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Diversification of coconut based farming system through community based organizations for income generation and sustaining productivity

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Abstract

Community based organizations (CBO) were formed in three coconut growing areas in Kerala during 2005-2008 and through farmer participatory process, various technological interventions for diversification of cropping system appropriate to the local community as well as subsidiary enterprises were taken up for income generation. The interventions included (a) intercropping with various crop species (cash and food security crops) aiming at year round farm income, (b) subsidiary enterprise comprising of animal husbandry component, (c) product diversification and value addition of coconut and intercrops as well as, (d) recycling of waste biomass through vermicomposting. The project not only brought out significant change in area put under crop diversification by way of inter/mixed cropping, but also in the average income derived from such farming system. Significant improvement in income was achieved through crop and enterprise diversification. While inclusion of various intercrops improved the share by 83 per cent compared to the income from coconut alone, it was up by 195 per cent when subsidiary enterprises like rearing of live stock and value addition were also considered, thus indicating the sustainability of crop and enterprise diversification in the project areas. The significant reduction in the value of Herfindahl Index, a measure of diversification, from 0.70 to 0.57 signified the improvement in the extent of diversification in various CBOs. Diversification of crops and adoption of coconut-based subsidiary enterprises through CBOs were found to be ideal strategies for sustaining productivity and rural upliftment in terms of income generation.

Keywords: Coconut cropping system, community based organizations, Herfindahl index, intercropping

Introduction

Coconut is a crop of economic importance to many Asian and Pacific countries in the world. In India, coconut is cultivated in an area of 18.95 million ha with total production of 16942.92 million nuts and productivity of 8937 nuts ha^{-1}. (http://coconutboard.nic.in/stat.htm). Its production in India is contributed mainly by marginal and small farmers and about 10 million people depend on coconut farming, trade, processing and other related activities. Coconut farmers in many parts of India face difficulties to sustain their livelihood from coconut income alone. One of the major reasons for low productivity of coconut in regions like Kerala in India is the fragmentation of holdings with little or limited resources with farmers for efficient farm management. The very small size of holdings also does not render themselves viable for the optimum utilization of resources and adoption of improved technologies by the cultivators. Declining productivity and unstable price of the crop are often found to be the other reasons. In spite of these problems, the farmers continue to grow coconut as it is a part of their tradition.

Convergence through Community Based Organizations

Though research and development programmes in coconut have proved the potential

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for increasing income by adoption of various technologies, expansion of income-generating opportunities and assurance of food security continue to be important challenges faced by the farmers. To augment the income from such homestead farms, it is suggested to have consolidation of farms and community level management of resources to overcome the inherent weaknesses of the fragmented holdings. Such an approach will also provide opportunities for better social integration among the participating farmers. Adoption of Coconut Based Farming Systems (CBFS) approach through Community Based Organizations (CBOs) will be an effective strategy for diversification to sustaining productivity, income generation and rural upliftment which aims at improving the quality of life of coconut farmers.

Central Plantation Crops Research Institute (CPCRI), Kasaragod, Kerala has successfully demonstrated the possibilities of such interventions through CBOs such as Ariyankuppam Commune Coconut Farmers Association, Pondichery, Pallikkara Community Coconut Development Centre, Kasaragod and CBO of Vayalar Community Coconut Development Project at Vayalar, Alappuzha implemented by Peekay Tree Crops Development Foundation through the IPGRI/COGENT supported project on 'Developing sustainable coconut based income generating technologies in poor rural communities in India'.

This concept of empowering CBOs was further tested under another International project on 'Overcoming poverty in coconut-growing communities: Coconut genetic resources for sustainable livelihoods in India', supported by IFAD/ COGENT/ Bioversity International and implemented by the Regional Station, Kayamkulam, Kerala of the CPCRI. The main objectives were to develop viable community based income generation technologies in support of sustainable livelihoods that directly benefit resource poor coconut farmers and socio-economically disadvantaged women; build the capacity of community based organizations for the development of sustainable livelihood intervention models for coconut growing communities. This investigation deals with the evaluation of the economic potential of diversification of crops, subsidiary enterprises including livestock rearing as well as product diversification and value addition.

