Increasing Incomes of Resource-poor Farm Families through an Integrated Farming System in the CDR Eco-system

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ABSTRACT

This study was undertaken in Deogarh district of Odisha in the North–western plateau agro-climatic zone where more than 53 % of total geographical area is under dense forests and hilly tracts. Three villages were randomly selected from the three community development blocks of the district with a sample size of 150 small and marginal farmers, 50 from each village. It was found that out of the thirteen farming systems followed by the resource-poor farming community of Deogarh district, rice-pulses with a pair of bullocks was the most prevalent farming system adopted by 18.3% of total farm households followed by rice-pulses-livestock. Rice-oilseeds-horticulture crop combination was adopted by only 2.7% of respondents. An on-farm trial (OFT) to assess a suitable integrated farming system (IFS) in one ha of land for resource-poor farmers of this complex, diversified and risk prone (CDR) plateau eco-system comprising both crop (rice-green gram-early tomato-early cauliflower) and non-crop components (poultry-mushroom-vermi compost) was tested by Krishi Vigyan Kendra, Deogarh during 2009-10. It was found that the gap of net income between the farming systems was 67,670 rupees. BC ratio calculated was 1.94 and 1.63 of the recommended and traditional farming systems respectively. The IFS was found valid for resource-poor farm families in a plateau eco-system with increasing land use efficiency, sustaining livelihood by strengthening the economic status and generating employment using the land and time judiciously.

INTRODUCTION

Farming is considered a bio-economic system in which man attempts to control the biological system in an uncertain environment to achieve some goals which are predominantly economic in nature (Wright, 1971). An integrated farming system (IFS) is one which focuses on judicious combinations of any one or more of such enterprises and effective recycling of residue waste for better management of available resources with small and marginal farmers to generate more income and employment for family labourers during off seasons (Behera *et. al*, 2001). IFS includes livestock, poultry, fishery, duckery, mushroom production, and apiculture along with crop components through which total biomass production per unit area can be increased by efficient utilisation of natural resources. The primary objective of a farming system is to improve the well-being of individual farm families by increasing the productivity of their farming systems given the constraints imposed by resources and environment (Norman and Collinson, 1985).The decrease in operational land holding, increasing rate of population and declining rate of per capita availability of cultivated land have been major concerns to our nation since the scope for horizontal expansion in farming is limited. Vertical expansion is possible only through adoption of the latest technology, bio-engineering and changing of cropping methods to integration of farming systems by putting the components systematically and scientifically in the right order, consuming the least space. The goal of such integrated farming systems also encompasses the objective of conservation of existing natural resources and efficiently using them for sustainable growth of productivity as well as profitability. Thus IFS activity is focused on a few selected interdependent, interrelated and interlinking enterprises of crops, animals and other related subsidiary professions. In integrated farming systems, bee keeping, fisheries, sericulture, mushroom cultivation and space-conservative subsidiary professions give additional high energy food without affecting production of food grains (Gill *et al*, 2009). Backyard poultry and vermi-composting can be added to increase farm income and strengthen livelihoods.

Deogarh district, located between the longitude $84^0 28'$ - $85^0 15'$ N and latitude 21^0 11'-$21^0 43'$ E, is in the North-Western plateau agro-climatic zone of Odisha state. The whole district is under a low rainfall lateritic agro-ecological situation. 53% of its total geographical area, 2 94,000 ha, is under dense forest and plateaus. It has only 66,950 ha total cultivated area. Most farm families belong to the resource-poor small and marginal category. The district has little scope

for industries and only one-third of the gross cropped area is irrigated. This situation has made farming a risk-prone occupation. The small and marginal category farmers depend on various options of this risk-prone rain-fed farming system for their livelihood. This paper highlights the different farming systems adopted by small and marginal farmers and assesses an alternative farming system comprising both crop and non-crop components, suitable to this complex, diversified and risk- prone (CDR) plateau eco-system.

