

Sustainable Agricultural, Fisheries and Livelihood Innovations in **Lakshadweep**

Harnessing Local Resources | Strengthening Livelihoods
Building Climate Resilience



भारत अनुप कृषि प्रौद्योगिकी अनुप्रयोग अनुसंधान संस्थान
ICAR-Agricultural Technology Application Research Institute
Zone-XI, Hebbal, Bengaluru - 560 024



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भारतीय कृषि अनुसंधान परिषद

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FORWORD

Lakshadweep, the smallest Union Territory of India, is distinguished by its fragile Island ecology, geographic isolation, and strong community stewardship of natural resources. Coconut-based farming systems, marine fisheries, and traditional livelihoods form the backbone of food security and income for the Island population. However, the ecological sensitivity of coral reefs, limited land availability, and a community-enforced ban on chemical inputs necessitate development approaches that are sustainable, organic, and locally adapted.

This publication presents a set of evidence-based policy briefs developed by the ICAR–Krishi Vigyan Kendra (KVK), Lakshadweep, in collaboration with the Union Territory Administration, ICAR institutes, research organisations, and local communities. The policy briefs document scientifically validated, field-tested models that integrate research-based interventions with indigenous knowledge, community participation, and institutional convergence. Collectively, they offer replicable, environmentally sound, and socially inclusive solutions aligned with national priorities on sustainable agriculture, natural resource management, and livelihood enhancement in fragile island ecosystems.

Special recognition is accorded to ICAR–ATARI, Bengaluru, and the Krishi Vigyan Kendra team for their sustained technical guidance, intensive field-level engagement, and institutional support, which enabled effective integration of grassroots innovations and field-level challenges into the policy development process.

It is anticipated that these policy briefs will serve as a valuable reference for policymakers, planners, and development agencies in facilitating evidence-based decision-making, guiding resource allocation, and advancing sustainable and resilient development strategies for Lakshadweep, as well as for other Island and coastal ecosystems with similar ecological sensitivities.

(Rajbir Singh)

Date : 15 April 2026





ICAR-Agricultural Technology Application Research Institute, Zone XI

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Director

PREFACE

Lakshadweep, India's smallest Union Territory, represents a unique confluence of ecological fragility, geographic isolation, and strong community stewardship of natural resources. Coconut-based farming systems, marine fisheries, and traditional livelihoods form the foundation of food security and income generation across the islands. At the same time, fragile coral ecosystems, limited land availability, and a community-enforced ban on chemical inputs necessitate development pathways that are inherently sustainable, organic, and locally adapted.

This document brings together a set of evidence-based policy briefs developed by ICAR–Krishi Vigyan Kendra (KVK), Lakshadweep, in close collaboration with the Union Territory Administration, ICAR institutes, research organisations, and Island communities. The briefs address key policy-relevant challenges, including biological control of rodents in coconut plantations, fish waste management for circular economy solutions, revitalisation of traditional Neera (Kalparasa) tapping, institutionalisation of organic farming, and rejuvenation of senile coconut plantations for sustainable yield enhancement.

Each policy brief documents a tested and field-validated model that integrates scientific research, indigenous knowledge, community participation, and institutional convergence. Collectively, these initiatives demonstrate scalable, environmentally benign, and socially inclusive solutions that align livelihood enhancement with ecological conservation.

I express our sincere gratitude to Dr. M. L. Jat, Director General, ICAR and Secretary, DARE, Government of India, for his visionary leadership and steadfast commitment to sustainability, resilience, and innovation in Indian agriculture, which provided the guiding framework for this policy briefs.

I gratefully acknowledge Dr. Rajbir Singh, Deputy Director General (Agricultural Extension), ICAR, for his strategic guidance and continued encouragement, which ensured alignment of the policy briefs with national extension priorities while addressing the specific needs of island communities.

Our sincere thanks are extended to Dr. R. R. Burman and Dr. Ranjay Kumar Singh, Assistant Directors General (Agricultural Extension), ICAR, for their scholarly insights that strengthened the scientific rigor, social relevance, and policy orientation of this work.

I acknowledge the active collaboration of the Departments of Agriculture, Environment and Forest, Animal Husbandry, and Fisheries of Union Territory of Lakshadweep Administration, whose support and contextual inputs were critical in capturing ground realities and shaping locally relevant policy recommendations.

I place on record our appreciation to the Directors of ICAR-CMFRI, ICAR-CPCRI, ICAR-CIFT, and national partners for their technical expertise and multidisciplinary contributions, which enriched the scientific foundation of the policy briefs.

Special recognition is accorded to ICAR–ATARI, Bengaluru and the Krishi Vigyan Kendra team, whose continuous handholding, field-level engagement, and institutional support ensured that grassroots innovations and challenges were effectively reflected in the policy discourse.

(V. Venkatasubramanian)

Date : 15 April 2026



Biological Control of Rodents in Coconut Plantations using Barn Owls (*Tyto alba*): A Sustainable Model from Kavaratti Island, Lakshadweep

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1.1 Executive Summary

Rodent infestation is a major constraint to coconut production in Lakshadweep, causing an estimated 30–40% yield loss. Conventional control measures have become less effective due to declining community participation, shortage of skilled climbers and the prohibition of chemical rodenticides under the organic farming mandate. To address this challenge, ICAR–KVK Lakshadweep, in collaboration with Kerala Agricultural University, ICAR–AINPVPM and the Department of Agriculture, introduced Barn Owls (*Tyto alba*) as a biological control agent in Kavaratti Island. Three pairs of owls were introduced with appropriate quarantine, acclimatization, aviary facilities, community awareness and systematic monitoring of 2,000 coconut palms.

The intervention achieved 100% survival and successful adaptation, with the owl population expanding to more than 35 individuals through breeding. Farmers observed reduced rodent activity and coconut damage, supported by pellet analysis confirming rat predation, with no reported poultry predation or significant adverse ecological effects. With an investment of approximately ₹10 lakh, the initiative offers a cost-effective, sustainable and eco-friendly alternative to chemical rodent control. The Kavaratti model has strong potential for scaling up across other inhabited islands of Lakshadweep and for integration into the island's organic agriculture and pest-management framework.

1.2 Background and Rationale

Lakshadweep, India's smallest Union Territory, is highly dependent on coconut cultivation for food security and livelihoods. It has deep historical roots, with early settlers planting palms for food and livelihood security. Over time, rodent infestations have emerged as a persistent challenge, severely affecting yields. It is observed that during the British period, wood owls were introduced in Bitra Island for rodent control, but results were unsatisfactory. In 2011, the rodent damage accounted at an estimate of about 44% yield loss, valued at approximately ₹6.04 crore per year from 1,64,808 palms cultivated in an area of 392.4 ha and producing 106 lakh nuts annually. At present the losses remain significant at an estimated 30–40%. Traditionally, there were regular crown cleaning and community rodent hunts which were performed by the community.



However, the reduced farmer participation, scarcity of skilled climbers, and dense plantations have allowed rodents to thrive by moving from canopy-to-canopy and intensifying the damages. The prohibition of rodenticides under the Organic State mandate removes a conventional control method, necessitating alternative strategies. This policy brief is about the biological control of rodents in coconut farms using Barn Owls (*Tyto alba*) which is a sustainable model derived from Kavaratti Island, Lakshadweep.

1.3 Policy Context and problem statement

Severe rodent infestation in coconut palms has emerged as a chronic constraint, causing substantial yield losses. Conventional rodent control methods viz., community hunting and use of chemical rodenticides have become ineffective or infeasible due to socio-economic changes, scarcity of skilled palm climbers, and the Union Territory's declaration as an "Organic State", which prohibits use of chemical pest control methods. As indicated earlier, this policy brief presents an evidence-based, eco-friendly alternative through biological control of using Barn Owls (*Tyto alba*).

