Coconut Cultivation and Coconut Based Enterprises in Lakshadweep -

Changing Scenario and Need for Revitalizing Coconut Sector

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Coconut farming is intrinsically woven into the socio-cultural life of the Lakshadweep islands. Copra and coir making were the major economic activities and livelihood options for the islanders during the olden days. Though coconut production and copra making continue to be the major options for livelihood, the local people experience various constraints which adversely affect coconut production. In general, farmers perceive that the productivity of coconut palms has been declining in the islands since the last few years. However, the official statistics indicate a consistently high level of coconut productivity.

Recently, in February 2022, a team of scientists from ICAR-CPCRI, Kasaragod and Krishi Vigyan Kendra, Lakshadweep conducted interface programmes in different islands with coconut farmers, entrepreneurs, palm climbers, and tappers. During the interaction sessions, the farmers and climbers opined that there is a decline in coconut productivity. The diagnostic field visits by the team to selected coconut gardens revealed various field problems that is adversely affecting coconut yield. Deficiency of nutrients, especially deficiency of potassium, nitrogen and boron, incidence of stem bleeding disease and infestation by white fly and eriophyid mite were the major field problems observed. Crop loss due to rodents continues to be another important field problem experienced by coconut growers in the islands. Overcrowding of coconut palms prevalent in the islands is quite congenial for intensified rodent attack and subsequent crop loss. Taking into cognizance the island agro-ecology and socio-economic situations, appropriate interventions are needed to overcome the field problems experienced by coconut growers

in Lakshadweep islands. Nature and functioning of coconut based enterprises in Lakshadweep islands are also undergoing changes owing to various socio-economic factors.

I. Management of coconut palms

As per the official statistics for the year 2018-19, the total area under coconut cultivation in Lakshadweep is 2674.87 ha with an annual production of 876.09 lakh nuts and a productivity of 32,753 nuts/ ha (Table 1). Though the data on the production and productivity of coconut in the islands indicate higher productivity compared to the national average, the average productivity of coconut palms realized in farmers' field at present is about 70-100 nuts per palm per year only, according to many farmers who were present during the interface programmes.

Table 1 Coconut cultivation in Lakshadweep islands

Name of island	Area(in ha)	Production (no. of nuts)	Productivity (nuts per ha)
Kavaratti	392.40	13964339	35587
Agatti	338.12	12131746	35 880
Amini	243.50	8675905	35630
Kadmat	306.10	10300265	33650
Kiltan	149.60	5068448	33880
Chetlat	100.1	3379376	33760
Bitra	7.70	51359	6670
Androth	452.75	16593288	36650
Kalpeni	258.50	8931175	34550
Minicoy	426.10	8513478	19980
Total	2674.87	87609378	32753
(Source: Coconut Development Board)			

During discussion, a 71-year old farmer Mr. Hamza Haji from Agatti Island and a 75-year old coconut grower Mr. Aboo Salam Koya from Agatti Island gave a detailed account of the yield of coconut in their orchards which is in line with the general perception of farmers about the coconut productivity in Lakshadweep islands. All farmers perceived that over the years, the care and management given to coconut orchards has gradually declined, which in turn has resulted in reduced palm health and yield. During earlier times there were many indigenous technical knowledge (ITKs) and practices related to the care and management of coconut palms from planting to harvesting to ensure high yield. Some of them are furnished in Table 2.

Table 2. Traditional practices of coconut cultivation

Mother palm selection and seed nut collection	High yielding palms over 35 years old
Sowing	Slanting position with the eye upward
Nursery management and selection of seedlings	Early germination
	Early splitting of leaves
	Maximum girth
	Transplanting in 'fathiyakett' which is a raised nursery
	Regular irrigation during the initial two years.
Field planting and aftercare	1-2 year old seedlings selected from the 'fathiya-kett' nursery are planted.
	2-3 years old seedling are planted in low lying 'thottam' areas
	Regular irrigation provided to palms using water from the open wells.
	Application of ash in palm basins
	Mulching of palm basins using dried leaves
	Community action for 'Elinayatt' (rat hunting) for rodent management in coconut gardens
Harvesting	Traditional climbing method using rope
	Harvesting in an interval of 45 days
	Crown cleaning twice in a year

