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Integrated Farming System for enhancing farm income in rainfed lowlands of Andaman Islands

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Abstract

For crop + dairy based system, total farm production increased from 10 MT in 2013 to 26.8 MT in 2018 in an area of 0.75ha. The increased farm production is mainly by diversification and intensification of cropping system through the inclusion of crops like pulses, vegetables, sorghum, maize during dry season after harvesting of rice, land manipulation facilitated round the year vegetable cultivation in raised beds. The integration of dairy component in 2014 resulted in sudden spike in total production resulted in increased net returns from ₹.92355/- to ₹.217450 from an area of 0.75ha during the same period indicating that the diversification of crops and integration of different farm enterprises provides an opportunity for the farmers to increase yield and productivity per unit area thus doubling the farm income.

Keywords: *Alternative farming, coastal lowlands, crop diversification, IFS, tropical islands*

Introduction

The agriculture in Andaman Islands is characterized by mixed farming with predominance of crop and livestock components. The agriculture is predominantly rainfed and no permanent irrigation facilities are available. In coastal lowlands and valley plains rice is the only crop grown during wet season because of high rainfall and water stagnation due to poor drainage facilities. During dry period, the crop cultivation is limited by scarcity of water and in some places farmers are growing vegetables, pulses like green gram using limited water resources in fresh water streams. Because of poor management practices the crop productivity is very low in these areas. Among the livestock, dairy cattle and backyard poultry were the major contributors of farm income especially among the small and marginal farmers. The productivity of animals was comparatively low due to climatic stress, unavailability of quality fodder during dry season etc. The total farm income is only Rs 35 to 40000/- per ha/ year. In this regard, Integrated farming system (IFS) is only possible way out to increase the farmer's income and also fulfill the need for increasing food production to feed the growing population. In IFS, all agricultural enterprises including animal husbandry, fishery, bee keeping, goat rearing, cropping systems, fruits, vegetable and others are set up into a single unit of land and hence better recycling of resource or input occurs ultimately increasing the farmer's income (Choudhary *et al*.2019). The judicious mix of two or more components based on cardinal principles of minimum competition and maximum complementarity with advanced agronomic management practices which aimed at sustainable and environment friendly improvement of farm income, family nutrition and ecosystem services is defined as integrated farming system (IFS). The preservation of bio-diversity, diversification of cropping/farming system and maximizing recycling is the base for success of the farming systems approach (Singh and Ravisankar, 2015).

To achieve doubling farmer's income might require novel strategies and some change in the policy stance. The income enhancement of farmer can be achieved by increase in productivity of crops, increase in production of livestock, improvement in input use efficiency to reduce cost, increase in farm level cropping intensity, diversification towards high value commodities, better remunerative price realized by farmers, and shifting surplus labour (unproductive) from agriculture to nom-farm activities, all of which could only be possible through government initiatives, technology generation and dissemination besides policies and reforms in agriculture sector (Ponnusamy and Kousalya Devi 2017). Integrated farming system provides the scope for achieving many of the proposed strategies like increasing production, productivity, cropping intensity, crop diversification and

efficient input use through resource recycling. Several studies were conducted in coastal lowlands for successful implementation of IFS strategies. In coastal lowlands, raised bunds are made around the rice fields to hold water for longer periods and to avoid over-flowing of flood water and a suitable fish refuge/trench system for successful rice-cum-fish farming (Velmurugan et al. 2015). In shallow lowlands, 500 to 700 kg/ha of fish or prawn and 5 to 6 t/ha of rice can be obtained under such mixed systems, while it is possible to increase the production of fish/ prawn to 2000 kg ha^{-1} in deepwater situations where water remains in the field for longer period. Vegetables and horticultural crops on raised bunds around the field with the soil excavated from the trenches further increase the land productivity to a great extent (Sinhababu and Venkateswarlu, 1998). The net income from tuber crop based farming system in tribal areas of Little Andaman in 0.2 ha, increased the net income to Rs 1, 32,820 from Rs.42,200 with the B: C ratio of 2.08 and employment generation up to 510 man days/ha as compared to 295 man days/ha in their traditional system (Domodaran et al.2015). By integrating livestock into a crop based farming increases the financial benefits and better use of farm resources such as manure and crop residues (Schiere *et al*., 2002 and Nedunchezhiyan, 2016). As there is greater scope for increasing the farm production and income, studies were conducted by crop diversification and its integration with other farm enterprises to enhance the farmer's income under rainfed lowland conditions.

Experimental set up

The study was conducted during 2010 to 2018 in an area of 0.75 ha at Field Crops Research Farm, Bloomsdale of ICAR- Central Island Agricultural Research Institute, Port Blair. The broad bed and furrow (BBF) system to grow vegetables on the beds and rice-fish in the sunken furrows was done in 0.30ha and in the remaining area of 0.35ha, different rice based cropping systems viz., rice (*Oryza sativa L.*) – maize (*Zea mays L.*), rice (*Oryza sativa L.*)- green gram (*Vigna radiata)*, rice (*Oryza sativa L.*) – sorghum (*Sorghum bicolor*) and rice (*Oryza sativa L.*) – vegetables (okra/brinjal/cowpea) were followed. The dairy component was integrated in 2014 by inclusion of 2 numbers of HF cross bred heifers. Fresh water cat fish such as singhi (*Heteropneustes fossilis*) and magur (*Clarias batrachus*) were introduced in the furrows and composting was done for residue recycling.

