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Community farm school approach for coconut seedlings/juveniles through collaborative social actions

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Abstract

Three Grama Panchayats in Kerala's Alappuzha district undertook community-level participatory action research in 2019–2021. A total of 90 coconut farmers participated in the adoption of ICAR-CPCRI technology to produce West Coast Tall (WCT) coconut seedlings that are resistant/tolerant to the root (wilt) disease at the community level. Partners included extension agents, coconut producers' societies (CPS) and clusters, women self-help groups (WSHGs), and agricultural labor organizations. The characteristics of technologies that are suggested for adoption in root (wilt) disease-affected tracts, such as the scientific management of young coconut trees and the production of high-quality seedlings through community nurseries, challenge the idea of adoption. There are a lot of variances in the homestead gardens' marginal holdings, including expertise, the use of technology, and access to advisory services. Government agencies provided the majority of the seedlings and extension advisory services, emphasizing the necessity for FPO-based or private extension in the coconut growing industry. The coconut farmers' understanding has significantly improved as a result of the participatory interventions for managing seedlings. The participatory demonstration and community farm school (CFS) strategy is discussed in the paper as a way for homesteads to manage juvenile coconuts while integrating new ideas and fostering cross and reciprocal learning. Refining the current extension approach requires integrating new knowledge about the characteristics of seedling growth, future economic performance, and social evaluation of choices of technological, individual, and skill-oriented interventions in risk-prone areas with debilitating root (wilt) disease.

Keywords: Coconut homestead profile, Root (wilt) disease, Seedling loss, Technology attributes

Introduction

Kerala, Tamil Nadu, Karnataka, and Andhra Pradesh are the leading coconut-growing states in India, which produces 31% of the world's coconuts. From 2000 to 2018, Kerala, Karnataka, and Tamil Nadu saw growth in coconut productivity of 68.85, 52.78, and 25.47 percent, respectively (Division of Horticulture, Ministry of Agriculture Development and Farmers Welfare, GOI, Department of Agriculture and Cooperation, 2021-2022). A perennial palm, coconut, has several growth stages, including seedlings, juveniles up to three years old, and then the non-productive pre-bearing stage. The time required to reach the economic phase of bearing, which provides yield and income to the growers, varies according to the cultivars, varieties, and management techniques used. Development and dissemination of technologies are critical for improving productivity, risk aversion and resilience in small and marginal holdings (Inter Academy Partnership, 2018), basically rooted in technology generation, participatory trials and transfer (Thornton *et al.,* 2017). Sources of information are very diverse and multi-pronged, from formal research, traditional knowledge and skills, experiential knowledge, informal knowledge sources, and formal extension sources within the innovation systems (Douthwaite *et al.,* 2001 and Sumberg, 2005). The technology adoption among coconut farmers indicated wide range among various studies, Anithakumari *et al.,* (2015), Anithakumari (2007), Krishnamurthy *et al.,*

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(2010) and Subhathma (2018). Khalfan (2015) reported from Tanzania an entirely different scenario among smallholder farmers as having negative attitude towards improved technologies for coconut production, with very low or absence of technology adoption. This showed region-wise, wide variation in technology adoption of various aspects of coconut cultivation, which demand appropriate extension strategies and approaches. Rogers (2003) stated that process of innovation-diffusion reduce the uncertainty in adoption, based on attributes of innovation. These are the five characteristics such as relative advantage, compatibility, complexity, trialability, and observability. He observed that these attributes predict the innovations adoptability. The studies on the rate of adoption and the perceived characteristics of innovations need explorations in the case of perennial crops like coconut, especially in risk prone diseased tracts. As a result, from 2019 to 2021, three Grama Panchayats in the Alappuzha district of Kerala State viz., Chunakkara, Bharanikkavu, and Vallikkunnam took part in a participatory demonstration and community coconut farm school (CFS). The objective of the study was to evaluate the farm and farmer profiles, examine knowledge and adoption levels, and evaluate the effectiveness of interventions carried out as part of participatory programs in the area impacted by the coconut root (wilt) disease.

