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Economic Empowerment of Tribal Farmers through Integrated Farming System Approachin Southern Rajasthan, India

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ABSTRACT
The present study was undertaken to examine the socio-economic empowerment of tribal farmers through integrated farming system approach in Southern Rajasthan, India. 38 tribal farmers from Chittorgarh district of Southern Rajasthan were selected during 2016-17 based on the benchmark survey for the year 2015-16. The study was based on the primary data which were collected from the 38 selected farm households through pre-structured schedule for the year 2015-16, 2016-17 and 2017-18. Prior to start the RKVY project (2015-16), three farming systems prevalent in study area viz. FS-I(Crop+Dairy), FS-II (Crop+Dairy+Goat) and FS-III (Crop+Goat). The results of the study had shown that the total cost was found lowest in FS-III (`65747.65) whereas highest was observed in FS-II (`119437.37)in the study area. On the basis of net return per farm, the most profitable farming system was FS-II with `78550.28. Based on returns per rupee invested by the farmer,the most profitable farming system was also found in FS-II(`1.66) in the study area. Employment generated per farm in study areawas found maximum in FS-I (325.85 man-days). After successfully completion of two years of the project in the year 2017-18, there five farming systems were observed viz. FS-I (Crop+Dairy+Vegetable),FS-II(Crop+Dairy+Vegetable+Orchard),FS-III (Crop+ Goat+ Vegetable), FS-IV (Crop+Dairy+Goat+Vegetable)and FS-V (Crop+Dairy+Goat+Vegetable+Orchard) in the study area. Among the improved farming systems, the total cost was observed lowest in FS-III (`121235.17) and it was found highest in FS-II (`201765.28). The most profitable farming system on the basis of net return per farm was FS-II (`193231.57). Based on the return per rupee invested, the FS-II (`1.96) study area was observed the most profitable farming systems. Based on employment generated per farm, it was found maximum in FS-II (783.95 man-days). The change in net income per farm was increased by 161.51 per cent and employment generation per farm was also increased by 72.78 per cent over existing to improved farming systems in the study area. Therefore, it can be concluded that integrated farming system approach not only enhance the income of farm households but also provide an off farm employment opportunities for small and marginal farmers to certain extent.
Key Words: Integrated Farming Systems, Economic Empowerment, Income and Employment.

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INTRODUCTION

In India, the growth rate of agriculture in the recent past is very slow inspite of the rapid economicgrowth. The country's population is expected to reach 1660 million in the year 2050 and for which 349 million tonnes of food grains will be required. It is anticipated that land area available in 2050 would be 137 million hectares. To meet this requirement there is a need to double the productivity of agricultural crops from the existing level of productivity. The current scenario in the country indicates that area undercultivation may

further dwindle and more than 20 per cent of current cultivable area will beconverted for non-agricultural purposes by 2030.

The operational farm holding in India is declining and over 85 million out of 105 million areless than one hectare. Due to ever increasing population and decline in per capita availabilityof land in the country, practically there is no possibility for horizontal expansion of land foragriculture. There is only possibility to expand the land vertically through the adoption of integrating farming approach which requireslesser space and time and ensurethe remunerative prices of agricultural produce to farm families. The integrated farming systems therefore assumes greater importance for sound management of farm resourcesto enhance the farm productivity and reduce the environmental degradation, improve thequality of life of resource poor farmers and maintain sustainability. In order to sustain apositive growth rate in agriculture, a holistic approach is the need of the hour. Farming systemis a mix of farm enterprises in which farm families allocate resources for efficient utilization ofthe existing enterprises for enhancing productivity and profitability of the farm. These enterprises are crop, livestock, aquaculture, agro-forestry, agri-horticulture and sericulture.Integrated farming system approach is not only a reliable way of obtainingfairly high productivity with considerable scope for resource recycling, but also concept ofecological soundness leading to sustainable agriculture. With increasing energy crisis due toshrinking of non-renewable fossil-fuel based sources, the fertilizer nutrient costs have increasedsteeply and with gradual withdrawal of fertilizer subsidy. It is expected to have further hike inthe cost of fertilizers. This will leave the farmers with no option but to fully explore thepotential alternate sources of plant nutrients at least for the partial substitution of the fertilizer nutrients for individual crops and in the cropping systems [3]. Several studies conducted on farming systems showed that farming system approach is better than conventional farming [17, 12].The adoption of integrated farming system could generate additional income ranging from ` 9,000 to ` 2,00,000 per hectare, depending on inclusion of number and kind ofadditional farm enterprises and their effective combination as reported by Dawood *et al.* [1], Shanmugasundaram and Balusamy [14], Rangasamy *et al.*[10], Meshram *et al.* [3], Rautaray *et al.* [11], Murugan and Kathiresan [5], Ponnusamy [7], Ponnusamy and Gupta [9].