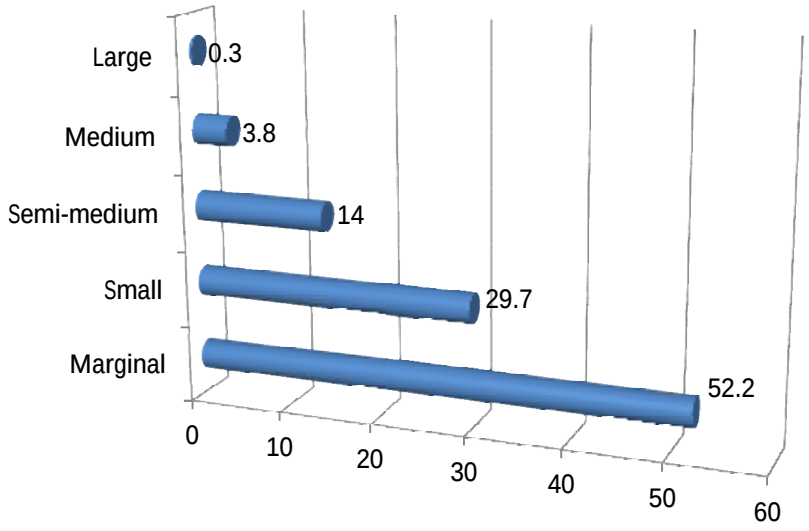
METHODOLOGY

In order to get an idea of different farming systems present in the complex and risk-prone plateau eco-system, all three community development blocks of Deogarh district were taken in the study. One revenue village of each block namely Kureibahal, Malehipada and Akshyarasila were selected randomly from the villages where more than 80% of farmers belong to the small and marginal category. Fifty farm families belonging to this category were selected randomly from each village. Data were collected through a pre-structured interview schedule incorporating all the information required for the study. All the 150 respondents were interviewed personally. The economics of the farming system were calculated.

RESULTS AND DISCUSSION

The geographical location and the lack of infrastructure have led to poor performance of Deogarh district. About 83% of its rural families depend upon agriculture. The economy of the district is agriculture-oriented. Only 32% of the cultivated area is irrigated. The land distribution among farm families is shown in Fig 1. There were 52.2% marginal farmers. Out of the five types of farming category i.e. marginal, small, semi-medium, medium and large, large farmers were the lowest in number with only 0.%. Small category farmers with average land holding size of 1.4 ha was 29.7%. Thus resource-poor farmers constitute about 81.9% of total farm families in the district.

Figure1. Distribution of farm families according to land distribution



The district is a rich source of bio-diversity, present at 250 mtr to 700 mtr from the MSL and a number of varieties of crops are cultivated here. The cropping intensity of the district is 189%. The deviation of the normal rainfall is up to 592mm from the normal rainfall of 1582.5 mm (2009-10). The diversity in cultivation of the district (Anonymous, 2008-09) is mentioned in Table 1.

Table1. Crop demography of Deogarh district

Sl.No.	Crop	Area(ha.)	Yield(q/ha)
1	Paddy	35540	18.74
2	Wheat	1135	12.57
3	Maize	1105	11.21
4	Pigeon pea	1280	9.01

5	Green gram	10554	3.37
6	Black gram	9020	3.61
7	Groundnut	2425	12.54
8	Mustard	2970	3.98
9	Sesamum	15400	4.18
10	Mango	2240	64.2
11	Litchi	591	37.9
12	Sweet orange	417	115.7
13	Banana	230	119.1
14	Vegetables	5853	111.36

Rice being the principal crop of the district, all farming systems were based on *kharif* rice. Though a number of crops including fruits are cultivated in the district, the productivity was poor (Table 1). The unbunded uplands with undulating topography mostly remain fallow or covered with horticultural crops, pulses and oilseeds, cultivated haphazardly. After rice, sesamum is the leading crop of the district with 15400 ha area as it is cultivated in all seasons.

A pair of bullocks was associated with all the studied farm families. Therefore it can be concluded that all the responding farm families had a crop and animal component. Livestock (leaving the pair of bullocks), goats, sheep, poultry bird and *desi* cows are also present with most of the farm families. The data on different types of farming systems in the district were collected and summarised in Table 2.