Materials and methods

The study was undertaken in participatory mode from 2019 to 2021 at three panchayats of Bharanikkavu block, which is a root (wilt) disease-affected coconut tract of Kerala state. Ninety coconut farmers participated in raising root (wilt) disease-tolerant coconut seedlings, with ICAR-CPCRI technologies. Field level extension officials, Coconut Producers Societies (CPS)/clusters, Women Self Help Groups (WSHGs) and farm labor groups were also partners. Primary intervention was participatory capacity building of farmer clusters, in identifying healthy root (wilt) disease free mother palms as per scientific norms fixed by ICAR-CPCRI from farmers' gardens. Seed nuts were QR tagged immediately after collection in the field itself to ensure source credibility and procured providing premium price to the farmers. Community based coconut nurseries established in the three panchayats for producing quality bio-primed poly-bag seedlings of West Coast Tall (WCT). Bio priming was done using 'Kera Probio' (ICAR-CPCRI product) 50 g in each polybag. Each cluster raised 2000 seedlings per annum utilizing a revolving fund of Rs. 50000, which was managed, in joint bank accounts of respective Agricultural Extension Officers and farmer cluster leaders. Demonstration of scientific seedling management practices for existing ones in farmers' gardens, and those supplied by community nurseries, were implemented in 90 farmers gardens. Community coconut farm school (CFS) approach was implemented in this case as an innovative extension approach. CFS comprises of analysis of technology needs, gaps in skills and scope for integration of community experiences. This approach enabled the diffusion of information among participants, across innovators to laggards, gender, and resource variations, among farmers. The data on farmer and crop profiles and the impact of interventions was collected through telephonic interviews and field observations. The data were analyzed using statistical tools viz., frequencies, percentages and t-tests.

Results and Discussion

The results of the study are furnished as socio-economic profile of farmers and the coconut based homesteads, of the root (wilt) disease tracts which serve for evolving customized outreach and research strategies. The age wise profile of coconut palms showed wide variations in knowledge and management requirements, field problems, technology dissemination methods, coconut consumption, harvest and marketing, are described in this section.

Socio-economic profile of the coconut farmers

The socio-economic profile of the coconut farmers reflects on the varied resource base of farmers in technology access and adoption. The personal profile of the participant farmers indicated that 34.27 percent among them are in the age category of 40 – 60 years and 65.73 percent are 61 years and above, showing the decline of youths engaged in coconut cultivation. This warrants policies and interventions to attract the youth towards coconut and coconut-based homestead systems, with technologies and integration of value chain and entrepreneurship in the coconut sector with responsive research and extension systems. Man and Shah (2020) reported that majority coconut farmers were between 50-89 years of age. The younger-aged farmers of 40-49 constituted the least seven percent.

The study respondents were literate (52.70 percent up to SSLC), 2.85 percent postgraduates and the rest plus two, diploma or degree qualified. Realizing decent income from small and marginal holdings is difficult in a consumer state like Kerala, with high costs for inputs, logistics, and labour, having a low marketable surplus production. One-fifth of the respondents (21.42 percent) earn their livelihood from farming, while 45.70 percent were either retired government staff or ex-servicemen (34.28 percent) or Gulf returnees (11.42 percent) and the others were having coconut cultivation combined with small business or skilled labour. It clearly indicated the prevailing absentee farming. Anithakumari *et al*. (2012) reported that only 11.03 percent of farmer's livelihood was from farming alone. The occupation profile and the age categories seem to be related. Hence, it demands for value chain systems of high resource efficiency and appropriate mechanization for reducing drudgery and labour requirements, rather than advocating package of practices for crop management alone. The respondents had a minimum of 10 years of experience (14.28 percent) in coconut farming (11-30 years for 37.13 percent, and 31-50 years among 42.83 percent of respondents and above 50 years for 19.99 percent). Man and Shah (2020) also reported similar results. Region wise participatory extension approach involving social actions is required for technology demonstration of seedlings and juvenile coconut management. The coconut palm profile in homesteads showed wide variations in area, age of seedlings, pre bearing and bearing palms, and demanding for refinements in existing extension and research systems.

Palm profile of coconut-based homestead systems

The area under coconut in the homesteads of sample respondent farmers revealed that all of them owned marginal size landholding only. The results indicated that 28.57 percent of farmers had more than one acre (0.4ha) of land, 22.85 percent had 51 cents to one acre, and 48.57 percent had land area below 50 cents. These results were in line with the report of Anithakumari *et al.* (2012). Batugal (1999) reported that the majority of coconut plantations in Indonesia belong to smallholders (98.7%), while the rest belong to private and state-owned enterprises.

