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Sustainability of the interventions in coconut based homesteads of Central Kerala

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Abstract

An ICAR *adhoc* scheme on 'Possible Diversifications and Restructuring of Coconut based Homesteads' was implemented in the six agro-ecosystems of Central zone of Kerala covering three districts namely Palakkad, Thrissur and Ernakulam with the holistic approach in coconut based homesteads from 2005 to 2008 by the participation of all the stakeholders. A comparative index namely Sustainability Development Index was developed for the study, which contained specific indices for economic, social, ecological sustainability, productivity, stability and equity dimensions. After three years of interventions, Sustainability Development Index was found to be the highest at High Elevation- Medium Rainfall (HEMR) situation (Kizhakkenchery) with 41.92. Economic sustainability (56.40) was the highest among all the dimensions because of the visibility of enhanced economic returns and increased employment opportunities. Ecological sustainability and stability were the two dimensions which contributed less for the Sustainability Development Index of the selected homesteads. It was concluded that the interventions on diversifications of coconut based homesteads indicated sustainability.

Keywords: Coconut based homesteads, farmers' participation, interventions, preferences, performance, sustainable development index

Introduction

Coconut based homestead farming with an integration of allied enterprises and use of the available resources is one of the major farming systems in Kerala. Traditionally these homesteads have developed into self-sustaining and productive farming systems with optimum utilization of available resources and recycling of farm and home wastes. Homesteads are considered as the most desirable strategy for maintaining social, economic and ecological sustainability. Farmers depending on farming alone without much diversifications are found with low and fluctuating income. It cannot be denied that there is a crisis in maintaining the age old tradition of integrated farming. The traditional concept of integration of homestead farming with allied enterprises in Kerala is declining because of various socio- economic reasons. Under such situation, it was felt that the interventions on appropriate combinations of enterprises based on the preferences of participating farmers in the coconut based homesteads would rejuvenate the integration of coconut based homesteads. This study was conducted with the objective of assessing the sustainability of the interventions made in the coconut based homesteads of Central Kerala.

Materials and Methods

The ICAR *adhoc* scheme on 'Possible Diversifications and Restructuring of Coconut based Homesteads' was conducted in the six agro-ecosystems of Central zone of Kerala covering three districts namely Palakkad, Thrissur and Ernakulam. The scheme was implemented during the period 2005 to 2008 with the holistic approach in coconut based homesteads through the participation of the stakeholders, *viz*., farm families, extension personnel, people representatives and researchers. The participatory interventions were aimed to generate additional income for the sustenance of the

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families depending on coconut based homesteads with the major thrust on conserving natural resources apart from meeting the basic needs of a family. The gradual shift in the socio-economic development in Kerala forces many families to move away from traditional conservation practices to commercial oriented farming. The interventions were hypothesised to prevent non-judicious use of resources, encourage conservation practices, increase employment opportunities and thereby enhance income of farm families.

Representing all the six agro-ecological situations in the Central zone of Kerala, a panchayat was selected on the basis of discussion with the extension personnel working at the block level. Two wards from each identified panchayats were selected based on the discussions with respective Agricultural Officers, Panchayat Presidents, Chair persons of the Agricultural Development Council and Board members, with the criteria of maximum area under coconut based homestead farming in the panchayat. Sixty farmers, mainly involved in coconut based homestead farming, representing the selected two wards, were invited for a session under Participatory Rural Appraisal (PRA) techniques. Transect analysis, time line, seasonal analysis, resource flow analysis, livelihood analysis, preference ranking, identification of indigenous technical knowledge and problem identification and prioritization were the PRA techniques followed. In addition, iterative household surveys were conducted to collect the existing diversifications in the individual homesteads. It helped to triangulate with the data obtained during the PRA sessions. Based on the discussions in the PRA session, farmers' interest and preferences, ten farmers were selected randomly for practicing the viable models in their homesteads from each of the six agro ecological situations constituting sixty farmers in the sample. The viable models in the homesteads were developed based on the preference ranking during the PRA session and the preferences of the selected farmers. Details of interventions made in the coconut based homesteads of the project area are given in the Table 1. Based on the preferences, needs and available resources of the participating farmers, the selection of interventions varied from homestead to homestead. For adopting each intervention, they were trained and exposed to selected technologies developed by the Kerala Agricultural University. Most of the critical inputs required to adopt the interventions were also made available through the

Table 1. Details of interventions made in the coconut based homesteads in the selected areas of Central Kerala

