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RESEARCH PAPER

Relative performance of various integrated farming system models with respect to system productivity, economics and employment generation

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Abstract : A field experiment was conducted at Main Agricultural Research Station, Raichur (Karnataka) during 2012-13 and 2013-14 to evaluate the relative performance of different integrated farming system (IFS) models. Different combination of various crops, animals, fishes and poultry birds were examined in the form of seven integrated farming systems (IFS) models. The mean of two years indicated that, cotton based integrated farming system model F_7 recorded higher system productivity (10,903 kg/ha/year) and net returns (Rs.1,89,069/ha/year), over conventional cotton alone (F_1) system (3,061 kg/ha/year and Rs.74,592/ha/year, respectively). The productivity per day was 3.56 folds higher in F_7 farming system model (29.87 kg/ha/day) over conventional system of cotton alone (8.39 kg/ha/day). Among different models, F_7 system recorded maximum total productivity in terms of cotton kapas equivalent yield, net returns and employment.

Key Words : Cotton kapas equivalent yield, Economics, Employment generation integrated farming system, System productivity

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INTRODUCTION

Adoptability of suitable integrated farming system model is very important for attaining sustainability in North-Eastern zone of Karnataka. The resource degradation and reduction in yield was noticed due to continuous practice of cotton monocropping in this area. The depletion of inherited soil reserves, developing pest scenario and problem of weeds were also noticed. These all are the potential reasons which influence food and livelihood security of resource poor farmer.

Integrated farming systems gave 6 - 8 fold increase in net returns in improved farming systems with value of household consumption (produced within farm) increasing by 51.4 per cent. The per day profit of marginal and small households can be increased by 69.2 per cent. If IFS models and allied farming system packages are planned in proper way it gives monthly net income of Rs. 25,000 ha/year in irrigated and Rs. 10,000 ha/year in rainfed systems for marginal and small farmers (Singh *et al*., 2010). The above factors have inevitably

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accelerated the process of integrating livestock into crop production, as the crop residues as feed and manure as nutrient source are becoming increasingly valuable. However, the challenge of assuring the sustainability of the integrated farming system is how to integrate animal production with crop production. It contributes to an intensification of both food production and income generation in addition to maintenance of soil fertility. Hence, a study was conducted to evaluate and compared the relative efficiency of various farming system models to suit the situation.

MATERIAL AND METHODS

A field experiment was conducted at Main Agricultural Research Station (MARS), Raichur, Karnataka, during 2012-13 and 2013-14. The soil of the experiment site was deep black with pH 8.1. The N, P and K content of the soil was 243, 34 and 292 kg/ha, respectively. The treatments consisted of six various farming system models of IFS compared with conventional system of cotton alone (Table A). Livestock components chosen by looking to the integration potentiality of the system. Poultry var., Giriraj was reared in cage constructed on the fish pit (F_7) or reared separately (F_4) as Brooder system. The poultry birds were fed with starter feed upto 20 days and later farm wastes (broken grains) were used as the source of feed. The droppings were allowed to drop directly into the fish pit in models (F_7) where the cage was constructed on the fish pit, while when poultry was reared separately (F_4) the droppings were collected once in 15 to 30 days and added to respective treatments. Fish (common carp) was reared in farm pond (F_7). After the harvest of fish, the fish pit silt was recycled to respective plots. Goat and dairy animals reared in stall fed system and dung/ refuge was collected and composted separately. The compost was recycled in the respective treatments. In F_7 system on regular basis certain, quantity of dung/ droppings added to the fish pond to supplement the dietary needs of fishes. Rabbits were reared in cages (F_6 system), droppings recycled in the respective treatments. Since, the study includes diversified enterprises like fish, poultry, goat, rabbit, milch animals and various crops, the yield was converted into cotton kapas equivalent yield as suggested by Singh *et al*. (2005). The data were calculated for its economics based on the rates prevailing during the year and presented in Table 1. Labour requirement for various activities in crop

