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Agronomy

Development of Profitable Integrated Farming Systems for Small and Marginal Farmers of Hyderabad Karnataka Region Under Irrigated Condition

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Abstract

A field experiment was conducted on performance of integrated farming system over conventional farming system for one ha. area at Main Agricultural Research Station, Raichur, Karnataka for three successive years of 2010-11 to 2012-13 under irrigated conditions in medium black soils to explore the productivity and profitability under irrigated condition. Among the system evaluated integrated farming system has recorded higher average net returns (Rs. 1,50,710) and benefit cost ratio (3.61) over conventional method as it records average net returns of Rs.65,000 with benefit cost ratio (2.85). The productivity and profitability during third year (2012-13) was more than second and first year under integrated farming system. During third year of integrated farming system records higher net returns (Rs. 2,45,398) with 4.63 B:C ratio than second year (Rs.1,29,442 net returns with 3.34 B:C ratio) and first year (Rs.76968 net returns with 2.53 B:C ratio) respectively.

Highlights

Among the different components evaluated it is concluded that crop + vegetable + dairy ensures most profitable income followed by crop + diary + floriculture

Keywords: Integrated farming system, conventional method, livestock and economics

The supply and demand profile food has changed due to higher economic growth, population explosion and shifts in dietary pattern. The average holding of land in India has been declining because of ever-increasing population and decline in per capita availability of land, there is hardly any scope for horizontal expansion of land for food, feed and fibre production. Vertical expansion by integrating appropriate farming components requiring lesser space and time, and ensuring higher total productivity of the system is the only alternate option left out. Unabated land degradation due to nutrient mining combined by topsoil loss by water erosion and climatic change towards adverse conditions are the serious problems affecting the agriculture. Use of cash returning farming practices will improve the socio economic conditions of the farmers. The potential of integration of dairy, poultry, goat rearing, vegetable production and fruit trees with dominant crops/cropping systems of irrigated areas should be exploited to make a judicious use of farm inputs and natural resources so as to provide, regular income and year round employment to small land holders.

In Karnataka, the majority of farmers hold less than two hectares of land. These farmers generally practice subsistence farming, where they need to produce a continuous, reliable and balanced supply of food, as well as cash for basic needs and recurrent farm expenditure. Therefore, there is need to develop suitable integrated farming system for such farmers since single crop production enterprises are subjected to high degree of risk and uncertainty because of seasonal, irregular and uncertain income and employment to the farmers. Sporadic but location specific research efforts in this regard have been encouraging (Jayanthi *et al.*, 2003, Shanmugasundaram *et al.*, 1995). Integrated farming system with multi-enterprise may pave the way for realizing increased productivity and profitability in small farms. Multi enterprise agriculture has the potential to decrease production costs by synergetic recycling of bi-products/residues of various components within the system and also to provide a regular source of income and employment. Many scientists reported significance of Integrated farming system over conventional method. Keeping this in view, a experiment conducted at Main Agriculture Research Station Farm, University of Agricultural Sciences, Raichur with a objective to study the profitability and productivity of conventional method and integrated farming system under irrigated ecosystem.

Materials and Methods

Experiment was conducted at Main Agriculture Research Station, UAS Raichur to study profitability and productivity of Integrated Farming System and conventional method for three successive years of 2010-11 to 2012-13. The Main Agricultural Research Station, Raichur is situated in North Eastern Dry Zone (Zone 2) of Karnataka state at 16° 12' N latitude and 77° 20' E longitude with an altitude of 389 meters above the mean sea level. The soil was deep black with a pH of 8.32. The available N, P K were 210.9, 25.4 141.5 kg ha^{-1}, respectively.

The experiment consist of growing of cotton for one ha (conventional method) and integrated farming system (IFS). The IFS model consisting of one ha. land holding with the components *viz.*, Crop and Cropping sequence (9000 m^2), Livestock (300 m^2), Farm pond (300 m^2), Composting unit, storage (250 m^2) and Farmhouse (150 m^2) as represented in Fig.1.

IFS Model for irrigated Ecosystem (1ha Area), Raichur

All along the border-planting of Glyricidia, Tamarind, Jamun, Sapota on the bunds and creeping vegetables on the fence were planted. Between the segments are planted with improved varieties of Drumstick, Curry leaf and fodder crops.

