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Economic Evaluation of Farming Systems for Agricultural Production in Southern Rajasthan

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ABSTRACT

The present investigation was under taken to work out internal cost adjustments in existing farming systems of Southern Rajasthan. A total sample of 120 households consisting of 60 under rainfed and 60 under irrigated situation was selected from two districts- one representing tribal area and the other non-tribal area for the study. Four farming systems (FS) existed in both the rainfed and irrigated areas of Chittorgarh and Banswara districts *viz.* FS-I: Crop+ Vegetables (C+V), FS-II: Crop + Dairy (C+D), FS-III: Crop + Dairy +Goat (C+D+G) and FS-IV: Crop + Poultry (C+PO). The cost involved in different farming systems were divided into two parts i.e. cost incurred within the farming system and cost incurred from outside the farming system. Internal cost adjustments were more in FS –III in both the districts *i.e.* 70.21 and 64.35 per cent in Chittorgarh district and 69.83 and 63.38 per cent in Banswara district in rainfed and irrigated conditions, respectively. In Chittorgarh district on per rupee investment basis FS-IV (1.55) in rainfed and FS-I (1.69) in irrigated area were more profitable than other systems. In Banswara district on return per rupee investment basis, FS-IV ((1.57) in rainfed area and FS-I (1.63) in irrigated area were found more profitable than other farming systems. Return per rupee investment (return cost ratio) was more in FS-IV in rainfed condition while FS-I in irrigated condition among the other farming systems in both the districts.

Keywords: Internal & External Cost Adjustment, Cost, Farming System, Returns and Profitability

Farming system approach introduces a change in farming techniques for higher production from the farm as a whole with the integration of all the enterprises like dairy, poultry, piggery, fishery, sericulture etc. suited to the given agro-climatic condition and socio-economic status of farmer would bring prosperity to the farmer. Every farmer tries to choose the farm activities/enterprises depending upon physical and economic conditions prevailing in his ecosystem. Integration of various farm enterprises ensures growth and stability in overall productivity and profitability. Since farming system differ in different situation such studies conducted on farming system showed that farming system approach is better than conventional farming (Ravishankar, *et al.,* 2007 & Singh *et al.,* 2007). Judicious mix of one or more of these enterprises also decides the cost of production of farming system affordable by farmers.

Rajasthan, the largest state of Indian union, occupies nearly 10.4 per cent geographical area of the country. Agriculture and allied activities accounted for nearly one fourth of the State 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 requirement, 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. Out of 10 agro-climatic regions of the state, two region *i.e.* Sub Humid Southern Plains and Arravalli Hills Zone (IV A) and Humid Southern Plains Zone (IVB) falls in Southern Rajasthan and is relatively more diversified for crop and livestock production. Sharma *et al.* (2014) studied the present and future prospectus for coriander seed production in Southeast Rajasthan on the basis of agro-ecological condition and soil suitability assessment clearly suggested a wide acceptability for expanding the area under coriander seed production. In this region crops like maize, Jowar, cotton, black gram, soybean, groundnut, cluster bean etc. are grown in *kharif* season and crops like wheat, rapeseed & mustard, gram, Isabgol, *etc.* are grown in *rabi* season. There is substantial area under different vegetables in this region. Among livestock, cattle, buffalo, goat and sheep are the most dominating animals. The farming system models practiced by the farmers include various combinations of field crops, horticulture crops and livestock in southern Rajasthan.

METHODOLOGY

Southern Rajasthan comprises of eight districts *viz.*, Udaipur, Chittorgarh, Bhilwara, Rajsamand (Sub Humid Southern Plains and Arravalli Hills Zone), Dungarpur, Banswara, Pratapgarh and Sirohi (Humid Southern Plains Zone). These districts fall in agro-climatic region IVA and IVB of Rajasthan. Among these districts Chittorgarh is non-tribal and Banswara is typical-tribal dominated district. Chittorgarh district from IV-A and Banswara district from IV-B was intentionally selected for the study of integrated farming systems, as these districts have high potential for development of agriculture and livestock. Multi-stage random sampling plan was used. Two Tehsils from each district were selected in such a way that one has highest proportion of irrigated area and another having highest share of rainfed area to total net sown area. These Tehsils were typical representative for irrigated and rainfed farming systems in tribal areas. Fifteen farmers from each village were randomly selected. Thus a total sample of 120 households was selected from Chittorgarh and Banswara districts, representing 60 households from rainfed and 60 households from irrigated farming systems.

Both primary and secondary data were collected. The primary data were collected from selected farmers while secondary data were collected from published sources. The data collected for the year 2012-13 were scrutinized, tabulated and analyzed by using different analytical tools.