Table A : Details of the experimental treatments

Treatments		Livestock components	Crops on bunds
F_1	Cotton alone	Nil	Nil
F_2	Maize - Bengal gram	Nil	Nil
F_3	Cotton + Cowpea (F) 1:1 Maize + Cowpea (F) 1:1 - Bengal gram	Goat (2)	Drum stick, Curry leaf and Stylo
F_4	Cotton + Cowpea (F) 1:1 Maize + Cowpea (F) 1:1 - Bengal gram	Goat (2) + Poultry birds	Drum stick, Curry leaf and Guinea grass (Samruddhi)
F_5	Cotton + Cowpea (F) 1:1 Maize + Cowpea (F) 1:1 - Bengal gram Pillipesara (*Phaseolus trilobus*)	Goat (2) + Cow (1)	Agati and Hybrid napier grass (CO-4)
F_6	Cotton + Chilli (1:1) Pillipesara (*Phaseolus trilobus*)	Goat (2) + Rabbit (4)	Agati and Hybrid napier grass (DHN-6)
F_7	Cotton + Onion 1:2 Maize + Cowpea (F) 1:1 - Bengal gram	Goat (2) + Cow (1) + Poultry birds + Fishery	Fish pond bund- Banana Plot bund- Agati, Drum stick and Curry leaf

F: Fodder crop

Animal components

1.	Goat (Jamanpari and Shirohi)	:	5 male (Stall fed system)
2.	Cow (HF)	:	1 each for F_5 and F_7
3.	Poultry birds (Giriraj Broiler)	:	25 Giriraj poultry birds each for F_4 (Brooder system) and F_7 (Battery system on fish pond)
4.	Rabbit (New Zealand White)	:	3 female + 1 male
5.	Fish (Common carp)	:	225 for F_7

Varieties and hybrids used: *Bt* Cotton (Jaadoo), Maize (Hiro-555), Chilli (G-4), Onion (Nasik Red), Fodder cowpea [Swad (DFC-1)], Pillipesara (Local), Bengal gram (A1), Drum stick (Dhanraj), Curry leaf (Suvasini), Banana (G-9), Stylo (Local), Guinea grass (Samruddhi), Hybrid napier grass (CO-4 and DHN-6) and Agati (Local).

and live stock production were recorded and given in man days per hectare (Jayanthi, 1995). The labour use efficiency (LUE) was calculated by taking the ratio of total production in cotton kapas equivalent yield to the total man days per hectare (Table 2).

RESULTS AND DISCUSSION

The results obtained from the present investigation as well as relevant discussion have been summarized under following heads :

System productivity:

The system productivity varied widely between the models. Among various farming system models, F_7 model recorded the higher system yield and productivity (10,903 kg/ha/year). This was closely followed by F_4 system and F_3 system (6,381 and 5,443 kg/ha/year). The system productivity per day was 3.56 folds higher (29.87 kg/ha/day) in F_7 farming system model and which is closely followed by F_4 farming system model (17.48 kg/ha/day). The lowest system productivity recorded with conventional system of cotton alone (8.39 kg/ha/day). This may be attributed to the better growth and development of farming system components thus, resulting in higher additional income (Table 1 and Fig. 1). The analysis revealed that the integration of different components were beneficial as compared to cotton alone. Similar findings were reported by Channabasavanna and Biradar (2007); Bhatnagar *et al*. (2005) and Rangasamy

Table 1 : System productivity or cotton kapas equivalent yield (kg/ ha/ year), system productivity per day (kg/ha/day) and net returns (Rs./ha/year) of various farming systems

Treatments	System productivity or Cotton kapas equivalent yield (kg/ha/year)			System productivity per day (kg/ha/day)	Net returns (Rs./ha/year)		
	First year (2012-13)	Second year (2013-14)	Pooled (2012-14)		First year (2012-13)	Second year (2013-14)	Pooled (2012-14)
F_1	2983	3140	3061	8.39	71825	77359	74592
F_2	5016	5407	5211	14.28	40147	42620	41384
F_3	3951	6959	5443	14.91	101415	136806	119111
F_4	4529	8233	6381	17.48	121086	158120	139603
F_5	4760	5349	5054	13.85	125461	168736	147098
F_6	3163	3577	3364	9.22	153186	170900	162043
F_7	8103	13604	10903	29.87	159533	218606	189069
S.E.±	135.80	282.40	206.58	-	-	-	-
C.D. (P=0.05)	418.44	870.15	636.55	-	-	-	-