Rajasthan state occupies nearly 10.4 per cent geographical area of the country. Agriculture and allied activities accounted for nearly one fourth of the State Gross Domestic Product against 14 per cent at National Level. Therefore, agriculture despite all odds considered to be the main stay of rural masses in the state. The agriculture in most part of the state is rainfed and is prone to high production risk. In order to meet the farm and family needs, the farmers in the state have evaluated different combinations of crop, livestock, horticulture, poultry etc. In such circumstances, farming system which has less share of external cost in total cost of production might be more sustainable for marginal & small farmers. Accordingly, every region of the state has evaluated crop and livestock species suitable for the region. Among the 10 agro-climatic zones of the state, IV A (Sub Humid Southern Plains and Aravali Hills Zone) and IV B (Humid Southern Plains Zone) falls in Southern Rajasthan and is relatively more diversified for crop and livestock production. Chittorgarh district is situated in south-east part of Rajasthan and covers a geographical area of about 7.50 lakh hectares. Agro-ecologically the district has been part of Zone-IVA (Sub-Humid Southern Plain & Aravali Hill Zone). The average annual rainfall of the district is 852 mm. The soils of the district are grey brown loam, medium black, moderately deep and medium to heavy in texture.In this district, crops like maize, jowar, cotton, black gram, soybean, groundnut, cluster bean etc. are grown in *kharif*season and crops like wheat, rapeseed & mustard, gram, *etc.* are grown in *rabi*season.Very small area is used for cultivation of fruits and vegetables.Looking to the environmental conditions and suitability of soil, some part of the land may be diverted for cultivation of medicinal crops like safedmusli, ashwagandha, ajwain, isabgol, fenugreek etc.Among livestock, cattle, buffalo, goat and sheep are the most dominatinganimals in the district. The farming system models practiced by the farmers include various combinations of field crops, horticulture crops and livestock in Chittorgarh district of Southern Rajasthan.

MATERIAL AND METHODS

Southern Rajasthan comprises of seven districts *viz.,* Bhilwara,Chittorgarh, Rajsamand and Udaipur (Sub Humid Southern Plains and Aravali Hills Zone), Banswara,Dungarpur and Pratapgarh (Humid Southern Plains Zone). These districts fall in agro-climatic zones IVA and IVB of Rajasthan. Among these districts,Chittorgarhdistrict from Zone-IVA was intentionally selected for the study of integrated farming systems, as this district have high potential for development of agriculture and livestock. Multi-stage random sampling technique was used for the present study. Onetehsils from district was selected in such a way that has highest proportion ofirrigated area to total net sown area. One villagewas typical representative for irrigated farming systems in the tribal belt of the selected tehsil. Thirty eight farmers from village were randomly selected. The present study was based on primary information regarding the farming systems which were collected from selectedfarmers from the year 2015-16 to 2017-18. The collected information were scrutinized, tabulated and analyzed by using various statistical tools.