Selection of mother palms for seednut collection, nursery management and selection of good seedlings were systematically followed by the farmers. During the interface meeting at Kavaratti, Mr. Aboobacker Koya of Kavaratti island narrated the genetic diversity of coconut nurtured by farmers in different islands. The predominant local ecotypes of coconut prevalent in islands in olden days were chenga (green nuts), karinga (orange nuts), cherukka (smaller nuts), thodom (bigger nuts), chentheng (orange dwarf) and pathinettampatta (green dwarf). Nuts of both the chenga and karinga are medium sized. Chenga types are steady yielders. The most common coconut varieties in the islands are Laccadive ordinary tall and Laccadive micro tall, which have been used in the coconut breeding programmes by institutes such as ICAR-CPCRI and Kerala Agricultural University. Seed nuts are selected from high-yielding palms that are more than 35 years old. Nuts are sown in slanting position with the eye facing upwards. When the seedlings attain three leaves stage, seedlings with good girth are taken for nursery planting for almost two years. Traditional nursery set up was known as "fathiyekket", where the sprouted seedlings are sown in a raised bed in which the hard pan is broken to get water, which is in turn used for irrigating the seedlings.

Mr. Ahamed Musliar of Kadmat Island mentioned that the young seedlings were provided with stakes of Thespesia plant and also fencing was provided to the nursery with dried and plated coconut leaves to protect them from sun scorching and also from animals.

For planting, pits of around 2 feet height, 2 feet width and 2 feet depth were taken and the dried leaves and farmyard manures were added along with the top soil, and then the seedling was planted at the centre as stated by Mr. Aboo Salam Koya. Basin opening regularly done once in an year. Crown cleaning was an important activity which can regularly carried out twice a year, mainly in the monsoon season as a prophylactic measure to prevent rodents and other pests. Mulching of coconut basins with dried leaves was also done. Gap filling with new seedlings was ensured by planting four seedlings in place of cutting two palms. Palms were planted closely in places where it is comparatively hotter. Nonetheless, presently, these indigenous technical knowledge has almost vanished from the islands as the younger generation lacks interest in farming.

Coconut climbing is a tedious operation in coconut farming. There is a traditional way of harvesting and undertaking post-harvest operations among the people of Lakshadweep. Palm climbing is done in the traditional manner with rope by skilled workers belonging to certain sections of the population. In addition, the services of skilled workers from the main land are also utilized by the farmers. The present wage rate is attractive; however, a shortage of skilled climbers is faced in all the islands as climbing coconut trees is considered an inferior job by the upper elite sections of the population.

Drudgery involved in palm climbing is another factor which deters younger generation from taking it up as an occupation. Recently, a few climbers have started using palm climbing machines. However many traditional climbers perceive that climbing with machine takes more time compared to the traditional climbing method. An experienced climber can climb 15–30 palms in 3-5 hours of climbing in a day, whereas it takes more time while using the climbing machine. On an average the wage rate for climbing palm is Rs. 50 per palm. Similar to their attitude towards coconut farming, younger generation is not much interested to take up palm climbing.

In earlier days, harvesting was done once in 45 days, which now has been reduced to once in 3-4 months. Other alternate jobs for the climbers are fishing and assisting in construction work. Many climbers have noticed alternate bearings in coconut palms. There is a phenomenon called 'Kulachaatam' where the bunches tend to bend in the direction of the wind, as stated by Mr. Aboobacker Koya. It is a common practice to store harvested nuts in heaps under shade for a few days before they are further processed. Farmers believe that this has many advantages, such as easier husking and shelling and superior quality of copra produced. In some places, harvested nuts are heaped in open areas till dehusking is done, which may affect the seasoning of the stored nut and further lead to deterioration of quality. Traditionally, husking is done manually by skilled workers with the help of an iron spike driven into the ground. A skilled worker can dehusk around 2000-2500 nuts per day.

Current scenario of coconut farming in Lakshadweep island is that it no longer attracts the younger generation and, at the same time, elderly farmers are unable to manage the cultivation of coconut in a systematic way. Because of the low level of management, there are many field problems which results in low yield. In some localities farmers experience problems due to shortage of water for irrigation in coconut gardens. Palms in the coconut orchards of islands look unhealthy with symptoms of nutritional deficiency including that of boron, potassium, nitrogen, etc.