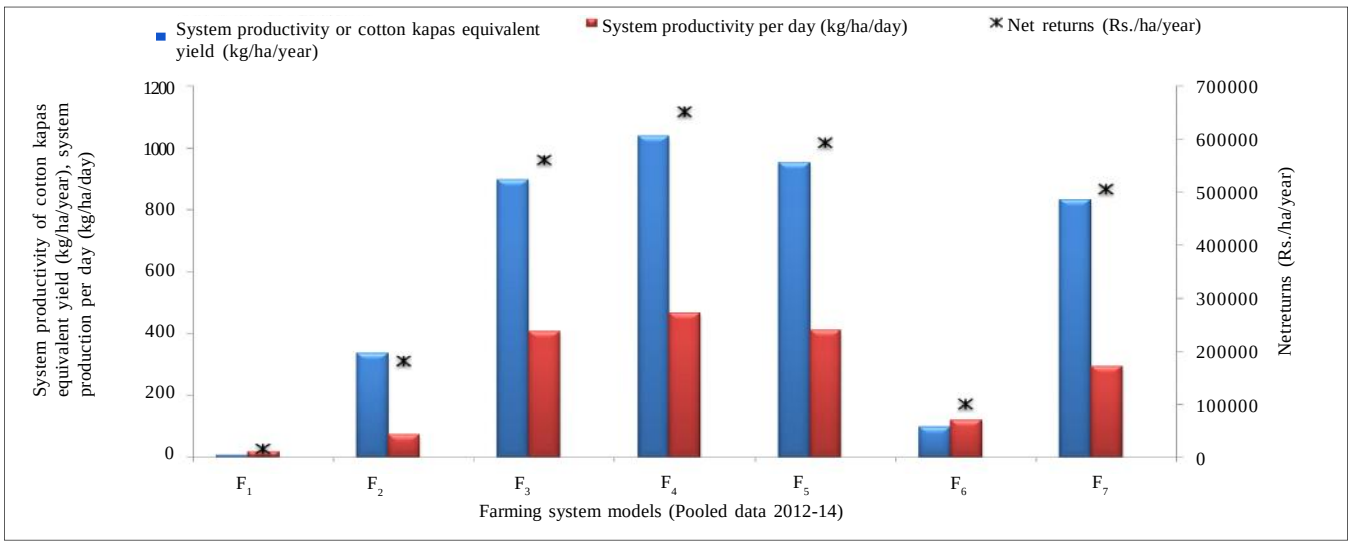

Fig. 1: System productivity or cotton kapas equivalent yield (kg/ha/year), system productivity per day (kg/ha/day) and net returns (Rs./ha/year) of various farming systems

et al. (1988).

Economic returns :

Among various integrated farming system models, F_7 system recorded the higher net returns of Rs. 1,89,069/ha/year over other farming systems and least returns recorded with conventional cotton alone (F_1) system (Rs.74,592/ha/year). The increase was to the tune of 253 per cent over the conventional systems (F_1). This may be attributed to the added income from the livestock components (Table 1 and Fig. 1). Moreover, recycling of droppings increased the biological productivity of the system (Jayanthi and Mythili, 2002). Similar results were reported by Govindan (1988). The net returns in 2012-13 were less compared to 2013-14 due to higher initial cost of cultivation, indicating the profitability of IFS in long run.

Employment generation:

The present investigation (pooled data of 2012-13 and 2013-14) revealed that, integration of livestock components required higher man days (116, 120, 134, 176, 135 and 206 man days in F_2, F_3, F_4, F_5, F_6 and F_7, respectively) over conventional system (79 man days in F_1 system). A highest additional employment of 38.34 per cent was generated in F_7 system. Labour use efficiency was follows similar trend (52.92 kg/ha/labour) over conventional F_1 system (38.75 kg/ha/labour) and it closely followed by F_2 system (44.92 kg/ha/labour). Increase in employment and LUE among farming system models is due to suitable integration of farm enterprises (Table 2 and Fig. 2). Similar results with IFS were earlier