The project was implemented in three coconut growing locations in Kerala *viz.*, Pathiyoor and Devikulangara (Alappuzha Dist.) as well as Thodiyoor (Kollam Dist.) during 2005-2008. In all the project areas, community based organizations (CBOs) were registered during January to March 2006. A total of two hundred and seventy one farmers (100 in Pathiyoor, 75 in Devikulangara and 96 in Thodiyoor) were involved in the implementation of the project from which data of 50 farmers from each CBO was collected for the present study.

Interventions implemented

As crop and enterprise diversification were found to be the most important strategies for improving productivity and income from homestead farms, through a farmer participatory process, various interventions appropriate to the local community for diversification of cropping system as well as subsidiary enterprises were taken up for income generation. The technological interventions included (a) intercropping with various crops (cash, food and nutritional security crops) aiming at year round farm income, (b) adoption of animal husbandry component along with cultivation of fodder grass and azolla as feed supplement, (c) product diversification and value addition of coconut and intercrops as well as, (d) recycling of waste biomass through vermicomposting.

The CBO members were given training on various aspects of coconut cultivation, intercropping, product diversification, value addition and organic recycling through vermicomposting during the initial phase of the project. Pre-project baseline data and post-project data on various aspects were recorded for economic analysis through personal interview as well as by referring the records maintained by the members of CBO.

Holding size *vis-a-vis* interventions

The baseline survey revealed that the overall average size of the selected holdings was as low as 0.09 ha, with more than 80 per cent of the members having an area less than 0.12 ha. The village-wise

average size of holdings was 0.11 ha in Pathiyoor, 0.10 ha in Devikulangara and 0.07 ha in Thodiyoor. The Average size of holdings in Kerala, India was found to be low from surveys by other researchers also (Prema and Thomas, 1998; Krishnakumar and Reddy, 2007). This highlights the necessity for a cluster/community approach for improving the productivity from such small holdings and livelihood of farm families. The pre and post- project adoption levels of various interventions are given in Table 1.

Table 1. CBO-wise adoption level (%) of various interventions (pre and post-project)

Sl. No.	Interventions	Pathiyoor		Thodiyoor		Devikulangara		Overall mean	
		A	B	A	B	A	B	A	B
1	Crop diversification through intercropping*	62	94	62	96	78	84	67	91
2	Enterprise diversification through livestock rearing**	18	38	38	87	24	42	27	56
3	Product diversification and value addition of coconut and intercrops***	0	22	0	36	0	20	0	26
4	Recycling waste biomass through vermicomposting	0	10	0	10	0	10	0	10
	Overall mean	24	46						

A= Pre-project (2005); B=Post-project (2008)

*Intercrops included vegetables, fruit crops, spices and tuber crops.

**Enterprise diversification included rearing of milch cows.

***Production of coconut oil, nutritive food, coconut-based confectionary items, coir from coconut fibre, mushroom *etc*.

While considering the overall picture of implementation of various interventions, the adoption in general increased by 22 per cent over the pre-project period. The increase in adoption was the highest in the case of enterprise diversification through livestock rearing (29%), closely followed by product diversification and value addition of coconut and intercrops (26%),which were new interventions and crop diversification through intercropping (24%).

Though a few of the identified farmers were found to adopt intercropping of crops such as banana and black pepper and raise cows in their homestead farms, scientific management practices were not followed and hence, interventions were able to regularise crop production and ensure income generation.

Crop diversification and cropping intensity

Though some kind of intercropping was observed to be undertaken by the farmers during the baseline survey, they were not done in any systematic manner and confined mainly of local varieties of crops and for household consumption. With the implementation of farmer participatory interventions, an improvement in percentage of adoption of intercropping and area put under intercrops was noticed in all the CBOs (Table 2). Integration of cropping with subsidiary enterprises and mutual utilization of inputs in farming helps in better income realization. Pushpa and Seetharaman (2004) reported that the integration of various enterprises through diversification of farming system leads to increased income, employment and recycling of resources between and among the components. Adoption of recycling waste biomass through vermicomposting was noticed in all the CBOs and vermicompost thus produced was utilized for cultivation of various intercrops.