Soil test results of the sample collected from the farm under Department Agriculture in Kadmat island pointed out the status of potassium, magnesium, and boron were very low, which clearly indicated the need for interventions to improve the soil health so that sustainable coconut production can be ensured. Many families have taken up cattle rearing and goat rearing as an income generating activity. However, non availability of fodder led to poor health of animals.

Incidence of pests and diseases such as white fly, eriophyid mite and stem bleeding are observed in some localities.

Farmers perceived that the recently observed widespread infestation of whitefly has made life miserable as the interspaces of coconut palms used for parking vehicles, drying clothes, were spoiled with honey dew secretions. Overcrowding of palms in coconut gardens which enhances rodent infestation and the substantial loss of nuts is another major problem in coconut farming in Lakshadweep islands. Rat hunting, locally known as 'Eli nayattu' organized as a community action for the control of rat menace in the coconut gardens is not followed at present in the islands.

Technological options for sustainable coconut cultivation in Lakshadweep

Taking into account the field problems observed in coconut gardens and the policy on organic farming prevalent in Lakshadweep islands various suggestions on technological options for sustainable coconut cultivation are made as summarized below.

i. Planting

Planting of coconut seedlings are to be taken up in a scientific manner rather than the current practice of planting in a very unsystematic way. The following measures are suggested.

- Opening of pits @ 75 cm x 75 x 60 cm
- Husk incorporation in the planting pits
- Regular watering of seedlings upto 2 years

ii. Organic recycling

About 15 to 21 tonnes of biomass as leaves, bunch waste and husk is available in one hectare of coconut garden which can be effectively used for *in-situ* organic recycling to improve soil health.

iii. Green manuring

Raising green manure crops such as cow pea, sun hemp, daincha and mimosa in the basin and interspace of coconut palms and incorporating into palm basins can be adopted for improving the soil health.

iv. Green leaf manure

The potential for raising green leaf manure crops such as glyricidia, thespesia, calotropis etc. can be utilized to generate substantial quantity of green leaf manure for application to coconut palms.

Coir pith mulching

Coconut leaf mulching

Husk mulching

v. Use of biofertilizers

Carrier based inoculants containing high population of plant-beneficial microorganisms capable of enhancing the availability of nutrients to plants can be used for coconut palms. These micro organisms help in fixation of atmospheric nitrogen (eg. Azospirillum) and solubilisation of phosphorus (eg. Phosphobacterium), produce plant growth promoting substances, enhance root growth and induce systemic resistance in plants to pests and diseases.

vi. Coconut based cropping system

Instead of the current practice of under planting of coconut, growing of intercrops is the good option. Vegetable crops like cowpea, cucurbits, moringa etc. can be intercropped in the coconut gardens.

vii. Inclusion of fodder trees in the coconut based integrated farming system

Fodder trees like glyricidia or subabool can be included in the coconut based integrated farming system to enhance the availability of fodder to the animals.

viii. Plant protection

Use of neem cake enriched with trichoderma need to be popularised for the control of stem bleeding disease. Similarly, eco-friendly pest management methods against rhinoceros beetle, eriophyid mite and white fly infestations are to be promoted as part of plant protection measures. Leaf axil filling with powdered neem cake/marotti cake/ pongamia cake @ 250 g/palm + fine sand (250 g) per palm during pre and post monsoon months as a prophylactic measure against rhinoceros beetle can be undertaken.

Use of Oryctes rhinoceros nudivirus (OrNV) for biological control of rhinoceros beetle and release of virus inoculated beetles brings down the pest population. Spraying against eriophyid mites requires an oil garlic soap mixture at a 2 percent mite concentration (neem oil 200 ml, soap 50 g, and garlic 200 g mixed in 10 litres of water). Severely infested palms, especially dwarfs with white flies, can be given a 0.5% neem oil spray. In addition, encourage build up of the aphelinid parasitoid (*Encarsia guadeloupae*) and re-introduce parasitized pupae to emerging zones of whitefly outbreak. Install yellow sticky traps on the palm trunk to trap adult whiteflies. Krishi Vigyan Kendra Lakshadweep in collaboration with ICAR-CPCRI can implement suitable interventions to conduct front line demonstrations and capacity development programmes to create awareness among coconut growers on these practices.

viii. Harvesting

Regular harvesting of coconut is a must. Harvesting should be done at 45-60 days interval. Harvesting can be done either manually or using mechanical climbing devices with proper safety measures.