Table 2 : Employment generation (man days/ha/year), additional employment generated (man days/ha/year) and Labour use efficiency (LUE) (kg/ha/labour) of various farming systems

Treatments	Employment generation (man days/ha/year)			Additional employment generation (man days/ha/year)			LUE (kg/ha/labour)		
	First year (2012-13)	Second year (2013-14)	Pooled (2012-14)	First year (2012-13)	Second year (2013-14)	Pooled (2012-14)	First year (2012-13)	Second year (2013-14)	Pooled (2012-14)
F_1	75	83	79	-	-	-	39.77	37.83	38.75
F_2	110	121	116	35	38	37	45.60	44.69	44.92
F_3	114	125	120	39	42	41	34.66	55.67	45.36
F_4	128	140	134	53	57	55	35.38	58.81	47.62
F_5	169	183	176	94	100	97	28.17	29.23	28.72
F_6	129	142	135	54	59	56	24.52	25.19	24.92
F_7	198	214	206	123	131	127	40.92	63.57	52.93

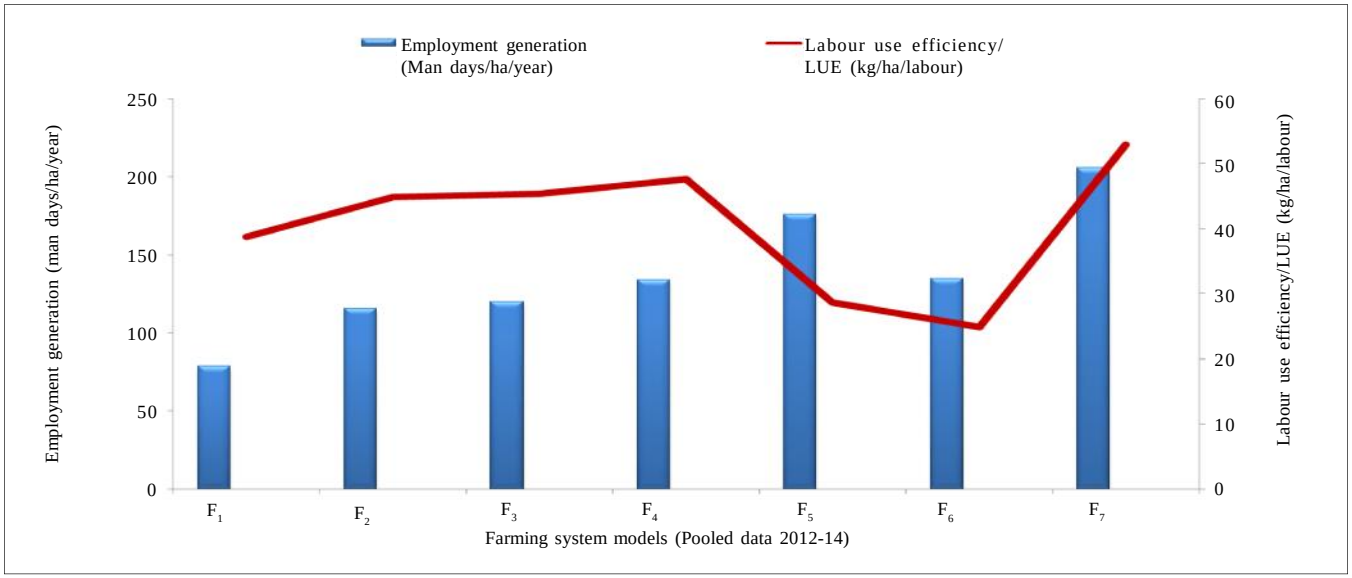

Fig. 2: Employment generation (man days/ha/year) and labour use efficiency (LUE) (kg/ha/labour) of various farming systems

reported by Chinnaswami (1994) and Veerabhadran (1994).

Conclusion:

–The integrated farming system with cow + goats along with other subsidiaries like poultry and fish is the most beneficial system which can augment the income of small and marginal to improve their socio-economic status.

–More emphasis is still required to generate a generalized model suited to various farm size holdings in different agro climatic conditions.

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