Research Article

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Group approach for enhancing profitability of small holders through technology integration - Reflections from coconut farming

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Abstract

Technology integration for enhancing productivity and income from coconut farming, facilitated through stakeholder participation, was a major objective of the NAIP sub-project on 'Value chain in coconut' implemented in a consortium mode with ICAR-Central Plantation Crops Research Institute, Kasaragod as the lead institute. To achieve this objective, 10 clusters of coconut farmers were formed under the project in selected panchayats of Kasaragod district in Kerala state. A total of 534 farmers covering 250 ha participated in the project interventions. Appropriate production technologies were integrated in their holdings which included intercropping, growing of leguminous crops in the coconut basin, organic recycling through vermicomposting and integrated nutrient management. Group action was initiated among the farmers for taking up need-based integrated disease management measures especially to control bud rot disease of coconut. Knowledge and skill upgradation of farmers on the selected technologies were achieved through various institutional and off campus training programmes. The net income from the coconut farming in small and marginal holdings could be increased through the interventions under the project. Technology integration in the holdings also resulted in the increase of coconut productivity from 60 to 112 nuts per palm. Technology integration in small and marginal coconut holdings for higher productivity and income through Community Based Organizations approach is scaled up by other agencies like Coconut Development Board for implementing development/extension programmes.

Keywords: Coconut, group approach, technology integration

Introduction

In India, coconut is cultivated predominantly by small and marginal farmers. In general, the income from coconut farming in such fragmented holdings does not provide enough for meeting the requirements of farm families. Though technology options for enhancing income from coconut farming do exist, the fragmented holdings do not render themselves viable for the optimum utilization of resources and the adoption of improved technologies by the cultivators. Group management of resources is suggested as a viable strategy to overcome the inherent weaknesses of the fragmented holdings. Farmer organizations assist their members to access and manage technology and resources, and build self-reliance through group approach. Support to Producer Organizations is considered as an investment in social capital to fight poverty and to improve the return of other types of investment (Rondot and Marie-Helene, 2001). The concept of group farming approach involves superimposing of group management of key farm operations over individual farm ownership and initiative with the objective of efficient management of farmers' resources to reduce cost of cultivation and to increase productivity even in very small farm holdings.

The concept of organizing small and marginal coconut farmers at grass root level for sustainable income enhancement has been pilot tested by ICAR-Central Plantation Crops Research Institute (ICAR-CPCRI) in selected localities

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(Thamban, 2010). The group approach has been scaled up by other agencies like Coconut Development Board (CDB), State Department of Agriculture and Local Self Governments among coconut farming communities through their development schemes. The ICAR sponsored National Agricultural Innovation Project (NAIP) sub-project on 'Value chain in coconut' was implemented by ICAR-CPCRI in ten coconut clusters by organizing small and marginal coconut farmers and rural women at grass root level with the aim of integrating interventions related to production and processing technologies for enhancing productivity and income from coconut farming. The objective of this paper is to discuss the experiences of ICAR-CPCRI in technology integration for enhancing productivity and income from coconut farming facilitated through stakeholder participation.

Methodology

The NAIP sub-project on 'Value chain in coconut' was implemented during the period from 2008 to 2012 in a consortium mode with ICAR-CPCRI, Kasaragod as the lead institute. The major objective of the project was technology integration for enhancing production and community level processing of coconut facilitated through stakeholder participation for strengthening the value chain. For implementing the coconut value chain, Kasaragod district of Kerala was selected. To overcome the structural constraints of coconut holdings for adoption of production technologies, clusters of coconut farmers were formed in the 10 selected panchayats with a total of 534 holdings under the project. Each cluster covered 25 ha of coconut holdings on a contiguous basis thus making the total area under the project 250 ha.

Baseline data on coconut farming scenario in the project area were collected for streamlining the technological interventions in the holdings. Technologies *viz*., basin management with green manure legumes, intercropping and integrated disease management were implemented in the coconut holdings. Four women Self Help Groups (SHGs) were formed for production and marketing of value added products of coconut. Training programmes and demonstrations on various aspects of coconut were conducted.