Problem Statement

- Coconut plantations in Lakshadweep experience 30–40% yield losses due to rodents
- In 2011 (as case study), the rodent damage in Kavaratti Island resulted in an estimated 44% yield loss, equivalent to ₹6.04 crore annually
- Dense coconut canopies facilitate rapid rodent movement, while reduced community participation limits traditional control measures
- The ban on rodenticides necessitates sustainable, non-chemical pest management solutions

Policy Objective

To evaluate and promote Barn Owls (*Tyto alba*) as a biological control agent for sustainable rodent management in coconut plantations, aligned with organic farming principles and ecological conservation

1.4 Intervention Strategy and implementation

KVK-Lakshadweep, in collaboration with Kerala Agricultural University (KAU), ICAR- AINPVP, and the Department of Agriculture, UT Lakshadweep Administration, implemented a pilot Pest Management programme based on biological control.



Key Components of IPM programme

a. Introduction of Barn Owls

- Three pairs procured from wildlife rescue centres in Kerala with statutory approvals.

b. Infrastructure Development

- Construction of a centrally located aviary (40 ft × 15 ft) at the State Medicinal Plants Garden, Kavaratti.
- Investment: approximately ₹8.0 lakh.

c. Safe Transport and Acclimatization

- Specially designed transport cages ensured stress-free movement.
- An 82-day quarantine and acclimatization period prior to release.

d. Community Awareness and Participation

- Public announcements, school programmes, and signage to ensure protection of Barn Owls and community acceptance.

e. Monitoring and Impact Assessment

- Monitoring of **2,000 coconut palms across all 12 wards**.
- Regular assessment of rodent damage and pellet analysis to confirm predation





1.5 Outcomes, Evidence and Benefits

The introduction of Barn Owls on Kavaratti Island resulted in highly positive outcomes, with 100% survival and successful adaptation of the introduced birds, followed by rapid breeding and population expansion to more than 35 individuals. Farmers reported a visible decline in rodent activity and coconut damage, which was further substantiated through pellet analysis confirming effective predation on rats. Importantly, there were no incidences of poultry predation or adverse ecological impacts, demonstrating the safety of the intervention. The initiative aligns strongly with Lakshadweep's organic farming mandate and delivered substantial economic and environmental benefits, including a marked reduction in rodent-induced coconut losses.

Environmental and Social Benefits

With a one-time investment of approximately ₹10 lakh, the intervention proved highly cost-effective by providing long-term pest control benefits, eliminating the need for chemical rodenticides, safeguarding human health, biodiversity, and soil ecology, and ultimately strengthening the sustainable livelihoods of coconut farmers.

1.6 Policy Implications and Recommendations

In Kavaratti, the pilot demonstration using Barn Owls as a biological control is a viable, scalable, and environmentally sound policy option for rodent management in island ecosystems and organic farming regions.

Recommendations for Policy Action

- Scale-up the programme by introducing at least 20 additional pairs of Barn Owls to enhance island-wide coverage.
- Institutionalize community awareness programmes to ensure long-term protection and acceptance of Barn Owls.
- Establish routine monitoring protocols, including pellet analysis, to track ecological impact and effectiveness.
- Replicate the model across other inhabited Islands of Lakshadweep.
- Integrate biological rodent control into the official Island-level pest management and organic agriculture policy framework.

1.7 Conclusion

The Barn Owl-based biological control initiative in Kavaratti Island provides a proof-of-concept for sustainable rodent management under organic farming conditions. The intervention is cost-effective, environmentally benign, and socially acceptable, offering a long-term solution to a persistent agricultural challenge. Adoption of this model at scale can significantly enhance coconut productivity, ecological resilience, and farmer livelihoods across Lakshadweep and similar island ecosystems.

Sustainable Fish Waste Management in Lakshadweep: Converting Marine Waste into Economic and Environmental Value

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2.1 Executive Summary

Lakshadweep's marine fisheries sector produces over 21,000 tonnes of fish annually, generating an estimated 6,300–10,500 tonnes of fish waste. Improper disposal of fish heads, entrails, bones, skin and fins creates serious coastal sanitation and environmental concerns, particularly for the fragile coral reef ecosystem, while also resulting in loss of valuable nutrients. To address this challenge, ICAR–KVK Lakshadweep, in collaboration with ICAR–CIFT, Kochi, established a decentralized fish waste valorisation model with a 500 kg/day processing facility, supported by technology transfer, training and entrepreneurship development.

The initiative converts fish waste into organic manure, fish silage and livestock/aquaculture feed, thereby transforming an environmental liability into an economic resource. Trials demonstrated the nutritional and economic potential of fish-waste-based feed, while 112 beneficiaries were trained and four SHGs were successfully incubated, each generating income through fish-waste products. The model reduces coastal pollution, supports organic farming, lowers input costs, promotes women-led enterprises and strengthens a circular economy. Scaling decentralized processing units across Lakshadweep, strengthening market linkages and integrating fish-waste valorisation into fisheries, agriculture, environmental and Blue Economy policies can provide a sustainable and replicable model for island and coastal ecosystems.

Lakshadweep's marine fisheries sector, producing over 21,000 tonnes of fish annually, generates an estimated 6,300–10,500 tonnes of fish waste each year. Improper disposal of this waste poses serious environmental risks to fragile coral reef ecosystems while also representing a missed economic opportunity.

2.2 Background and Rationale

Lakshadweep's marine fisheries sector, producing over 21,000 tonnes of fish annually, generates an estimated 6,300–10,500 tonnes of fish waste each year. Improper disposal of this waste poses serious environmental risks to fragile coral reef ecosystems while also representing a missed economic opportunity.



2.3 Problem Statement and Policy Context

The Lakshadweep archipelago is heavily dependent on marine fisheries, with tuna accounting for 80–86.5% of the total landings. Fish processing and marketing activities generate large quantities of waste, including heads, entrails, bones, skin, and fins. When dumped indiscriminately on beaches or near landing centres, this waste leads to:

- Public health and sanitation concerns
- Loss of valuable nutrients that could be reused in agriculture and animal husbandry

Given Lakshadweep's ecological sensitivity and its emphasis on organic and sustainable development, there is an urgent need for an integrated policy approach to fish waste management that combines environmental protection with livelihood generation.

2.4 Intervention strategy and implementation

Collaborative Waste Valorisation (CWW) Model

KVK–Lakshadweep, in partnership with ICAR–CIFT, Kochi implemented a decentralized fish waste management model with the following key elements:

- Establishment of a Fish Waste Management Unit, inaugurated on 2 October 2021, equipped with shredders and mixers supplied by ICAR–CIFT at a cost of ₹3.5 lakh.
- Technology transfer and capacity building
- Technology transfer and capacity building formed a critical component of the intervention, ensuring long-term sustainability and community ownership. Structured and need-based training programmes were organized for farmers, fishers, women Self-Help Groups (SHGs), and rural youth.
- Introduction of a 500 kg/day fish waste processing line, enabling local production of manure, silage, and feed
- Continuous skill development support by KVK to promote entrepreneurship and self-reliance.





2.4 Evidence, Results and Economic Analysis

Fish waste valorisation initiatives have generated notable outcomes in terms of product development, environmental sustainability, and economic viability. Each year, about 21,016 tonnes of fish—predominantly tuna—are harvested, resulting in an estimated 6,304.8 to 10,508 tonnes of waste. This waste, consisting of heads, entrails, bones, skin, and fins, is rich in proteins, lipids, amino acids, and minerals, making it a valuable resource for producing high-value products.

