis* (*juçara or jussara*) from Brazil, *Bactris gasipaes* (*peach palm*) from South and Central America, and coconut (*Cocos nucifera*) from Southeast Asia (primarily the Philippines and Thailand).

Biochemical composition of heart of palm: Hearts of palm in general, are relatively rich in protein as they are immature meristems and contain 17 amino acids. They are low in fat and sugar and an excellent source of dietary fibre. They are also a moderate source of calcium. 88-91% of it is water. It has a surprisingly high concentration of vitamins and minerals. It can be used as a good alternative source of cabbage or vegetables. Fresh hearts of palm are good for a heart healthy diet because they are very low in fat, have no cholesterol, and are low in sodium. A 1-ounce serving of raw hearts of palm provides 32 calories, according to the U.S. Department of Agriculture's National Nutrient Database.

Post harvest management and processing of heart of palm: Since it is active meristematic tissue, it needs to be carefully processed immediately after cutting. It oxidises fast. Hence, it has to be soaked in a brine solution upon cutting. As mentioned earlier, it is consumed as fresh or processed into canned products. The preferred colour is white or yellowish. During harvesting, one or two protective sheaths covering the internodal hearts are kept to minimise the bruising damage during transit to the processing site. As the shoots are stored longer, they become more fibrous. Harvested shoots must be kept in cool places to minimise dehydration.

Canning: Following removal from the sheath and cutting into required sizes, the heart of palm is treated with a salt solution (generally 2.5% NaCl or a salt and citric acid combination), followed by filling in cans containing brine (2.5%) and citric acid (0.68%), exhausting, sealing, and cooling.

As a fresh vegetable, the cylinders and the bases are packed in plastic bags and refrigerated. In this manner, it can be stored for around one week.

Preliminary investigation carried out at ICAR-CPCRI

The five different accessions (including Straits Settlement Green Tall, Tiptur Tall, NiuLekha Green Dwarf, St.Vincent Tall, and Guam 3) in polybags were cut down and the outer leaf sheaths were removed using a sharp knife, followed by taking out the central core of the cabbage. Cabbage thus collected was immediately sealed in polyethylene pouches (LDPE) and used for the biochemical qualitative evaluation.

Biochemical quality evaluation:

Table 1 shows the proximate composition of coconut cabbage observed in five different accessions. The moisture content ranged from 84.5% to 90.58%, crude fat varied from 0.45% to 5.35%, total minerals or ash ranged from 2.09% to 3.99%, soluble protein ranged from 1.19% to 1.25%, and total carbohydrates varied from 1.18% to 8.89%. Way back in 1984, Martin and co-workers analysed the

Cutting 3-4 year old seedlings

Palm cabbage after removing the outer leaves

Extraction of palm cabbage

Extracted coconut cabbage or heart of coconut

Collected cabbage with outer leaves

Table 1 Proximate quality characteristics of coconut heart of palm

Accessions	Moisture (%)	Crude fat (%)	Ash (%)	Soluble protein (%)	Total carbohydrates
Straits Settlement Green Tall	85.9	5.35	2.84	1.25	4.67
Tiptur Tall	90.58	5	2.09	1.148	1.18
NiuLekha Green Dwarf,	87.05	0.45	2.62	1.19	8.69
St.Vincent Tall	86.38	1.05	2.47	1.21	8.89
Guam 3	84.5	3.75	3.99	1.24	6.52

(Source: CPCRI)

Table 2 Nutritional value of coconut cabbage compared to cabbage

Particulars	Coconut	Cabbage
Protein (g)	4.3	1.10
Carbohydrates (g)	5.6	4.3
Fat (g)	0.8	0.2
Thiamine (mg)	0.5	0.04
Vitamin A (units)	0.0	100
Riboflavin (mg)	0.3	0.04
Niacin (mg)	16	35
Calcium (mg)	33	45
Iron (mg)	0.2	0.3

(Source: Martin, 1984)

nutritional value of coconut cabbage and compared it with vegetable cabbage (Table 2).

The obtained cabbages were dipped in water in order to prevent enzymatic browning. To prevent browning and increase shelf life, it was cut into thin slices for salads and subjected to pretreatments such as blanching at different temperatures and time combinations ranging from 80 to 100°C and 30 to 60 second, salt treatments (1%, 1.5%, and 2% for 60 second), and sugar treatments (2%, 4%, and

6% for 60 second). The cabbage slices, after being exposed to different pretreatments, were packaged in Polystyrene cups (50 ml), covered with cling film and stored under ambient (33±2°C) and refrigerated (4±2°C) conditions. 12 g of coconut cabbage was used for each treatment.

Result: The result indicated that coconut cabbage slices packaged in cling film after the pretreatment with 4 % and 6% sugar solutions remained fresh in terms of appearance, colour, and taste in refrigerated condition for 4 days.

Conclusion

The heart of coconut palm, also known as palm cabbage or palmito, is considered a non-conventional vegetable presently underutilised in India, especially in Kerala. However, in countries like Brazil, the Philippines, Indonesia, and the UAE, it is widely used as a salad and processed into canned form, with some exported to countries such as the United States and France. Apart from senile and mature coconut palms, younger palms can also be utilised for harvesting hearts. It is low in calories, fat, and sugar and has a considerably good amount of protein, fibre, minerals, and amino acids. With the help of minimal processing using pretreatments such as blanching and sugar solution, its shelf life could be extended further.

Fig3: Minimally processed heart of palm salads

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New Distribution Record of Palm Whitefly, Aleurotrachelus atratus Hempel in Kerala, India

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Abstract

The exotic palm whitefly, *Aleurotrachelus atratus* Hempel was first field intercepted on coconut from Mandya and Mysuru, Karnataka, India during 2019. It was later reported from Tamil Nadu during 2021 from coconut. This technical note highlights on the new distribution record of *A. atratus* from Kannur, Kerala, India during 2022. Morphological features of *A.atratus* puparium were compared with that of the puparium of arecanut whitefly, *Aleurocanthus arecae* David and Manjunatha and the palm aphid, *Cerataphisbrasiliensis* (Hempel). Co-occurrence of *A.atratus* with Bondar's nesting whitefly, *Paraleyrodesbondari* Peracchi was also reported on coconut. Conservation biological control using the predator, *Cybocephalus sp.* and the entomopathogenic fungus, *Aschersonia sp.* was emphasized. Being a non-native pest of Neotropical origin, sensitization campaign among the stakeholders is the need of the hour to halt its spread.

Introduction

Exotic pests have been threatening biodiversity and upset the biotic balance in the newly introduced region. Initially population of such exotic pests outburst in the new environment due to the absence of potential natural enemies. In the post-liberalization era of enhanced trade and travel, such introductions have been quite common. Coconut palms have witnessed the introduction of at least four non-native whiteflies since 2016 attracting specific attention from different stakeholders to combat such biosecurity risks. Strengthening quarantine at the strategic entry points of sea ports and air ports are therefore very crucial to arrest transboundary regression of invasive pests.

Impact of exotic pests on coconut

Advent of the exotic coconut eriophyid mite (*Aceria guerreronis* Keifer) in 1998 and its documentation from Kochi, Kerala by ICAR-CPCRI was definitely a beginning of significant impact of alien invasive species in coconut farming. Concerted efforts by research organizations all over the coconut growing belts could effectively tackle the outbreak which spread across the country in no time. Similarly, the exotic rugose spiralling whitefly [RSW] (*Aleurodicus rugioperculatus Martin*) reported from Tamil Nadu and Kerala in 2016 is another example of potential setback faced by coconut farmers from all over the country during the initial phase of introduction. Weather factors and conservation biological control using the aphelinid parasitoid, *Encarsia guadeloupae Viggiani*, predators such as *Apertochrysasp., Cybocepahalus sp*. and coccinellids and *in situ* habitat conservation of sooty mould scavenger beetle, *Leiochrinisnilgirianus Kaszab* reduced the invasive potential of RSW significantly in all regions in a period of 5-6 months bringing down the pest intensity to <20%.

Subsequently two nesting whiteflies, *Paraleyrodesbondari* Peracchi and *Paraleyrodesmineilaccarino* were reported by ICAR-CPCRI during 2018. Relatively smaller than A. *rugioperculatus*, the impact of nesting whiteflies

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Fig 1. Palm whitefly pupae

Fig 2. Arecanut whitefly pupae

Fig 3. Palm aphid

was not well felt in coconut system and these nesting whiteflies co-existed with other non-native whiteflies in both coconut and guava ecosystems. Before the fire was doused, another exotic palm whitefly (*Aleurotrachelus atratus* Hempel) was reported from Mandya and Mysuru, Karnataka during 2019 (Selvaraj et al., 2019). Subsequently, *A. atratus* was reported from Tamil Nadu as well during 2021. Henceforth, in a period of four years, four exotic whiteflies of quarantine significance invaded coconut palms and reported from all coconut belts of the country. Though the exotic spiralling whitefly (*Aleurodicus dispersus Russell*) was reported on coconut in 1996, it remained as a minor pest and is still a less preferred host.

