Performance of Rainfed Farming Systems in selected districts of Southern India

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Rainfed agro eco-system occupies a significant place in Indian Agriculture, covering 96 mha. which is about 66 per cent of the net cultivated area. This area supports 40 per cent of the country's human population, 60 per cent livestock population and contributes 44 per cent to the food basket. As such, rain fed farming is found to be the key for future development of agriculture in the country.

The development of agriculture in the rain fed areas has been a challenge. One of the factors leading to complexity in the process is the large number of farm holdings (165 million). More than eighty per cent of these holdings are held by small and marginal holders (SMF). These farmers are not only economically disadvantaged but also ecologically disadvantaged. The average size of farm holdings has declined over a period of time and more than 85 million operational holdings are less than one hectare, posing a serious threat to food security.

Due to the high levels of risks, farmers in the rain fed farming systems have to diversify and depend on production of various types of commodities to mitigate the risk factor. As such the farming systems are characterized by multiple enterprises such as field crops, plantations, animals, fish etc. The farmers expect losses or less returns in one enterprise and gains in the other as a natural phenomenon in managing their own economy. Hence any intervention in rain fed farming needs to consider the risk factors in production planning of individual farmer's enterprises based on the economic returns of the existing farming systems for various categories of farmers. Accordingly the extension delivery mechanisms have to be fine-tuned for profit maximization of the rainfed farmers. Keeping this in view the present study was undertaken with the following objectives

1) To know the different types of farming systems followed by the rainfed farmers.

2) To understand the economics of different rainfed farming systems and identify the ones providing maximum returns.

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Methodology

The study was carried out on an ex-post facto research design in 3 southern states i.e Andhra Pradesh, Karnataka and Tamil Nadu based on the least irrigated area as the major criteria. One district representing the lower levels of irrigated area in the state was selected randomly. Hence in all, 3 districts selected for the study were Mahboobnagar, Gulburga and Salem.

From each one of the selected districts, one block was selected randomly from among the blocks with low levels of irrigated area in the district. From each of these blocks, two villages were selected, one representing a better response for the developmental interventions and the other representing not so better response for the developmental interventions. From each one of the villages, four categories of farmers were selected representing marginal, small medium and large holding categories. Five farmers from each of the categories were selected on a random sampling basis to be included in the study. In all, 120 farmers were included in the study. The data was collected by a specially designed structured pre tested schedule. Interview method was adopted to collect the primary data from the farming community. The data collected has been analyzed using means and percentages. The presentation of the data has been done on a comparative basis for various categories of the farmers in a simple tabular format.

Results and Discussion

The results relating to the economics of the farming systems for the three selected states i.e Andhra Pradesh, Karnataka and Tamil Nadu are presented below.

A) Andhra Pradesh:

An attempt is made to study the economics under different scenarios of farming. The data reveals that there are two different situations viz., Agriculture based and Agriculture + Livestock based. The discussion is individual for the respective scenario or system. The agriculture based cropping ranged from raising a single crop to four crops during the study period. The crops cultivated are castor, maize and sorghum by different categories of farmers. The costs and returns of farming systems of the sampled respondents are presented below in Table 1.

Table 1. Costs and Returns of farming systems in Mahaboobnagar District of Andhra Pradesh

Farm Category / Enterprise	% of farmers to total under respective farm size	Average yield (qtl/ha)	Gross Returns (Rs/ha)	Operational Costs (Rs/ha)	Net Benefit (Rs/ha)	Input Output ratio
Single Crop enterprise						
Marginal						
Sorghum	10	3.50	1680	2950	-1270	0.57
Maize	20	25.33	10978	8310	2668	1.32
Castor	30	6.50	7800	6255	1545	1.25
Small						
Maize	10	13.50	6413	5897	516	1.09
Medium						
Castor	20	8.00	9600	6994	2606	1.37
Maize	20	13.75	6531	6047	484	1.08
Single Crop enterprise + Livestock (Milch)						
Medium						
Sorghum	10	4.00	4800	3458	1342	1.39
Buffaloes			21000	11500	9500	1.83
Total			25800	14958	10842	1.72
Double Crop enterprise						
Small						
Castor	20	7.42	8603	6067	2537	1.42
Maize		11.00	5033	6136	-1104	0.82
Total			13636	12203	1433	1.12
Medium						
Castor	20	6.88	8250	6269	1981	1.32
Maize		13.50	6480	6875	-395	0.94
Total			14730	13144	1586	1.12
Large						
Castor	20	9.00	10800	8780	2020	1.23
Maize		21.00	10710	6815	3895	1.57
Total			21510	15595	5915	1.38