Major outputs include organic fertilizers and manure produced by composting fish waste with cocopeat and microbial cultures. These nutrient-rich products improve crop growth, reduce dependence on chemical fertilizers, and support Lakshadweep's organic farming mandate. Fish silage, a protein-rich liquid obtained through enzymatic fermentation, is being effectively used both as animal feed and as a liquid fertilizer.

On-farm trials (OFTs) confirmed the superior nutritional quality and cost-effectiveness of feed prepared from high-protein tuna waste compared to commercial feeds. For example, the benefit–cost ratio of fish waste–based feed for marine ornamental fish reached 1.78, far exceeding the 1.02 recorded for conventional feed.

The initiative has delivered significant economic and social benefits, with 112 beneficiaries—including Self-Help Groups (SHGs) and individual entrepreneurs—trained in fish waste processing. Four SHGs have been successfully incubated, each producing an average of 2,890 kg of products per month and earning approximately ₹14,450 in monthly income. Overall, the programme has lowered agricultural input costs while generating sustainable livelihood and employment opportunities at the local level.

Economic, Environmental, and Social Benefits

- Significant reduction in beach pollution and improved coastal sanitation
- Lower input costs for organic farming and animal husbandry
- Creation of local employment and women-led enterprises
- Strengthening of circular economy and resource efficiency
- Enhanced resilience of island livelihoods aligned with sustainable development goals

2.6 Policy Implications

The Lakshadweep experience demonstrates that fish waste is a valuable bio-resource rather than a disposal burden. Institutionalizing fish waste valorisation can simultaneously address environmental management, organic agriculture input needs, and livelihood diversification. The model is highly suitable for island territories and coastal regions with limited waste disposal options.

Recommendations for Policy Action

i. Enhance Infrastructure

- Establish decentralized fish waste processing units across additional islands using ICAR–CIFT technologies.
- Strengthen Capacity and Entrepreneurship
- Expand training programmes for fishers, SHGs, and youth with emphasis on enterprise development.

ii. Foster Market and Institutional Linkages

- Improve supply chains for waste collection and product distribution.
- Promote Fish Farmers Producer Organisations (FFPOs).
- Link products with agriculture, horticulture, and animal husbandry departments.

iii. Integrate into Policy Frameworks

- Incorporate fish waste management into UT-level fisheries, agriculture, and environmental policies.
- Align with Blue Economy, Swachh Bharat, and organic farming initiatives.

2.7 Conclusion

Sustainable fish waste management in Lakshadweep offers a win–win solution for environmental conservation and economic development. A collaborative initiative between KVK–Lakshadweep and ICAR–CIFT has demonstrated a scalable and sustainable model for converting fish waste into high-value products such as organic fertilisers, fish silage, and poultry/aquaculture feed. Validated through On-Farm Trials (OFTs), Frontline Demonstrations (FLDs), and mandatory KVK activities, the model has proven both technically feasible and economically viable. The initiative supports organic farming, reduces environmental pollution, promotes a circular economy, and creates new livelihood opportunities. It aligns strongly with national priorities under the Blue Economy and Swachh Bharat Mission, offering a replicable framework for other small island ecosystems.

Neera (Kalparasa)–Based Livelihoods: Policy Opportunities for Sustainable Development in Lakshadweep

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3.1 Executive Summary

Neera (Kalparasa), the non-alcoholic sap extracted from unopened coconut inflorescences, is a traditional livelihood activity in Lakshadweep with high economic and nutritional potential. However, reliance on unhygienic traditional collection methods results in rapid fermentation, quality loss, and limited income generation. Interventions by KVK-Lakshadweep and ICAR- CPCRI through Coconut Sap Chillers (CSCs) and Neera Cookers have demonstrated significant improvements in quality, shelf life, processing efficiency, and profitability. Lakshadweep’s organic certification further provides a strategic advantage for premium branding. This policy brief recommends targeted subsidies, skill development, enterprise promotion, quality certification, and market linkages to transform Neera into a viable, scalable livelihood enterprise.

3.2 Purpose

To apprise policymakers and development agencies of the potential of Neera (Kalparasa) as a sustainable, coconut-based livelihood intervention in Lakshadweep, and to recommend policy measures for scaling hygienic production, value addition, and organised marketing using proven technologies.



3.3 Policy Context and Rationale

Lakshadweep’s economy is predominantly coconut-based, with limited land resources and few alternative livelihood options. Neera tapping, practised for generations, supports nearly 120 skilled tappers across islands such as Androth, Agatti, Kalpeni, Kadmat, Kavaratti and Minicoy. Although Neera is widely recognised for its low glycaemic index, rich mineral content, and consumer demand as a natural health drink, its commercial potential in Lakshadweep remains underutilised due to inadequate technology, declining skilled manpower, and weak institutional support.

Problem Statement

- Traditional collection using earthen pots and improvised containers accelerates fermentation within 2–3 hours
- Poor hygiene and contamination reduce shelf life and market acceptability
- Low processing efficiency increases raw material requirements for jaggery and sugar

- Declining number of trained tappers threatens continuity of the practice
- Absence of organised processing units and market linkages limits income diversification

3.4 Objectives

1. To enhance and stabilise incomes of coconut-dependent households
2. To preserve traditional tapping skills through modern, safe, and hygienic practices
3. To promote value addition and enterprise development, especially among SHGs and youth
4. To position Lakshadweep as a premium source of organic Neera and its derivatives

3.5 Interventions strategy and Implementation

KVK-led frontline demonstrations conducted during 2021–2024, in collaboration with ICAR– CPCRI, provided strong empirical evidence on the advantages of adopting Coconut Sap Chillers (CSCs) and Neera Cookers over traditional Neera tapping practices in Lakshadweep. The improved technology ensured the collection of high-quality, contamination-free Neera with a near-neutral pH of 7.0–7.5, significantly enhancing food safety and consumer acceptability. Unlike traditional methods, where fermentation begins within 2–3 hours under ambient conditions, CSC-collected Neera retained its freshness for up to 45 days under refrigerated storage, enabling storage, transport, and organised marketing. Productivity also improved markedly, with average yields increasing to about 3 litres per palm per day compared to 1–2 litres under conventional practices. Economically, the technology demonstrated substantial income potential; at a conservative market price of ₹350 per litre, producers could earn up to ₹3,500 per day from 10 litres of Neera, considerably improving tapper livelihoods. Processing efficiency was another major gain, as CSC-collected Neera required only 7.5 litres to produce 1 kg of jaggery, compared to 10–11 litres under traditional methods, resulting in significant raw material savings. Notably, the demonstrations achieved the first successful production of coconut sugar in Lakshadweep, yielding approximately 1 kg of sugar from 7 litres of Neera, highlighting the strong scope for high-value product diversification and enterprise development in the islands.

