Integrated farming system: is it a panacea for the resource-poor farm families of rainfed ecosystem?

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Rainfed agriculture by resource-poor farm families plays a pivotal role in maintaining global food security. Poor access to resources has been a major concern for the farming community of such risk-prone areas. It is also characterized by social maladies like poverty, malnutrition and migration. Judicious and systematic use of available limited resources through integrated farming system paves the way for generating more employment and thereby could prove a sustainable and potent tool in fighting poverty.

Farming system approach helps in poverty reduction, food security, competitiveness and sustainability in production[1]. An integrated farming system (IFS) is one which focuses on judicious combinations of any one or more of the enterprises and effective recycling of residue waste for better management of available resources. It helps small and marginal farmers to generate more income and provides employment for family labourers during off-seasons[2]. It includes livestock, poultry, fishery, duckery, mushroom production, apiculture, sericulture along with crop components through which total biomass production per unit area can be increased. Backyard poultry and vermicomposting can be added to IFS to increase farm income and strengthen livelihoods[3]. An IFS also encompasses the objective of conservation of existing natural resources and efficiently using them for sustainable growth of productivity as well as profitability. Thus the IFS approach focuses on a few selected interdependent, interrelated and interlinking enterprises of crops, animals and other related subsidiary professions. In this process, bee-keeping, fisheries, mushroom cultivation and space-conservative subsidiary professions are added to give additional high-energy food without affecting production of food grains[4]. It can be taken up in all types of social systems as well as both in rainfed and irrigated areas where the farmers need more output from the limited resources. Thus, mono-cropping which restricts productivity per unit of land can be substituted by farming system approach. It is different from corporate farming due to its integration of different complementary components. Moreover, the IFS process is aimed at strengthening the nutritional security and employment generation.

Status of rainfed agriculture

About 30% of the world's land surface of 13.4 billion ha is suitable for rainfed agriculture[5]. It is estimated that more than 70% of the world's staple food is harvested from the rainfed areas. About 93% of cultivated land of Sub-Saharan Africa, 87% of Latin America, 67% of the East and North Africa, 65% of East Asia and 58% of South Asia are rainfed[6]. For a significant number of sovereign nations of the world, rainfed agriculture forms the basis of their food grain production as well as food security. Rainfed ecosystem in India comprises 57% of the total cultivated area and habitat for 40% of human and 60% of livestock population. Out of an estimated 140.3 m ha of net cultivated area, 79.44 m ha is rainfed. It contributes 44.5% of the total food grain production of the nation[7]. Extent of irrigated area is determined by several factors. Important among them are land topography, source of irrigation, socio-economic status of the farming community and policy issues of the state governments. Punjab and Haryana have the highest percentage of cultivated area under irrigation, i.e. 98.0% and 87.3% respectively, whereas Assam (5.5%) and Maharashtra (19.2%) have poor irrigation intensity. In Odisha (35.1%), Chhattisgarh (26.7%), Madhya Pradesh (33.2%) and Rajasthan (33.6%) agriculture is predominantly rainfed as over two-thirds

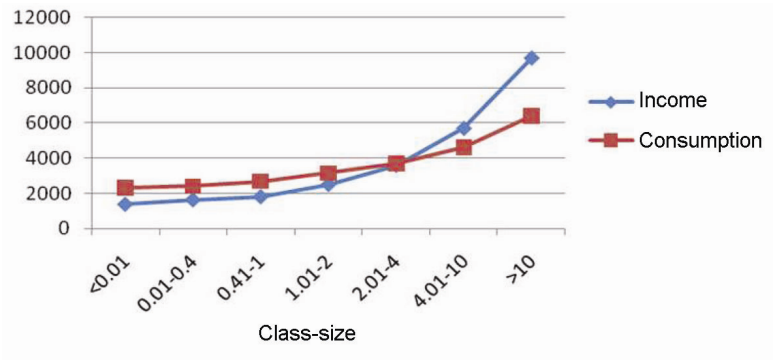

Figure 1. Income and consumption (Rs) of farmers from different categories in India.