Occurrence of palm whitefly from Kerala

Despite the prevalence of all exotic whiteflies on coconut from Kerala, the palm whitefly (*Aleurotrachelus atratus* Hempel) was not reported from Kerala so far. During the recent surveillance surveys (April, 2022) performed by ICAR-CPCRI to Kannur, Kerala, black puparium bordered by white waxy fringes could be observed on the lower leaflets (Fig 1). This black puparium differed from that of indigenous arecanut whitefly *Aleurocanthus arecae* David and Manjunatha by the absence of conspicuous dorsal spines which is very characteristic to that of *A. arecae*. The white wax fringes of A. arecae are restricted along the margin of the puparium and are quite rigid (Fig 2). On the contrary the white wax fringes of *A. atratus* are quite loose and are not only restricted along the margin of the pupae, but cover the back puparium body and obscure it. Even though the palm aphid, *Cerataphisbrasiliensis* (Hempel) resembles palm whitefly, the aphids are1 to 2 mm long, oval, slightly convex body that is dark brown and glossy with a peripheral fringe of white wax plates. A white distinctive transverse suture is also present in the middle of the dorsum which divides the body (Fig 3). Based on the shape of the pupae, absence of dorsal spines, presence of loose white fringes almost covering the pupae as well as other distinct puparium features, the whitefly was identified as the palm whitefly, *Aleurotrachelus atratus* Hempel. This forms the first distribution record of the pest from Kannur, Kerala and recorded from the villages of Pulingome (12.29^{o}N, 75.39^{o} E) and Cherupuzha (12.28^{o}N, 75.38^{o} E). Out of the 50 palms observed in the villages, about 80% of palm leaflets were found infested by palm whitefly population coexisting with Bondar's nesting whitefly, P. bondari. The older leaflets had a greater number of colonies than the younger leaflets. The palm whiteflies, *A. atratus* were also recorded from ICAR-Central Plantation Crops Research Institute, Research Centre, Kidu, Karnataka (12.70^{o}N, 75.57^{o} E) during March, 2022 where they were found co-existing with areca whitefly, rugose spiralling whitefly and Bondar's nesting whitefly. The palm whiteflies were observed to infest coconut in hilly tracts (Kidu: 291m and Cherupuzha: 72 m above the MSL) having high humidity (Kidu: 87.4 %and Cherupuzha: 92.2 %).Though palm whiteflies are known to cause necrotic lesions on palm leaflets elsewhere in the world, such an extensive damage was not visualized on the infested palms.

Diagnosis

The palm whiteflies lay elliptical, stalked eggs on the lower side of coconut leaflets, which turn black before eclosion. The nymphs possess eight prominent white spots on the dorsal surface, which later coalesce and partially cover the black body. The puparia are black in colour with marginal serrations, round lingula and sub-marginal fold is interrupted at vasiform orifice. Adults are longer than width, with white wings which are held roof like over the body (Fig 4). *A. atratus* has more genetic lineage with *Aleurotrachelussocialis* Bondar and forms a monophyletic sub-clade with solanum whitefly,

Fig 5. Grub of *Cybocephalus* sp.

Fig 6. *Aschersonia* sp. infecting palm whitefly

Aleurotrachelustrachoides Back (Josephrajkumaret al., 2020).

Damage symptoms

Palm whitefly was found to cause mild to moderate level of infestation (around 10%) on palm leaflets. No necrotic feeding lesions could be observed. The level of honey dew deposit and sooty mould encrustation was definitely low compared to that of RSW feeding damage mainly due to the smaller size of adult whiteflies. *A. atratus* was found feeding on older palm leaflets of juvenile palms of West Coast Tall, Chowghat Orange Dwarf, Chowghat Green Dwarf and Gangobondam in the surveyed regions of Kannur district(Kerala) and Kidu (Karnataka).

Natural enemies

Occurrence of the predator, *Cybocephalussp*. (Fig 5) and natural infection by the entomopathogenic fungus, *Aschersoniasp*. (Fig 6) were observed on the palm leaflets infested by palm whitefly. At Kidu, Aschersoniasp. infected nearly 42.28 per cent A. atratus colonies. These natural bioagents are found effective in the bio-suppression of the pest and arrested the pest population escalation beyond action threshold in the region warranting no specific intervention. In the presence of natural bioagents on the infested palm leaflets arresting the pest population to explode, conservation biological control is suggested at this point of time.

However, close scrutiny on the population dynamics of palm whitefly is very important for timely intervention. Till that period, conservation biological control would be advised with a pesticide holiday approach. Systematic surveillance surveys and awareness campaign are very important to sensitize

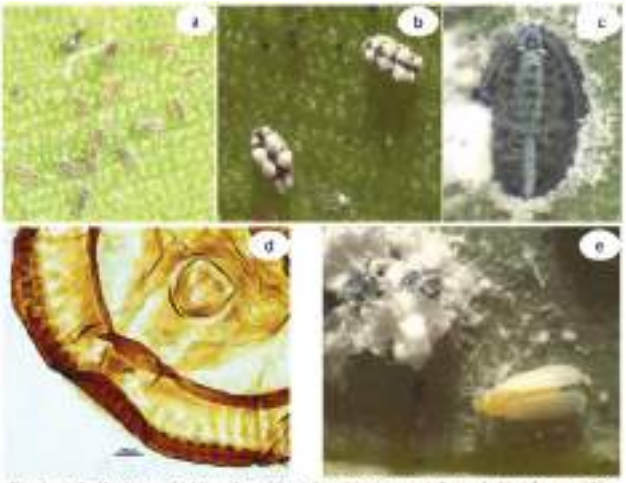

Fig 4. a) Stalked eggs b) Nymphs with eight white spots c) Pupa d) Vasiform orifice with round lingula e) Adult palm whitefly

the stakeholders through the State Department of Agriculture. Strengthening quarantine is the need of the hour to arrest the entry of exotic pests in to the country as several potential invasive pests are waiting at the doorsteps including coconut leaf beetle (*BrontispalongissimaGestro*) and false coconut scale (*Aspidiotus rigidus Reyne*).

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Outbreak of new fungal disease in coconut gardens of Northern Kerala

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Among the plantation crops, coconut palm is the major crop grown both under plantation and homestead management system. It provides livelihood security to several lakhs of people across Kerala, and the capacity of coconut in providing improved nutrition, employment and income generation are well known. There are several diseases which cause damage and death thereby giving economic losses to coconut farmers. Bud rot, Thanjavur wilt and stem bleeding are the major diseases affecting coconut production especially in northern districts of Kerala.

Recently there have been many reports showing rapid drying and death of coconut palms in and around Kannur –Kasaragod districts. Experts from ICAR-CPCRI Kasaragod had visited these places based on the complaints received from farmers. To understand the etiology of the disease, different samples were collected from symptomatic palms, studied and analyzed thoroughly.

Samples were taken from Edavarmabu, Kariyankkara, Chunda, Vayalayi, Koluvalli, Pandikadavu villages of Cherupuzha Panchayat of Kannur district. Experts also visited and noticed same symptoms in and around Alakkod, Changalayi and Peringome Vayakara Panchayats of Kannur. In Kasaragod district, samples were collected from Kottodi, Poodamkallu of Kallar Panchayat, Pindikadavu, Udayapuram of Kodom Belur Panchayat and Arinkal, vallikadavu, Muttakadavu of Balal Panchayat. Apart from these, samples were taken from Nullipady of Kasaragod Municipality as well as Manya, Chedikana and Talpanaje of Badiadka Panchayat of Kasaragod.

Symptoms:

The new disease symptoms are similar to that caused by *Phytophthora palmivora* in case of bud rot

and *Ganoderma sp.* in case of Thanjavur wilt disease of coconut. Based on the observations taken from the diseased palms, the general symptoms of this disease are listed below.

1. Drying of leaves of outer whorl and skirting of dried coconut leaves.

2. Spreading of the infections to inner leaf whorls and subsequent drying and skirting of leaves.

3. Sudden fall of immature and mature nuts

4. The infections from leaves spread to the petioles and from the petioles, the infection spread to stalk portions of the spathe and the inflorescence leading to rotting of those regions.

5. In advance stages, infection reach upto the

1) Myceilal culture of Lasidiplodia theobromae and Neodeightonia phoenicum grown on PDA plate 2) microscopic view of two-celled, dark brown, striated conidia of L. theobromae and N. phoenicum

1) Drying of outer whorls of leaves 2) Skirting of all dried leaves 3) Toppling down of inner whorls and death of the palm 4 and 5) Rotting of petiole, spathe, inflorescence and internal tissues 6) leaf blight and drying symptoms on leaflets 7) Sudden nut fall

inner whorls of leaves around the cabbage portion resulting in severe rotting of internal tissues of the bud.

6. As a result, the last whorl of leaves along with bud portion topples down and the palms die.

7. Palms succumb to death in few months time interval.

In case of bud rot, only the bud portion rots and fall off, other leaves and nuts will be still intact. Bleeding patches and root rotting symptoms are associated with Thanjavur wilt disease are not observed in the new disease.

Casual organism:

Based on the observations and laboratory experiments including morphological and molecular studies conducted on symptomatic samples, two fungi, namely *Lasidiplodia theobromae* and *Neodeightonia phoenicum* were found to be associated with this disease. The fungi belong to the same family *Botryosphaeriaceae* of the division Ascomycota. Hence the morphology of mycelia and spores are quite similar making it tough to distinguish from one another.

The pathogens have a very wide host range. It causes rotting and dieback in most species it infects. *L. theobromae* causes diseases such as dieback, blights, and root rot in a variety of different hosts in tropical and subtropical regions. These include guava, coconut, papaya, cocoa and grapevine. Leaf blight caused by *L. theobromae* is very severe in Tamil Nadu. It is also known to cause fruit rot in coconut. *N. phoenicum* is known to cause leaf spot and palm rot in date palms in many countries outside India.

The fungi over-winters as pycnidia on the outside of diseased wood. The pycnidia produce and releases two-celled, dark brown, striated conidia. The conidia are then dispersed by wind and rain splash, spreading the fungi from one palm to the other.

Integrated disease management strategies:

Detailed studies about the disease and the pathogen are under progress. The adhoc management strategies to be undertaken immediately are as follows:

1. Burn off the diseased dead palm's crown portion to kill the fungus thereby reducing the spread of the inoculam.

2. In early stage of disease development, cut and burn the dried up leaves of outer whorls and spray 1% Bordeaux mixture as prophylactic to the nearby leaves.

3. Root feeding of 3 healthy coconut roots with fungicide Hexaconazole 5%EC (Contaf) @ 2ml/100 liter of water is effective in controlling the disease.

4. Soil drenching with Hexaconazole 5%EC (Contaf) @ 80ml/40 liters of water is also effective for disease control. The drenching with fungicide can be repeated after 15 days interval.