Table 1: Comparative assessment of traditional and CSC methods of neera production

Indicators	Traditional Method	Coconut Sap Chiller
Device	Coconut shells, plastic bottles, buoys and other indigenous materials	High Density Polyethylene (HDPE): A device made for this purpose
Cost of the device	Used materials like plastic bottles which are negligible costs	Rs. 1200 (including the transportation)
Drudgery	Less	High (Easy method of tying with ropes and pulling towards the spadix). The device weighs 1.8 kg without ice
Additional materials required	Nil	1. Plastic covers for collection of sap inside the device 2. Ice (500 gm/device) 3. Rope to pull the device to the spadix
Hygiene	Low	High
Capacity	1-2 Litres	3 litres/day
Contaminants	Ants, insects, pollen and others	Nil
pH	4.00-4.50	7.00-7.50
Colour of neera	Oyster white	Orange brown (honey colour)
Flavour	Harsh odour	Sweet
Fermentation	Within 2-3 hours under ambient temperature	In open condition it can be fresh for 12 hours. Under refrigeration it can sustain its freshness up to 45 days
Jaggery making	1 kg/ 10 litres	1 kg/ 7.5 litres



3.6 Policy Implications and Recommendations

a) Technology Support and Subsidies

To promote entrepreneurship as a sustainable livelihood option among the island population, focused technology support and targeted subsidies are essential. Provision of Coconut Service Centres (CSCs) and Neera cookers under MSME, NRLM and island livelihood schemes will enable value addition, hygienic processing and diversification of coconut-based products, thereby improving income and employment opportunities. Simultaneously, extension of transport and logistics subsidies is crucial to offset island-specific challenges such as high freight costs, limited connectivity and input procurement constraints. Such support will enhance market access, reduce operational costs and encourage local entrepreneurs to adopt enterprise activities as a primary livelihood, strengthening island economies and ensuring inclusive development.

b) Capacity Building and Skill Development

To strengthen Lakshadweep's coconut processing, structured training and certification programmes combining practical modules for coconut tappers and processors must be delivered through development agencies, to train on safe climbing, hygienic nut handling, standard VCO and value-added products and quality assurance for market access. Introduce youth apprenticeship schemes (NAPS) embedding trainees in oil mills, FPOs and cooperatives with stipends, assessments and certification to prevent skill attrition, build entrepreneurial skills and ensure sustainable, island-adapted value-chains that boost incomes and retain local talent in Lakshadweep. This will enhance the entrepreneurship development in the sector.

c) Value Addition and Enterprise Promotion

Establishing decentralized Neera processing units across Lakshadweep can convert coconut inflorescence sap into premium jaggery, sugar, vinegar and ready-to-drink health beverages, reducing spoilage and creating island employment while suiting local logistics and climate constraints. Linking these micro-units with women-led SHGs, cooperatives and FPOs for training, microfinance, hygienic processing, branding and packaging will strengthen inclusive entrepreneurship, retain value locally and improve market access for premium island products. Technical support and capacity building from KVK-Lakshadweep, ICAR-CPCRI and Coconut Development Board will ensure quality standards.

d) Quality Assurance and Certification

Quality assurance and certification are critical for food safety and market access. Facilitating FSSAI licensing ensures producers meet statutory hygiene, labelling, and safety standards mandated in India, enhancing consumer trust and legal compliance. Supporting organic certification helps farmers adopt certified organic practices through accredited bodies, verifying absence of synthetic chemicals and adherence to ecological standards. Together, these certifications improve product credibility, enable premium pricing and expand access to domestic and export markets while safeguarding public health.

e) Market Development and Branding

Support for cooperative marketing and island-specific organic branding empowers local value chains by enabling smallholders to collectively certify, market and promote products that reflect Lakshadweep's unique terroir and sustainability. Linking producers with tourism outlets, mainland retail chains and niche export markets enhances visibility, demand and premium pricing for organic products. Strategic partnerships with hotels, resorts, specialty stores, supermarkets and e-commerce platforms foster consistent supply, improve income and build global recognition of island brands in high-value organic markets. Integrated branding, training and logistics partnerships build value, enhance incomes and ensure ecological stewardship while preserving local identity and strengthen regional economic resilience.

f) Research-Extension Convergence

Research-extension convergence is critical for promoting low-cost, portable preservation technologies in coconut processing, particularly in island ecosystems like Lakshadweep. Adaptive research should focus on developing and refining affordable, energy-efficient and transportable units for coconut oil extraction, drying, desiccation and value addition, suited to smallholders and entrepreneurs. Strengthening KVK-led frontline demonstrations ensures field-level validation of these technologies, while structured feedback from farmers, SHGs and processors helps fine-tune designs, improve usability and enhance adoption through participatory extension and continuous technology refinement.

3.7 Implementation Framework and Expected outcomes

The implementation framework will be led jointly by the Department of Agriculture (UTLA), KVK-Lakshadweep and ICAR-CPCRI, ensuring a coordinated, science-driven and field-oriented approach. The Department of Agriculture will facilitate policy support, convergence of schemes and infrastructure development, while KVK-Lakshadweep will act as the nodal agency for technology dissemination, capacity building, frontline demonstrations and skill-oriented trainings. ICAR-CPCRI will provide technical backstopping, improved varieties, processing protocols and quality standards specific to island ecosystems. Supporting institutions such as SHGs, cooperatives, FPOs and Panchayati Raj Institutions will facilitate community participation and outreach. In the short term (1-2 years), the focus will be on farmer sensitization, hands-on training and adoption of validated technologies, leading to improved productivity and quality. In the medium term (3-5 years), outcomes will include scaling up of enterprises, brand development of island-specific products, strengthened market linkages and sustainable income enhancement for farming.

Economic, Environmental and Social Benefits

The intervention will contribute to increased and resilient incomes for coconut tappers and Self-Help Group (SHGs) members by ensuring better price realization through value addition, collective marketing and reduced dependence on intermediaries. Post-harvest losses will be minimized through scientific handling, hygienic processing and improved storage practices, leading to superior product quality and enhanced consumer acceptance. The initiative will also generate meaningful employment opportunities for women and youth by promoting skill development in processing, packaging, branding and entrepreneurship. Further, sustainable utilization of coconut resources will be ensured by adopting organic practices, efficient use of by-products and eco-friendly technologies, thereby aligning coconut-based livelihoods with fragile island ecology and long-term environmental sustainability.

Alignment with National Priorities

Coconut value addition and processing strongly align with key national priorities by creating inclusive, sustainable and income-generating opportunities. By transforming raw coconuts into products such as virgin coconut oil, desiccated coconut, coconut sugar, fibre-based goods, health drinks and ready-to-eat foods, farmers can substantially enhance returns, directly supporting the goal of Doubling Farmers' Income. Local processing units promote Atmanirbhar Bharat by reducing dependence on imports and strengthening domestic value chains. Coconut-based enterprises offer significant scope for MSME development through low-to-medium scale processing, rural entrepreneurship and market diversification. Integration with NRLM enables women-led self-help groups to participate actively in processing, packaging and marketing, thereby strengthening women empowerment. Collectively, these interventions contribute to SDG 1 (No Poverty), SDG 8 (Decent Work and Economic Growth) and SDG 12 (Responsible Consumption and Production) by fostering livelihoods, employment and sustainable resource utilization.

3.8 Conclusion

Modernisation of Neera production through hygienic, temperature-controlled technologies presents a viable and inclusive pathway for strengthening coconut-based livelihoods in Lakshadweep. Strategic policy support and institutional convergence can unlock the full economic, social, and cultural potential of Neera, positioning Lakshadweep as a national model for sustainable island agriculture and value addition.