Variable Cost

The actual costs incurred by the farmer along with incidental charges incurred towards labour and material costs. The various inputs of operational costs were seed, farmyard manure, fertilizers, plant protection chemicals, feeds and concentrates, fodder and straw, labour (hired labour and family human labour) etc. Labour in all enterprises was converted into man-days by multiplying female and child labour by 0.70 and 0.50, respectively. Bullock labour, both owned and hired were accounted at the prevailing hire rates. The operational costs in terms of labour (human, bullock and machine) and other outputs (main and by-products) of one activity utilized as an input in the other activity within the integrated farming system were worked out to assess the cost effectiveness of different integrated farming systems.

Fixed Cost

The various items of fixed cost were land revenue, land rent, interest on fixed capital and depreciation. The depreciation rates, life span and junk value for various agricultural implements and machinery were decided in consultation with the respondents. Consequently, the depreciation was calculated using the straight line method as shown below.

$$\text{Depreciation (`)} = \frac{\text{Purchase Value (`)} - \text{Junk Value (`)}}{\text{Life Span (Years)}}$$

Interest on fixed capital was calculated at the prevailing bank rate (10 %) on the value of the farm and livestock assets.

The returns from crops, dairy, horticultural crops and goat rearing were estimated by multiplying the actual price realized to quantity sold by them and the quantities that was retained for seed or consumption was evaluated at the rates prevailing at the time of harvest. The same method was also followed for the valuation of by-products of various enterprises.

A. Gross Return from Integrated Farming System (GIIFS) was worked out as:

$$GIFS = \sum_{i=1}^{n} Q_i \times P_i$$

Where,

Q_i is the Physical output (main and by product) of i^{th} component of IFS and

P_i is the price of i^{th} output.

B. Paid Out Cost of Integrated Farming Systems (PCIFS) was work out as:

$$PCIFS = \sum_{i=1}^{n} x_i \times p_i$$

Where,

x_i = the i^{th} external input in quantity term

p_i = the price of i^{th} external input

C. Net Income from Integrated Farming System (NIIFS) was worked out as:

NIIFS = GIIFS –PCIFS

D. Cost of Internally Adjusted Input (CIAI)

TC-PCIFS

Where,

TC = Total Cost (Fixed Cost + Variable Cost).

PCIFS = Paid out cost of integrated farming system.

RESULT AND DISCUSSION

ExistingFarming Systems

Farming system is a combination of crops, vegetables, orchards, dairy enterprise, goatry and poultry to maximize the farm income and employment. The three farming systems were prominently observed during the year 2016-17 of the benchmark survey for the year 2015-16 in Chittorgarh district of Southern Rajasthan (Table 1). They were FS–I: Crops + Dairy (C+D), FS–II: Crops + Dairy + Goat (C+D+G) and FS–III: Crops + Goat (C+G).

Table 1: Existing Farming Systems in Study Area

S. No.	Farming Systems	
1	FS-I	Crop + Dairy (C+D)
2	FS-II	Crop + Dairy + Goat(C+D+G)
3	FS-III	Crop +Goat (C+G)

Comparison of Cost and Returns of Existing Farming Systems

Costs and returns in existing farming systems prevalent in the study area are presented in Table 2. Results of the Chittorgarh district from the Table 2 and Figure 1 had shown that the total cost was found lowest in FS-III (`65747.65) and it was observed highest in FS-II (`119437.37). As percentage share of total cost, the total variable cost was highest in FS-III (86.89%) and lowest in FS-II (82.91%) whereas the total fixed cost was highest in FS-II (17.09%) and lowest in FS-III (13.11%). The highest net return per farm and return per rupee investment was in FS-II (`78550.28) and `1.66, respectively followed by FS-I and FS-III. Overall result showed that the total cost, net return and return per rupee investment were `93454.76, `52262.07 and `1.53, respectively. Similar finding were also observed in many studies conducted by Singh and Burark [15], Singh *et al.* [17], Ponnusamy and Devi [9] and Negi *et al.* [6].