5. Application of recommended dose of fertilizers (1 kg Urea, 1.5 kg Masoori phos or Rock Phosphate or 2 kg Super Phosphate and 2 kg Murate of Potash) helps in early recovery of palms from disease. ■

Entomopathogenic fungus, *Isaria fumosorosea*: a Potential alternative Biocontrol Agent for Management of invasive whiteflies in Coconut

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Fig.1. Different formulations of Isaria fumosorosea

Coconut *Cocos nucifera L.* (*Arecaceae*) is an important plantation crop and millions of people depend directly or indirectly on this crop for their livelihood. India is one of the leaders in coconut cultivation and stands third in coconut production in the world. The coconut palm is attacked by several insect and pests all around the year from seedling stage to aged palm. Among, Eriophid mite, *Aceria guerreronis, rhinoceros beetle, Oryctes rhinoceros*, red palm weevil, *Rhynchophorus ferrugineus,* black headed caterpillar, Opisina arenosella and white-grub, *Leucopholis coneophora* are considered as the major pests of coconut. While the two whiteflies viz., areca nut whitefly, *Aleurocanthus arecae* and invasive spiralling whitefly, *Aleurodicus dispersus* recorded on coconut in India are considered as minor pests.

Since 2016, coconut ecosystem is facing continuous succession of several invasive whiteflies and poses great threat to its production and productivity. Between 2015-2019, the following four exotic, highly polyphagous whiteflies viz., rugose spiralling whitefly, *Aleurodicus rugioperculatus*; Bondar's nesting whitefly, *Paraleyrodes bondari*; nesting whitefly, *Paraleyrodes minei* and palm infesting whitefly, *Aleurotrachelus atratus* invaded rapid succession on coconut *(Sundararaj et al., 2021)*. The most insidious spread of these species in India is likely mediated by humans through the movement of infested seedlings and planting materials. Extensive surveys have revealed that these species spread rapidly in the large geographical region of India mostly through transportation of infested seedlings. Extensive spread along the coastal regions and gardens near the backwater of India is predicted owing to the favourable weather factors and availability of host plants.

Nymphs and adults of these exotic whiteflies feeds aggressively on leaf sap results in depletion of nutrients and water which leads to premature leaf drop and it produces wax and sticky honeydew on infested areas leading to extreme growth of black sooty mold which results in the reduction of photosynthetic efficiency of affected palms. These invasive species have now become regular pests of coconut and active throughout years, warranting control measures to avoid crop losses. Species of

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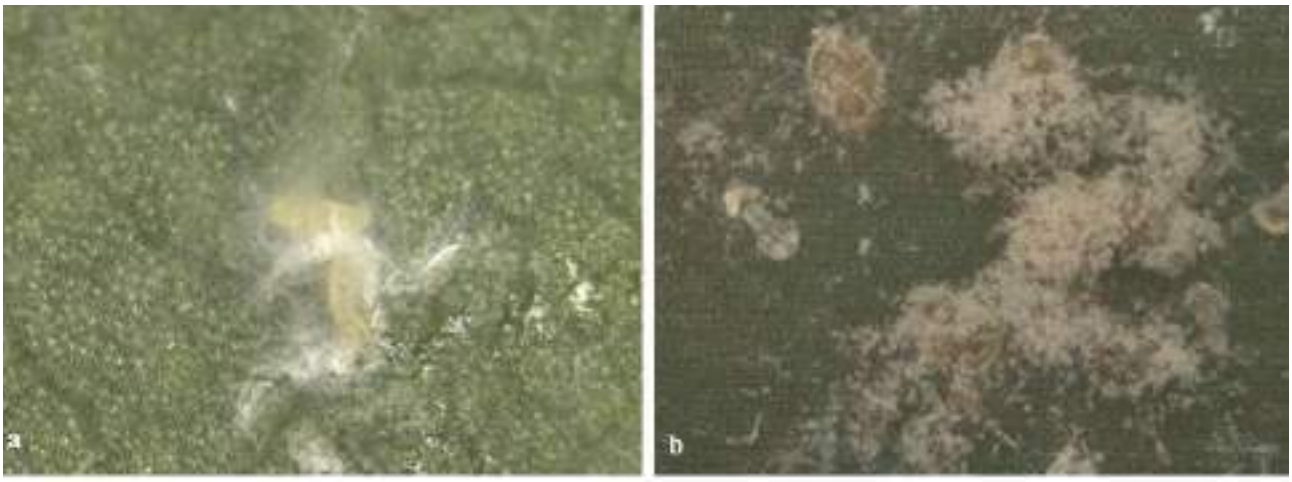

Fig.2. Isaria fumosorosea infection on eggs (A) and fourth nymphal instar (B) of RSW

exotic whiteflies with similar habits co-exist in more or less the same niche on coconut and have a similar pattern of growth and development.

Alarmed by the invasion of a pest unknown to them, farmers resorted to spraying of chemical pesticides to control RSW. But the efforts were in vain as the chemicals turned out to be a temporary fix and moreover, other ill effects like environmental pollution, killing of natural enemies and health risks to the people involved in spraying operations were also reported. Therefore, biological control is the most sustainable solution to tackle these invasive whiteflies. Explorations were carried out so that biological control of the pest could be accomplished through insect predators and parasitoids which are economically feasible, ecologically compatible and environmentally benign. Among natural enemies encountered, two aphelinid parasitoids, *Encarsia guadeloupae and E. dispersa* were found to have colonized the rugose spiralling whitefly and naturally suppressing the pest. *E. guadeloupae* emerged to be the dominant one among which recorded maximum natural parasitism of 56-82% while it was only 5-10% for *E. dispersa (Selvaraj et al., 2017)*. Apart from these, predators viz., *Dichochrysa astur, Jauravia pallidula, Cheilomenes sexmaculata* and *Cybocephalus sp.* were also observed to be feeding on rugose spiraling whitefly. In India, *E. guadeloupae* was well established by augmentation, re-distribution and various conservation strategies, no natural parasitism was observed on other invasive whitefly species except few generalist predators. Moreover, using a single biocontrol agent to suppress the whitefly population may be difficult under severe outbreak conditions especially in the case of invasive pests.

Keeping this in view, ICAR-NBAIR initiated the preliminary studies on evaluation of available entomopathogenic fungus available at microbial repository. The studies showered two strains of *Isaria fumosorosea* (ICAR-NBAIR Pfu-1) and (ICAR-NBAIR Pfu-5) high virulence against eggs, nymphs and adults of *A. rugioperculatus* life stages *(Sumalatha et al., 2019).* This entomopathogenic fungus, *Isaria fumosorosea* is used worldwide as potential biocontrol agent against *A. rugioperculatus* and Paraleyrodes bondari on coconut (*Ali et al., 2015; Kumar et al., 2016*) in Florida. Further, Pfu-5, Pfu-6, Pfu-8 and Pfu-9 strains tested and evaluated against rugose spiraling whitefly, nesting whiteflies and palm infesting whitefly.

Considering the importance of these invasive pest complex in coconut, the project on "Exploration of entomopathogenic fungus *Isaria fumosorosea* for the management of emerging invasive whiteflies in coconut" was sanctioned by Coconut Development Board, Kochi with following objectives viz., to standardize liquid state fermentation technology for the mass production of *Isaria fumosorosea* to develop suitable formulations with longer shelf-life, persistence and higher bio-efficacy against the invasive whiteflies on coconut; to evaluate the bio-efficacy of *I. fumosorosea* against invasive whiteflies in coconut and to assess the impact of *I. fumosorosea* on non-target organisms (compatibility studies with predators, parasitoids and pollinators) and to conduct area wide demonstrations in collaboration with farmer producing organizations (FPOs) and Demonstration-cum-Seed Production (DSP) farms in Karnataka and Tamil Nadu.

Fig. 3. Isaria fumosorosea infection and growth on adults of RSW

1. Standardization of liquid state fermentation technology for the mass production of Isaria fumosorosea

The entomopathogenic fungus, *Isaria fumosorosea strains* viz., ICAR-NBAIR Pfu-5, Pfu-6, Pfu-8 and Pfu-9 were identified as a promising microbial bio control agent against rugose spiralling whitefly, palm infesting whitefly, nesting whiteflies of coconut. Evaluation of different liquid fermentation culture technology for mass production of I. fumosorosea with potato dextrose broth (PDB), molasses yeast extract broth (MYB), jaggery yeast extract broth (JYB) and Sabouraud dextrose yeast extract broth (SDYB) were carried out for growth and sporulation of *I. fumosorosea* (ICAR-NBAIR Pfu-5, Pfu-6, Pfu-8 and Pfu-9). Among these SDYB was found to be the best suitable media for mass production of *I. fumosorosea.*

2. Development of oil, rice and talc based formulations of Isaria fumosorosea for longer shelf-life, persistence and higher bioefficacy

• Based on the liquid fermentation technology, talc, rice grain and oil based formulations were standardized for *I. fumosorosea* (strains ICAR-NBAIR Pfu-5, Pfu-6, Pfu-8 and Pfu-9) with longer persistence under field conditions (Fig.1), shelf life and bio-efficacy. Shelf-life for about 90, 180, 210 days, talc, oil and rice grain based formulations, respectively.

• Viable spores of *Isaria fumosorosea* were persistent in the phyllosphere as well as in the field conditions up to three weeks after spray at Bengaluru conditions and re-isolated from spray leaves surface and soil rhizosphere. This study also indicates that the fungus grows optimally between 25-28^{0}C in Karnataka region but tolerates up to 30^{O}C.

• Under laboratory conditions, *Isaria fumosorosea* showed high virulence and effective against all the life stages of rugose spiralling whitefly including eggs and adults. Mortality was ranged from 35.2 to 99.6%, 48.8 to 91.8%, 36.9 to 86.1% and 28.6 to 80.6% on the eggs, first, third and fourth instars of RSW, respectively with 1×104 -1×108 spores/ml at 5 days of treatment (Fig.2 &3).