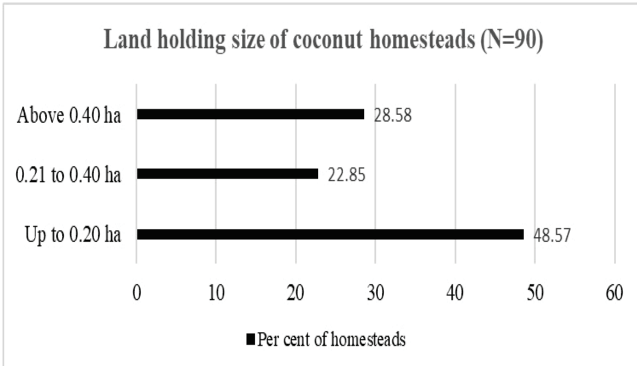

Fig. 1. Profile of holding size of coconut based homesteads (n=90)

A look into the number of seedlings per homestead indicated that 37.14 percent do not have any seedlings, 28.57 percent had 1 to 10 numbers, 8.57 percent had 11 to 20, 14.28 percent had 21 to 30 and 11.42 percent had 31 to 50. The decisions of farmers to plant coconut seedlings may have been determined by factors like total land under coconut, the attitude of the farm family, land type, dependence on farm income, risk factors etc. Anithakumari *et al.* (2012) found that all the coconut gardens surveyed had 25 to 30 percent of seedlings. But, in this study, third of the surveyed gardens are devoid of seedlings/juveniles requires analysis and corrections in terms of research and extension paradigms. This scenario summons further study on under planting or new planting of coconut seedlings in small and marginal land holdings. A similar scenario is that two-year-old juvenile palms were absent in 24.28 percent and three-year-old seedlings in 42.85 percent of the sampled holdings (Figures 2,3 & 4).

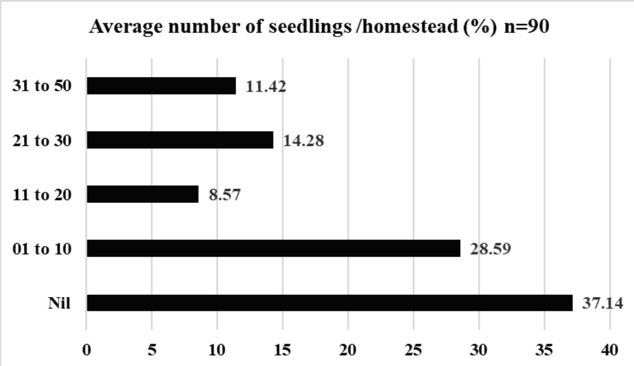

Fig. 2. Age wise profile of coconut palms in homesteads

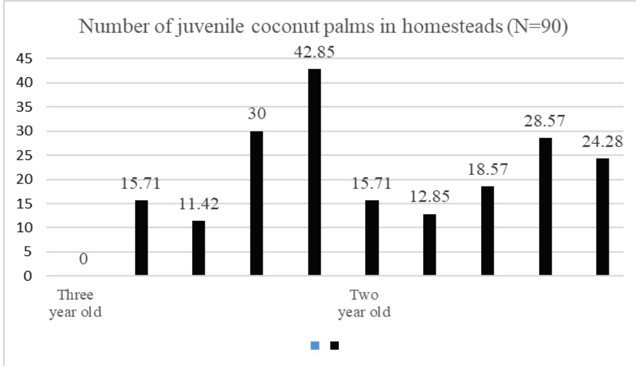

Fig. 3. Scenerio of juvenile coconut palms in homesteads (n=90)

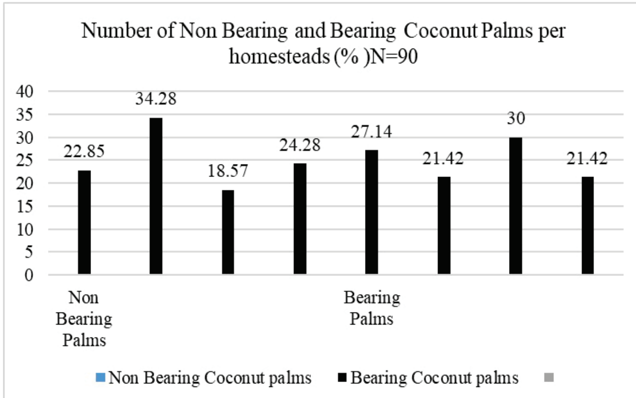

Fig. 3. Scenerio of juvenile coconut palms in homesteads (n=90)