Sl. no.	Agro- ecological situations	Selected Panchayats	Interventions made based on the individual preference of farmers	Number of components	Number of farm families involved
1	High Elevation - High Rainfall (HEHR)	Pananchery	Goats- Malabari	14	6
			Heifers- Cross breeds	4	4
			Fodder grass- Co-1	450 slips	9
			Turmeric- Sona and Kanthi	10 kg of rhizomes	2
			Vegetables	10 g seeds - 10 nos.	10
2	Medium Elevation - High Rainfall (MEHR)	Karukutty	Goats- Malabari	16	8
			Chicks- Gramapriya	55	7
			Turmeric- Sona and Kanthi	40 kg	8
			Fruit tree seedlings	4	1
			Vegetables	10 g seeds- 10 nos.	10
3	Low coastal area, Low Elevation - High Rainfall (LEHR)	Thalikulam	Goats- Malabari	6	3
			Heifers- Cross breeds	2	2
			Chicks- Gramapriya	45	2
			Banana- Njalipoovan	75	4
			Turmeric- - Sona and Kanthi	50 kg	9
			Fodder grass- Co-1	250 slips	5
			Vegetables	10 g seeds - 10 nos.	10
4	High Elevation- Medium Rainfall (HEMR)	Kizhakkenchery	Goats- Malabari	20	10
			Chicks - Gramapriya	20	4
			Fodder grass- Co-1	300 slips	6
			Vegetables	10 g seeds- 10 nos.	10
5	High Elevation - Low Rainfall (HELR)	Muthalamada	Chicks- Gramapriya	140	10
			Biocontrol agents- *Pseudomonas fluorescens*	1	1
			Vegetables	10 g seeds- 10 nos.	10
6	Medium Elevation- black soil- Low Rainfall (MELR)	Eruthenpathy	Heifers- Cross breeds	10	10
			Vegetables	10 g seeds- 10 nos.	10

University. The cost of the critical inputs required to adopt the interventions were shared equally by the participating farmers and the project. Field visits were made to solve the field problems and the technologies adopted by the farmers were monitored. After adopting the preferred enterprises, their performance was assessed in terms of sustainability of the interventions after a period of three years.

Assessment of sustainability in the diversified homesteads of the participating farmers

Sustainability Development Index **(**SDI): It is a composite index measured for each homestead according to the perception of the participating farmer using economic, social and ecological sustainability, productivity, stability and equity dimensions. Each dimension was measured using a five point continuum *viz.*, most experienced, more experienced, undecided, less experienced and least experienced with scores 5,4,3,2 and 1 respectively.

Economic Sustainability Index (ESI): Economic sustainability is defined as the extent to which the interventions made on the growth of the participating farm families in economic terms which demands a sustainable per capita income and efficiency in use of available resources for their economic development. It includes control over the interventions, employment and income generation, control over the produces generated from the interventions and optimization of agricultural productivity.

$$ESI = \frac{\Sigma \left[\frac{e_i}{E_i}\right] R_{ei}}{\Sigma R_{e\,i}} \times 100$$

Where e_i = score obtained for the i^{th} dimension of economic sustainability

E_i = Maximum score obtained for the i^{th} dimension of economic sustainability

R_{ei} = Scale value of i^{th} dimension of economic sustainability

ΣR_{ei} = Summation of the score of i^{th} dimension of economic sustainability

The same procedure was followed in assessing the indices of rest of the dimensions of sustainability.

Social Sustainability Index (SSI): Social sustainability was referred to how well a participating farm family can meet the basic human needs such as food, shelter and clothing. It also involves providing support services that could improve the quality of life of the family. The main items included were food security, human resource development, health and nutritional security, participation in group activities, protection of cultural heritage and infrastructure development because of technological interventions.

Ecological Sustainability Index (EcSI): Ecological sustainability was intended ensuring the protection, conservation and better management of natural resources particularly those which were vital for the survival of the farm family. Conservation of resources, ecosystem preservation, indigenous knowledge system, recycling of agricultural produce and energy conservation are the items included under the dimension of ecological sustainability.

Productivity Index (PI): It was worked out based on the output per unit of interventions made in the homesteads during the completed period of one year.

Stability Index (SI): It was assessed depending upon the responses of the participating farmers on the nature of income obtained, meeting the requirements of the family continuously and the ability of the components in the homesteads to compensate interchangeably during off season or lean period.

Equity Index (EI): Equity was appraised based on the responses of the participating farmers on the nature of sharing of benefits by the members of the family, opportunity in decision making and utilizing the output from the interventions.