• *Isaria fumosorosea* strains (Pfu-6, Pfu-8 and Pfu-9) showed significantly less eggs mortality as compared to Pfu-5 and less virulence against nymphal stages as well. Moreover, these *I. fumosorosea* strains took slightly longer time to grow on RSW and kill them.

• *Isaria fumosorosea* strain (Pfu-5) was found pathogenic to eggs and nymphs of Bondar's nesting whitefly, *Paraleyrodes bondari* (Fig.4). The nympal stages were found to be more susceptible as compared to egg stage and 70-80% mortality was observed on 5th day and it was enhanced up to 95% on 7th days after treatment. The results revealed that Pfu-6, Pfu-8 and Pfu-9 were showed significantly lesser virulence as compared to Pfu-5 under laboratory conditions.

• *Isaria fumosorosea* strains (Pfu-5) was found pathogenic to eggs and nymphs of nesting whitefly, Paraleyrodes minei (Fig.5). The nympal stages were more susceptible to Pfu-5 as compared to egg. Nymphal mortality was about 70% mortality on 5th day and about 95% on 7th days after treatment under laboratory condition. The results revealed that Pfu-6, Pfu-8 and Pfu-9 were showed significantly lesser virulence as compared to Pfu-5.

• Similarly, *I. fumosorosea* strain (Pfu-5) was found pathogenic to eggs and nymphs of *Aleurotrachelus atratus* (Fig.6). The nymphal stages were found to

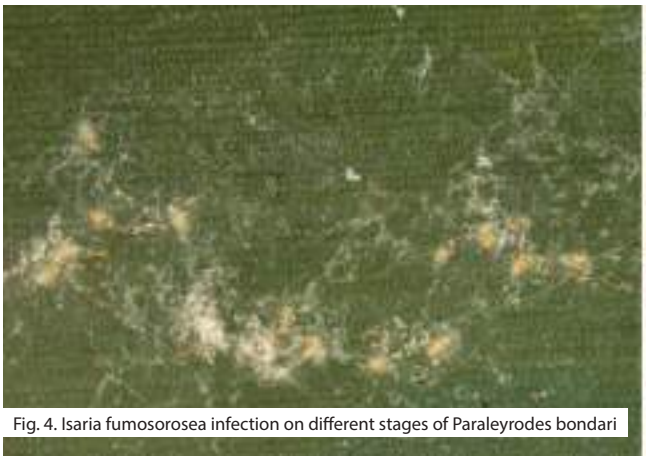

Fig. 4. Isaria fumosorosea infection on different stages of Paraleyrodes bondari

Fig. 5. Isaria fumosorosea infection on different stages of Paraleyrodes minei

be more susceptible as compared to egg stage and overall mortality 72-82% was observed on 7th days after treatment. Adult whitefly mortality was not observed during the study. The results revealed that Pfu-6, Pfu-8 and Pfu-9 showed significantly lesser virulence as compared to Pfu-5.

• Among the formulation, talc formulation was found to be less effective against different life stages of invasive whiteflies as compared to oil and rice formulation of *I. fumosorosea*. The effectiveness of rice and oil formulation was on par with respect to mortality among the formulations against all the invasive whiteflies and persists for longer time under field conditions.

3. Assessment of the impact of Isaria fumosorosea on non-target organisms (compatibility studies with predators, parasitoids and pollinators)

• Studies on non-target effects of *I. fumosorosea* on parsitoids, *Encarsia guadeloupae*, *Goniozus nephantidis*, predator, *Pseudomallada* astur and silk worm, *Bombyx mori* (Fig.6) revealed that no infectivity was observed on different stages of *P. astur, G. nephantidis, B. mori* and insignificant effect (5-12% inhibition in parasitoid adult emergence). Therefore, these biocontrol agents can be integrated simultaneously for the management of invasive whiteflies in coconut.

4. Field evaluation of Isaria fumosorosea for management invasive whiteflies on coconut in Karnataka and Tamil Nadu

• Field evaluation of *I. fumosorosea* was carried in Karnataka (Fig.7) and Tamil Nadu (Fig.8) for management invasive whiteflies on coconut to determine the effectiveness under different locations. The results showed that *I. fumosorosea* reduced the overall population of RSW range from 78.57-80.10% as compared to untreated control (11.69-13.24%) after 28 days treatment across different location in Karnataka and it was 71.05-76.84%) in the treated palms as compared to untreated palms (11.67-13.81%) across other location in Tamil Nadu.

• In case of nesting whiteflies, maximum overall

Fig. 6. Isaria fumosorosea infection on different stages of Aleurotrachelus atratus

Fig. 6. Evaluation of Isaria fumosorosea on silkworm larvae under laboratory condition

reduction (67.57%) was significantly greater as compared to the untreated palms (5.50%) at 28 days after treatment. Similarly, the mortality of palm infesting whitefly was significantly higher (64.24%) in the treated palms as compared to untreated palms (5.52%) at 28 days after treatment on coconut in Karnataka.

• Effect of *Isaria fumosorosea* on natural enemies in coconut ecosystem under field conditions revealed that no significant variation in activity of predators, *P. astur* and parasitoids, *E. guadeloupae* and *G. nephantidis* in the *I. fumosorosea* (ICAR-NBAIR Pfu-5) treated palms and on par with untreated coconut palms. Further, there was no significant variation in visiting activity and behavior of honey bees observed in I. fumosorosea treated palms and *I. fumosorosea* untreated palms.

• Extensive extension activities such as 28 area wide demonstrations, farmers meet and awareness programme/ field day were conducted in collaboration with farmer producing organizations (FPOs) and Demonstration-cum-Seed Production (DSP) Farms, ICAR- Krishi Vigyan Kendra, Department of Horticulture (Fig.9), Department of Agriculture, All India Coordinated project on Biological control centres and Coconut Development Board in Karnataka & Tamil Nadu, and few in Andhra Pradesh and Lakshadweep islands for the management of invasive whiteflies in coconut using *I. fumosorosea.*

• Around 10 training programme on large scale mass production of *I. fumosorosea* was conducted and training was given to 60 progressive farmers from Andhra Pradesh and Maharashtra, 15 officials working in different biocentres, parasite laboratory of department of Horticulture, Government of Karnataka, five officials of Dr Reddy foundation officials, Srikakulam, two technical persons from Godraj Agrovet, Vijayawada and DSP Farm, Mandya.

• About 400 kg or liters of *Isaria fumsorosea* formulations were distributed to farmers, Coconut Development Board, Department of Horticulture, KVKs, FPOs, Department of Agriculture, and AICRP

Fig.7. Field demonstration on Isaria fumosorosea at KRS, Mandya

Fig.8. Field demonstration on Isaria fumosorosea at Pollachi

Fig.9 Shree R. Shanker, Minister of Horticulture and Sericulture, Government of Karnataka, briefing about Isaria fumosorosea to farmers and stakeholders

on BC centres for the field evaluation against invasive whiteflies in coconut. Besides, Nucleus culture of *I. fumosorsea* also distributed to FPOs, KVKs, Farmers, Agricultural universities and private organization for their mass production and distribution.

• Foliar application of *I. fumosorosea*, two sprays at 15 days intervals with 5 g of talc formulation or 5 ml of oil formulation in one litres of water during evening hours result in Rs 9500/ha reduction in crop protection and 900 ml of pesticides/ha. Besides bio-suppression of invasive whiteflies, this also conserves the natural enemies in coconut ecosystem and saving environment.

• Besides core studies on *I. fumosorosea*, it was also documented the geographical and host range expansion and their associated natural enemies of these invasive whiteflies in India through regular survey and monitoring programme. Natural infection of *I. fumosorosea* on RSW was also documented in Andhra Pradesh.

• The project's salient achievements were published as eight research articles in national and international reputed publications in one book and book chapters, three extension folders (Kannada, English), ten abstracts were presented in national and international conference and symposium. Thirteen newspaper articles were published in different regional languages and one radio talk (Kodai FM) was broadcast on biological control of invasive whiteflies infesting coconut.

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Enhancing planting material production in coconut through decentralised community nurseries -

Successful experiences of Farmer Producer Organisations

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Introduction

Rejuvenation of coconut orchards by large scale removal of senile and unproductive palms and replanting with quality seedlings of improved varieties is an important strategy suggested for making coconut farming profitable. Even though a substantial number of improved coconut varieties having high yield potential and other desirable attributes have been released by coconut research institutions in the country, lack of availability of quality seedlings is a major constraint experienced by coconut growers to adopt these varieties. It is estimated that about 14.5 million seedlings are required annually to meet the planting material demand in coconut in India. Coconut seedlings are produced and distributed by ICAR-Central Plantation Crops Research Institute (CPCRI), Coconut Development Board (CDB), State Agriculture/ Horticulture Universities and State Agriculture/ Horticulture Departments from public sector, and a few nurseries from private sector. Public sector contribution is about 4.2 million seedlings only. It is projected that another four million seedlings comes from private nurseries and farmers. Thus, there is a huge gap between demand and supply of coconut seedlings and many unscrupulous elements exploit the situation and cheat the coconut growers in the country by selling inferior quality seedlings which would adversely affect production and productivity of coconut in the long run.

Facilitating decentralised coconut nurseries managed by FPOs

Promoting decentralised coconut nurseries by utilising superior coconut genetic resources available in farmers' gardens is one of the important short term strategies suggested to enhance seedling production to meet the demand for quality coconut seedlings. Decentralised coconut nurseries can be established and managed by Farmer Producer Organisations (FPOs) to produce coconut seedlings by utilising mother palms of locally adapted coconut varieties available in farmers' gardens and seedlings can be made available locally with the active participation

of coconut farmers. Technical support is needed to locate and identify mother palms, collect seed nuts, raise nursery and select quality seedlings for supply to the coconut farmers.

Successful experiences under the novel initiative implemented by ICAR-CPCRI with the support of State Department of Agriculture and Farmers' Welfare, Government of Kerala, since the year 2018 clearly indicate that FPOs in coconut sector can be empowered to establish and manage decentralised coconut nurseries to produce coconut seedlings by utilising mother palms of locally adapted coconut varieties available in farmers' gardens so that seedlings can be made available locally with the active participation of coconut farmers.