Data were collected from the farmers on experiences of implementing selected interventions under the project. Structured pre-tested interview schedule and participatory tools such as transect walk, focused group discussion, matrices scoring *etc.* were employed for data collection.

Results and discussion

Coconut farming scenario: Pre-intervention phase

The baseline survey and analysis revealed that agriculture is the prime occupation of the farm families in two-third of the holdings selected for implementing the project. More than 70 per cent of the agricultural holdings were less than 2 ha in size which reveals the predominance of small and marginal holdings. Coconut was the most important crop cultivated in the project area. More than 65 per cent of the farmers had at least 15 years of experience in farming.

The survey had showed that the level of adoption of improved production technologies including plant protection was low. Though many types of crops can be successfully grown simultaneously in a coconut garden, only one or two crops were cultivated in 54 per cent of the holdings where intercropping was practiced. Mono-cropping of coconut was practiced in 34 per cent holdings. Optimum number of plant density was also not followed in majority of the gardens. The area under irrigation in the selected holdings was 102 ha (40%).

Seventy six percentage of farmers of the project area availed credit from Service Co-operative Banks as well as Nationalized Banks for agricultural activities. In most of the cases, farmers sold mature coconut to the collection agents of copra making units. In a few instances, the nuts are dehusked and sold to the nearby markets. Nearly half the matured nuts harvested (47%) were being sold without any value addition. The coconut based industries are scanty in Kasaragod and they do only minimal processing of the product. It was found that the extension services through Krishi Bhavan were inadequate in the district causing a huge knowledge gap. It was found that only 25 per cent of the farmers have attended training programmes related to crop production, which implies an urgent requirement of imparting technical know-how on

Table 1. Knowledge gain on coconut production technology

Technology	Knowledge score (%)	
	Pre-intervention	Post-intervention
Basin management with green manure legume	86	94
Organic recycling through vermicomposting of coconut leaves	22	70
Balanced chemical fertilizer application	16	68
Intercropping	26	75
Integrated management of bud rot disease	08	65

various aspects of farming through training and demonstration.

The survey also revealed that functional linkages among the research/developmental agencies, NGOs and Local Self Governments are to be strengthened for formulating and implementing effective extension programmes.

Coconut farming scenario: Post-intervention phase

Group approach for implementing technological interventions, front line demonstrations/training programmes was conducted and critical inputs were provided to benefit coconut growers and rural women.

Knowledge gain on coconut production technology

There was substantial improvement in the knowledge of farmers on various aspects of coconut production technology due to the interventions carried out under NAIP (Table 1). Pre-intervention knowledge score was highest for the technology on basin management with green manure legume (86%) and lowest for integrated management of bud rot disease (8%). Similarly, post-intervention knowledge score was highest (94%) for basin management with green manure legume and lowest (65%) for integrated management of bud rot disease. Maximum gain in knowledge (57%) was for integrated management of bud rot disease followed by balanced chemical fertilizer application (52%). Anithakumari *et al.,* (2007) reported that the knowledge on the bio agents, symptoms, breeding sites, non pesticide management of rhinoceros beetle improved by 51 to 100 per cent after farm field school. Rayudu *et al*., (2010) reported that trained farmers had medium level of knowledge on vermicomposting technology (79%) followed by high (11%) and low (10%).

Knowledge gains by farmers on coconut production technology indicate the effectiveness of awareness-cum-training programmes and exposure visit to experimental plots of ICAR-CPCRI organized as part of the implementation of NAIP.