Costs and Returns Estimation

The following method for estimation of costs and returns was used:

Gross Cost = Total Variable Cost (TVC) + Total Fixed Cost (TFC)

Gross Return = (Quantity of produce × Prevailing price of produce + Quantity of by-produce × Price of by-produce)

Net return = Gross return – Total cost

Operational or Variable Cost: Operational costs were the actual costs incurred by the farmer along with incidental charges incurred towards labour and material costs. The various items of operational costs were seed, farmyard manure, fertilizers, plant protection chemicals, feeds and concentrates, fodder and straw, labour (hired 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 Costs (FC): The various items of fixed costs were land revenue, land rent and depreciation. The depreciation rates, life span and junk value for various agricultural implements and machinery were decided in consultation with the respondents. The depreciation was calculated using the straight line method and interest on fixed capital was

calculated at the prevailing bank rate (12 %) on the value of the farm and livestock assets.

Total Cost (TC) = Total Variable Cost (TVC) + Total Fixed Cost (TFC)

External & Internal Cost of Production

Farming systems include enterprises like diary, goat, poultry and orchard. The cost involved different farming systems were divided into two parts i.e. cost incurred within the farming system and cost incurred from outside the farming system. Cost incurred from within farming system included the value of all those inputs required for different enterprises and are supplied from within the system like cost of FYM, owned labour, green/dry fodder, seed and feed. The value of the inputs brought from outside the farm (or farming system) for different enterprises were included in the cost incurred outside the farming system. Out of the total cost, the cost incurred within the farming system, show the utilization of resources within the system. The system is more feasible and sustainable when there is more utilization of resources within the system than the other systems. Financial requirement to purchase the inputs from outside the farm is also less in such a system. This also reduces the dependency of the households for cash in hand. Return/cost ratio or return on per rupee investment is also the criteria to select the best farming system among the existing one.

Paid out cost of Integrated Farming Systems (PCIFS)

The PCIFS was work out as:

$$\text{PCIFS} = \sum_{i=1}^{n} xi.pi$$

Where, xi = the i^{th} external input in quantity term

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

NIIFS = GIIFS – PCIFS

NIIFS = Net income from integrated farming system

Cost of Internally Adjusted Input (CIAI)

CIAI = TC–PCIFS

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

PCIFS = Paid out Cost of Integrated Farming System.

Returns: The returns from crop, livestock, goat rearing and poultry were estimated by multiplying the actual price realized to quantity sold by them and the quantities that was retained for seed or consumption purpose was evaluated at the rates prevailing at the time of harvest. The same method was also followed for the evaluation of by-products of various enterprises.

Gross Income from Integrated Farming System (GIIFS)

It is the value of main and byproduct received from various farming systems as:

$$\text{GIIFS} = \sum_{i=1}^{n} Qi.Pi$$

Where, Qi is the physical output (main and by product) of i^{th} component of IFS and

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

RESULTS AND DISCUSSION

Existing farming systems

There were four farming systems prevalent in the rainfed and irrigated condition of Chittorgarh and Banswara districts as shown in Table1. Mostly FS-I includes crops + vegetables while crops + dairy cattle form FS-II. Crops + dairy + goats constitute FS-III. Crops either supported by poultry or orchards were the part of FS-IV in both the districts. All the existing farming systems in rainfed area in Chittorgarh district (non-tribal) and Banswara district (tribal) were studied on the basis of cost incurred within and outside the farming system as well as on per rupee investment.

Rainfed Farming Systems

External & internal costs of various farming systems in the rainfed area are presented in Table 2 and Fig. 1. Outside cost means cost of inputs purchased by farmers from outside. The rainfed area of Chittorgarh district having four farming systems of which FS – III showed maximum share of internal cost in total cost of production (70.21%) followed by FS – II (65.32%), FS – I (61.04%) and FS – IV had least share (56.51%) where as in the rainfed area of Banswara district also had four farming systems of which FS – III showed maximum share

Table 1: Existing Farming Systems in Study Area

Farming System	Chittorgarh		Banswara	
	Rainfed	Irrigated	Rainfed	Irrigated
	Description			
FS-I	Crop + Vegetable (C+V)	Crop + Vegetable (C+V)	Crop + Onion Nursery (C+ON)	Crop + Vegetable (C+V)
FS-II	Crop + Dairy (C+D)	Crop + Dairy (C+D)	Crop + Dairy (C+D)	Crop + Dairy (C+D)
FS-III	Crop + Dairy + Goat (C+D+G)	Crop + Dairy + Goat (C+D+G)	Crop + Dairy + Goat (C+D+G)	Crop + Dairy + Goat (C+D+G)
FS-IV	Crop +Goat +Poultry (C+G+Po)	Crop + Goat + Orchard (C+G+O)	Crop + Poultry (C+Po)	Crop+Poultry+ Orchard (C+Po+O)

of internal cost adjustment (69.83%) followed by FS – II (65.04%), FS – I (60.45%) and FS – IV had least share (57.96%). The FS – III shown more self-dependence than others farming systems because in this system maximum cost was adjusted internally and only 30.17 percent cost inputs were purchased from outside. The FS – III exhibited more self-dependency due to rearing of dairy and goat that's why in this system maximum cost was adjusted internally and only 30 percent cost inputs were purchased from outside the farm. Farming system-IV (1.55) and (1.57) were found more profitable than other systems in rainfed area in both Chittorgarh and Banswara districts on per rupee investment.