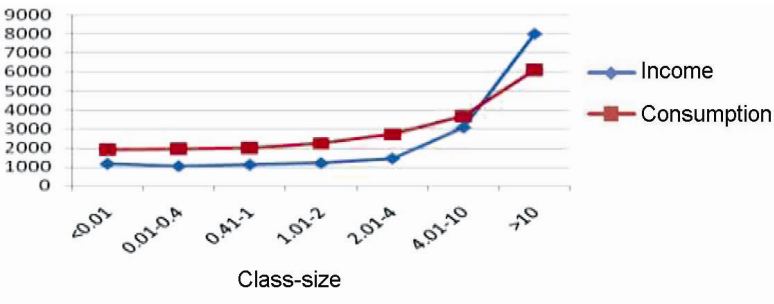

Figure 2. Income and consumption (Rs) of farmers from Madhya Pradesh, India.

Table 1. Operational land holdings distribution in India (1970–2010)

Year	No. of holdings ('000)	Average size (ha)	Marginal (%)	Small (%)	Semi-medium (%)	Medium (%)	Large (%)
1970–71	71,011	2.3	51.0	18.9	15.0	11.2	3.9
1980–81	88,883	1.8	56.4	18.1	14.0	9.1	2.4
1990–91	106,638	1.6	59.4	18.8	13.1	7.1	1.6
2000–01	119,931	1.3	62.9	18.9	11.7	5.5	1.0
2005–06	129,222	1.2	64.8	18.5	10.9	4.9	0.8
2010–11	137,757	1.2	67.0	17.9	10.0	4.3	0.7

of cropped area do not have assured irrigation facility. Lack of assured irrigation restricts the farmers in adoption of hybrid crops, high-valued crops and precision agriculture like the latest technologies. Coarse cereals (91%), pulses (91%), oilseeds (80%) and cotton (65%) dominate the cropping systems of these rainfed areas[8]. The state of rainfed agriculture in India is precarious and the problems associated with it are multifarious. Prominent among them are low cropping intensity, high cost of cultivation, poor adoption of modern technology, low productivity, lack of institutional credit, inadequate public investment, high incidence of rural poverty and farmer suicides[9].

Rainfed areas have lower per capita income as well as low consumption expenditure due to low purchasing power. A comparative view of Figures 1 and 2 shows that in both cases, the performance of a rainfed dominating state, Madhya Pradesh, is less than the all-India average[10].

Status of small farm holders in India

The population of India is increasing at the rate of 1.2%, indicating that it will be the most populous nation in the world by 2025. The increasing population causes fragmentation of land and as a consequence the average land holding of the Indian population has reduced from 2.3 ha in 1970–71 to 1.2 ha in 2010–11. Moreover, the number of marginal farmers with less than 1 ha of cultivated land has increased from 51% to 67% during that period (Table 1). The share of resource-poor community of total farmers has increased from 69.9% to 84.9% within this period. The reducing trend of per capita land holding of the majority farmers is a major concern for food security of the nation in the coming days[11]. Their contribution is still around 70% to the total production of vegetables and 55% to fruits against their share of 44% in land area[12]. Their share in cereal and milk production is 52% and 69% respectively. Only in the cases of pulses and oilseeds, their share is lower than the other farmers. Thus, these poor farming communities have a major role in the diversification of production, poverty reduction, development as well as food security of the nation[13]. As computed from National Sample Survey Organisation (NSSO) data (2003), the value of output per hectare was Rs 14,754 for marginal farmers, Rs 13,001 for small farmers, Rs 10,655 for medium farmers and Rs 8783 for large farmers. This shows that from efficiency point of view, small holdings are equal or better than large holdings. But due to paucity of resources, the small farm holders often suffer from social maladies such as poverty, malnutrition, unemployment and migration.