Policy Brief 4

The Lakshadweep Organic Territory Model: Community, Institutional, and Technological Innovations

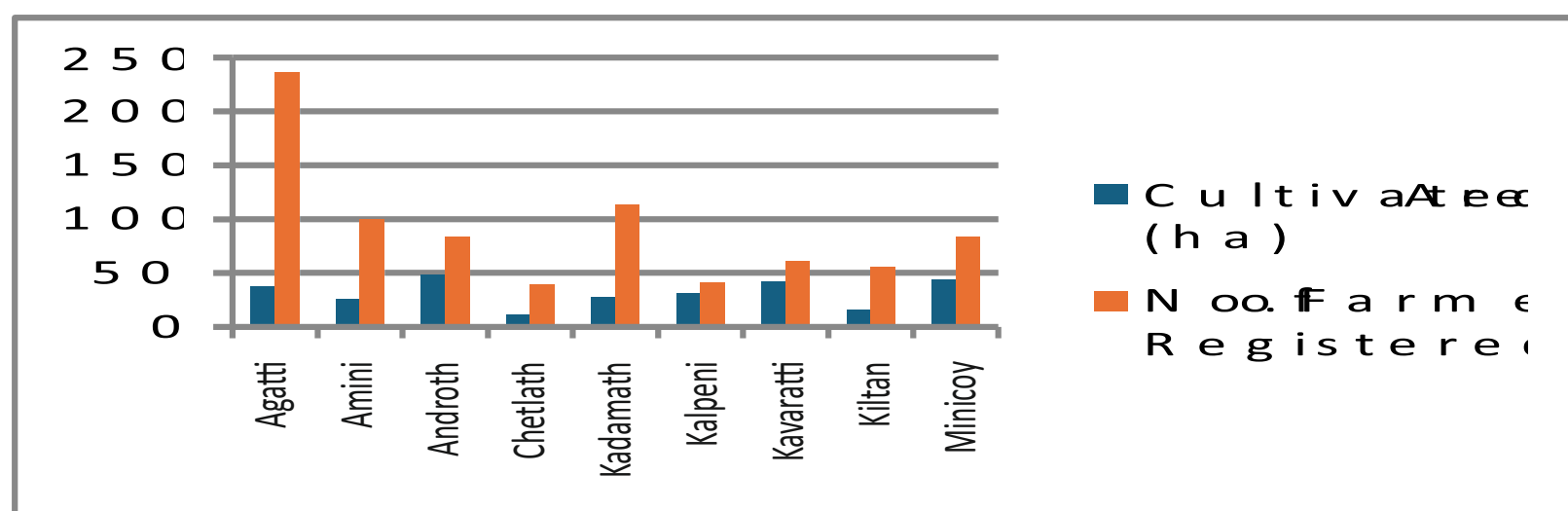
Ananth P.N., Abhishek Das and Abdul Gafoor V.M.
ICAR-Krishi Vigyan Kendra, Lakshadweep

4.1 Executive Summary

Lakshadweep Union Territory represents a unique and nationally significant case for large-scale organic agriculture owing to its geographical isolation, fragile coral ecosystem, rainfed subsistence farming systems, and long-standing community-led avoidance of chemical inputs. Recognising this inherent advantage, the Union Territory of Lakshadweep Administration (UTLA), in collaboration with Krishi Vigyan Kendra (KVK), Lakshadweep, initiated a structured organic certification programme to formally validate and enhance the credibility of agricultural produce from the islands.

Since 2019–20, organic certification has been undertaken under the Participatory Guarantee System (PGS-India) facilitated by the National Centre of Organic and Natural Farming Ghaziabad, UP. As of 2024, a total of 8,126 farmers across different islands have been registered on the PGS portal and awarded Large Area Certification (LAC), covering the entire cultivable area of the Union Territory.

This policy brief documents the community-driven initiatives, institutional mechanisms, and technological interventions that enabled Lakshadweep to be declared an organic territory, highlighting the certification process, governance framework, and the socio-economic and ecological benefits accruing to farmers.



4.2 Policy Context and Problem Statement

Organic farming has gained national priority under India's sustainable agriculture agenda due to increasing concerns related to food safety, soil degradation, and climate resilience. Lakshadweep presents a rare case where organic agriculture exists by default, rather than through transition, as the entry of chemical fertilisers and pesticides has been voluntarily banned by the island communities since 2005. However, the absence of formal certification, limited market access and premium price realisation existed for island produce. Hence, institutional support was required to provide an authenticate organic status, improve marketability, enhance the consumer trust and integrate island farmers with national organic value chains.



Agricultural Profile of Lakshadweep Islands

As per NBSS&LUP classification, Lakshadweep falls under Agro-Ecological Region (AER) 21-Hot Humid to per-humid eco-region with coastal alluvium and islands. The islands are characterised as coral sandy soils with high porosity with low organic carbon content, slightly alkaline to neutral pH and high vulnerability to nutrient leaching.

Cropping and Livelihood Systems

Coconut-based farming systems dominate the agricultural landscape of Lakshadweep occupying about 2,675 ha and nearly 10 lakh palms producing around 10 crore nuts annually, forming the primary source of food, income, and raw material for value addition. Vegetable cultivation is practiced on a limited scale due to land scarcity and fragile soil conditions, largely confined to backyard gardens and rooftop systems that cater mainly to household nutritional needs. Fisheries constitute the backbone of the island economy, with tuna and lagoon fisheries providing sustained livelihoods, food security, and employment to a large proportion of the population. Complementing primary production, value addition activities such as coconut oil extraction through expeller units and processing of fish into dried, smoked, and other value-added products play a vital role in income diversification. These enterprises are largely managed by private entrepreneurs and women-led Self-Help Groups (SHGs), contributing significantly to local employment generation, women's economic empowerment, and strengthening the resilience of the island livelihood systems.



Due to severe land constraints and ecological sensitivity, agriculture remains **subsistence-oriented**, with minimal external inputs and complete reliance on organic manures, biomass recycling, and biological pest management practices.

Table 1: Area, Production, and Productivity of Major Crops in Lakshadweep

S. No.	Crop	Area (ha)	Production (Metric tons)	Productivity (kg/ha)
1	Coconut	2,675	87,609,378 nuts	32753 nuts/ha/year
2	Banana	53	27.2	-
3	Papaya	25	12.15	-
4	Brinjal	1.8	2.7	-
5	Bhindi	2.9	3.2	-
6	Tomato	2.4	2.49	-
7	Chilli	2.3	2.6	-

4.3 Intervention strategy-Status of Organic Farming Practices

Traditional farming systems in Lakshadweep have inherently complied with PGS-India standards, including:

- Use of farmyard manure, compost, and biological inputs
- Mixed and intercropping systems (banana and vegetables in coconut gardens)
- Absence of synthetic fertilisers and pesticides
- Emphasis on ecological balance and biodiversity conservation

These practices have ensured the protection of fragile island ecosystems, coral reefs, and lagoon environments, making Lakshadweep organically compliant even before formal certification.