Details of crop components

Cropping sequence	Area (m^2)
Cotton	2000
Vegetables	900
Dolichos bean	100
Marigold +Jasmine+ Rose	2000
Maize - Bengal gram	2000
Fruit crops+ Green gram- Bengal gram	2000
Total	9000

Livestock component: 150 m^2

Species	No's	Area (m^2)
Milch cow	2	40
Bullock	2	40
Goat	11	70

Farm pond :	1	300 m^2
Farm pond	1	200 m^2
Poultry shed over pond	1	
Poultry	16	8 (Within pond)
Azolla	1 unit	3 m^2

Embankment	Fodder, Coconut, Papaya, Banana, Pomegranate, Fodder trees

Composting unit, storage godown, threshing floor etc: 150 m^2

Item Quantity Area (m^2)
Compost pits, rings (Vermi & quick composting) 2 No 50
Storage godown for inputs/outputs 1 No 100 50Threshing cum drying floor

To sustain the productivity the residues obtained in the system was recycled. The productivity of the conventional method and integrated farming system was based on the quantity of marketable produce obtained during all three years. A multi-disciplinary research team representing the disciplines of agronomy, soil science, animal science, farm power machinery engineering and agricultural economics was involved for in-depth analysis of data.

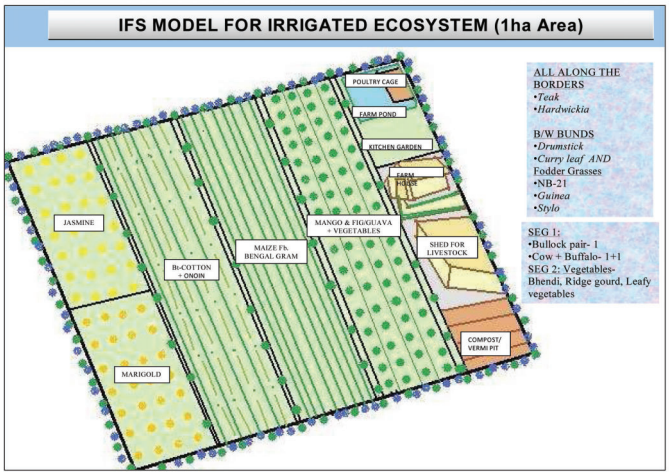


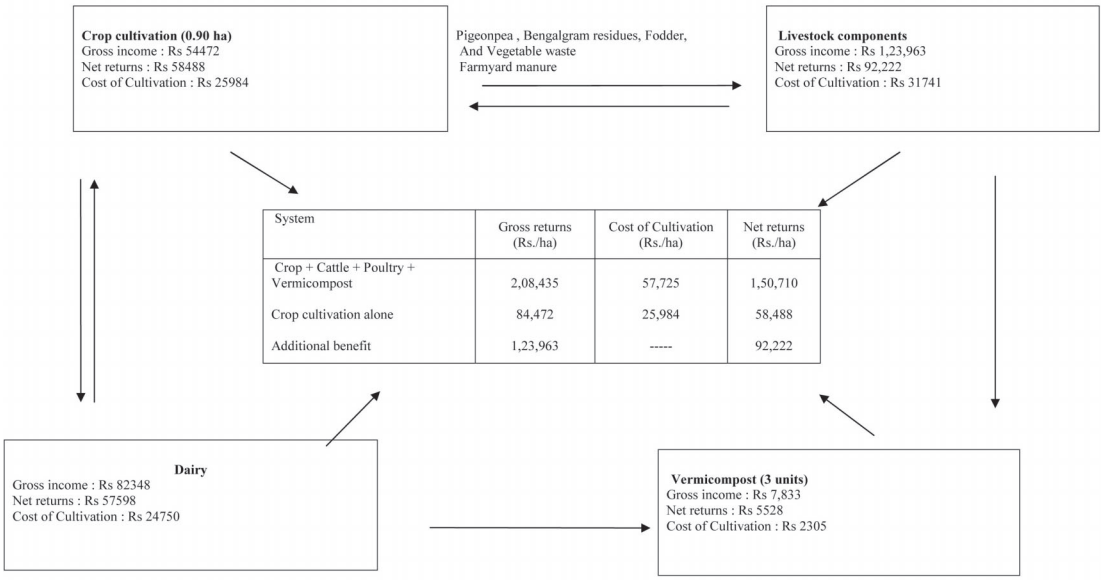
Fig. 1: A view of integrated farming system module with one ha area

Fig. 2: A view of components integrated farming system module

Results and Discussion

Results of three years of conventional method and integrated farming systems are discussed here