Table 2: Comparison of Cost and Return in Existing Farming Systems(`/Farm/Year)

S. No.	Particulars	Farming Systems			Overall
		FS-I	FS-II	FS-III	
A	**Cost (`)**				
1	TVC	80740.56 (84.83)	99025.52 (82.91)	57128.13 (86.89)	78964.74 (84.50)
2	TFC	14438.69 (15.17)	20411.85 (17.09)	8619.52 (13.11)	14490.02 (15.50)
3	**TC**	**95179.25 (100.00)**	**119437.37 (100.00)**	**65747.65 (100.00)**	**93454.76 (100.00)**
B	**Return (`)**				
1	GR	147317.45	197987.65	91845.37	145716.82
2	NR	52138.20	78550.28	26097.72	52262.07
3	**Returns per Rupee Investment**	**1.55**	**1.66**	**1.40**	**1.53**

Income and Employment Generation among Existing Farming Systems

Labour employment plays a vital role in the realization of farmer's family goals in different farming systems adopted by him. Table 3, Figure 2 and Figure 3 showed the quantum of income and employment generated under different farming systems by the tribal farmers in the Chittorgarh district of Southern Rajasthan. From the table, it was observed that among the three farming systems prevalent in the Chittorgarh district of Rajasthan, the maximum net income per farm was generated from FS-II (`78550.28) and it was found minimum income generation from FS-III (`26027.72). The net income on per hectare basis was observed maximum in FS-II (`58619.61/ha) followed by FS-I (`48276.11/ha) and FS-III (`31826.49/ha). The per farm employment generation was highest in FS-I (325.85 mandays/year) followed by FS-II (283.65 mandays/year) and FS-III (173.35 mandays/year).

On the basis of per hectare, the employment generation was also maximum in FS-I (301.71 mandays/year) and minimum in FS-III (211.40 mandays/year).Sekhar *et al.* [13], Singh and Burark [15] and Khan and Parashari [2] have reported the similar finding in their studies.

Table 3: Farm Income and Employment Generated in Existing Farming Systems

S. No.	Particulars	Units	Farming Systems			Overall
			FS-I	FS-II	FS-III	
I	**Income**					
A	Net Income/Farm	`/Farm	52138.20	78550.28	26097.72	52262.07
B	Net Income/ha	`/ha	48276.11	58619.61	31826.49	48390.80
C	Average Land Holding	Ha	1.08	1.34	0.82	1.08
II	**Employment**					
A	Employment/Farm	Mandays/Farm	325.85	283.65	173.35	260.95
B	Employment/ha	Mandays/ha.	301.71	211.68	211.40	241.62

Improved Farming Systems

There were only three farming systems existed during the benchmark survey for the year 2015-16. After two years of the implementation of the project from 2016-17 and 2017-18, the five improved farming systems were observed in the study area (Table 4). These improved farming systems were developed through the various interventions proposed to the tribal farmers of the selected area. The various interventions provided to the selected household farmers like improved variety seed of crops like cereals, pulses, oilseeds and cash crop like cotton and clusterbean, crop diversification through introduction of hybrid vegetables seeds/seedlings and fruit plants, follow the proper crop rotation, need of high water use efficiency by using the drip/sprinkler irrigation practices, need of labour management by better farm mechanization and need of better feeding management practices in livestock rearing. All these interventions have been provided as per requirement of the farmers under the RKVY project.