Sustainability Development Index (SDI)

$$SDI = \frac{W_1(ESI) + W_2(SSI) + W_3(EcSI) + W_4(PI) + W_5(SI) + W_6(EI)}{W_1 + W_2 + W_3 + W_4 + W_5 + W_6}$$

ESI = Economic Sustainability Index

SSI = Social Sustainability Index

EcSI = Ecological Sustainability Index

PI = Productivity Index

SI = Stability Index

EI = Equity Index

W_i = Weightage for the economic sustainability dimension

W_2 = Weightage for the social sustainability dimension

W_3 = Weightage for the ecological sustainability dimension

W_4 = Weightage for the productivity dimension

W_5 = Weightage for the stability dimension

W_6 = Weightage for the equity dimension

The SDI was developed in such a manner that when a farmer attained maximum economic, social and ecological sustainability, the index reached 100. The SDI, a composite index of economic, social, ecological sustainability, productivity, stability and equity indices was measured in six agro ecological situations constituting 60 farmers. It was worked out based on the procedure followed by Rajendralal (2005).

Results and Discussion

Agro ecosystem wise assessment of sustainability in the diversified homesteads of the participating farmers after three years of interventions

The agro ecosystem wise assessment of sustainability in the diversified homesteads of the participating farmers after three years of interventions is presented in Table 1. Sustainability Development Index was the highest (41.92) at High Elevation and Medium Rainfall (HEMR) situation (Kizhakkenchery). Except ecological sustainability, all other dimensions showed the highest SDI values at HEMR situation (Kizhakkenchery) among all the agro-eco systems. Stability was the highest at Low coastal area, Low Elevation- High Rainfall (LEHR) situation (Thalikulam) because the number of components adopted by the farmers of this situation was more and they felt that the various requirements of the family were met from the different components of homesteads and earning stable income. They believed that they would be able to meet the requirements in future as they were in the process of expanding the number of components in their homesteads.

Economic sustainability (56.40) was the highest among all the dimensions of the sustainability because of the enhanced economic returns and increased employment opportunities realized by the farmers. This finding was in line with the results of Jayanthi *et al.* (2009). Social sustainability (46.20) and equity (46.00) were perceived almost equally, as the interventions enriched the nutritional security of all the family members. They had the opportunity of equipping themselves in managing the interventions and they felt that each and every family member benefited the returns from the interventions.

Ecological sustainability and stability were the two dimensions which contributed less for the SDI of the selected homesteads. It takes much longer time to realise the ecological sustainability and stability of the diversified homesteads. Gangadharappa *et al.,* (2007) also reported that the economic sustainability was perceived more by the farmers when compared to ecological sustainability.

Agro ecosystem wise assessment of income and expenditure pattern in the selected diversified homesteads of the participating farmers

Table 3 presents the agro- ecosystem wise assessment of farm income and expenditure pattern in the selected homesteads of the participating farmers before intervention during the year 2006. It was reported that MEHR situation, (Karukutty) showed the highest farm net income of ₹ 39,443 per household and the lowest farm net income of ₹ 13,478 per household at HEMR situation (Kizhakkenchery), before the interventions.

Table 4 shows the agro-ecosystem wise assessment of farm income and expenditure pattern in the restructured homesteads of the participating farmers after intervention. HEMR situation (Kizhakkenchery) showed the highest farm net income of ₹ 56,298. The intervention on rearing malabari goats showed a major change in income when compared to other components. The lowest farm net income of ₹ 25,002.80 per household was at the LEHR situation (Thalikulam).

The agro-ecosystem wise assessment of increase in farm net income in the restructured diversified homesteads of the participating farmers over the period

Table 2. Agro ecosystem wise assessment of sustainability in the diversified homesteads of the participating farmers after three years of intervention

Sl. no.	Dimensions	Sustainability Development Index Values Agro eco systems and Panchayats					
		HEHR- Pananchery	MEHR- Karukutty	LEHR- Thalikulam	HEMR- Kizhekkanchery	HELR - Muthalamada	MELR- Eruthenpathy
1	Economic sustainability	48.80	45.00	53.25	56.40	50.00	47.32
2	Social sustainability	40.00	36.20	38.60	46.20	42.40	34.80
3	Ecological sustainability	23.40	21.00	23.52	26.33	24.80	23.07
4	Productivity	37.83	40.23	36.92	43.01	31.58	28.46
5	Stability	29.80	27.60	34.67	33.60	32.40	24.80
6	Equity	40.00	39.42	43.24	46.00	42.00	45.47
	Overall Sustainability (Mean)	36.64	34.91	38.37	41.92	37.20	33.99

Table 3. Agro ecosystem wise assessment of income and expenditure pattern in the selected diversified homesteads of the participating farmers before intervention (Ten farmers per situation)