The productivity of the farming systems was based on the quantity of marketable produce obtained during all three years. Integrated farming system method (IFS) recorded higher productivity and profitability than conventional method. The conventional method recorded net returns of Rs. 65,000 with 2.85 B: C ratio (Table 1). IFS method records higher net returns and benefit cost ratio in all the three years because this method comprising the components like cropping, vegetables, vermicompost, goat rearing, poultry and cattle (bullocks, cow and calves) rearing. At the end of third successive year IFS method contributed a net return Rs. 2,45,398 with 4.63 benefit cost ratio, which gives 26.5 per cent higher net returns compared to conventional method. Similar results were reported by Ugwumba *et al.* (2010) and Ortega *et al.* (2009 a). Higher net income generated during third year compared to first and second year due to proper recycling of farm resources each other through use of vermicompost, FYM and also from yielding of horticulture components like drumstick, curryleaf, adoption of floriculture and good planning of vegetables according to good seasonal demand might be contributed to good returns. These results are in accordance with channabasavanna *et al.* (2009) were he stated IFS approach recorded 26.3 and 32.3 per cent higher productivity and profitability respectively over conventional rice-rice system. The results indicated IFS become more profitable during perennial years compared to single year.



System	Gross returns (Rs./ha)	Cost of Cultivation (Rs./ha)	Net returns (Rs./ha)
Crop + Cattle + Poultry + Vermicompost	2,08,435	57,725	1,50,710
Crop cultivation alone	84,472	25,984	58,488
Additional benefit	1,23,963	-----	92,222

Fig. 3: Productivity and profitability in integrated farming system method for average of three years

Table 1: Comparative performance of conventional method and Integrated Farming System on productivity (MARS, Raichur)

Crops grown	Conventional method		IFS method2010-11 (1st year)		IFS method2011-12 (2nd year)		IFS method2012-13 (3rd year)	
	Total income	Total expenditure	Total income	Total expenditure	Total income	Total expenditure	Total income	Total expenditure
Cotton	1,00,000	35,000	26,693	6,224	20,500	4,594	18,720	4,943
Vegetable	-	-	10,256	3,298	35,366	4,905	36,862	5,416
Maize - Chickpea	-	-	10,290	5,986	13,953	6,383	11,478	6,426
Jasmine + Marigold + Onion + Watermelon	-	-	5,124	4,271	14,393	4,850	22,175	5,306
Dolichus bean + Banana	-	-	-	-	6,869	1,310	6,060	1,458
Fruit crops + Chickpea	-	-	828	3,842	5,395	4,115	7,466	4,624
Dairy	-	-	59,384	23,135	63,470	24,835	1,24,190	26,280
Poultry	-	-	6,110	1,186	1,850	325	12,672	1,423
Vermicompost	-	-	7,500	2,275	8,000	2,320	8,000	2,320
Goat	-	-	-	-	15,055	1,772	54,108	5,416
Fishery	-	-	-	-	-	-	11,550	2,260
Green fodder on bunds	-	-	-	1,950	-	1,680	-	1,475
Azolla	-	-	-	200	-	200	-	200
Total income	1,00,000	-	1,27,185		1,84,851		3,13,270	
Total expenditure		35,000		50217		55,409		67,547
Net profit	65,000	76,968	1,29,442	2,45,398				
B c ratio	2.85	2.53	3.34	4.63				

Among components studied in irrigated IFS method, cotton + vegetable cultivation + diary + vermicomposting unit was more profitable than growing of single crop cotton. This system has recorded average net returns of Rs. 108212 with 5.41 B:C ratio (Fig.. 3). Similar results reported by Jayanthi *et. al.,* (2003), Channabasavanna *et. al.,* (2009), Ugwumba *et al*. (2010), Singh *et al*. (2009) and Ravishankar *et. al.,* (2007). Among enterprises studied animal components recorded higher net income than crop and cropping sequences. These results are in accordance with Jahan *et al.,* (2011) and Sachinkumar *et al.* (2012) were he reported inclusion of allied activity for small farms to increase income and promote ecological soundness. Similar results reported by Dey *et. al.,* (2010) and Torane *et al*., (2009).

Organic Manures from Livestock Components of ifs Method

Dung collection: Dung collected from bullocks (2 No's), Goats, HF Cow and poultry are recorded

The available quantity of organic manures obtained from the livestock components of IFS are presented in Table 2.

Available organic manure on wet weight basis was 41.23, 6.77, 22.95 and 2.32 t from bullocks (2), goat unit , cow (1) and poultry birds (40 No's), respectively and on dry weight basis available manure was 25.61, 3.84, 14.36 and 1.51 t from bullocks, goat unit, cow and poultry birds respectively. The total quantity of organic manure received from livestock components of IFS was 73 t. Out of 73 t manure was used as input in farm segments.