4.4 Institutional Process of Organic Certification

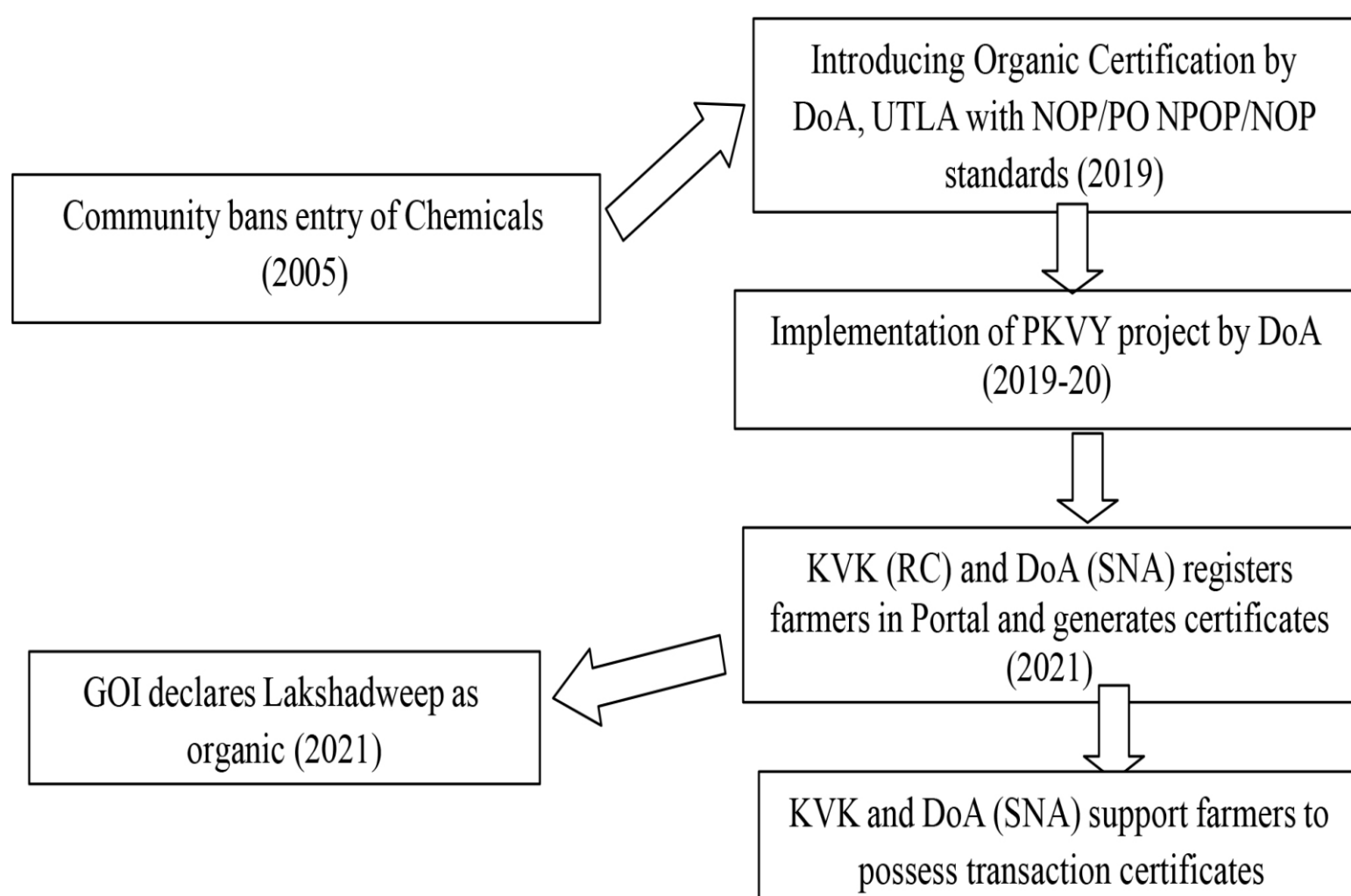
Initial Certification Efforts

The UTLA initiated organic certification in 2009 under APEDA, following NPOP/NOP standards recognised by USDA and the European Union. Certification was conducted through an external agency, INDOCERT, Aluva. While technically robust, this model posed challenges related to cost, periodic renewal, and logistical constraints.

Transition to PGS-India and Large Area Certification

Considering the suitability of community-based certification for smallholders, UTLA adopted PGS-India under the Paramparagat Krishi Vikas Yojana (PKVY). Under this framework:

- Entire islands were treated as a single organic unit
- Farmers were registered through group-based approaches
- KVK Lakshadweep provided technical backstopping, documentation, and capacity building
- This approach culminated in **Large Area Certification (LAC)** for Lakshadweep, making it one of the largest contiguous certified organic territories in the country.





Renewal of Organic Certification

As per PKVY guidelines, LAC mandates annual verification and renewal by the State Nodal Agency (SNA), with oversight from Zonal and Regional Councils. The organic certificate for Lakshadweep expired on 14 October 2022. To ensure continuity:

- A State Level Executive Committee (SLEC) meeting was convened on 6 November 2023, chaired by the Secretary (Agriculture), UTLA.
- KVK-Lakshadweep was entrusted with the responsibility of coordinating renewal, farmer verification, documentation, and compliance reporting.
- The process reinforced institutional ownership and sustainability of the certification mechanism.

4.5 Large Area Certification (LAC)- Benefits and Outcomes

Farmer-Level Benefits

- Enhanced credibility and recognition of organic produce,
- Improved access to premium markets and value chains,
- Strengthened farmer institutions and collective action.

Environmental Benefits

- Conservation of soil health and marine ecosystems,
- Prevention of chemical contamination in lagoons and coral reefs,
- Sustained biodiversity and ecological resilience.

Institutional and Policy Impact

- Strengthened convergence between UTLA, KVK, and farming communities,
- Creation of a replicable governance model for island and fragile ecosystems,
- Alignment with national goals of sustainable and climate-resilient agriculture.

4.6 Policy Implications and Recommendations

To consolidate and upscale the gains, the following policy measures are recommended:

- Certification of agricultural products has improved the remuneration received by farmers.
- The Government should supply quality seeds and organic fertilizers at subsidised rates.
- Strengthening organic value chains and branding of Lakshadweep produce,
- Developing island-specific organic standards and traceability systems,
- Enhancing market linkages, logistics, and digital platforms,
- Integrating organic farming with eco-tourism and blue economy initiatives.

4.7 Conclusion

Lakshadweep's unique geographical isolation, community-enforced ban on chemical inputs, and traditional ecological farming practices position it as an organic territory by default. The coordinated efforts of KVK Lakshadweep and the Department of Agriculture, UTLA, have institutionalised these practices through scientific validation and certification. With sustained policy support and strategic investments, Lakshadweep can emerge as a national model for sustainable island agriculture, ensuring food safety, ecological conservation, and enhanced livelihoods for its residents.

Rejuvenating Senile Coconut Plantations for Sustainable Yields and Farmer Prosperity

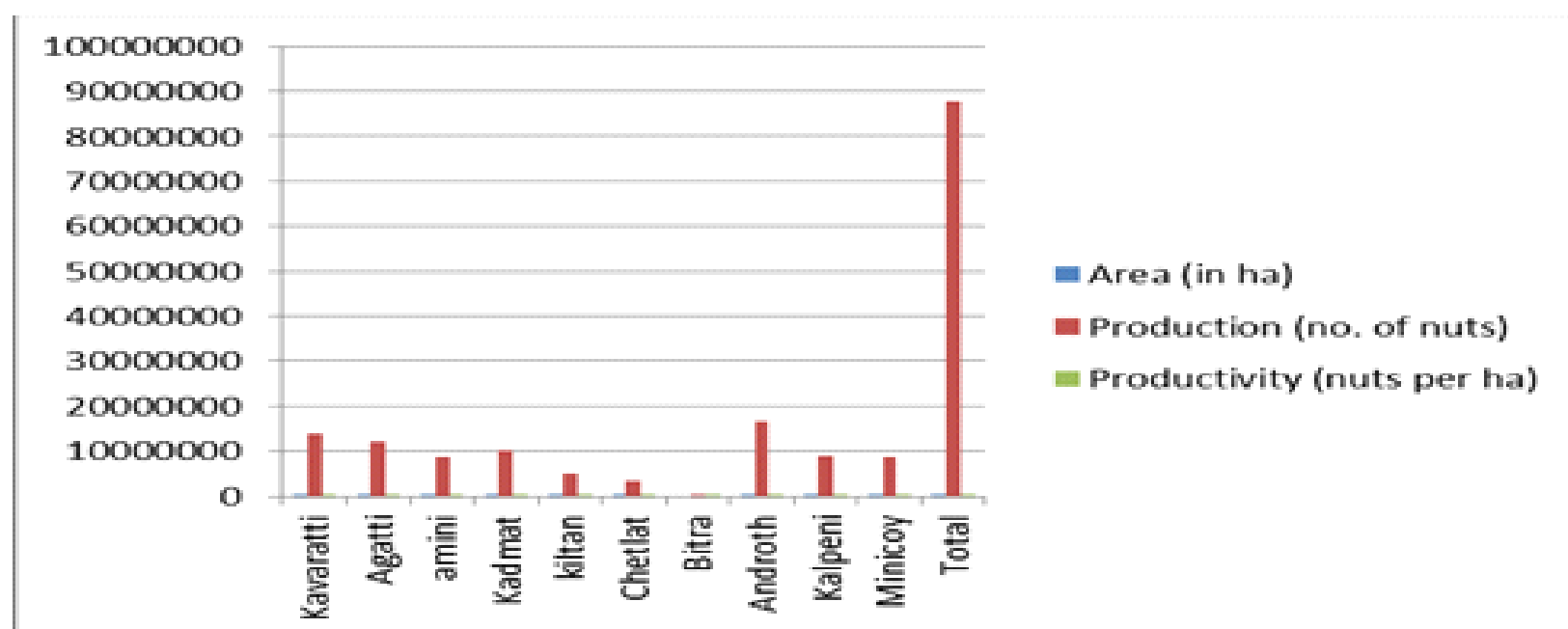
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5.1 Executive Summary