Awards were given to the best performing decentralised coconut nurseries managed by Farmer Producer Organisations under the project on decentralised coconut nurseries implemented by CPCRI with the financial support of State Department of Agriculture Development & Farmers' Welfare in the programme organised as part of World Coconut Day celebration conducted online on 8th October 2020. The successful experiences of award winning FPOs viz., Kunnamangalam Federation of Coconut Producers Society and Changaroth Federation of Coconut Producers Society from Kozhikode District and Bharanikkavu Panchayat Federation of Coconut Producers Society, from Alappuzha District in managing decentralised coconut nurseries with the active participation of coconut farmers are narrated below.

Kunnamangalam Federation of Coconut Producers Societies

Based on the activities and achievements in production and marketing of coconut seedlings through decentralised coconut nursery, Kunnamangalam Federation of Coconut Producers Societies from Kozhikode district secured first prize and a cash award of Rs 30,000/- sponsored by CDB in the competition conducted as part of World Coconut Day celebration among the decentralised community coconut nurseries established with the support of ICAR-CPCRI and State Department of Agriculture Development & Farmers' Welfare.

Kunnamangalam CPF was formed in the year 2013 and it covers 20 Coconut Producers Societies spread over three gramapanchayats viz., Kunnamangalam, Chathamangalam and Kuruvattur in Kunnamangalam block of Kozhikode district with a total of 2100 coconut growers as members having a total of 95000 coconut palms.

Production and distribution of quality coconut seedlings has been an important activity of Kunnamangalam CPF ever since it started functioning. During the last five years the federation produced and distributed a total of 55,000 seedlings of WCT and 20,000 seedlings of dwarf varieties. For carrying out planting material production and distribution in the initial four years from 2013 to 2017 the CPF availed financial incentives from CDB under the scheme for promotion of coconut nurseries.

The coconut nursery under Kunnamangalam Federation is located at Pilasseri in Kunnamangalam grama panchayat. The CPF very actively participated in the implementation of decentralised coconut nursery project implemented by ICAR-CPCRI. As part of the project they are maintaining about 400 mother palms in farmer's field for seed nut collection and during the period 2018-20, they collected 13600 and 4302 seed nuts of tall and dwarf varieties respectively. During 2019-20 the Federation distributed 4600 WCT seedlings, 1551 COD seedlings and 621 CGD seedlings to the farmers.

During the current year ie 2020-21, Kunnamangalam CPF could collect 10,000 seed nuts of WCT, 3,000 seed nuts of COD and 2,500 seed nuts of CGD varieties of coconut which are sown in the nursery. They have undertaken pollination in 100 WCT palms using COD pollens for the production of Kersankara hybrids. So far, they have harvested 1530 hybrid nuts and sown in the nursery. Through the planting material production activity, the federation could generate profit of Rs. three lakhs. Members of the federation attended training on coconut planting material production conducted by ICAR-CPCRI. The Federation organized seminars/ workshops in the locality for creating awareness among farmers on the necessity of using quality planting material for coconut cultivation. The office bearers of CPF indicated that through the decentralised nursery activities the Federation was able to make available quality coconut seedlings to the farmers near to their locality besides generating employment opportunities benefitting many rural households.

Office bearers of Kunnamangalam CPF opined that the concept and practice of decentralised coconut nursery is highly beneficial to the coconut growers. After gaining experience from successfully managing the nursery established at Pilasseri and based on the demand from coconut farmers

during this year, the CPF has initiated three more coconut nurseries at Kunnamangalam, Kuruvattur and Vadakara in Kozhikode district. Services of two technical personnel who were trained at CPCRI, Kasaragod on hybridization technique in coconut are being utilized by CPF for the maintenance of the newly started three nurseries. For the production of seed nuts of hybrid varieties pollination work is being carried out in 110 selected mother palms of coconut.

It has been observed that success of Kunnamangalam CPF in effectively managing decentralised coconut nursery is mainly due to their efforts to establish and maintain functional linkages with State Department of Agriculture through the local Krishibhavans and also with the Local Self Government Institutions. These agencies helped in marketing of coconut seedlings produced by CPF by linking with the implementation of coconut development schemes. During last year 2000 WCT seedlings, 957 COD seedlings and 621 CGD seedlings were distributed to farmers through Krishibhavans. Under the schemes implemented by LSGIs about 4000 WCT seedlings were distributed to farmers.

The CPF give wide publicity through newspapers and other media about availability of quality seedlings in their nursery. The unique feature about the CPF is that they arrange to supply the seedlings in the farmer's garden if the farmer gives indent for bulk quantity of seedlings. Similarly, the federation facilitate the coconut farmers who purchase seedlings from their nursery to avail financial incentives from CDB under the scheme for rejuvenation of coconut.

Kunnamangalam CPF is implementing various activities to benefit coconut farmers besides planting material production through decentralised nurseries. As a market intervention initiative, the CPF has been procuring coconut from farmers since the last two years through the procurement centres at Kunnamangalam grama panchayat and Perumanna grama panchayat. The federation is also having licence for neera production and marketing. However, neera production has been discontinued due to various constraints. The federation facilitates effective implementation of schemes for distribution of fertilizers to coconut farmers implemented by the State Department of Agriculture and LSGIs through the CPSs. The federation is actively involved in marketing of coconut oil produced by Kozhikode Coconut Producer Company, in which many coconut farmers under the federation are shareholders, through the CPSs. Kunnamangalam CPF has been organizing various transfer of technology programmes on scientific coconut farming in collaboration with CDB, State Department of Agriculture and ICAR-CPCRI for the benefit of coconut growers.

An executive committee with Shri Chandran Thiruvalath as President, Shri P.P.Rajan as Secretary and Shri Venu Koduvangot as Treasurer provides efficient leadership for all the activities of the federation.

Changaroth Federation of Coconut Producers Societies

Changaroth Federation of Coconut Producers Societies from Kozhikode district secured second prize and a cash award of Rs 20,000/- sponsored by CDB in the competition conducted as part of World Coconut Day celebration among the decentralised community coconut nurseries established with the support of ICAR-CPCRI and State Department of Agriculture Development & Farmers' Welfare. Changaroth CPF started functioning in the year 2014. The federation covers 19 Coconut Producers Societies with a total of 2300 coconut growers as members.

In the year of establishment itself the federation started production and distribution of coconut seedlings under the nursery scheme of CDB. 10000 seednuts of dwarf varieties of coconut were procured from Pollachi and Udumalpet in Tamil Nadu and about 7000 quality seedlings were raised and the federation could gain a net income of two lakh rupees through the nursery activities. In the next year also Changaroth CPF continued nursery activities. However, since demand for seedlings of dwarf varieties was on the decline among the coconut growers in the locality, the federation did not produce any seedlings during 2016-17. But with the support from CDB and demand from coconut growers the nursery activities were restarted in 2017-18. Changaroth CPF very actively participated in the implementation of decentralised coconut nursery project implemented by ICAR-CPCRI. Changaroth is located in the eastern hilly terrain of Kozhikode district where palms of the popular 'Kuttyadi' ecotype of WCT cultivar of coconut are in abundant and procurement of seed nuts of tall variety from farmers' gardens is quite feasible for the federation. State Department of Agriculture also regularly procures coconut seed nuts from the locality.

The federation has identified and geo-tagged mother palms of dwarf coconut varieties such as Chowghat Organge Dwarf (COD) and Chowghat

Green Dwarf (CGD) in farmers' gardens. These mother palms are used for collecting seed nuts for raising seedlings of dwarf varieties and also for pollination to produce seed nuts of hybrid varieties. They are maintaining about 390 mother palms in farmer's field for seed nut collection. During the period 2018-20, they collected 13400 and 4355 seed nuts of tall and dwarf varieties respectively. The federation distributed more than 4600 seedlings of various coconut varieties to the farmers during the period. They have undertaken pollination in 95 WCT palms using COD pollens for the production of Kersankara hybrids. So far, they have harvested 3000 hybrid nuts and sown in the nursery. Through the planting material production activity, the federation could generate income of Rs. five lakhs. Members of the federation attended training on coconut planting material production conducted by ICAR-CPCRI.

Office bearers of the CPF indicated that they get tremendous support from the coconut farmers of the locality and they have already received indent from farmers for the supply of seedlings in the nursery which would be ready in the coming planting season. The federation is planning to utilise about 300 palms for the production of hybrid seed nuts. Identification and geo-tagging of the palms would be done in December.

The community decentralised nursery of CPF is located at Changaroth in 60 cents of leased in land. The office bearers of the federation opined that efforts are to be made by the concerned for the distribution of quality seedlings raised in decentralised nurseries under the coconut development schemes implemented by government departments and Local Self Government Institutions (LSGIs). It would prevent the sales of inferior quality seedlings to coconut growers by the unscrupulous elements which are happening widely throughout the state. It is also important that awareness programmes are organised by agencies such as CDB, state Department of Agriculture and ICAR-CPCRI.

According to the CPF representatives, another area of concern is the lack of availability of skilled workers for pollination in coconut palms required for the production of hybrid seed nuts. Available skilled climbers demand exorbitant amount as wages which the CPF is unable to manage. Two trained pollination workers are there under the Changaroth CPF.

Apart from planting material production Changaroth CPF implements a variety of other coconut development and extension programmes. The CPF is having a copra dryer of capacity 10,000 nuts per day. With the support of CDB the CPF has established the 'Coconut Point' as a sales outlet for coconut products at Paleri town besides creating facilities for the production of value added coconut products. The CPF was procuring coconuts from farmers earlier. But due to paucity of working funds coconut procurement activities have been stopped since the last few months. Changaroth CPF was the leading producer of neera in Kozhikode district. In the beginning even few palm climbers from Assam and Chhattisgargh were employed by the federation in the neera production enterprise. However, due to the huge loss incurred they have discontinued neera production and marketing.