The variations in the number of pre-bearing and bearing coconut palms showed that all the sampled holdings had these categories. Out of the total coconut palms per homestead, 46.50 percent were in the bearing or economic growth stage. Age categories of existing non-bearing palms including juveniles and seedlings showed diversity viz., non-bearing palms above three years (17.48%), three-year-old juveniles (10.25%), two-year-old juveniles (15.27%), and one-year or below-old seedlings (10.50 %), a pointer to the diverse resource needs of coconut farmers, in terms of knowledge and skills for management. The farmers were of the opinion that, risks of incidence of root (wilt) disease affect the health of palms, lack of policy support for scientific under planting in existing gardens, and loss due to red palm weevil and rhinoceros beetle infestations at a young age are reasons for this type of varied age group of palms even in small and marginal land holdings, as a local resilience practice. Profits from the bearing palms have to be invested by the farmers in the proper management of the non-economic growth stages of coconuts, which may be one of the reasons for the low investment for adoption of recommended practices for non-bearing or juveniles or seedling stages. The field realities must be considered while recommending practices/ inputs for homesteads. The theory of affordances, put forward by Gibson (1966) defined as the available situational or environmental resources including their knowledge, decision-making intelligence, economic resources, gender, mental capabilities, and cultural and social behavioral norms, for different agricultural domains. The social and personal assets or resources of homestead coconut farmers are of wider affordability and warrant refinement in extension approaches for technology dissemination rather than categorizing them as poor adopters.

Crop and farming diversity in coconut homesteads

Intercrops are integral in homestead systems, such as tubers, spices, bananas/fruits, and vegetables which were the most adopted. The area under inter crops in coconut homestead gardens, varied with farmers' interests, family involvement, food preferences, and market demand. Tubers and bananas had a immediate market demand preferred for domestic consumption. Mixed crops like nutmeg, were cultivated in more than 0.3 ha among surveyed gardens. Nutmeg is an upcoming crop as per the farmers' perceptions offering a decent annual income of Rs. 2000-4000 per tree. The data indicated that only 4.28 percent of coconut gardens had no intercrops. Among sample respondents, 21.42

percent cultivated intercrops in an area of 21-50 cents, 24.28 percent is 51-100 cents and more than an acre by 8.5 percent of respondent farmers. The results showed that the coconut farmers' gardens in the root (wilt) affected locations reflected wide variations in terms of the age of the palms, economic returns, resource base of land/ farmers, and management requirements. The changed food choices and preferences of family members, market-dependent consumer behaviours in diet, lifestyle shift towards eating out of home, and ready availability of an array of indigenous and exotic foods contributed to change in food systems followed, which were formerly dependent on local agriculture production. Ruales *et al.*, (2020) reported that farmers prioritized intercropping and improved coconut varieties as climate-resilient practices. Mendoza *et al.,* (2018) indicated that coconut with banana or fruit trees such as mango, durian, mangosteen, coffee, and cacao can generate the highest revenues than mono-cropping. Similarly, De Guzman *et al.,* (2015) recommended the practice of diversified and integrated farming systems, coconut-based multi-storey system in Cavite, Philippines. Besides, Rodriguez *et al.,* (2007) reported that intercropping coupled with improved access to credit and technical assistance contributed to better outcomes in coconut farming.

The homestead component profile of the coconut gardens indicated variations in the number and size of crops and farming components. About 21.42 percent of coconut farmers had poultry layer birds ranging from 25 to 100 numbers per unit. Around 7.1 percent reared ducks. Similarly, goat rearing adopted among 7.14 percent of homesteads with 2 to 7 animals. Livestock offered regular daily and monthly income to farmers. Twenty percent of the respondents owned 1 to 5 milch animals, but none of them had indigenous breeds. The adoption of IFS components is either discontinued or discarded due to the shift from farming as a major income source, sub-fragmentation of coconut holdings, and socioeconomic changes over time, as perceived by the respondents. Among the respondents, 15.72 percent maintained homestead farm ponds for irrigation and fish culture for family consumption.

Adoption of juvenile palm management practices

Scientific management of seedlings and juveniles are critically important in realizing sustainable yield and health of palms, particularly in the root (wilt) disease affected areas. The characteristics considered were the source of coconut seedlings, coconut varieties, pit size for planting, spacing, mulching, mechanization, plant protection, seedling losses, source of advisory services and adoption. Krishibhavan (Extension office) of the respective panchayats were the major source of coconut seedlings among the respondents.

Table 1. indicated major sources for coconut seedlings among the farmers as Department of Agriculture and one-third of them raised seedlings from the mother palms of their gardens. A quarter of the respondents obtained seedlings from ICAR-CPCRI also, due to the proximity. Similar pattern was reported by Man and Shah (2020). They found that multiple sources for obtaining seedlings or seed nuts were utilized by farmers, as observed in this study also. The field observation and group discussions before project implementation indicated that the coconut farmers are following the traditional methods of selecting mother palms, seed nuts, and seedlings. But 73.2 percent of them could not identify all the symptoms of root (wilt) disease-free mother palms correctly. The project was designed with the hypothesis that community-level selection procedures and nursery management improve cross-learning, experiential skills, knowledge, and adoption of scientific techniques in farming.