Challenges to small holders in the changing scenario and role of IFS

Small farm holders have poor access to land, water, inputs, credit, technology and markets. In the post-liberalization days, new threats have come up in terms of sustainability of these small holdings. The concept of contract and commercial farming is gradually gaining ground in India. Therefore, the farmers face new challenges in integration of value chains, market volatility, risks and vulnerability besides the effects of liberalization, globalization and climate change[14]. For efficient use of existing resources and farm by-products, the resource-poor farmers are now encouraged to integrate the crops with non-crop components, and land-based vocations with non-land based enterprises through different types of IFS. The ancillary components in these IFS are characterized by low investment, higher profit, homestead and involving family labour. Various resource conservation mechanisms have evolved up to follow 'more crops per drop' theory. Table 2 provides a comparative study of two IFS against traditional farming in different locations of two rainfed states. The farm area taken represents 67%, i.e. marginal category of farmers. The cropping system was modified in the case of Odisha and only more components were added in Chhattisgarh.

Table 2 depicts two IFS vis-à-vis traditional farming system in rainfed ecosystem in India. The study in Odisha indicates that the net return multiplies more than seven times in the same patch of land (1 ha) when a system of rice–pulse–vegetable–mushroom–poultry–vermi composting is taken up judiciously, managing the time and cost factor by the same marginal farmer[15]. The straws produced were used for paddy straw mushroom cultivation which gave more income and nutritional security to the poor farmers. The partial decomposed paddy straw of mushroom cultivation was used in the farm vermi compost pit which produced good organic fertilizer for the field as well as the off-season vegetable crops. The early tomato and cauliflower harvested in late *kharif* period gave better price to the produce. Poultry was attached as one of the components of IFS which gave employment to farm women and increased family income. In Chhattisgarh, the net return increased four times in the IFS of 1.5 acre of land against the traditional cropping. The marginal farmer and his family could get employment of 316 man days per year instead of 165 days in the same patch of land[16]. The green fodders and straw produced were consumed by the animals reared, i.e. bullock, buffalo and goat. It increased the animal productivity and in return their dung was used as manure to increase soil fertility status. Backyard poultry and duckery were for more income and better nutrition to the family.

Table 2. Comparison of integrated farming systems (IFS) in different rainfed locations of India

Reference	Barik *et al.*[15]		Ramrao *et al.*[16]	
Location	Deogarh district, Odisha		Durg district, Chhattisgarh	
Farming type	Traditional	IFS	Traditional	IFS
Area	1 ha	1 ha	1.5 acre	1.5 acre
Components	Rice–green gram	Rice-green gram–early tomato–early cauliflower–paddy straw mushroom (50 beds)–poultry (100 chicks)–one vermi-compost pit	Rice–fodder	Rice + fodder + two bullocks + one cow + one buffalo + ten goats + ten poultry + ten ducks

Table 3. Economic and employment avenues in integrated farming systems

Reference	Barik *et al.*[15]		Ramrao *et al.*[16]	
Location	Deogarh district, Odisha		Durg district, Chhattisgarh	
Farming type	Traditional	IFS	Traditional	IFS
Gross expenditure/annum	16,420	83,140	12,396	24,899
Net return/annum	10,390	78,060	7843	33,076
BC ratio	1.63	1.94	1.63	2.23
Employment generation	82	134	165	316

Conclusion

The above study clearly indicates that instead of mono-cropping or traditional cropping practices, adoption of IFS by the resource-poor farmers could be of immense help in strengthening their net income as well as creating jobs, thus paving the way for sustainable family farming. Crops cultivated and other components in the IFS should be complementary so that the farming could be profitable and sustainable. In the limited resources, some rainfed pulse fodders, e.g. lucerne, berseem, cow pea should be cultivated, which will increase the productivity of the domesticated animals and soil fertility status as well. Thus IFS enhances farm productivity, nutritional security and net income of the small and marginal land holders, which ultimately reduces poverty. Increasing of net income and employment leads to socioeconomic development of farm families. In this context, the 11th Five-Year Plan (2007–12) stressed that 'the agricultural strategy must focus on 85% of farmers who are small and marginal, increasingly female, and who find it difficult to access inputs, credit and extension or to market their output. While some of these farmers may ultimately exit from farming, the overwhelming majority will continue to remain in the sector and the objective of inclusiveness requires that their needs are attended to'.

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