The federation organized seminars/ workshops in the locality for creating awareness among farmers on the necessity of using quality planting material for coconut cultivation and on the disease & pest management.

Changaroth CPF representatives are of the opinion that the decentralised coconut nursery project implemented with the technical support of ICAR-CPCRI and funding support from Department of Agriculture Development and Farmers' Welfare, Govt. of Kerala should continue for at least five years to benefit the coconut growers. During the online programme conducted by CPCRI in connection with the World Coconut Day celebration the CPF representatives raised this demand. An executive committee of nine members including Shri O.T.Rajan Master as President, Shri. M. Aravindakshan as secretary and Shri Santhosh Koshy as treasurer leads the activities of the Changaroth CPF. A separate sub-committee with three members is constituted to oversee the coconut nursery activities.

Office bearers of Changaroth CPF are optimistic that the activities of the federation can be further strengthened to better serve the coconut growers ensuring the active participation of coconut farmers and support from various coconut development agencies.

Bharanickavu Panchayat Federation of Coconut Producers Society

Bharanickavu Panchayat Federation of Coconut Producers Society very actively implemented various interventions for establishing and maintenance of the decentralised coconut nursery and they secured third prize and a cash award of Rs 10,000/- sponsored by CDB in the competition conducted as part of World

Kunnamangalam Federation

Changaroth Federation

Coconut Day celebration among the decentralised community coconut nurseries established with the support of ICAR-CPCRI and State Department of Agriculture Development & Farmers' Welfare.

Bharanickavu CPF started functioning in the year 2012. The federation covers 15 Coconut Producers Societies with a total of 1502 coconut growers as members covering 398 ha. The CPF produced and distributed about 570 coconut seedlings in 2017 under the 'Amma thengu' scheme implemented by ICAR-CPCRI Regional Station, Kayangulam.

Bharanickavu CPF very actively participated in the implementation of decentralised coconut nursery project implemented by ICAR-CPCRI. The federation has identified and geo-tagged 98 mother palms of dwarf coconut varieties in farmers' gardens and these mother palms are used for collecting seed nuts for raising seedlings of dwarf varieties.

During the period up to May 2018 the CPF collected 570 seed nuts of tall varieties and 6700 seed nuts of dwarf varieties. The federation has so far distributed about 5800 seedlings of dwarf varieties and 570 seedlings of tall varieties. Bharanickavu federation could realise a net income of 4.5 lakh rupees through the nursery activities which they plan to utilise to strengthen planting material production programme in the coming years.

A public meeting was convened by CPF in connection with the first sales of coconut seedlings on 13.12.2018. CPCRI Regional Station, Kayangulam supported the CPF for the marketing of seedlings by giving information to coconut farmers about seedling availability with the CPF nursery. The CPSs under the federation were motivated to distribute coconut seedlings to farmers utilising available funds with them. The CPF participated in the Farm Festival organised by a nearby Farmers' Club and arranged for sales of coconut seedlings to farmers through its pavilion. Local Krishi bhavans also were contacted for support in the sales of coconut seedlings. Federation also supported coconut growers by selling the seedlings at subsidised rate.

According to the leaders of Bharanickavu CPF a major problem in the management of decentralised coconut nursery is lack of availability of skilled palm climbers and the difficulty due to the fact that the mother palms are identified in farmers' gardens which are located in a scattered manner. They also experienced difficulties for seed nut procurement due to the flood and also due to the present COVID-19 pandemic. Limitations to provide continuous employment to labourers engaged in nursery related activities is also another problem.

The CPF representatives suggests that to sustain the activities of decentralised coconut nurseries efforts need to be made to retain the service of experienced palm climbers of the locality who are quite familiar with the locations of mother palms identified in farmers' gardens. It is also necessary to constantly in touch with the coconut farmers in whose plot mother palms are identified so that seed nut procurement is made easy. Technical support is required for the CPF for identifying the naturally crossed dwarf seedlings in the nursery and also for locating disease tolerant WCT palms in farmers' gardens. Members of the federation attended training on coconut planting material production conducted by ICAR-CPCRI.

The CPF regularly conducts meetings of the members and discuss about various activities to be implemented besides taking necessary steps for renewal of registration of CPSs with the CDB. The federation also facilitate marketing of coconut oil produced by the Onattukara Coconut Producer Company and also for the procurement of coconut from the farmers for the CPC coconut oil processing unit.

Various activities of Bharanickavu CPF are carried out under the leadership of Shri Thomas M Mathewkutty as President, who is also a member of the Director Board of Onattukara Coconut Producer Company, Shri Augustin Manoharan as the Secretary, Shri Omanakuttan as the Treasurer Shri Hareesh Kumar, Shri K.K.Sivadasan, Shri Hariharan Nair and Shri Gangadharan Nair as members of the executive committee.

Conclusion

The successful experiences under the project on decentralised coconut nurseries implemented by CPCRI with the support of State Department of Agriculture, Government of Kerala, clearly indicate that there is great potential for empowering the FPOs for enhancing planting material production in coconut sector through decentralised community nurseries.Continued support from research institutions, development agencies and Local Self Government Institutions is essential for sustaining the activities of decentralised nurseries managed by FPOs. ■

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Agri Intex 2022 Trade Fair

Coconut Development Board, Regional Office, Chennai participated in Agri Intex 2022 Trade Fair held at CODISSIA, Coimbatore from 15th to 18th July 2022. Five Coconut Producer Companies viz, Vinayaga, Madathukulam, Elancharal, Vellingiri and Global CPC from Tamil Nadu displayed their products like Neera, Coconut Milk, VCO, Coconut Oil, Vinegar etc. in the Board's stall. Coconut based entrepreneurs namely Pure Tropic, Mathura Foods and Sakthi Coco also took part and exhibited their products like Tetra packed tender coconut water, Neera Sugar, Jagerry, flavoured coconut milk, DC, neera honey, VCO etc. in the Board's stall.

Farmers, students and entrepreneurs, from various districts of Tamil Nadu and other states visited CDB stall and gathered information related to coconut cultivation, varieties, nursery, value addition, and Board's schemes. They also enquired about the export details of coconut based products. Officers of CDB briefed on the Boards scheme, coconut palm insurance and various assistances extended to the farmers and entrepreneurs by the Board under different schemes.

Smt. T. Bala Sudhahari, Director i/c, CDB, RO, Chennai, Shri. K.S. Sebastian, Asst. Director (Mkg), CDB, Kochi, Shri. Pramod P Kurian, Asst. Director (Dev), Development Officers Shri. Sasikumar C. and Shri. G. Ragothuman and Mr. Vishnu, Processing Engineer CDB participated in the exhibition.

Use of Drones in Agriculture for improving Farmers Income

Use of Drones for the Crop-protection in India is new and the country is gaining experience. Indian Council of Agricultural Research (ICAR) initiated a network program during September, 2021 where in Research on use of Drones and Artificial Intelligence (AI) for timely monitoring of crop growth, health and managing it with enhanced input use efficiency were taken up. Drone and AI technology are used to monitor near real-time crop health. Drone is also used for variable rate technology for pesticide and liquid fertilizer applications, mapping of water spread area, water sampling, mapping macrophyte infestation and aquaculture management practices, etc. Drone and AI technology are also used for precision livestock farming, particularly its health monitoring.

For enhancing farmers' income, the emphasis is on adopting a multi-dimensional strategy, which includes increase in production through creation of resources for improving irrigation; effective use of inputs; reduction of post-harvest losses; value addition; reforms in agriculture marketing; minimizing risk and providing security and assistance, and promotion of allied activities. The Government has adopted several developmental programmes, schemes, reforms and policies that focus on higher income for the farmers. All these policies and programmes are being supported by higher budgetary allocations, non-budgetary financial resources such as creating Corpus Funds like Micro Irrigation Fund etc.

There have been several reforms to unleash the potential, e.g. Formation and Promotion of 10,000 FPOs along with necessary financial support under AtmaNirbhar Package (Agriculture). Under AtmaNirbhar Bharat special attention is being paid for creation of infrastructure for which "Agri Infrastructure Fund (AIF) has been created with Rs.100,000 crore. Other special initiatives include Supplementary Income transfers under PM-KISAN; Pradhan Mantri Fasal Bima Yojna (PMFBY); Pradhan Mantri Krishi Sinchai Yojana (PMKSY); Increase in Minimum Support Price (MSPs) for all Kharif & Rabi Crops ensuring a minimum of 50 percent of profit margin on the cost of production, Bee-Keeping; Rashtriya Gokul Mission; Blue Revolution; Interest Subvention Scheme; Kisan Credit Card (KCC) that now offers production loan to even dairy & fishery farmers besides agricultural crops etc.

The adoption of Drone technologies in agriculture has a potential to revolutionize the Indian agriculture. In order to make Drone technology affordable to the farmers and other stakeholders of this sector, financial assistance @ 100% cost of drone together with the contingent expenditure is extended to ICAR/SAU/State Governments/State Government Institutions under Sub-Mission on Agricultural Mechanization (SMAM) for its demonstration on the farmer's field. Apart from this, farmers are getting timely information and advisory services through online and telecom mediums such as Kisan Call Centre and Kisan Suvidha App so that farmers can make decision for increasing crop productivity. During last three years (2019-2021) a total of 946 field crop varieties have been released comprising of 379 of cereals, 146 of Oilseeds, 168 of Pulses, 55 of Forage Crops, 158 of Fibre Crops, 26 of Sugarcane and 14 of other crops (potential/minor crops). In addition, 288 varieties of Horticultural crops were also released. These improved varieties are helping farmers to increase their income. *Source: PIB*

Retirement

Shri. M A Abdul Azeez retired from the services of Coconut Development Board on 30th June 2022 after serving the Board for thirty years.