Coconut cultivation is the backbone of agriculture-based livelihoods in Lakshadweep, contributing significantly to household income and food security, second only to fisheries. The Union Territory has a coconut area of 2,674.87 ha, with an estimated production of 87.61 million nuts with an average productivity of 306,237 nuts ha⁻¹. Since 2005, the prohibition on chemical inputs has made all farming systems in Lakshadweep inherently organic, enhancing the market potential of coconut and its value-added products. Despite this advantage, coconut production has declined sharply due to the high prevalence of senile and unproductive palms, many exceeding 60 years of age. These palms produce 30–50% fewer nuts compared to palms in the optimal productive age group (15–50 years). Unless systematically replaced, senile plantations threaten farm incomes, raw material availability, and export earnings. Multiple institutions viz., Department of Agriculture, Coconut Development Board (CDB), and ICAR– KVK Lakshadweep are undertaking rejuvenation initiatives. Field-level evidence highlights the urgent need for systematic replanting, expanded nursery capacity, improved logistics, and income support mechanisms during the juvenile phase of new plantations.

5.2 Policy Context and Problem Statement

Lakshadweep, India's smallest Union Territory situated in the Arabian Sea, comprises 36 coral islands, covering an area of 32 square kilometres, with a population of 64,429 (2011 Census) inhabiting ten of these islands. Coconut is the principal agricultural product of the region, with a total production of 87,609,378 metric tonnes and productivity of 306,237 nuts per hectare across 2,674.87 hectares.



Area, production and productivity of different island of Lakshadweep

Coconut wood possesses unique structural characteristics viz., high fibre density and gradient distribution and making palms resilient to cyclones, storm surges, and tsunamis.

During February 2022, a team of scientists from ICAR-CPCRI, Kasaragod and KVK- Lakshadweep conducted interface programmes in different islands with coconut farmers, entrepreneurs, palm climbers and tappers. During the interaction sessions in these programmes farmers and other participants opined that there is decline in coconut productivity.

However, the sector faces multiple constraints: small and fragmented holdings, overcrowding of palms, prevalence of senile trees, limited inter- cropping, shortage of skilled climbers, high labour costs, pest and disease outbreaks, micro-

nutrient deficiencies, low product diversification, and inadequate transport, storage, and marketing infrastructure. Senile coconut palms generally over 60 years old in tall varieties and 40-50 years in dwarfs exhibit significant declines in nut yield, copra production, and economic value. Physiological degeneration results in reduced leaf production, smaller and fewer fruit bunches, poor fruit setting, and heightened vulnerability to pests, diseases, and environmental stress.

Without timely replanting, these plantations contribute to reduced productivity, threatening both livelihoods and export earnings. Rejuvenation of coconut plantations through phased removal of senile palms, replanting with improved varieties, and integrated organic management is essential to



Problem Statement

- Over **50–60% of coconut palms** in Lakshadweep are senile and beyond peak productivity
- Senile palms show **reduced leaf emergence, poor fruit set, smaller bunch size**, and higher susceptibility to pests, diseases, and climatic stress
- Small, fragmented landholdings and **overcrowding of palms** limit replanting efforts.
- Acute **shortage of skilled coconut climbers** and high labour costs increase maintenance expenses
- Limited diversification, inadequate post-harvest infrastructure, and weak market linkages constrain farmer profitability
- Farmers face income loss during the 4–5 year juvenile phase after replanting, discouraging removal of old palms.

5.3 Interventions Strategy and Implementation

1. Department of Agriculture and Coconut Development Board (CDB)

The Department of Agriculture, in close collaboration with the Coconut Development Board, is implementing multiple measures aimed at mitigating the decline of coconut productivity in Lakshadweep. These measures are focused on both short-term relief for farmers and long-term sustainability of coconut plantations:

a. Distribution of Dwarf Coconut Variety 'Ganga Bondam'

- The dwarf variety *Ganga Bondam* has been selected for its early bearing ability, starting to produce nuts within approximately four years of planting
- Its short stature (~3 m at maturity) makes it easier for farmers to manage palms without reliance on highly skilled climbers, thereby reducing labour costs and safety risks associated with coconut harvesting
- This variety is high-yielding and well-suited to the saline and fragile soil conditions of the Lakshadweep islands. Its early productivity contributes to faster recovery of income for farmers during the replanting phase.

b. Financial Assistance for Removal of Diseased and Senile Palms

- Farmers are provided with monetary support to safely remove old, unproductive, and disease-affected palms.
- This incentivizes the staggered replacement of senile palms, ensuring a systematic rejuvenation of plantations without causing abrupt income loss.
- The program also includes technical guidance on safe felling, transport, and utilization of removed palms for timber, oil, or fuel, thereby reducing environmental waste.

c. Crop Insurance Coverage for Coconut Climbers

- Coconut harvesting in Lakshadweep is labor-intensive and hazardous due to the height and density of palms.
- The Department and CDB provide insurance schemes for coconut climbers, ensuring coverage against accidental injuries or fatalities during harvesting operations.

Scheme on Replanting and Rejuvenation of Coconut Gardens (R&R) of CDB

This scheme is to increase production and productivity of coconut by promoting adoption of cutting and removal of disease advanced, old, and senile palms and integrated management practices to address state specific problems in coconut. A subsidy @ Rs.1000 per palm, subject to a maximum Rs.32000/ha shall be provided to the farmers for cutting and removal of disease advanced, old, and senile palms.



- This measure enhances safety, encourages continued engagement in coconut harvesting, and reduces the financial vulnerability of families dependent on climbers for livelihood.

2. Krishi Vigyan Kendra (KVK), Lakshadweep

KVK Lakshadweep is playing a pivotal role in research, demonstration, and farmer training, bridging the gap between scientific knowledge and local agricultural practices:

Establishment of FPO-Managed Coconut Nursery at Kavaratti

- A Farmer Producer Organisation (FPO)-managed nursery has been established to produce 500–600 quality seedlings per production cycle, ensuring a steady supply of healthy and genetically superior planting material.
- The nursery produces both hybrid and stress-tolerant coconut seedlings, suitable for saline soils, drought-prone areas, and high-wind zones of the islands.
- Centralized nursery management ensures disease-free seedlings, uniform growth, and optimal planting age, addressing limitations of previous farmer-saved seed nut systems.