Table 2. Distribution of Farming systems N=150

Sl. No.	*Farming systems	Frequency	Per cent
1	Rice only	8	5.3
2	Rice – Pulses	28	18.6
3	Rice - Pulses – Oilseeds	10	6.7
4	Rice - Pulses - Oilseeds – Livestock	14	9.3
5	Rice - Pulses - Oilseeds - Horticulture crops - Livestock	12	8.0
6	Rice - Pulses - Livestock	17	11.3
7	Rice - Pulses - Oilseeds - Horticulture crops	10	6.7
8	Rice - Pulses - Horticulture crops	12	8.0
9	Rice - Horticulture crops	6	4.0
10	Rice - Oilseeds – Livestock	8	5.3
11	Rice - Horticulture crops - Livestock	7	4.7
12	Rice - Livestock	14	9.3
13	Rice - Oilseeds - Horticulture crops	4	2.7

*all the farming systems include pair of bullocks for farming

Table 2 shows that there were thirteen rice-based farming systems in the district. Rice-pulses farming system was the most prevalent one adopted by 18.6% of respondents. Rice-pulses-livestock was the second most popular farming system. Rice-pulses-oilseeds-livestock and rice-livestock both have 9.3% of presence in the district. Rice - pulses - oilseeds – horticulture crops - livestock and rice - pulses – horticulture farming systems are adopted by 8% farmers in both cases. Similarly rice and rice - oilseeds -livestock farming systems each had 5.3% of total respondents. Rice-oilseeds-horticulture crops were the least adopted farming systems (2.7% of respondents) and they were half of the only rice farmers among the responding small and marginal farmers.

Table 3. Component wise configuration of farming systems N=150

Sl. No.	Components	Frequency	Per cent
1	Rice	150	100
2	Pulses	103	68.7
3	Oilseeds	58	38.7
4	Livestock	72	48

5	Horticulture crops	51	34

It is evident from Table 3 that pulses were the second most preferred component behind rice in the existing thirteen farming systems. From discussions with respondents, it was found that after rice, *dal* was the second preferred food of the inhabitants of the plateau eco-system. Hence pulses were the components of the maximum number of farming systems. Livestock are the companions of resource-poor farmers. Traditional goatery, poultry and dairy were practised by good numbers of farmers as Table 2 shows about 48% had these livestock. Horticulture crops were the least preferred components (34% of respondents) behind oilseeds. This might be due to the lack of irrigation facilities during the *rabi* and *summer* season in the plateau eco system.

Among the pulses, green gram was cultivated in the highest areas i.e.10554 ha during the year 2009-10. Rice-green gram farming was the most prevalent farming system in this eco-system. The Krishi Vigyan Kendra, Deogarh assessed an integrated farming system model substituted for the most prevalent rice-green gram farming system in the risk- prone rain-fed plateau ecosystem of Deogarh district through its on-farm trial (OFT) programme during 2009-10. The OFT programme was taken in 1 ha area of rain-fed upland in Kureibahal village. The OFT was designed with two treatments, i.e. two farming systems in five farmers' fields as replications. The existing farming system was taken as a rice-green gram combination and the recommended practice was the diversification to IFS, integrating the crop and non-crop components (Table IV). In the recommended IFS practice, out of one ha of land, a short duration rice variety like *Khandagiri* rice was cultivated in 0.8 ha instead of the total land and the rest was diverted to cultivation of local *kharif* green gram variety with application of paper mill sludge(PMS) 5q per ha and recommended doses of fertiliser. After the *kharif* rice was harvested, with the residual moisture wilt resistant *Utkal kumari* high yielding variety(HYV) tomato and *Barkha* variety of late *kharif* cauliflower was cultivated in 0.4 ha each with the all the critical inputs. The rearing of dual purpose *Banaraja* breed chicks for six months and mushroom farming of 50 beds was recommended for the post-*rabi* period. All the crop and non-crop residues were recycled through a low cost vermin-compost unit for increasing productivity and reducing the cost of cultivation. The early tomatoes harvested were marketed at the rate of twelve rupees per kilogram whereas the cauliflower sold at fifteen rupees. The paddy straw mushroom was sold at 80 rupees and birds of six months at 90 rupees per kilogram in the local market.

Table 4. Components in the recommended Integrated Farming System

Sl. No	Season	Crop	Area (ha)	Variety	Character of the variety	Interventions
1	Kharif	Rice	0.8	Khandagiri	High yielder, short duration, suitable for upland	Fertiliser application NPK @ 60:30:30kg/ha
2	Kharif	Green gram	0.2	Kalamuga	Unique taste and flavour	Fertiliser application NPK @ 20:40:20kg/ha- PMS 5qtl/ha
3	Late Kharif	Tomato	0.4	Utkal kumari	Wilt resistant , early (off-season)	Fertiliser application NPK @ 120:50:50 kg/ha, PMS 5qtl/ha
4	Late *Kharif*	Cauliflower	0.4	Barkha	Early harvesting, high yielder	Fertiliser application NPK@120:50:50 kg/ha, PMS 5qtl/ha, 2gm boron/ltr
5	Post-crop period	Poultry	100 Chicks	Banaraja	Free range, rearing for both meat and egg	Vaccination and mineral mixture