The percentage of farmers adopting crop diversification through intercropping improved with implementation of the project from 67 during the pre-project period to 91 during the post-project period. With crop diversification, there was an

Table 2. Improvement in adoption of intercropping and area under intercropping

Particulars	Pathiyoor		Thodiyoor		Devikulangara		Overall mean	
	A	B	A	B	A	B	A	B
Percentage of adopters	62	94	62	96	79	84	67	91
Average area under intercrops (ha)	0.013	0.033	0.009	0.02	0.012	0.02	0.011	0.024

A=Pre-project; B=Post- project

increase in cropping intensity to the extent of 125-175 per cent in majority of the homestead farms. The impact of interventions on productivity of coconut is presented in Table 3. Regeena (2005) and Krishnakumar *et al*. (2007) also observed increase in cropping intensity due to restructuring and subsequent inclusion of more intercrops in homestead farms of southern and northern Kerala. Anithakumari (2007) noticed two-fold increase in area under cultivation of different intercrops due to integrated farming of coconut based homestead farms. In the case of coconut, an improvement in the total yield and productivity was noticed (22% increase in productivity) with implementation of various interventions. The impact was more visible in the age group of 21 to 40 years, which is the economically important period of yielding in coconut.

Table 3. Overall yield improvement of coconut palms (total/mean of three CBOs)

Age of palms (years)	Pre-project			Post-project		
	No. of bearing palms	Total yield (nuts year^{-1})	Productivity (nuts palm^{-1} year^{-1})	No. of bearing palms	Total yield (nuts year^{-1})	Productivity (nuts palm^{-1} year^{-1})
6-20	162	4,243	27	162	5,365	33
21-40	364	12,756	35	362	15,962	44
>40	92	3,026	33	93	3,639	39
Total/mean	618	20,025	32	617	23,966	39

Intercropping and income generation

An analysis of percentage distribution of respondents based on income categories from coconut and intercrops was made to find out the magnitude of improvement in income (Table 4). With the implementation of various interventions, there was considerable reduction in the percentage of farmers earning annual income less than Rs.1,500 per annum both from coconut and intercrops. The overall percentage of farmers earning annual income (Rs.>5,000/-) enhanced from 36 to 88 in the case of coconut and 38 to 138 for intercrops, highlighting the beneficial effect of crop diversification in increasing farm income.

Table 4. Percentage distribution of respondents based on income categories from coconut and intercrops (CBO-wise) (N=150)

Income category (Rs)	Coconut		Intercrops	
	A	B	A	B
Below 1500	18	4	144	42
1501-5,000	246	208	118	120
>5,000	36	88	38	138

A : Pre-project, B : Post-project

Attempts were made to ascertain the average income derived from coconut, intercrops and their percentage to total income including other sources by the farmers of different CBOs and the results are given in Table 5. Analysis of the average annual income from coconut and intercrops before and after the project revealed the potential for augmenting income from coconut farms through adoption of scientific management practices including intercropping. This was made possible through imparting necessary trainings to beneficiary farmers on various aspects of scientific cultivation of coconut and intercrops. Though there was some reduction in the share of coconut for post-project, there was higher response noticed for various intercrops, which are annual in nature.

Table 5. Average annual income (Rs) derived from coconut and intercrops (CBO-wise)

Name of CBO	Pre-project		Post-project	
	Coconut	Intercrops	Coconut	Intercrops
Pathiyoor	2,960 (13.3)	1,280 (5.7)	4,240 (6.6)	5,960 (9.3)
Thodiyoor	2,560 (10.8)	440 (1.9)	3,520 (5.3)	3,720 (5.7)
Devikulangara	3,800 (16.4)	680 (2.9)	4,880 (8.5)	3,200 (5.6)

Figures in parenthesis is percentage to total income

A significant impact of various interventions on the yield of coconut in the coconut based farming system will be visible only after 36 to 42 months as coconut palms take longer time for initiation of inflorescence to harvest of nuts. During the pre-project period, majority of the beneficiaries were relying on non-farm sources than on-farm mainly because of the small size of the holdings, the income from which was not sufficient to meet the daily requirements of a family. With the diversification of cropping with inclusion of intercrops of various types, their share to total income improved considerably.

The share of income from main crop coconut and other sources to the total income worked out during the pre and post-project period indicated that the share of crop diversification by intercropping and enterprise diversification through livestock rearing doubled in the post-project period compared to the pre-project period (3% to 6% and 5% to 10%, respectively), while the overall mean through various diversification enhanced by 12 per cent (*i.e*., from 8% to 20%). Analysis of income from coconut and other allied enterprises including cropping system interventions from various CBOs indicated significant changes in the levels of income (Table 6).