Table 1. Sources of coconut seedlings among small and marginal homestead farmers (n=90)

Sl. No.	Seedling source	Percent
1	Krishibhavan	32.85
2	Own seedlings	21.42
3	Krishibhavan + ICAR-CPCRI	15.71
4	ICAR-CPCRI + Own	5.71
5	Krishibhavan + ICAR-CPCRI + Own	7.14
6	Krishibhavan + Own	7.14
7	Friends + ICAR-CPCRI + Own	5.71

The data also indicated that 71.42 percent of farmers adopted seedlings of West Coast Tall (WCT) and 1.42 percent of dwarf varieties. Dwarfs and DxT hybrids are preferred, for their dwarf nature due to the shortage and high charges of palm climbers for plant protection and harvesting. Hybrid seedlings (one to five) were planted, by 7.14 percent of farmers as new planting or under planting, 17.14 percent of the respondents adopted WCT and dwarf seedlings, and 2.55 percent WCT and hybrids. Inadequate and non-availability of quality seedlings of dwarf and hybrids was reported by 88.3 percent of respondent farmers. This demands concerted efforts in educating coconut farmer communities in the root (wilt) disease-affected areas to have disease-free, high-yielding seedlings of local WCT mother palms as a social action in convergence with relevant stakeholders. Community-level mother palm gardens of WCT and dwarf varieties as a social action /policy could bridge the gap and cater to the future production of hybrids too. Man and Shah (2020) stated that although the attitude and knowledge level among coconut growers toward the new coconut seed is high, the extension agencies must enhance their commitment to transfer the knowledge and information on the new seed. Anandu (2016) indicated that the occurrence of pests and diseases, high input cost, lack of irrigation facilities, shortage of trained tree climbers and lack of scientific knowledge in coconut production, price fluctuations, lack of market information, and inadequate storage facilities were the problems faced by the coconut farmers.

From the Table 2 it is inferred that pit size for planting, spacing between seedlings, and soil testing were adopted, by more than 75 percent of sampled farmers. The improvement in soil sampling reflects the concerted field efforts with the linkage of Department of Agriculture and Farmers' Welfare, KVKs and Research Institutes. Regarding the adoption of spacing, field-level adoption in individual plots does not reflect spacing in a contiguous coconut area. Marginal and sub-marginal fragmented holdings require community-level coordination and social decisions in deciding scientific coconut palm density in a unit area. Integrating organic and inorganic fertilizers attained acceptance among farmers even though the appropriate adoption of recommended quantities is not in practice unless supported by projects or schemes. The findings showed that 74 percent of the respondents used fertilizers in their gardens and majority of respondents reported using organic inputs (cattle manure, chicken manure, ash, oil cakes, common salt and dried fallen leaves), and the remaining used inorganic fertilizers during planting. Irrigating seedlings is practiced mostly, by hose irrigation since seedlings are under planted, in majority of gardens. High labour charges and scarcity shifted farmers towards mechanization. Institutionalization at decentralized levels through *Karshika Karmasena* (Farm technical support groups supported by local self-governments) is a welcome step.

Table 2. Adoption of seedling management among coconut-based homestead farmers (n=90)

Category	Technologies	Percent
Planting of seedlings	Pit size	90.22
	Spacing	82.85
	Soil testing	74.28
Nutrient management	Integrated nutrient management	92.85
	Chemical fertilizers only	1.42
	Organic fertilizers only	5.71
Irrigation management of seedlings	Rainfed	14.28
	Drip	2.85
	Hose	75.71
	Manual (collecting in pitcher/container for irrigation)	5.71
	Mulching	85.71
Mechanization for intercultural operations	Tractor Tiller	48.57
		11.42
		25.71

Table 3. Coconut seedling loss in gardens of coconut homestead farmers

Age of Juvenile palms	Percent of coconut gardens reported
I year	65.71
II year	22.85
III year	10.0
IV year	01.42
Causes for loss	**Loss in coconut garden (%)***
Loss by rhinoceros beetle (> 10 numbers/year)	78.57
Loss by rhinoceros beetle (10 – 20 numbers /year)	11.42
Flood	10.00
Drought	5.71
Others (Cattle Physical damages)	17.14

*Multiple causes of loss

Loss of seedlings due to pests and other factors leads to economic loss for farmers considering the cost of seedlings, labour charges for taking pits, and management. The major factor reported by farmers is infestation by rhinoceros beetle, in the early stages. Table 3 clearly shows that pest infestation is high in the first year of establishment and with the aging of palms, the loss is gradually reduced. Rigorous scrutiny, management, and surveillance by the farmers are essential during the early growth stages. Farmers opined that changing climate conditions and the cost of adoption needs quest for innovations and adaptations.