Table 2. Biomass and nutrient contribution through basin management of cowpea

Cluster	No. of coconut basins	Availability per coconut basin			
		Biomass (kg)	N (g)	P (g)	K (g)
Ajanoor	4,476	15.0	126.9	9.4	100.5
Bedadka A	3,845	18.0	122.8	9.6	100.4
Bedadka B	3,475	16.1	109.1	8.1	89.8
East Eleri A	2,746	21.1	160.6	12.4	136.6
East Eleri B	2,856	15.1	129.2	9.8	109.6
Karadka	3,395	18.0	117.8	8.3	90.7
Madikkai	4,857	20.0	127.4	9.7	125.6
Muliyar	3,699	14.9	106.8	7.8	83.5
Nileshwaram	4,195	18.1	141.6	10.3	117.8
West Eleri	4,151	14.9	107.2	8.9	79.5

Table 3. Soil fertility status of coconut gardens after the project intervention on INM

Cluster	No. of holdings	pH	O C (%)	N (ppm)	P (ppm)	K (ppm)
Ajanoor	36	5.5	1.5	190	33	166
Bedadka A	38	5.6	1.9	230	59	186
Bedadka B	39	5.5	1.8	222	44	194
East Eleri A	29	5.5	2.3	245	66	250
East Eleri B	20	5.3	1.9	219	57	214
Karadka	34	5.3	1.8	196	28	149
Madikkai	31	5.4	1.6	233	55	130
Muliyar	27	5.3	1.8	241	53	185
Nileshwaram	33	5.6	0.8	183	55	140
West Eleri	28	5.6	2.0	254	49	227

Basin management with green manure legume

Lack of availability of organic manure is a constraint experienced by farmers in enhancing coconut productivity. ICAR-CPCRI evolved the simple technology for basin management with green manure legume to make available biomass for incorporating in coconut basins. The details of biomass and nutrient contribution through basin management of cowpea (var. C-152) in farmers' gardens are furnished in Table 2.

Average biomass produced in a coconut basin is 17.1 kg by which about 25 per cent of the nitrogen requirement of coconut palms could be substituted. In the project area, a total of 645 t biomass was produced per annum. The saving in terms of cost of equivalent amount of chemical fertilizers is worked out to be ₹ 1,07,000 per year.

Integrated nutrient management

Regular manuring is essential for high yield of coconut palms. However, coconut farmers were unable to adopt the recommended fertilizer application mainly due to low price of coconut and high cost of chemical fertilizers. As part of integrated nutrient management, chemical fertilizers were applied as per the recommendations. Integrated nutrient management with chemical fertilizers and organic manures provided satisfactory level of nutrient availability for coconut cultivation in the project area as seen from the soil analysis data furnished in Table 3.

Ex-post evaluation of soil fertility revealed that the organic carbon percentage was more than 1.45 in all the clusters (except Nileshwaram). The phosphorus content was more than 20 ppm and thus skipping application of phosphatic fertilizers was

Table 4. Organic recycling through vermicomposting

Name of cluster	No. of farmers	Quantity of coconut leaves (kg)	Quantity of cow dung (kg)	Compost recovered (kg)	Recovery percentage of compost	No. of days per production cycle
Ajanoor	6	300	30	200	67	125
Bedadka A	5	300	30	200	67	130
Bedadka B	9	500	50	350	70	115
East Eleri A	6	400	40	250	63	140
East Eleri B	6	400	40	225	56	135
Madikkai	5	200	20	150	75	145
Muliyar	7	200	20	150	75	120
Karadka	6	500	50	350	70	125
Nileshwaram	4	500	50	300	60	130
West Eleri	6	400	40	225	56	130

recommended in subsequent years. The soil availability of nitrogen was medium to high and that of potash, the most important nutrient, was towards high.

Organic recycling through vermicomposting

Technological interventions on organic recycling through vermicomposting of coconut leaves were implemented in 60 holdings which were having livestock component in the farming system. Quantity of vermicompost obtained per production cycle ranged from 150 kg to 350 kg with an average 65.9 per cent recovery in a production cycle (Table 4).

Majority of the farmers perceived that rather than coconut leaves alone, in future, they may go for a mixture of coconut leaves, banana leaves and wastes, arecanut leaves, leaf litters *etc.* in varying proportions as the substrate for vermicomposting. This feedback indicates the need for standardising the methods of vermicompost preparation using different combination of substratum.