The percentage increase in annual income between coconut and coconut + inter crops during the pre-project was 25.7 and 84.98 between coconut + inter crops + subsidiary enterprises indicating that cultivation of intercrops and inclusion of subsidiary enterprises could enhance the farm income. Inclusion of subsidiary enterprises (more livestock rearing) along with intercropping and their scientific management in the project area has resulted in significant increase of mean income by 350.8 per cent over the income derived from coconut alone.

Diversity analysis

As the project was expected to change the composition of total household income, The Herfindahl-Hirschman index, better known as the Herfindahl index (HI), which indicates the economic diversity of a household (Herfindahl, 1950), was calculated. It is the sum of the squared shares of income from each activity *i.e*., coconut, intercrops, livestock and other subsidiary enterprises. Mathematically, the index is as follows:

$$HI = \sum_{i=1}^{N} Pi^2$$

where, N is the total number of components and Pi^2 represents square of proportion of contribution under i^{th} component to the total income. The value of this index is bounded by 0 (to represent perfect diversification) and 1 (to represent perfect specialization). The value of HI approaches zero as N becomes larger and takes one when there is only one component is considered.

While the increase in income from coconut noticed was 35 per cent, significant improvement was possible through crop and enterprise diversifications. Inclusion of various intercrops improved the share (83%) compared to the income from coconut alone, whereas, it was up by 195 per cent when subsidiary enterprises like rearing of live stock and value addition were also considered, thus indicating the sustainability of crop and enterprise diversification in the project areas. This was also proved through working out Herfindahl Index, which indicates the economic diversity of a household.

Low Herfindahl index and diversity

The Herfindahl Index always should be a value between 0 and 1, whereby 1 represents complete specialization or adoption of a specific cropping or enterprise without any diversification. Hence, the reduction in the value of 0.70 observed during pre-project period to 0.57 in the post-project period (Table 6) signifies the improvement in the extent of diversification. Thamban *et al.* (2006) opined that to improve stability in farm income, the farmers have to adopt a flexible cropping/farming system with inclusion of intercrops and subsidiary income generating enterprises. Mehta (2005) opined that the crop diversification not only indicates the options and opportunities of cropping, but also harmonises the supply to demand of diverse

Table 6. Comparison of source of annual income from main crop (coconut) and other allied enterprises (N = 150)

Generation of income	Mean income (Rs)		Increase (%) between pre- and post-project	Increase due to diversification
	Pre -project	Post- project		
A. From coconut	3,110	4,213	35	
B. From coconut + inter crops	3,910	8,506	118	83
C. From coconut + inter crops + subsidiary enterprises	5,753	18,996	230	195
Herfindahl Index	0.70	0.57 **		

**Significant at 0.01 level

commodities and in the process diffuses the price volatility in the market. Such on farm diversification also helps in reducing farming risk due to climatic, market and other such aberrations and often improves resource use efficiency (Joshi *et al*., 2007). Mehta (2009) analysed the trend towards diversification/ specialization in different states of India from 1970 to 2000 and observed that Kerala is one of the states showing stagnancy in their index of concentration or spread and it was around 0.780. Analysis of the overall change in the poverty status of communities, which is an important factor deciding the success of a project, also indicated a significant reduction in terms of percentage of holdings below poverty threshold level from 95 to 56 (the poverty threshold level being measured based on the income of <$1 per head per day).

Conclusion

From the study it was found that formation of CBOs in coconut growing areas and implementation of various interventions through farmer participatory approach not only brought significant change in area put to crop diversification by way of inter/mixed cropping, but also in the average income derived from such farming system. While the increase in income from coconut with implementation of the project was 35 per cent, significant improvement was achieved through crop and enterprise diversification. Inclusion of various intercrops improved the share by 83 per cent compared to the income from coconut alone, whereas, it was up by 195 per cent when subsidiary enterprises like rearing of live stock and value addition were also considered, thus indicating the sustainability of crop and enterprise diversification in the project areas. Diversification of crops and adoption of coconut-based subsidiary enterprises through CBOs were found to be ideal strategies for sustaining productivity and rural upliftment in terms of income generation.

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