Table. 3 indicated that coconut farmers should take intensive observation and management of seedlings for up to 4 years rather than routine checks in the root (wilt) disease-affected areas. Khalfan (2015) reported that 56 percent of the respondents had faced the challenge of the unavailability of improved varieties/seedlings and livestock raids. The majority of the respondents (82%) specified that despite the adoption of improved technology, farmers fail to control pests (coreid bug, rhinoceros beetle, and termites) in coconut production, while 15% of the respondents indicated that there were no changes due to the adoption of management practices of the major pests and 3% of the respondents had managed to control the pests. Seguin (2010) also reported that rhinoceros beetles were most threatening pests in all coconut growing areas infesting 47 percent of coconut palms, followed by coconut mites (5%) and coreid bug (1.3 %).

Table 4. Advisory service sources on coconut seedling/juvenile management (n=90)

Training sources	Percent
Krishibhavan	17.14
ICAR-CPCRI	21.42
Krishibhavan + ICAR-CPCRI	61.42
Advisory service sources	**Percent**
Krishibhavan	77.14
ICAR-CPCRI	4.28
Krishibhavan + ICAR-CPCRI	11.42
Krishibhavan + ICAR-CPCRI +Others	7.14

Training and advisory services are critical in improving the knowledge of farmers. Table 4 indicated that farmers preferred multiple sources of training programs and preferred research institutions for direct access to quality information, field and lab visits, and skill attainment. However, for advisory services, three-fourths of the farmers seek Department of Agriculture and Farmers' Welfare due to its proximity and easy access. This is an important consideration in designing reaching-out programs for farmers. Research institutions can give more effort to train extension officials of Krishibhavans in quality and authentic delivery of advisory services.

Coconut consumption

Coconut provides nutritional supplements in the daily diet of families in the state. The study showed that consumption varies among farm families based on family size, preferences, and availability. The monthly average consumption was up to 30 nuts among 41.42 percent of the families, 31-50 nuts by 37.1percent, 51-60 nuts by 12.85 percent, and more than 60 nuts per month by 8.57 percent of respondent families, indicating the case of consumption of at least one fresh coconut a day among the sampled families in their diet. But in the case of coconut oil, one-third of them are not consuming coconut oil due to high prices and preference for other oils and 70 percent of the families consumed an average of one litre of coconut oil per month. The need for evoking scientific awareness regarding the nutritional and health benefits of coconut and coconut products is the indication.

Harvest and marketing of coconuts

The availability and charges of coconut climbers are a growing worry among most of the coconut homestead farmers in Kerala. The data showed that 17.14 percent of the sampled farmers regularly harvest the palms once in 45 days, whereas 75.71 percent once in 60 days and 7.14 percent only once in 90 days. The farmers lamented that the quality or skill of coconut palm climbers deteriorated, especially in carrying out regular plant protection, crown cleaning, and management of affected palms which was done earlier along with harvesting. This critical gap is affecting the health and yield of palms which cannot be done by general farm labourers or coconut farmers per se.

A look at the total nuts marketed per year, a fifth of the sampled farmers sold up to 500 nuts per year, 10 percent among them sold 500 to 1000 nuts, 24.28 percent had 1000 to 2000 nuts for marketing and 15.17 percent sold 2000 to 3000 nuts per year. One-fourth of the sampled farmers (25.71 percent) marketed 3000 to 4000 nuts and 4.28 percent only could market more than 4000 nuts per year from their homesteads, besides utilized for consumption in the family.

The data indicated need for clustering small and marginal coconut farmers for regular harvesting of palms in a stipulated area utilizing a batch of climbers under agreed-upon charges and procedures. The quantum of marketable surplus also pointed to the need for federating as FPOs for procurement, upgrading knowledge, and adoption of production technologies for improving productivity and quality of nuts and marketing the products benefiting the members as a coherent community.