Economic evaluation

Economic evaluation was made based on observations on productivity in terms of rice–grain equivalent yield, net returns, cost of production, and employment generation from different farm enterprises and for the farming system as a whole.

Results and discussion

The inclusion of different components with diversified species of crops viz., rice, pulses, oilseeds, vegetables in the cropping system and integrating other farm enterprises like dairy and fishery in an area of 0.75 ha in coastal low lands not only increased the overall farm production but production of diversified food items resulted in achieving food and nutritional security of the household. The analysis revealed that the IFS model improved the total farm production and enhanced the livelihood security of marginal and small farmers. The total farm production during the same period increased from 10 MT in 2013 to 26.8 MT in 2018.This increase was mainly by integration of livestock component which contributed around 50% of total farm production followed by vegetable production in BBF system which enabled the crop diversification and increased cropping intensity. Wide variations were observed in performance of crops especially rice based cropping systems. During last two years the productivity of rice based cropping system was lowered due to more than 70% loss in rice caused by pests especially gundi bug *(Leptocorisa oratoria*) and birds during milky and grain filling stages. Eventhen, system stability was achieved by livestock component which alone contributed more than 50% of the total farm production after its integration.

Table 1.Physical production of different components of farming system model over the years

Cropping Systems/components	Total production (Rice Equivalent Yield kg)					
	2013	2014	2015	2016	2017	2018
Rice - Maize	866	575	749	939	985	606
Rice- sorghum	1033	637	933	1024	1309	873
Rice - Black gram	604	491	440	194	356	410
Rice - vegetable	1090	2895	3874	1229	1607	1627
Okra-radish-cucumber	1459	2046	1753	1496	1694	724
Amaranth- okra- brinjal	1312	905	1065	1349	925	1330
Okra-French beans-Bottle gourd	1853	2202	1411	1464	854	1044
Brinjal-brinjal-Bottle gourd	1419	687	1633	1642	495	1533
Fodder	0	1089	1786	1703	645	606
Furrows (rice)	438	311	345	256	290	286
Total (Crops)	10074	11837	13988	11296	9160	9031
Dairy	0	12187	13633	16348	16256	16388
Fisheries	0	240	0	194	240	171
Compost	0	1672	2370	1325	1226	1230
Total	10074	25937	29991	29162	26882	26829

This increase in farm production also led to rice in net farm income from Rs. 92355 /- in 2013 to Rs. 217450 /- in 2018. However, the major issue is increase in variable costs from Rs.57000/- to Rs.1.98 lakhs in 2018 during the same period(Fig 1). The total variable costs are inclusive of labour charges (44%) and recycled products (30%) within the system. Only 26% of the costs are accounted for inputs purchased from outside the system mainly of concentrated feed for the dairy animals, fertilizers, pesticides, seed costs and hiring charges of tractor and other farm machinery. So the actual expenditure will be Rs.51480/- for an income of around Rs.2 lakhs if family labour is engaged and wastes are efficiently recycled within the system.

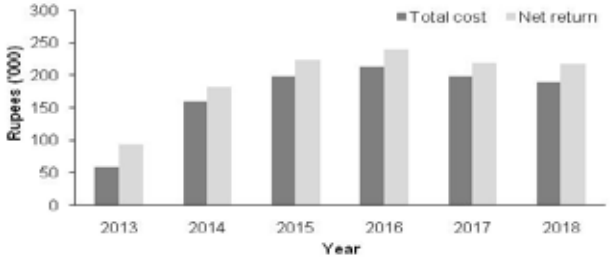

Fig. Total running cost and net income from 0.75 ha IFS model

The livestock components had contributed 60% of the total net income and 32.5% by crops. The system had generated total employment of 365 man days in a year with mean monthly employment generation of 30 man days. As expected highest share of employment or labour requirement is from dairy unit (56%) and it is spread throughout the year. It is followed by crops accounting 40.9% of labour requirement. Unlike, dairy component, the labour requirement is concentrated in few weeks of a season mainly for transplanting or sowing, weeding, harvest and threshing. Among, the crop component the vegetable cultivation in BBF is labour intensive unlike rice based cropping system where the work load is only seasonal.

Conclusions

The crop diversification and integration of livestock component in a mixed farming system model provides an opportunity for the marginal and small farmers to increase the farm production and total farm income from the same piece of land. The integration of livestock component proves to be more effective in increasing the farm income than crop diversification alone. Thus farmers can realize

the doubling of their income within a contemplated period of five years by adopting mixed farming system. However, the heavy investment in the initial years and non-availability of labour were observed as the major constraints in adopting integrated farming system.

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