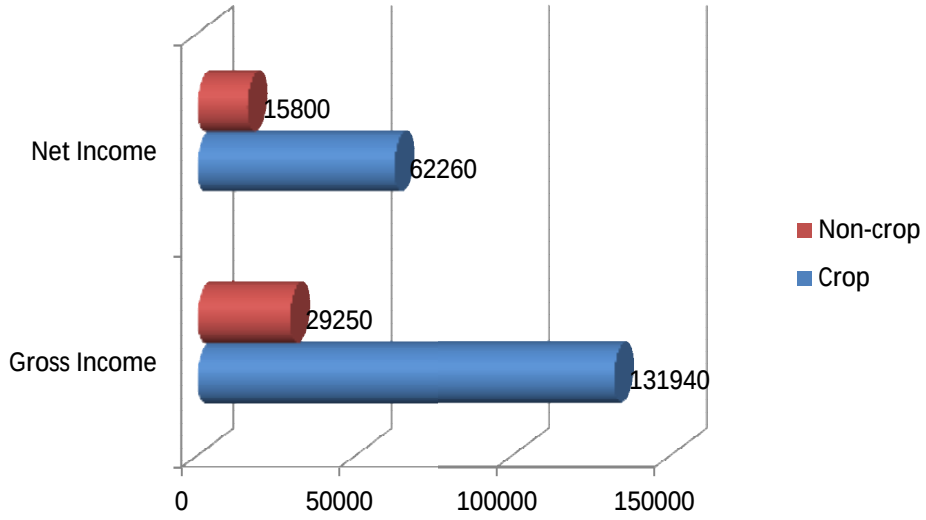
6	Post crop period	Mushroom (paddy straw)	50 beds	*V.volvacea*	Household business	Spawn and accessories
7	Throughout the year	Vermi-compost	1 pit	*E. euginae*	Good decomposer	Earthworms

Table 5. Economics of the Integrated Farming System

Sl. No	Crop	Area (ha)	Production (q)	Total expenditure (Rs.)	Net profit(Rs.)	BC ratio
1	Rice	0.8	17	11000	4900	1.45
2	Green gram	0.2	0.8	750	2800	4.73
3	Tomato	0.4	48.5	30,500	27700	1.90
4	Cauliflower	0.4	36.2	27440	26860	1.98
5	Paddy straw mushroom	50 beds	1.0	1750	6250	4.57
6	Poultry	100 Chicks	2.25	11250	9000	4.0
7	Vermi-compost	1 pit	2.0	450	550	2.22
Total				83140	78060	1.94
Conventional method of Farming						
1	Rice	1.0	21.0	15020	5890	1.39
2	Green gram	0.5	1.5	1400	4500	4.21
Total				16420	10390	1.63

It is clear from Table 5 that the recommended integrated farming system gave 67,670 rupees more than the traditional method of rice-green gram cropping system in the same one ha. of land. The cost benefit ratio was increased from 1.63 to 1.94 in the recommended IFS. From Figure 2 it is evident that the gross income from the crop component was 131,940 rupees whereas non-crop components like poultry rearing, vermi-composting and mushroom cultivation contributed 29,250 rupees. The net income from crop and non-crop components was 62,260 and 15,800 rupees respectively. Farm families were able to get more employment opportunities in comparison to the traditional rice-green gram farming system. In rain-fed conditions the family got employment from mushroom cultivation, poultry rearing and vermi-composting during the post-crop period when they would normally remain idle at his home without employment or migrate outside in search of a job.

Figure 2. Economics of Integrated farming System



This proposed integrated farming system for the plateau ecosystem was found profitable and viable by efficient and judicious use of every bit of land without hampering the environment.

CONCLUSION

An integrated farming system involving both crop and non-crop components is economically more viable than the traditional cropping system. It not only enhances the net income minimising risk factors but also provides employment opportunities during the leisure period. In such a CDR agro- eco-system integrating both the crop and non-crop components is thus a suitable and better alternative to the traditional cropping system for small and marginal farmers.

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