World Coconut Day 2022-
Growing Coconut for a better future

World Coconut Day 2022- Growing Coconut for a better future

All coconut growing countries in the Asia and Pacific region observe 2nd September as World Coconut Day every year. The foundation day of the International Coconut Community (ICC) an intergovernmental organization is observed as the World Coconut Day in the member countries. Every year, all coconut growing countries organizes programmes and events to promote the goodness and benefits of coconut as The Tree of Life. The theme announced by ICC for World Coconut Day 2022 is Growing Coconut for a better future.

International Coconut Community- World Coconut Day Awards 2022

With the objective of empowering smallholder farmers and coconut industries in ICC member countries, stimulating scientific research activities in coconut sector and to raise public awareness on the positive attributes of coconut and its benefits , the ICC Secretariat, in collaboration with its member countries and other international organizations is instituting awards to recognize prominent figures in coconut sector. The five award categories are Best Innovative Farmer, Best Micro Small and Medium Enterprises (MSME), Best Coconut Farmer Organization, Coconut Scientist and the Coconut Song Writer. Each member country can nominate best candidates under each and forward to ICC Secretariat along with the supporting documents.

Scientists, researchers & lecturers, Coconut development officers, Coconut farmer's organizations, Coconut farmers and their families, Coconut industry stakeholders, Government officers, Research institutes, International organizations/ institutions and School and university students can submit nominations

With regard to the award for the best Innovative Farmer; Innovation aspects like improved varieties, improved crop management, creativity, new method, Product diversification, polyculture planting, appropriate intercropping and livestock integration system, activities in growing coconut including nursery replanting and good agriculture practices (GAP), Knowledge & skills, Better coconut cultivation management, seed selection, sourcing and application of modern inputs, proper harvesting, and post harvest handling and environmentally friendly aspects will be taken into consideration.

For the Best MSME, the impact created among the farmers, various Certifications like Fair Trade, Organic (Consumption) and other certifications of the MSME will be taken into consideration.

With regard to the Best Coconut Farmer Organisation, the number of years since its establishment, impact on members farmers, number of members, betterment made in the member's income and/ or benefits. number of products developed, market platform, Management and the Survivability of the Farmer Organization during the pandemic etc. will be taken into consideration.

For the Best Coconut Scientist; the Innovative technologies generated, innovative product(s) or technology implementation to farmers to coconut industries and other stakeholders, number of paper publications and the number of patent(s) granted will be taken into consideration.

For the Best Coconut Writer and Composer, lyrics related to coconut and impact of the lyric, the theme, melody, rhythm and arrangement can be directly forwarded to wcd@coconutcommunity.org in mp4/mp3/AAC format

Each category will have one best representative. Each member country can recommend one best candidate under the first four categories. USD 500 and plaques will be presented to the winner under each category. Plaque of Participation will be also given to all nominations submitted by each country. Winners will be announced on the ICC's publications, website, social media, and during the World Coconut Day . Fore more details please visit the website of the Board, www.coconutboard.gov.com

ICAR-CPCRI, Regional Station, Kayamkulam celebrated 94th ICAR-Foundation Day

ICAR-CPCRI, Regional Station, Kayamkulam celebrated 94th ICAR-Foundation Day' on 16th July 2022 by organizing a 'commemorative bicentenary lecture on Gregor Johann Mendel' alongwith a workshop on 'Advanced Microscopic techniques' for the new generations research scholars, students and faculties.

Dr P. Anithakumari, Acting Head in her welcome address highlighted the role of Indian Council of Agricultural Research in ensuring the food security of the Nation. In her inaugural address conducted in virtual mode, Dr Anitha Karun, Director, ICAR-CPCRI, Kasaragod outlined the stellar performance of ICAR in agricultural research, education and extension making the nation from ship to mouth in to silo to ship economy. While inaugurating the commemorative bicentenary lecture on Gregor Johann Mendel, she emphasized how systematic experimentation on pea plants through application of mathematics made the law of inheritance discovered by Gregor Mendel as a gene editing tool in the present era.

Dr Joseph Job, Vice-Principal, St. Berchman's College, Changanacherry delivered the commemorative bicentenary lecture on Gregor Johann Mendel. Dr Regi J Thomas, Principal Scientist proposed the vote of thanks.

The meeting was followed by a workshop on 'Advanced Microscopic Technique' by M/s InBiotek Microsystems, Kochi. Sri CV Ajithkumar, CEO, InBiotek highlighted on the fundamentals of microscopes and highlighting features on resolution, magnification, numerical aperture, Kohler illumination, different types of microscopes from light microscope to confocal microscope and the unique role of cameras capturing the best images for the benefit of all participants. A brief presentation on the Application of Microscopy in Coconut Research was made by Dr. A. Joseph Rajkumar, Principal Scientist. Around 100 participants attended the workshop.

Cultivation practices for coconut-August

New planting

Plant the coconut seedlings after the cessation of the monsoon in low lying areas subject to inundation during monsoon.

Incorporate green manure legumes into coconut basin / interspace

Green manure crops sown in the coconut basin or in the interspace of coconut gardens have to be incorporated into the soil if they have attained 50% flowering. In the coconut basin, green manure, legumes can be incorporated by using a spade. If tractor is used for incorporating the green manure in the interspace of coconut garden, care should be taken to avoid injury to the coconut trunk.

Nursery management

If sufficient moisture is not available due to insufficient rainfall, continue irrigation for the seedlings in the nursery until rains set in to provide sufficient moisture. Weeding has to be done wherever necessary.

Drainage

Wherever water logging is experienced provide drainage channel to drain the excess water. If continuous heavy rain occurs, make raised bunds around the planting pits of newly planted coconut seedlings to avoid entry of water into the pits.

Manuring

In rainfed areas, circular basins of 1.8 m radius and 25 cm depth may be dug during the fag end of August and green leaf or compost or farm yard manure may be spread at the rate of 50 kg per palm basins. The remaining two-third of the recommended dose of fertilizers may be spread over the green leaf or compost and covered. Application of 500 g N, 320 g P_2O_5 and 1200 g K_2O per palm per year is generally recommended for adult plantations. To supply two-third of the above nutrients it is necessary to apply 0.67 kg urea, 1 kg rock phosphate (in acidic soil) or 1.4 kg Super Phosphate (in other soils) and 1.35 kg of Muriate of potash (MOP). Whereever boron deficiency is observed borax can be applied @100 g/palm. It is always advisable to test soil in the coconut garden periodically (once in 3 years) based on the results of which, type and dosage of chemical fertilizers can be decided.

Moisture conservation practices

Most of the coconut growing tracts in the country received less than average monsoon showers during this season. The month of June recorded 40-50% less rainfall compared to the average. Same trend is being observed during July also. The erratic behaviour of south-west monsoon indicates the significance of conserving each drop of water received. Depending upon the topography and soil type, the following soil and moisture conservation practices can be adopted in coconut gardens.

Mulching

In order to conserve soil moisture in the coconut plantations, mulching with various types of organic materials can be practiced. The best time for mulching is before the end of the monsoon and before the top soil dries up. For mulching, cut coconut leaves into two or three pieces. To cover 1.8 m radius of coconut basin, 10 to 15 fallen coconut leaves are required and can be spread in two to three layers.

Mulching with composted coir pith to 10 cm thickness (approximately 50 kg/palm) around coconut basin is also an ideal method to conserve moisture. Coir pith can hold moisture five times its weight. Due to its fibrous and loose nature, incorporation of coir pith considerably improves the physical properties and water holding capacity of soil. The applied material may last for about 1 to 2 years. Coconut husks are also used as surface mulch around the base of the palm. It can hold moisture to the tune 3 to 5 times of its weight. Approximately 250 to 300 husks will be required for mulching one coconut basin. Mulching is usually done up to a radius of 2 m leaving approximately 30 cm near the palm. Two layers of husk may be buried in the coconut basin with the concave side facing upwards. These layers facilitate absorption of moisture. Above this, another layer of coconut husk is placed with the convex side facing upwards to arrest evaporation. Effect of this mulch lasts for about 5-7 years.

Husk burial

Burial of husk in trenches in between the rows of palms is also effective for moisture conservation in coconut gardens. Husk burial is to be done at the beginning of the monsoon, in linear trenches of 1.2 m width and 0.6 m depth between rows of palms with concave side of husks facing upwards and each layer is to be covered with soil.

Catch pit filled with coconut husk

Catch pits can be constructed at slopes to conserve soil and water. Though there are no standard dimensions for catch pits, catch pits of 1.5 m length x 0.5 m width x 0.5 m depth can be constructed. A bund is to be made at the downside using the excavated soil and pineapple suckers may be planted on it. This pit is also to be filled with coconut husk.

Contour trench filled with coconut husk

This measure is to be taken up where the land slope is high. Trenches of 50 cm width x 50 cm depth and convenient length are to be made in between two rows of coconut palms. These trenches are to be filled with coconut husk. Coconut husks need to be filled in layers with the bottom layers facing up and top layer facing down. A bund of 20 cm height and suitable width (>50 cm) is made at the downstream using the excavated soil. Two layers of pineapple plants are to be planted on the bund with a spacing of 20 cm x 20 cm. Pineapple plants would stabilize the bund and provide additional income to the farmer. The runoff water from the upper side would be collected in the trenches. Soil particles would also get deposited in the trench along with the runoff water. Coconut husk retains the moisture and makes it available for plants during summer months.

Half-moon bund around coconut basin reinforced with pineapple

This measure is to be taken up where there is mild slope (15-20%). Here a flat basin with a slight inward slope towards upstream is made by excavating soil from the upstream side and filling the excavated soil at the downstream side. After making the basin, a bund of 30 cm height and >50 cm width is made at the downstream side of the coconut using the excavated soil. Two layers of pineapple plants could be planted with a spacing of 20 cm row to row and 20 cm plant to plant on the bund. The bund prevents runoff and water gets collected within the basin and percolates down. Pineapple would help to protect the bund and stabilize the same in addition to giving fruit yield.