Table 5. Intercropping of food crops and output realized

Sl. No.	Intercrop (variety in brackets)	No. of holdings	Average yield obtained (t ha^{-1})
I	**Vegetables**		
	Ash gourd (Indu)	117	17.1
	Cow pea (Lola)	140	8.9
	Pumpkin (Ambili)	124	12.9
II	**Fruits**		
	Banana (Chengalikodan)	123	13.8
	Banana (Mysore poovan)	113	18.8
	Banana (Nadan Nendran)	146	13.9
III	**Tuber crops**		
	Elephant foot yam (Gajendra)	285	17.1
	Tapioca (Sree Vijaya)	275	17.5
	Dioscorea (Sree Keerthi)	129	14.1

Intercropping

Crop diversification in coconut gardens is an important strategy suggested to overcome the difficulties due to price fluctuation in coconut. Intercrops such as banana, pineapple, vegetables, elephant foot yam, tapioca, colocasia, ginger, turmeric *etc.,* were introduced as intercrops. Perennials such as black pepper, nutmeg and cocoa were also introduced in some coconut gardens. Details pertaining to the average yield of food crops raised as intercrops are furnished in Table 5. Elephant foot yam was observed to be the most suitable intercrop under rain fed condition. Gajendra, the variety of elephant foot yam newly introduced to the locality under the project, was very well received by the farmers due to its good cooking quality and taste. Through exchange of seed materials, adoption of Gajendra variety of elephant foot yam as intercrop in coconut garden increased substantially even in the non-project area. Among the different intercrops cultivated, banana (var. Chengalikodan) recorded the highest net returns (Table 6).

Integrated management of bud rot

Bud rot of coconut was in serious proportions in three clusters under the project area in the hilly terrain. ICAR-CPCRI has evolved Integrated Disease Management (IDM) practices against bud rot, which include removal of dead palms, treating the affected palms with fungicide (Mancozeb), prophylactic measures and integrated nutrient management. However, the level of adoption of

Table 6. Net return (₹ha^{-1}) from intercropping

Intercrops	Minimum	Maximum	Average	CV (%)
Banana-Chengalikodan	18,516	445,313	216,134	60.3
Banana-Mysore poovan	18,750	242,578	85,435	77.7
Banana-Nadan nendran	12,891	335,156	190,834	52.8
Elephant foot yam	52,284	159,330	115,685	43.6
Dioscorea	20,160	163,775	109,618	37.3
Tapioca	15,556	167,750	104,171	53.0
Vegetables	3,125	182,500	73,686	73.5

IDM practices was very low and there was severe crop loss. It was revealed that coconut growers were unaware about the IDM practices and hence the initial interventions were to enhance awareness and knowledge about the IDM practices through demonstrations and training programmes.

Apart from farmers, the skilled palm climbers were also targeted as they climb the palms, clean the affected tissues and place the fungicide sachets in the leaf axils as part of IDM. Adoption of IDM practices by few individual farmers alone cannot control the incidence of the fungal disease. Hence, efforts were made to facilitate group action among the farmers in the selected clusters to get desired results for the adoption of IDM practices against bud rot. Cutting and removal of dead palms due to disease was a major problem because it is labour intensive and, hence costly. However, the project team could motivate the farmers to organize themselves to remove the dead palms, which helped in reduction of inoculum load of the disease causing fungus thereby reducing the spread of the disease. The prophylactic measures against the disease involved placing of two sachets containing 5 g Mancozeb in the top leaf axils. Hence, farmers were trained to make sachets containing fungicide. Adequate quantity of Mancozeb was procured under the project. There was a visible impact for the adoption of IDM practices against bud rot disease (Table 7).

During the year 2008, the incidence of bud rot disease ranged from 26 to 31 per cent which was reduced to 6.3 per cent during 2009 and 0.7 per cent during 2010. Based on the successful experience under NAIP, a scheme was implemented for scaling up the adoption of IDM practices against bud rot disease covering three grama panchayats of Kasaragod district *viz*., East Eleri, West Eleri and Balal with financial support from Coconut Development Board. The superiority of area wide IPM programmes over the conventional farm by farm management for insect pests has been previously recommended by Knipling, 1992; Lindquist, 1998; Mumford and Tan, 1998.