Research and On Farm Testing

Research and on farm testing are required to be initiated to:

- Isolate nitrogen fixers and phosphorus solubilizers from the soil of Lakshadweep islands and develop location specific microbial consortia for nitrogen fixation and solubilisation of phosphorus.
- Develop location specific microbial consortia and plant decomposers for enhancing the decomposition of recyclable biomass.
- Sea weed manure utilisation for potassium management
- Effective utilisation of fish waste as organic manure
- Screening of fodder varieties suitable for rainfed conditions and high pH conditions
- Efforts should be made for the comprehensive assessment of soil health status and formulation of package of practices recommendations for soil health and crop health management taking into cognizance the local availability of inputs and policy on organic farming in the islands.

II. Coconut based enterprises

In the olden days, coir twisting was an important activity carried out by the women of certain classes which the nuts would be harvested by the men. Husk was then steeped for six or eight months in pits built with coral rock between the high and low water-mark in sheltered situations on either the lagoon beach or the sea beach. When sufficiently rotten, the husks are taken out and beaten by the women with a wooden beater on a fiat stone. The resulting coir is then washed out, dried, and finally twisted by the women by hand into yarn. Feet as well as hands are cleverly used. The quality depends upon the fineness of the twist and the colour.

Copra making was another economic activity. Although copra processing is still continued as the major economic activity, certain problems exist in copra making and marketing. Copra is prepared by sun drying in the traditional way. The season

Table 3. Comparison between traditional 'Meera tapping' and CPCRI method of neera (Kalparasa) tapping		
Particulars	**Traditional 'Meera tapping'**	**Kalparasa® tapping technology**
Selection of palm	Good yielding palms and with strong trunks	After attaining a stable yield.
Selection of inflorescence	Inflorescence seen next to an unopened spadix	Any unopened spadix
Length of cutting spathe	10-15 cm	15cm
Process of neera tapping	Unopened spathe is cut around 10 cm from the tip followed by gentle beating for a day using knife (rear end of knife).	The development of female flowers inside the spathe causes a swelling at the base, which is an indication of appropriate stage for tapping
	In addition, the sap flow will be ensured by rubbing the cut opened area with green coconut leaves.	The inflorescence selected for tapping is first tied around with a strong coir or plastic rope to prevent it from bursting
	If the sap flow is lesser, then around 2 cm is cut further. The sap flow will start within 2 days of cutting.	A gentle uniform beating is given using a mallet and massaged using palm all over the spadix, twice a day
	• After a day or two, small froth starts to form which indicates the opening of spathe, and at this time, the spathe is removed.	After 4-5 days of stroking 7-10 cm tip is cut off
	Meera comes out within 2-3 days is discarded for better flow and good quality, there after the sap is collected.	In a week's time sap starts oozing out from the cut end
Neera collecting tool	In olden days, coconut shell was used for collecting meera, and nowadays either PVC or boya or plastic pots or even bottles are used for tapping	Coco sap chiller
Length of tapping	One spadix is tapped for 2-2.5 months (60-75 days)	45 days
Sap collection	Two times a day (morning and evening)	Two times a day (morning and evening)
Yield	0.5-4 litres meera per spadix per day	1.5 to 3.0 liter of sap per spadix per day
Neera quality		
Colour	Oyster white	Light orange & honey color
pH	6-6.8	7-7.5
Insects, pollen, dust	Present	Absent as there is filter inside the chiller box
Processing	Meera thus collected are mainly sold in household for preparing vinegar which is an essential raw material in fish based cuisines.	Consumed as zero alcoholic health drink. Products like natural coconut sugar, jaggery, honey and confectionery can be prepared without the addition of lime and other chemicals
	A smaller portion is sold as fresh drink.	
	Occasionally, the collected meera is concentrated and converted into semi solid form as 'katti' or neera jaggery.	
	While concentrating, limestone is added to increase the pH	
	Katti and coconut gratings are used for making Lakshadweep halwa, which is a traditional sweet and has a good market potential.	