Table 2: Quantity of available organic manures from the livestock components of IFS

Year	Organic manures (kg)			
	Bullocks	Goats	Cow	Poultry
2010-11	13025	1062	5712	625
2011-12	14189	2461	8212	752
2012-13	14025	3224	9025	950
On wet weight basis	41237	6773	22950	2326
On dry weight basis	25611	3845	14366	1510

The nutrient content on dry weight basis of different manures is presented in Table 3. The poultry manure contained higher per cent of N and P nutrients than cattle manure. The K content of vermin compost was much higher than poultry manure and cattle manure.

Table 3: Nutrient content different manures and urines collected from IFS (On dry weight basis)

Sl.No.	Particulars	Nitrogen (%)	Phosphorous (%)	Potassium (%)
1.	Cattle manure	0.75	0.50	0.88
2.	Cattle urine	1.20	0.10	0.75
3.	Goat manure	1.80	1.36	0.14
4.	Goat urine	1.70	0.02	0.25
5.	Poultry Manure	2.96	1.70	1.43
6.	Vermicompost	1.85	1.16	1.53

The quantity of total nutrients (kg/year) from the livestock components of IFS (on dry weight basis) is presented in Table 4.

The total quantities of nutrients were 118.4 kg, 79.8 kg, and 108.12 kg NPK from the various livestock components of IFS (Bullocks, cow, goats and poultry birds).

Table 4: Quantity of available nutrients (kg/yr) from the livestock components of IFS (On dry weight basis)

Sl. No.	Live stock Components	Nitrogen (kg)	Phosphorous (kg)	Potassium (kg)
1.	Bullocks	54	35.75	62.92
2.	Cow	32	21.40	38.10
3.	Goats	21	16.15	1.60
4.	Poultry unit	11.40	6.5	5.50
	Total	118.40	79.80	108.12

Fruits and Vegetables Production in IFS method:

The raised dykes of the pond and kitchen garden were utilized for raising seasonal leafy vegetables, vegetables and fruits to meet daily food and nutritional requirement of 5-6 persons and to generate additional income. The monthly income generated throughout the year study period varied between Rs.300 to Rs.2100 during first year, Rs.1200 to 6100 during second year and Rs. 1000 to Rs. 6350 during the third year respectively (Table 5). Income generated during particular year may vary because of seasonal market demand, availability of inputs, labour availability etc.

Table 5: The month wise data on variation in vegetables income during study period.

Month	2010-11	2011-12	2012-13
May	400	1500	1000
June	680	1700	1850
July	1000	3200	3600
August	1100	4525	4850
September	2100	4900	3362
October	1600	6100	5800
November	1080	5400	6350
December	1400	4441	5950
January	596	2400	2600
February	300	1200	1500
Total	10,256	35,366	36,862

Vermicompost Production in IFS method

During lean period activities *viz.*, compost preparation and vermicompost production activities taken up in the IFS module to recycle the animal wastes, crop residues, grass and fodder tree wastes etc within the farm. In all three years on an average about 31 quintals vermicompost produced and used as farm input. The integrated farming system provides excellent opportunity for organic recycling, moreover, and it reduces farmer's dependency on external or market purchased inputs. It offers good scope for recycling of crop components to the animals and vice versa.

Animals Multiplication

Initially in IFS method two HF cow and improved Goat breed Shirohi (5 female +1male) introduced to the farm and evaluated for dryland situation of this region. After three years three calves from cow and 21 goats kidding obtained in three years. Not much care involved in animal's management. Goats used to feed with locally available napier grasses and tree leaves.

Survival of Farm Family

As per trial one farm family consisted farmer, his wife and two children were leaves in farm house. Both farmer and his wife use to work in IFS method. During all cropping Season farm family meeting their food requirements from farm produce. Farm family members satisfied they are getting diversified produces in their own farm and it includes nutritional vegetables, cereals, pulses, oilseeds, milk, fruits and others. So the family secure in terms of nutrition and food through integrated farming system method.

Conclusion

It is clear from the above results that IFS method for irrigated situations enhances productivity, profitability and nutritional security of the farmer and sustains soil productivity through recycling of organic sources of nutrients from the enterprises involved. In this system, animals are reared on agricultural waste and animal power is used for agricultural operation and voids are used as manure and fuel. The most notable advantage of utilizing low-cost/no-cost material at the farm level for recycling is that it will certainly reduce the production cost and ultimately improve the farm income considerably.

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