Table 7. Cluster wise details of number of coconut trees affected by bud rot

Cluster	Total no of coconut trees	No. of coconut trees affected		
		2008	2009	2010
East Eleri A	3527	1022	193	21
East Eleri B	3884	1009	233	25
West Eleri	20437	6335	1328	143
Total	27848	8366	1754	189

Impact of interventions on coconut yield

For assessing the impact of technological interventions carried out in the project on coconut productivity, yield of 2000 coconut palms from the project area as well as non-project area was estimated for the year 2011-12. Stratified random sampling procedure was followed and skilled climbers were employed for data collection. There was substantial improvement in yield of coconut in the project area due to the implementation of various technological interventions. The yield of palms in the project area was obtained as 112 nuts compared to 60 nuts prior to implementation of the project (*i.e.,* base line data), details of which are furnished in Table 8.

Earlier studies also reported successful experiences in facilitating Community Based Organizations of small and marginal coconut growers for better technology integration including intercropping to realize higher yield and income from coconut farming (Batugal and Oliver, 2003). Group approach on integrated root (wilt) management resulted in increasing yield from 24 to 46 nuts palm^{-1} year^{-1}. (Thamban, 2010). Observation on yield of coconut revealed an increase in productivity of palms from 95 nuts

Table 8. Comparison of pre- and post- intervention yield (number of nuts palm^{-1})

Cluster	Base line yield (2007-08)	Yield (2011-12)
Ajanoor	80.2	107.9
Bedadka A	40.2	121.5
Bedadka B	45.0	117.4
East Eleri A	73.6	121.5
East Eleri B	86.4	111.5
Karadka	52.3	98.2
Madikkai	53.0	130.7
Muliyar	68.0	118.2
Nileshwaram	46.9	81.7
West Eleri	58.4	120.3
Mean	60.4	112.9

Table 9. Perception of farmers about the sustained use of technologies

Sl. No.	Technology	Scope for sustenance
1	Basin management with green manure legume	Suitable for sustained adoption
2	Organic recycling through vermicomposting of coconut leaves	Limited scope for replication since livestock component is required
3	Balanced chemical fertilizer application	Little scope due to high cost and lack of assistance since the district is declared organic
4	Intercropping	Suitable for sustained adoption with institutional support for ensuring availability of seeds/planting material and marketing
5	Integrated management of bud rot disease	Limited scope for due to lack of availability of climbers, high wage rate and less possibility for any assistance since the district is declared organic

(monocrop) to 122 nuts under high density multispecies cropping system (CPCRI, 1997).

Sustenance and replication of activities

Coconut farmers organized into clusters were convinced about the benefits of group approach. Thamban (2010) reported that Community Based Organizations helped in increasing the income of farm women by 3-5 times through the production and marketing of coconut value added products. Coconut growers in all the 10 clusters in Kasaragod district hence decided to sustain the activities by utilizing the opportunities provided by the CDB by facilitating the formation of Coconut Producers Societies and Federations. However, the farmer representatives of the clusters under NAIP project perceived some limitations for the sustained use of technologies as summarized in Table 9.

Perception of farmers as summarized in the above table indicates that efforts are required to assist the coconut growers to overcome the limitations through appropriate institutional support for the sustained use of technologies. High cost of inputs and lack of availability of quality planting materials are the constraints in coconut (Thampan, 1999).

Conclusion

The experiences of ICAR-CPCRI in facilitating Community Based Organizations of small and marginal coconut growers under the NAIP evidently reflects that better technology integration is possible through group approach for enhancing productivity and income. In the project area where group approach was implemented, the average yield of coconut was substantially increased after technology package implementation. The group approach in coconut farming for income enhancement in small holdings can be scaled up through appropriate schemes to be implemented by agencies like CDB, State Department of Agriculture and Local Self Governments. Research organizations such as ICAR-CPCRI would be able to extend technical support for implementing the technological interventions under such schemes.

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