Participatory demonstration and community coconut farm school approach

In coconut root (wilt) diseased tracts the community farm schools and participatory demonstrations have to start with identification of disease-free mother palms, community nursery management and continued management in farmers' gardens. Scientific management of coconut seedlings is critical in obtaining sustainable yield and health of coconut palms, particularly in the root (wilt) disease-affected tracts. Hall *et al*., (2000) reported that many research organizations in the public sector could not develop ground-level participatory and client-based intervention practices. Other mechanisms to improve participation and ownership of the farmers by being part of technology generation and utilization need to be explored suitably. Muliyar (1983) opined that the facilitation and extension of research through growers' associations could be a potential process toward the goal of participatory research and extension.

The necessity of clustering participants for a participatory, regional demonstration of coconut seedling management is essential for improving the current extension process. Through participant-driven observations, documentation, community farm school (CFS) on coconut production and seedling management, the fundamental justifications for the evolution of the approaches were well stated.

- The resource base of homestead coconut gardens is diverse, necessitating customized interventions posing challenge to extension systems.
- The quality, legitimacy, and consistency of the coconut seedlings in the farmers' gardens needed appraisal, as they are from a variety of sources, including public agricultural agencies, NGOs, other farmers, and own or private nurseries.
- Farmers need to be aware of the technologies and suggestions for each age group of coconut palms, since same gardens had palms of various ages.
- The quality of technology demonstration in one or few gardens is influenced by the awareness, knowledge, attitudes, perceptions, and management skills of the individual farmers and the generality of the results may not be applicable to community of farmers.
- Rather than managing seedlings, which has long term benefits that are more difficult to quantify financially and to convince in terms of technology attributes, local and state level coconut projects and programs are focusing on enhancing productivity and health management of bearing palms, which have direct and observable benefits to beneficiaries.

Hence, participatory demonstration and community farm school approach are needed for the case of seedlings and juvenile palms among coconut farmers. This may enable triangulation on the knowledge, performance of the technologies demonstrated and the factors which contributed to the positive or negative consequences. Laurens (2022) indicated farming entails much more than managing technical issues. A range of social, economic, financial, and human resource issues or physical and mental health factors of farmers and other farm workers come into play in overall farm management. The observation of Fiskova *et al.* (2021) on technology demonstration, maintains that it is aimed at the public good, and incorporates diverse learning and practical with tangible and sensory experiences as well, that are applicable to improve farmers' practices.

Coconut seedling management demonstration and community farm school approach encompasses this element of public good since the crop is perennial, physiologically cross-pollinated, and planted in a contiguous area of marginal land holdings. Studies have shown that interactive social networking of farmers, and peer-to-peer learning, had an important role in promoting the adoption of innovations. It inculcates change in practice, and enables social capital building (Kilpatric 2000; Saint Ville *et al.* 2016; Torabi et al, 2016), highlighting the potential of on-farm demonstrations.

Community Coconut Farm Schools (CFS)

Community Farm schools encompass social action in problem identification, conducting participatory demonstrations involving technology developers, disseminators, and users in a single platform with multiple perspectives of monitoring and refinement. This needs to be focused since coconut seedlings require continuously 2 or 3 years of management enabling learning of the community on the direct and indirect attributes of technology or innovations adopted. Intensive field-oriented farmer participatory demonstration strategies were pilot tested in the project for two years. Muyengi (2017) reported that new seedlings planted per hectare decreased by 75 percent between 1999 and 2014, at the household level in Tanzania. Wulandari and Alouw (2021) reiterated that replanting coconuts are a sure method for improved performance in small holdings in Indonesia. The most significant constraint found was the low financial capacity for replanting scientifically. Muyengi *et al*., (2015), the low planting rate of seedlings in the study area was associated with fewer efforts among farmers to engage in coconut production compared to other crops. Specifically, poor availability and low application of technologies, poor extension services, low level of planting, re-planting of coconut seedlings, production of seed and seedlings, and low investments in research and coconut development.

Table 5. Impact of interventions on knowledge of the participant homestead farmers

Mother palm selection in root (wilt) disease affected areas			
Category	Before (%)	After (%)	
Low	32.85	1.40	Pre test x̄= 1.75 s=24.81
Medium	58.57	14.28	Post test x̄= 2.83, s=11.91
High	8.57	84.28	P<0.00001
Seedling selection			
Category	Before (%)	After (%)	
Low	38.57	0	Pre test x̄ = 1.68 s=24.99
Medium	52.85	12.85	Post test x̄= 2.87, s=7.83
High	8.57	87.14	P<0.00001
Fertilizer application for juvenile palms			
Category	Before (%)	After (%)	
Low	18.57	1.53	Pre test x̄ = 1.94, s
Medium	68.57	1.42	=21.77
High	12.85	97.05	Post test x̄ = 2.96 s =4.87
Summer management of juvenile palms			
Category	Before (%)	After (%)	
Low	68.57	14.28	Pre test x̄ = 1.32 s=16.99
Medium	30.24	22.85	Post test x̄ = 2.42,
High	1.19	62.85	s=37.22
Plant protection of juvenile palms			
Category	Before (%)	After (%)	
Low	70.20	9.84	Pre test x̄ = 1.30 s=18.22
Medium	28.30	26.28	Post test x̄ = 2.32,
High	1.50	63.88	s=38.22