Irrigated Farming Systems

External & internal costs of various farming systems in the irrigated area are presented in Table 3 and Fig. 2. In irrigated area of Chittorgarh district FS – III showed highest share of internal cost in total cost of production 64.35 per cent and only 35.65 percent cost items were purchased from outside of the farm or market. FS – II showed same trend in these systems where dairy played an important role in cost adjustment. In irrigated condition of Banswara district FS – III showed 63.38 per cent internal cost adjustment and only 36.62 per cent cost items were purchased from outside or market. FS-II also showed same trend here dairy and goats also play important role like Chittorgarh district FS-I and FS-III still depended on other sources of cost. FS-IV required more investment or long term in setting-up of orchards. In Chittorgarh and Banswara districts both on per rupee investment basis FS-I (1.69) and (1.63) respectively, were more profitable than other systems in irrigated area.

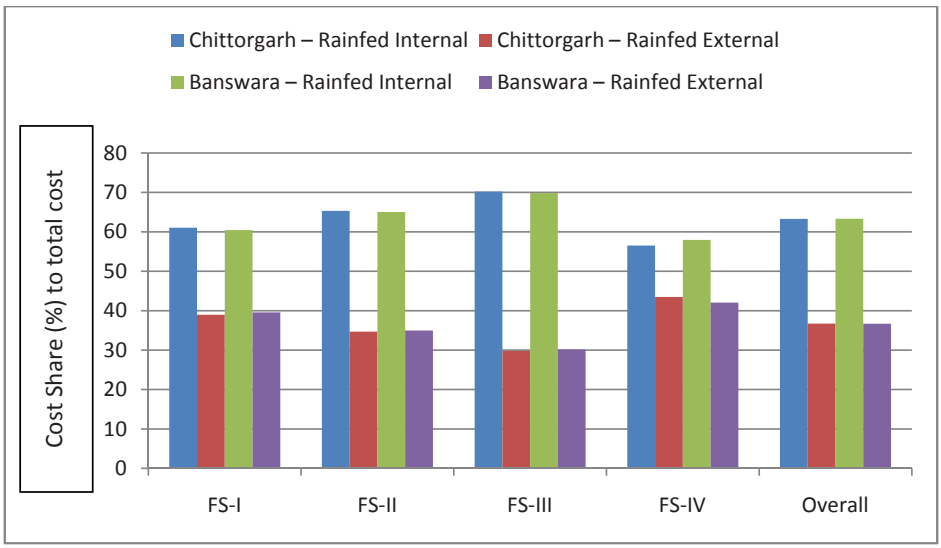

Fig. 1: External &Internal Cost of production in Rainfed Farming Systems

Table 2: External & Internal Cost of production in Rainfed FS

Farming systems	Gross return (₹)	Cost incurred from			Cost Share (%) to total cost		Return/ Unit Cost
		Internal (₹)	External (₹)	Total Cost (₹)	Internal	External	
Chittorgarh district – Rainfed							
FS-I	138716.34	61773.42	39428.12	101201.54	61.04	38.96	1.37
FS-II	188109.33	95147.36	50516.08	145663.44	65.32	34.68	1.29
FS-III	257079.15	124224.73	52708.37	176933.10	70.21	29.79	1.45
FS-IV	194058.50	70628.43	54355.52	124983.95	56.51	43.49	1.55
Overall	**194490.83**	**86803.60**	**50391.91**	**137195.51**	**63.27**	**36.73**	**1.42**
Banswara district – Rainfed							
FS-I	84650.53	36092.97	23614.18	59707.15	60.45	39.55	1.42
FS-II	161595.6	75004.29	40315.96	115320.25	65.04	34.96	1.40
FS-III	224317.7	116418.31	50298.44	166716.75	69.83	30.17	1.35
FS-IV	150087	p55258.57	40080.58	95339.15	57.96	42.04	1.57
Overall	**155162.71**	**69190.29**	**40080.54**	**109270.83**	**63.32**	**36.68**	**1.42**