Table 4: Improved Farming Systems

S. No.	Farming Systems	Improved Farming Systems
1	FS-I	Crop + Dairy + Vegetable (C+D+V)
2	FS-II	Crop + Dairy + Vegetable + Orchard(C+D+V+O)
3	FS-III	Crop + Goat + Vegetable(C+G+V)
4	FS-IV	Crop + Dairy + Goat + Vegetable(C+D+G+V)
5	FS-V	Crop + Dairy + Goat + Vegetable + Orchard(C+D+G+V+O)

Comparison of Cost and Return of Improved Farming Systems in Study Area

Data presented in Table 5 and Figure 1 indicated that the costs and returns in improved farming systems in Chittorgarh district of Southern Rajasthan. Results from the table shows that The total cost was found highest in FS-II of `201765.28 followed by FS-V (`195665.19), FS-IV (`147945.85) and it was lowest in FS-III (`121235.17). Among the total cost as percentage share, the total variable cost was seen maximum share in FS-III (86.75%) and minimum in FS-II (80.91) while the total fixed cost was found highest in FS-II (19.09%) and lowest in FS-III (13.25%). On the basis of net return per farm over the year, the FS-II was found most profitable farming systems with `193231.57 followed by FS-V (`168110.44), FS-I (`120609.20) and least profitable farming system was FS-III with `82130.17 per farm per year. Based on return per rupee invested on the farmers field, the most profitable farming system was also FS-II (`1.96) followed by FS-I (`1.89), FS-V (`1.86) and least profitable was FS-III (`1.68). The overall result of Chittorgarh district on the basis of total cost, net return and return per rupee investment per farm over the year was `160389.59, `136671.94 and `1.84, respectively. The percentage change over existing farming system during the year 2015-16 to improved farming system in the year 2017-18 in total cost, net return and return per investment was 71.62 per cent, 161.51 per cent and

19.83 per cent, respectively.Similar finding were also reported in many studies conducted by Singh and Burark [15], Singh *et al.* [16], Ponnusamy and Devi [9] and Negi*et al.* [6].

Income and Employment Generated in Improved Farming Systems in Study Area

Income and employment generated in improved farming systems in Chittorgarh district are presented in Table 6, Figure 2 and 3. Net income per farm over the year was found highest in FS-II i.e. `193231.57 followed by FS-V (`168110.44), FS-I (`120609.20) and it was lowest in FS-III (`82130.17) while on the basis of net income per hectare, the most profitable farming system was seen FS-V with `137795.44 followed by FS-IV (`135543.52), FS-II (`126295.14) and least profitable farming system was also FS-III (`114069.68). Highest employment generation based on per farm over the year was found in FS-II (783.95 mandays /farm /year) followed by FS-V (565.25 mandays /farm /year), FS-I (385.15 mandays /farm /year) and it was seen lowest in FS-III (164.52 mandays /farm /year) whereas on the basis of employment generation per hectare was observed highest in FS-II (512.39 mandays /farm /year) and lowest in FS-III (228.50 mandays /farm /year). The overall result from the table showed that the net income and employment generation per hectare was `126548.09 and 417.47 mandays per farm per year, respectively. The percentage change over existing farming system to improved farming systems in net income and employment generation per hectare was seen 173.67 per cent and 72.79 per cent, respectively. Sekhar *et al.* [13], Singh and Burark [15] and Khan and Parashari [2] have reported the similar finding in their studies.

Table 5: Comparison of Cost and Return in Improved Farming Systems (`/Farm/Year)

S. No.	Particulars	Farming Systems					Overall	Percentage Change over Existing to Improved Farming System
		FS-I	FS-II	FS-III	FS-IV	FS-V		
A	**Cost (`)**							
1	TVC	112045.05 (82.79)	163248.29 (80.91)	105171.51 (86.75)	124082.18 (83.87)	166589.34 (85.14)	134227.27 (83.69)	69.98
2	TFC	23291.40 (17.21)	38516.99 (19.09)	16063.66 (13.25)	23863.67 (16.13)	29075.85 (14.86)	26162.31 (16.31)	80.55
3	**TC**	**135336.45 (100.00)**	**201765.28 (100.00)**	**121235.17 (100.00)**	**147945.85 (100.00)**	**195665.19 (100.00)**	**160389.59 (100.00)**	**71.62**
B	**Return (`)**							