for copra making is from December to May. By December-January farmers and entrepreneurs prepare temporary drying yards in the open space near the sea shore. Each square shaped drying unit is demarcated using thatched coconut leaves. Dehusked nuts are transported to these drying yards, cut and spread for drying, the shelling done and packed in gunny bags after proper drying for sending to markets. Drying time usually takes seven days. Fully dried copra is assessed by breaking the dried copra cup and listening to the sound while breaking by hand. Due to the inadequacies of the traditional method of sun drying, farmers often find it difficult to produce copra that meets the minimum standards specified by the procuring agencies, thus realizing less income. In earlier days, copra was traded to the mainland (Mangalore and Kozhikode) through local boats called 'odom'. Later on, motor sailing vessels ('macnhu/ uru') were used as a mode of transport, which reduced the time of travel. In return, the household groceries and other items for the next season were purchased and brought to the islands.

Of late, many oil expelling units have been installed in all the islands, in addition to one or two units under the government which were closed recently. A few copra dryers have been installed along with oil expelling units in various islands. Home scale processing of Virgin Coconut Oil (called bentha neii) by hot processing has been a traditional practice in the households of the Lakshadweep islands, in which



women folk were engaged. The process involves grating the kernel of mature coconuts, extraction of milk from the gratings, keeping the milk thus extracted for cooling overnight, boiling the milk the next day for about two and a half hours, and separating the VCO, which was mainly used for new born babes and as hair oil for the elderly, which had no commercial value. Presently, a few women's self help groups are involved in the processing and marketing of VCO, which needs to be mechanized to reduce drudgery and to enhance efficiency. In the 1990s, a few desiccated coconut units were established by the Lakshadweep Development Corporation Limited, under the Lakshadweep Administration, which were closed recently due to operational issues. Inadequacy of entrepreneurship among the islanders for exploring the potential for income generation through coconut based value-added enterprises is quite evident.

Traditional neera tapping and value addition in Lakshadweep

The traditional method of neera tapping (called meera) using earthen pots is practiced in the islands since time immemorial. In fact, the practice of meera tapping and its value addition to vinegar and jaggery was mentioned in the publication of 1920 (Ellis, 1924). However, there are slight differences in the method of tapping compared to Kerala. Tapping starts with palm selection. The palms that are good at yielding and with strong trunks are selected for tapping. It is believed that healthy trees that bear more nuts also yield more sap. An interesting observation made by a progressive tapper, Mr. Jamaluddeen from Agatti island, who started neera tapping at the age of 12, is that the best palms will be those whose bunches bend naturally, and also, when non bearing palms are tapped for neera, they start bearing in successive years.

IACR- CPCRI has developed a technology for neera tapping using 'coco sap chiller' in which the neera collected is with zero alcoholic content. The differences observed between the traditional meera

tapping and Kalparasa tapping which is patented technology of CPCRI of neera tapping are summarized in table 3.

There is a potential for popularising CPCRI technology of neera collection using "Coco-sap chiller' and production of coconut sugar in the islands. Krishi Vigyan Kendra, Lakshadweep in collaboration with ICAR-CPCRI, Kasaragod has already initiated On Farm Testing of these technologies in few islands.

Conclusion

Coconut growers in Lakshadweep islands experience various constraints in coconut farming and there is a declining trend in productivity of coconut. It is necessary to implement interventions taking into account the field problems observed in coconut gardens and the policy on organic farming prevalent in Lakshadweep islands for sustainable coconut cultivation. Similarly, there is scope for modernizing the coconut based enterprises in the islands and bringing more efficiency. Utilization of advanced technologies for value addition, capacity building of labour and ensuring support to the enterprises through financial incentives are needed for rejuvenating the coconut based enterprises in Lakshadweep islands. The potential of marketing value added products under the brand as "Lakshadweep organic" should be encouraged to fetch better price for the local produce. Moreover, initiative should be made for Geographical Indication (GI) tagging for all coconut products from Lakshadweep highlighting its natural farming tradition. ■