Sl. no.	Particulars	Agro eco systems and Panchayats					
		HEHR-Pananchery	MEHR-Karukutty	LEHR-Thalikulam	HEMR-Kizhekkanchery	HELR - Muthalamada	MELR-Eruthenpathy
1	Average farm size (ha)	0.96	0.60	0.41	0.70	0.84	1.01
2	Gross annual farm income (₹)	84,630	78,443	68,007	56,978	34,731	57,105
3	Total annual farm expenditure (₹)	66,500	39,000	53,001	43,500	21,094	34,758
4	Net income (₹)	18,130	39,443	15,006	13,478	13,637	22,347

HEHR - High Elevation-High Rainfall
MEHR - Medium Elevation- High Rainfall
LEHR - Low coastal area, Low Elevation- High Rainfall
HEMR - High Elevation- Medium Rainfall
HELR - High Elevation- Low Rainfall
MELR - Medium elevation- black soil- Low Rainfall

Table 4. Agro ecosystem wise assessment of farm income and expenditure pattern in the diversified homesteads of the participating farmers (Ten farmers per situation)

Sl. no.	Particulars	Agro eco systems and Panchayats					
		HEHR-Pananchery	MEHR-Karukutty	LEHR-Thalikulam	HEMR-Kizhekkanchery	HELR - Muthalamada	MELR-Eruthenpathy
1	Average farm size (ha)	0.96	0.60	0.41	0.70	0.84	1.01
2	Gross annual farm income (₹)	1,40,900	88,940	1,58,003	1,69,898	1,01,473	79,200
3	Total annual farm expenditure (₹)	1,03,600	41,000	1,33,000	1,13,400	57,900	38,400
4	Net income (₹)	37,300	47,940	25,003	56,498	43,573	40,800

of three years is presented in Table 5. The highest increased farm net income was realized at HEMR (Kizhakkenchery) with ₹ 43,020 and the lowest with 8,497 per household at MEHR situation (Karukutty). John and Nair (2007) explained that the economic situation of the homestead system in South Kerala was profitable, resulting in a net profit of ₹ 28, 532 and an average benefit cost ratio of 2.35. Jayanthi *et al.* (2009) found that integration of farms with crops and allied enterprises improved the productivity, profitability, nutritional security and thereby increased the economic sustainability of the farm.

All the farmers at the HEMR situation (Kizhakkenchery) depended completely on integrated farming and, therefore, they obtained the highest increased net income. The average landholding size of the homesteads in this situation was 0.7 ha whereas, majority of the farmers in the MEHR situation (Karukutty) earned income from off-farm activities. Their attention on farm activities was less and hence, they earned the lowest income. These results supported the conclusions of Peter and Rao (2005) who reported that the gross income per unit of land in Kerala was higher because of the integration and diversity in homesteads.

Conclusion

Sustainability Development Index was the highest at HEMR situation (Kizhakkenchery) with 41.92. Economic sustainability (56.40) was the highest among all the dimensions because of the realization of enhanced economic returns and increased employment opportunities as viewed by the farmers. Ecological sustainability and stability were the two dimensions which contributed less for the Sustainability Development Index of the selected homesteads. The highest increased

Table 5. Agro ecosystem wise increase in farm net income in the diversified homesteads of the participating farmers over the period of three years (Ten farmers per situation)

Sl. no.	Particulars	Agro eco systems and Panchayats					
		HEHR-Pananchery	MEHR-Karukutty	LEHR-Thalikulam	HEMR-Kizhekkanchery	HELR - Muthalamada	MELR-Eruthenpathy
1	Average farm size (ha)	0.96	0.60	0.41	0.70	0.84	1.01
2	Net income after intervention (₹)	37,300	47,940	25,003	56,498	43,573	40,800
3	Net income before intervention (₹)	18,130	39,443	15,006	13,478	22,347	13,637
4	Increased net income (₹)	19,170	8,497	9,997	43,020	21,226	27,163

HEHR - High Elevation-High Rainfall
MEHR - Medium Elevation- High Rainfall
LEHR - Low coastal area, Low Elevation- High Rainfall
HEMR - High Elevation- Medium Rainfall
HELR - High Elevation- Low Rainfall
MELR - Medium elevation- black soil- Low Rainfall

farm net income per annum was realized at HEMR (Kizhakkenchery) with ₹ 43,020 and the lowest with ₹ 8,497 at MEHR situation (Karukutty) after three years of interventions. Therefore it was concluded that the interventions with appropriate integration of components in homesteads on participatory mode could achieve all the six dimensions of sustainability.

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