Introduction of Hybrid and Stress-Tolerant Varieties in Collaboration with ICAR-CPCRI

- KVK works closely with ICAR-CPCRI to introduce high-yielding hybrids / varieties with improved resistance to pests, diseases, and environmental stresses.
- These varieties demonstrate earlier and higher nut production, better copra quality, and enhanced resilience to cyclones, salinity, and nutrient deficiencies.
- Adoption of these varieties is promoted through on-farm trials and demonstration plots, allowing farmers to directly compare performance and productivity.

Capacity Building, Training, and Exposure Visits

- KVK organizes regular training programs, workshops, and field demonstrations to educate farmers on integrated coconut management practices.

Key training topics include:

- Soil fertility management using organic manures
- Irrigation and drainage optimization
- Integrated pest and disease management (IPDM)
- Optimal planting densities, intercropping strategies, and canopy management
- Exposure visits to model farms and nurseries enable farmers to observe best practices and replicate them in their own holdings.
- These initiatives enhance adoption of scientific practices, increase yield, and strengthen the link between research institutions, extension services, and farming communities.



Integrated Rejuvenation Package

The integrated management approach promoted includes

- Soil-test-based organic nutrient management
- Basin management, mulching, and weed control
- Soil and moisture conservation
- Drainage improvement
- Botanical and bio-agent-based plant protection
- Regulation of palm density and shade
- Promotion of intercropping and mixed farming systems

Integrated Rejuvenation Package of CDB

If farmers are adopting Integrated management practices, a subsidy of Rs.17500/ha will be provided in two annual installments of Rs.8750/-each ie 25% of cost (Rs.70,000/ha) in two equal installments by CBD. The maximum eligibility for availing assistance under this component is 4 ha per beneficiary.

5.4 Key Outcomes, Evidence and Benefits

i. Declining Productivity of Senile Coconut Palms

- A substantial proportion of coconut palms in Lakshadweep have crossed 60 years of age, placing them in the senile and economically unproductive category.
- Field assessments indicate that senile palms produce 30–50% fewer nuts compared to palms in their prime productive phase (15–50 years).
- The productivity decline is linked to physiological degeneration, manifested as reduced leaf emergence, poor inflorescence development, low fruit set, and smaller bunch size.
- Senile palms also exhibit increased susceptibility to pests, diseases, and climatic stresses, further accelerating yield losses and undermining plantation resilience.

ii. Effects of Overcrowding and Inadequate Replanting

- Traditional planting layouts, coupled with fragmented landholdings, have resulted in overcrowded plantations, restricting sunlight interception, root expansion, and nutrient uptake.
- Limited and delayed replacement of senile palms has progressively reduced per-hectare productivity, affecting both nut yield and copra output.
- The coexistence of old palms and high planting density has increased management complexity, raised labour requirements, and lowered net economic returns for coconut growers.

iii. Role of FPO-Managed Nursery in Improving Access to Quality Planting Material

- The establishment of an FPO-managed coconut nursery at Kavaratti has substantially reduced reliance on farmer-saved seed nuts, which were often genetically inferior and low yielding.
- The nursery supplies disease-free, hybrid, and stress-tolerant seedlings, resulting in higher establishment success, improved early vigour, and uniform crop stands.
- Centralized seedling production and distribution have enabled timely, equitable, and planned replanting across islands, supporting systematic plantation rejuvenation.

iv. Adoption of Improved Agronomic and Plantation Management Practices

- Capacity-building initiatives, demonstrations, and advisory support have accelerated the adoption of recommended planting densities, improved hybrids, and integrated organic management practices.
- Farmers are increasingly implementing soil-test-based nutrient management, organic amendments, intercropping systems, and integrated pest management, enhancing productivity and ecological sustainability.
- These interventions have strengthened farmer confidence and acceptance of staggered removal of senile palms, ensuring income continuity during the transition period.
- Early evidence suggests that the integrated approach can restore coconut productivity, reduce vulnerability to climatic and biotic stresses, and improve long-term farm incomes in Lakshadweep.

5.5 Policy Recommendations

i. Phased Removal and Replanting of Senile Palms

Adopt an island-wise, phased strategy to remove and replace 5–10% of senile coconut palms annually, ensuring continuity of production and minimizing income shocks to farm households.



ii. Promotion of Improved Coconut Varieties

Scale up the production and distribution of **high-yielding, pest- and disease-tolerant dwarf and hybrid coconut varieties** specifically suited to island agro-ecological conditions

iii. Income Support During the Juvenile Phase

Introduce **direct income compensation, conditional cash transfers, or alternative livelihood support** for **4–5 years** following replanting, until palms reach economic bearing.

iv. Expansion and Strengthening of Nursery Infrastructure

Strengthen **FPO-led, KVK-supported, and departmental nurseries** to ensure **year-round availability of certified, quality planting material** within the islands.

v. Capacity Building and Extension Intensification

Intensify **farmer training, on-farm demonstrations, exposure visits, and awareness campaigns** focusing on coconut rejuvenation technologies and best management practices.

vi. Strengthening Research–Extension–Farmer Linkages

Enhance institutional coordination among **ICAR institutes, Coconut Development Board (CDB), UT Administration, KVKs, and FPOs** to accelerate technology validation, dissemination, and adoption.

vii. Intercropping for Income Diversification

Promote **short-duration intercrops such as banana, tapioca, pineapple, and pulses** during the **first 3–4 years of plantation establishment** to generate interim income and improve system productivity.

viii. Soil Health and Moisture Management

Encourage the adoption of **organic mulching, green manuring, compost application, and biomass recycling** to enhance soil fertility, moisture retention, and long-term plantation resilience.

5.6 Conclusion

Coconut cultivation is a vital livelihood in Lakshadweep, contributing significantly to rural incomes and organic produce markets. However, productivity has declined due to the prevalence of senile palms, overcrowding, and limited replanting, with palms over 60 years yielding 30–50% less than productive palms aged 15–50 years. To address this, coordinated interventions by the Department of Agriculture, Coconut Development Board, KVK- Lakshadweep, and Farmer Producer Organisations focus on:

- Distribution of dwarf varieties like *Ganga Bondam* for early bearing and manageable height
- Establishment of FPO-managed nurseries producing 500–600 quality seedlings per cycle to reduce dependence on farmer-saved seed nuts
- Integrated management practices including organic nutrient management, intercropping, pest and disease management, and recommended spacing
- Capacity building and training to enhance farmer awareness and adoption of improved agronomic practices

These efforts aim to gradually replace senile palms, restore per hectare productivity, improve farmer income, and enhance the sustainability and resilience of coconut plantations in Lakshadweep.

Towards a Resilient and Prosperous Agriculture in Lakshadweep

Key Strategies for Sustainable and Climate-Smart Agriculture

Lakshadweep's agriculture and allied sectors, anchored in its unique Island ecosystem, hold immense potential for food and nutritional security, livelihood enhancement and climate resilience. These policy briefs highlights key strategies and actionable recommendations to promote sustainable agricultural practices, strengthen value chains, enhance climate adaptation, and improve the livelihoods of farming communities in Lakshadweep.

Drawing from field experiences, research insights and stakeholder consultations, these briefs suggests priority interventions for a resilient, prosperous and green Lakshadweep.



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