Table 3: External& Internal Cost of production in Irrigated FS

Farming systems	Gross return (₹)	Cost incurred from			Cost Share (%) to total cost		Return/ Unit Cost
		Internal (₹)	External (₹)	Total Cost (₹)	Internal	External	
Chittorgarh district – Irrigated							
FS-I	394983.16	137943.70	95424.09	233367.79	59.11	40.89	1.69
FS-II	389835.25	179403.25	103611.82	283015.07	63.39	36.61	1.38
FS-III	409432.06	180535.51	100016.96	280552.47	64.35	35.65	1.46
FS-IV	407128.71	156345.83	111461.34	267807.17	58.38	41.62	1.52
Overall	**400344.80**	**163191.75**	**102993.87**	**266185.63**	**61.31**	**38.69**	**1.50**
Banswara district – Irrigated							
FS-I	379576.51	137980.24	94309.73	232289.97	59.4	40.6	1.63
FS-II	376280.9	165466.13	106547.89	272014.02	60.83	39.17	1.38
FS-III	410509.01	185329.00	107080.27	292409.27	63.38	36.62	1.40
FS-IV	369815.75	142186.67	106826.76	249013.43	57.1	42.9	1.49
Overall	**384045.54**	**157323.04**	**104108.63**	**261431.67**	**60.18**	**39.82**	**1.47**

Thus, on cost adjustment basis, FS-III was more profitable in both the conditions. If the funds are limited with the household; the return per rupee investment is more appropriate tool to decide the suitability of a farming system. On the other hand, when funds and other resources are not constraint with the household, then highest net return should be the criteria to select a farming system. Mostly the farmers of sample studied were the resource constraint farmers.

Thus, it can be concluded that internal cost adjustment was more in FS-III among all the farming systems in rainfed and irrigated condition in both the districts while the return per rupee investment (return cost ratio) was more in FS-IV in rainfed

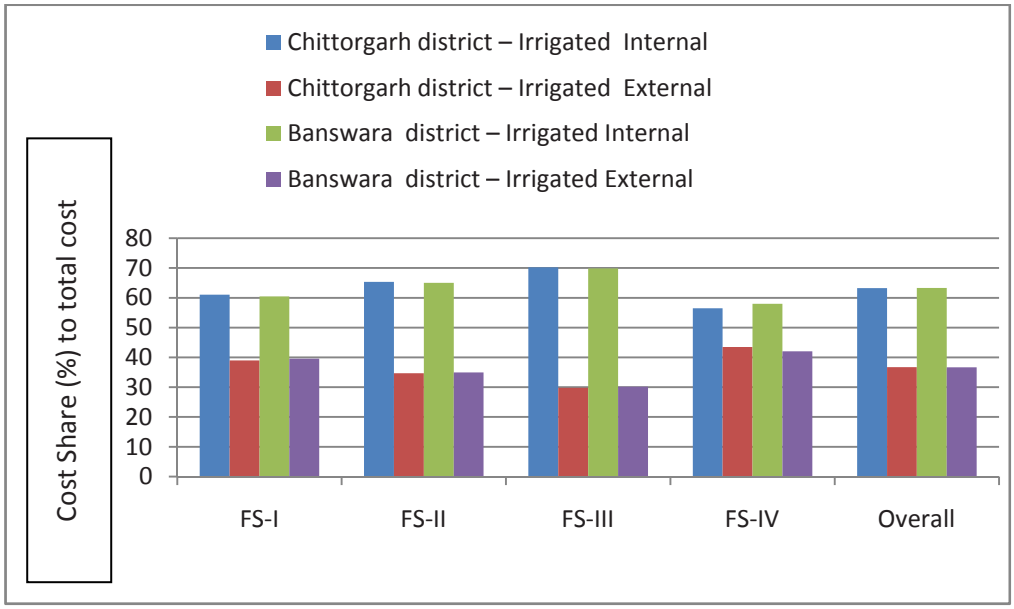

Fig. 2: External & Internal Cost of production in Irrigated Farming Systems

condition and in FS-I in irrigated condition among the other farming systems in both the districts.

CONCLUSION

The system is more feasible and sustainable when there is more utilization of resources within the system than the other system. On cost adjustment basis, FS-III i.e. growing of crops for food grain requirement, rearing of dairy animals along with goat for milk/meat marketing was more profitable in both the conditions on per rupee investment criteria. FS-IV (₹ 1.55) in rainfed and FS-I (₹ 1.69) in irrigated condition of Chittorgarh gave more return. On cost adjustment basis, FS-III showed maximum share of internal cost adjustment in rainfed (69.83%) and irrigated (57.96%) condition of Banswara district. Thus, internal cost adjustment was more in FS-III among all the farming systems in rainfed and irrigated condition while the return per rupee investment (return-cost ratio) was more in FS-IV in rainfed condition and in FS-I in irrigated condition among the other farming systems in both the districts.

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