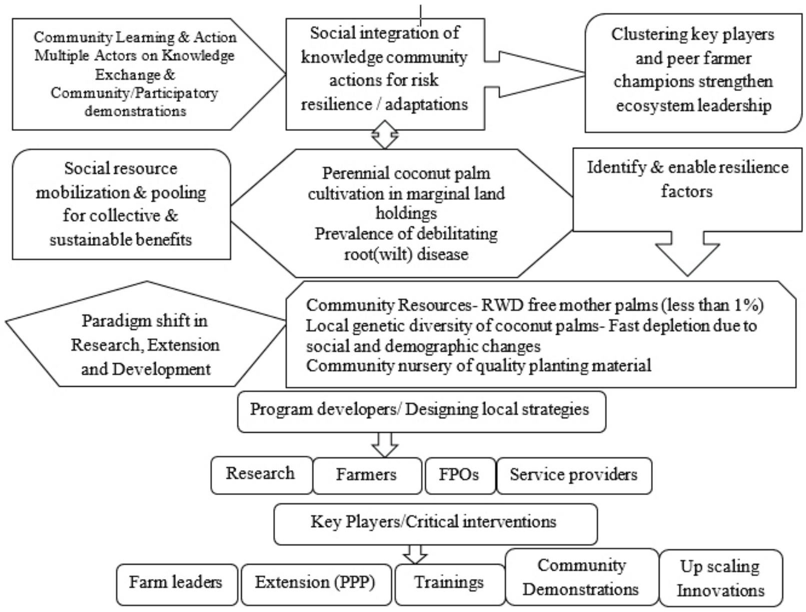

Fig. 5. Diagrammatic representation of Community Farm School (CFS) for coconut

One can readily motivate diffusion in rational choice-theoretic terms even when no information about consequences is provided (Banerjee, 1992). And outcome needs to be described implicitly about the practice or interpretation with local knowledge or a good theory. Classical formal models of intra-population diffusion also assume spatial homogeneity, where most of the members of the area have the same chance of affecting and being affected by each other. Several studies reported that spatial proximity often provides the best opportunities for mutual awareness and interdependence.

Practices that accord with cultural understandings of appropriate and effective action tend to diffuse more quickly than those that do not. This aspect also seems to be critical in extension strategies for coconut seedlings. New planting, replanting, replacing seedlings lost due to disease/pest/other reasons especially in risk prone tracts like root (wilt) affected areas, requires technology refinement, customized calendar of operations for agro ecological zones (AEU), supportive policies, scientific planning and programs of state institutions (Fig. 5).

The impact of the participatory interventions among coconut farmers indicated significant improvement in knowledge on scientific aspects (Table 5). Muyengi (2017) found that the provision of extension services for coconut farms and farmers was another main factor that affected the productivity of coconut in Tanzania. They analyzed that, if there is an agricultural extension service in the village, the coconut harvest can change by 131 nuts per ha per year.

Conclusions

The highest quality planting material and scientific early palm management are the two main factors that determine the sustainability of coconut farming. The majority of coconut development initiatives highlight the economic stages of palm trees while showcasing their technological advantages. Since coconut is a perennial crop cultivated continuously in small and marginal homestead gardens with a variety of crop stands of kinds, types, age groups, and individual management options, proper extension tactics are clearly required. Due to the loss of seedlings caused by biotic and abiotic stress as well as investment conundrums in the risks of yield and profit vagaries in the non economic growth period, coconut seedling management plays a crucial role in risk-prone locations of root (wilt) disease-affected tracts. Currently and generally, plantation-based research is the focus of coconut recommendations. However, the bulk of small and marginal coconut farmers' actual field circumstances reflect different realities from those assumed and estimated by research systems. In this research, we propose enhancing seedling management and community action in maintaining the continuity of this economic and ecological superiority of coconut palms by fine-tuning the extension innovation of participatory demonstration and community farm schools. In places where the root (wilt) disease is prevalent, this is crucial for the social development, entrepreneurship and value chain, nutritional security, and livelihood of farm families.

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