Plant protection

August marks the transition phase between the two monsoon periods. Since the quantum of monsoon showers had dropped significantly, there is more emergences of sucking pests in this phase, especially the coried bug and spiralling whiteflies. Extreme care should now be focussed on the early diagnosis of coreid bug incidence as this pest causes a greater damage on the nut yield potential in different parts of the country more specifically in Southern Kerala. In areas where rugose spiralling whitefly was not reported so far, this pest could emerge as well for which greater emphasis is laid on biological control. Greater emergence of the killer disease, bud rot is more visible in this part of the year for which adequate prophylactic measures need to be undertaken to tackle this problem. Weakening monsoon showers as well as weather dynamics favoured a major shift in the pest and disease kinetics invading coconut, and therefore warrants systematic monitoring and timely prophylactic measures.

Pests

▶ *Rhinoceros beetle (Oryctes rhinoceros)*

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

Management

- Prophylactic treatment of top most three leaf axils


Life stages of the pest


Nut damage


Elephant-tusk like symptom


Metarhizium packets

with either botanical cake [Neem cake /marotti cake / pungam cake (250 g)] admixed with equal volume of sand or placement of 12 g naphthalene balls covered with sand.

- Routine palm scrutiny during morning hours along with brushing of teeth and hooking out the beetle from the infested site reduces the floating pest population. This strategy could reduce the pest population significantly.
- Shielding the spear leaf area of juvenile palms with fish net could effectively entangle alighting rhinoceros beetles and placement of perforated sachets containing 3 g chlorantraniliprole /fipronil on top most three leaf axils evade pest incursion.
- Dairy farmers could treat the manure pits with green muscardine fungus, *Metarhiziuman isopliae* @ 5 x 1011 /m3 to induce epizootics on the developing grubs of rhinoceros beetle. Area-wise farmer-participatory approach in technology adoption could reduce the pest incidence very effectively and forms an eco-friendly approach in pest suppression.
- Incorporation of the weed plant, *Clerodendron infortunatumin* to the breeding pits caused hormonal irregularities resulting in morphogenetic transformational aberration in the immature stages of the pest.
- Crop diversity induced by intercropping and ecological engineering principles would disorient pests and provide continuous income and employment as well.

White grub, *Leucopholis coneophora*

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

Management

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

Rugose Spiralling Whitefly *(Aleurodicus rugioperculatus)*

This period could also witness the establishment of the invasive rugose spiralling whitefly (*Aleurodicusrugioperculatus*) in new areas as well as re-emergence in already reported areas. Presence of whitefly colonies on the lower 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.

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

Rugose spiralling whitefly Parasitized pupae

Encarsiaguadeloupae Sooty mould scavenger beetle

● No insecticide should be used as this causes resurgence of the pest and complete destruction of the natural aphelinid parasitoid, *Encarsiaguadeloupae*. 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, *Leiochrinusnilgirianus* 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.

Coreid Bug, *Paradasynus rostratus*

Nymphs and adults puncture the meristematic regions of tender buttons (1-3 months old) injecting toxin around the feeding site causing necrosis. Feeding punctures develop into necrotic lesions and these spindle-shaped depressions could be visible when the perianth of shed button is removed. Female flowers are attacked prior to pollination and such flowers get dried and can be seen attached to inflorescence on the crown resulting in production of barren buttons. Most of the infested buttons and tender nuts shed down. Retained nuts on the bunch develop furrows and crinkles on their husks and are malformed. In many cases gummosis can be seen on such

Management

● Crown cleaning to destroy eggs and immature stages of the pest

● Spraying of azadirachtin 300 ppm (Nimbecidene) @ 0.0004% (13 ml / l) reduced the pest incidence at the highest level. Two rounds of azadirachtin spray on young coconut bunches 1-5 months old during May-June and September-October are quite essential for satisfactory control of the pest in the field

● Among the natural enemies, the weaver ant, Oecophyllasmaragdinais found to be the most efficient predator of coreid bug in the field.

● Two egg parasitoids, namely *Chrysochalcissaoviceps* and *Gryonhomeoceri*, were identified as potential egg parasitoids. Forty per cent parasitism was observed in the egg mass collected from the field due to these parasitoids.

● Spraying cholrantraniliprole 0.3 ml/litre or lambda cyhalothrin @ 1.0 ml/litre on the pollinated bunches was found effective.

Disease

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

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

period to assess the health of the palm especially the spear leaf zone.

Management

● Regular cleaning of the crown and prophylactic spraying of Bordeaux mixture (1%) to the crown just before the onset of monsoon and one more spray after 35-40 days help in reducing the bud rot incidence. For the newly planted seedlings also prophylactic spraying of Bordeaux mixture (1%) can be given to avoid infection. In localities where heavy wind is experienced and leaves of coconut palms got damaged, spraying of Bordeaux mixture (1%) is essential to prevent infection by Phytophthora.

● Field sanitation and provide proper drainage during rainy season.

● Placement of two Trichoderma (Trichoderma harzianum CPTD28 isolate) enriched coir pith cakes in the inner most leaf axils just before the onset of monsoon and again after every two months as prophylactic measure.

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

As envisaged, timely monitoring and prophylactic measures are very critical to safeguard palm health and provide optimum nut yield. Protection is therefore the key strategy to boost up productivity and double farmer's income. ■

Market Review – June 2022

Domestic Price

Coconut Oil

During the month of June 2022, the price of coconut oil opened at Rs. 14600 per quintal at Kochi, Alappuzha market and Rs. 14800 per quintal at Kozhikode market. The prices opened and closed at the same price at these markets.

During the month, the price of coconut oil at Kangayam market opened at Rs. 12467 per quintal and closed at Rs. 12333 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
01.06.2022	14600	14600	14800	12467
04.06.2022	14600	14600	14800	12400
11.06.2022	14600	14600	14800	12667
18.06.2022	14600	14600	14800	12667
25.06.2022	14600	14600	14800	12600
30.06.2022	14600	14600	14800	12333

Milling copra

During the month, the price of milling copra opened at Rs.8450 per quintal at Kochi and Rs.8400 per quintal at Alappuzha and Rs.8750 per quintal at Kozhikode market. The prices opened and closed at the same price at these markets.

During the month the price of milling copra at Kangayam market opened at Rs.8200 and closed at the same price.

Weekly price of Milling Copra at major markets (Rs/Quintal)				
	Kochi	Alappuzha (Rasi Copra)	Kozhikode	Kangayam
01.06.2022	8450	8400	8750	8200
04.06.2022	8450	8400	8750	8200
11.06.2022	8450	8400	8750	8250
18.06.2022	8450	8400	8750	8300
25.06.2022	8450	8400	8800	8300
30.06.2022	8450	8400	8750	8200

Edible copra

During the month the price of Rajpur copra at Kozhikode market opened at Rs. 13000 per quintal and closed at Rs. 12000 per quintal with a net loss of Rs. 1000 per quintal.

Weekly price of edible copra at Kozhikode market (Rs/Quintal)	
01.06.2022	13000
04.06.2022	12500
11.06.2022	13200
18.06.2022	12600
25.06.2022	12000
30.06.2022	12000

Ball copra

The price of ball copra at Tiptur market opened at Rs. 13000 per quintal and closed at Rs.14200 per quintal with a net gain of Rs.1200 per quintal.

Weekly price of Ball copra at major markets in Karnataka (Rs/Quintal) (Sorce: Krishimarata vahini)	
01.06.2022	13000
04.06.2022	12600
11.06.2022	13600
18.06.2022	14000
25.06.2022	14300
30.06.2022	14200

*NR-Not reported

Dry coconut

At Kozhikode market, the price of dry coconut opened at Rs.11300 and closed at the same price.

Weekly price of Dry Coconut at Kozhikode market (Rs/Quintal)	
01.06.2022	11300
04.06.2022	11300
11.06.2022	11300
18.06.2022	11300
25.06.2022	11300
30.06.2022	11300

Coconut

At Nedumangad market in Kerala, the price of coconut opened at Rs. 17000 per thousand nuts and closed at Rs.12000 per thousand nuts with a net loss of Rs.5000 per thousand nuts during the month.

At Pollachi market in Tamilnadu, the price of coconut opened Rs. 21000 per tonne and closed at Rs.22000 per tonne during the month with a net gain of Rs. 1000 per tonne.

At Bangalore market in Karnataka, the price of coconut opened at Rs. 20000 per thousand nuts and closed at Rs.19000 per thousand nuts with a net loss of Rs.1000 per thousand nuts during the month.

At Mangalore market in Karnataka, the price of coconut opened Rs. 26000 per tonne and closed at Rs.28000 per tonne during the month with a net gain of Rs. 2000 per tonne.

Weekly price of coconut at major markets				
	Nedumangad (Rs./1000 coconuts)#	Pollachi (Rs./MT) ##	Bangalore Grade-1 coconut,(Rs./ 1000 coconuts) ##	Mangalore Black coconut (1 tonne) ##
01.06.2022	17000	21000	20000	26000
04.06.2022	17000	21000	20000	28000
11.06.2022	17000	22500	22500	28000
18.06.2022	12000	23000	22500	28000
25.06.2022	12000	22000	19000	28000
30.06.2022	12000	22000	19000	28000

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*
04.06.2022	192	250	148	266
11.06.2022	180	213	146	285
18.06.2022	179	235	126	291
25.06.2022	177	224	NR	279
				*Pollachi market

Coconut Oil

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

Weekly price of coconut oil in major coconut oil producing countries					
	International Price(US$/MT)	Domestic Price(US$/MT)			
	Philippines/ Indonesia (CIF Europe)	Philippines	Indonesia	Sri lanka	India*
04.06.2022	1672	NR	NR	1957	1571
11.06.2022	1760	NR	NR	1918	1605
18.06.2022	1684	NR	NR	1918	1605
25.06.2022	1637	NR	NR	NR	1596
					*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
04.06.2022	944	830	971	1039
11.06.2022	1017	845	903	1045
18.06.2022	1007	811	903	1051
25.06.2022	896	761	NR	1051
				* Kangayam

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

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