1	GR	255945.65	394996.85	203365.34	267224.15	363775.63	297061.52	103.86
2	NR	120609.20	193231.57	82130.17	119278.30	168110.44	136671.94	161.51
3	**per Rupee Investmen**	**1.89**	**1.96**	**1.68**	**1.81**	**1.86**	**1.84**	**19.83**

Table 6: Farm Income and Employment Generated in Improved Farming Systems

S. No.	**Particulars**	**Units**	**Farming Systems**					**Overall**	**Percentage Change over Existing to Improved Farming Systems**
			FS-I	**FS-II**	**FS-III**	**FS-IV**	**FS-V**		
I	**Income**								
A	Net Income/Farm	`/Farm	120609.20	193231.57	82130.17	119278.30	168110.44	136671.94	161.51
B	Net Income/ha	`/ha	114865.90	126295.14	114069.68	135543.52	137795.44	126548.09	173.67
C	Average Land Holding	Ha	1.05	1.53	0.72	0.88	1.22	1.08	
II	**Employment**								
A	Employment /Farm	Mandays/Farm	385.15	783.95	164.52	355.45	565.25	450.86	72.78
B	Employment /ha	Mandays /ha.	366.81	512.39	228.50	403.92	463.32	417.47	72.79

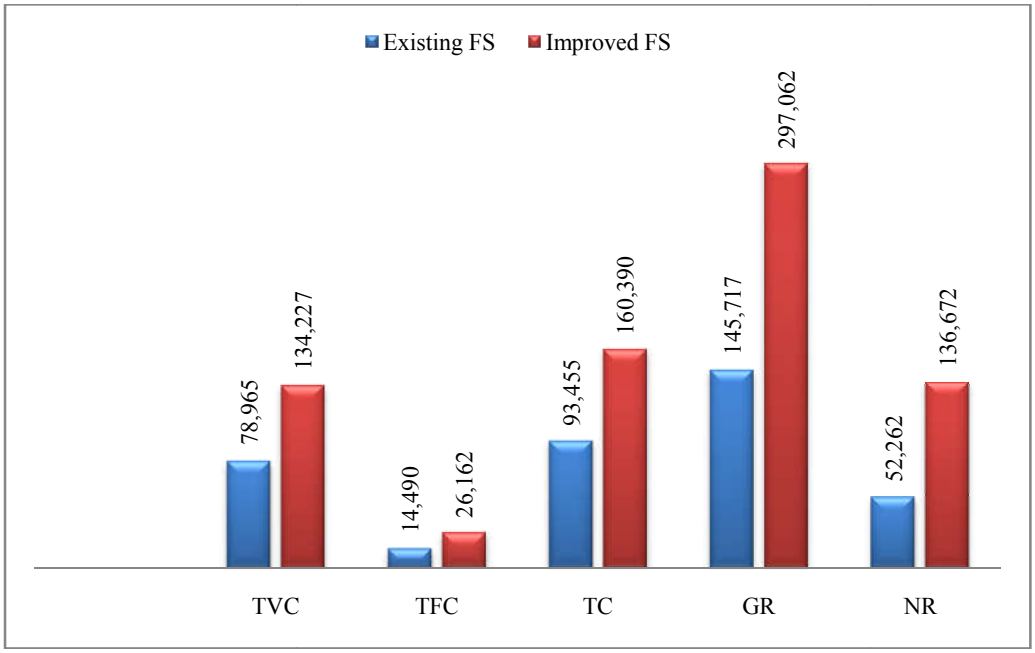

Fig. 1: Comparative Analysis of Existing and Improved Farming Systems

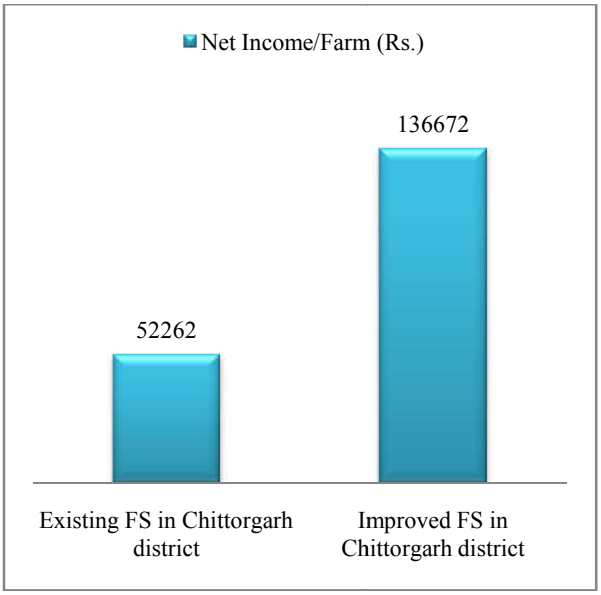

Figure 2: Comparison of Income between Existing and Improved Farming Systems

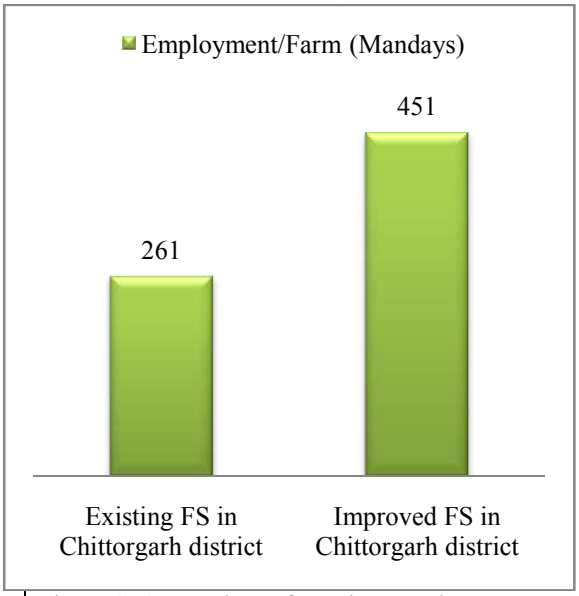

Figure 3: Comparison of Employment between Existing and Improved Farming Systems

CONCLUSION

It can concluded thatafter two years of implementation of the project from the year 2016-17, there are five farming systems were observed viz. FS-I: Crop+Dairy+Vegetable,FS-II: Crop+Dairy+Vegetable+Orchard,FS-III: Crop+Goat+Vegetable,FS-IV: Crop+Dairy+Goat+ Vegetable, and FS-V: Crop+Dairy+Goat+Vegetable+Orchard in the study area.

The major findings of the study are as follows:

1. Among the improved farming systems, the total cost was observed lowest in FS-III *i.e.*`121235.17 and it was found highest in FS-II *i.e.*`201765.28 in the study area. The most profitable farming system on the basis of net return per farm was FS-II *i.e.*`193231.57.

2. Based on the return per rupee invested, the FS-II (`1.96) was observed the most profitable farming systems. Based on employment generated per farm in study area, it was found maximum in FS-II (783.95 man days).
3. The change in net income per farm was increased by 161.51 per cent and employment generation per farm was also increased by 72.78 per cent over existing to improved farming systems in both the districts.
4. Implementation of project had significant impact on diversification of agriculture towards vegetables, oilseeds, pulses and inclusion of livestock through modern agricultural techniques adopted by tribal farmers proved economically viable intervention in tribal dominated areas of Southern Rajasthan.
5. It is not only enhanced income of household but also provide on and off farm employment opportunities for small and marginal farmers.
6. In the present situation, the main focus of government is on doubling the farmers' income by 2022. Thus, the partial budgeting, economic estimation of manure and urine from animal components and factors associated with the total income from different enterprises combinations have shown the directions for policy makers, extension functionaries and progressive farmers to prepare strategies for doubling farmers' income.
7. Further, we can rightly concluded that integrated farming system approach has helped us in achieving the ecological sustainability, enhanced productivity and economic prosperity.

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