Double Crop enterprise + Livestock (Milch)						
Small						
Castor	30	7.00	8400	6525	1875	1.29
Maize		0.00	0	2250	-2250	0.00
Buffaloes			39000	20000	19000	1.95
Total			47400	28775	18625	1.65
Medium						
Castor	30	7.54	9600	7212	2388	1.33
Paddy		37.67	21031	12638	8392	1.66
Cows			46600	28800	17800	1.62
Total			77231	48650	28581	1.59
Small						
Castor	20	6.25	7500	5415	2085	1.39
Sorghum		7.50	6000	3475	2525	1.73
Cows			57730	39600	18130	1.46
Total	71230	48490	22740	1.47		
Double Crop enterprise + Livestock (Caprine)						
Marginal						
Maize	20	0	0	5400	-5400	0.00
Paddy		33.00	18315	10032	8284	1.83
Sheep			18000	6550	11450	2.75
Total	36315	21982	14334	1.65		
Three crop enterprise						
Marginal						
Castor	20	6.00	7200	5950	1250	1.21
Sorghum		10.00	5000	4800	200	1.04
Maize		25.00	12125	9275	2850	1.31
Total			24325	20025	4300	1.21
Small						
Castor	20	8.00	9520	6408	3112	1.49
Sorghum		4.50	3150	3086	64	1.02
Maize		19.00	8930	10310	-1380	0.87
Total			21600	19804	1796	1.09

Large						
Castor	20	9.00	10800	6346	4454	1.70
Maize		16.00	8000	5185	2815	1.54
Paddy		25.00	15000	9678	5322	1.55
Total			33800	21209	12591	1.59
Large						
Paddy	30	28.00	22400	10060	12340	2.23
Maize		19.50	9653	6087	3566	1.59
Pigeon pea		5.00	5500	2520	2980	2.18
Total			37553	18667	18886	2.01
Three crop enterprise + Livestock (milch)						
Large						
Paddy	20	52.00	29120	15430	13690	1.89
Maize		8.00	3600	7800	-4200	0.46
Castor		2.00	2400	7335	-4935	0.33
Buffaloes			23100	13250	9850	1.74
Total			58220	43815	14405	1.33
Four crop enterprise						
Large						
Castor	10	8.70	10440	8084	2356	1.29
Onion		250.00	62500	43730	18770	1.43
Paddy		39.25	24335	13865	10471	1.76
Finger millet		5.00	2625	1734	891	1.51
Total			99900	67413	32487	1.48

I. Single Crop Enterprises

a) Sorghum: It is seen from the table that sorghum crop was confined to marginal farms alone and to the extent of 10 per cent only. The net returns were negative (Rs.1270/ha) due to very poor yield, which was chiefly attributed to the delayed monsoon. Sorghum cultivation during delayed monsoon in the study region triggers the heavy incidence of Shoot fly, which cannot be controlled. The above is the sole reason for drastic reduction in the area under sorghum in the district.

b) Castor: Castor crop is perpetual in a majority of the farming systems in the study region chiefly on account of the ease in management and the demand for lower level of purchased inputs vis-à-vis other commercial crops in the region. The study reveals that the yield ranged from 6.50 to 8.00 qtl/ha on marginal and medium farms respectively thereby resulting in additional net returns of Rs.1545 and 2606/ha respectively. Higher

level of yield on the medium farms is due to the management aspects as evidenced by the higher cost of cultivation. The profitability ratio was also high on medium farms as compared to marginal farms.

c) Maize: The area under maize has shown a gradual increase during the last two to three years owing to the demand by the poultry feed industry and also for catering to the requirements of fodder to the livestock. The data reveals that the average yield was almost the same on small and medium farms (13.50 and 13.75 qtl/ha respectively). The additional net returns were Rs.516 and 484/ha on small and medium farms respectively.

II. Double Crop Enterprises

The principal crops cultivated under this system were castor and maize by small, medium and large farms.

a) Castor: The productivity of castor ranged from 6.88 qtl. /ha on medium farms to 9.00 qtl. /ha on large farms. The same was 7.42 qtl. /ha on small farms. The profitability was the highest (Rs.2537/ha on small farms) followed by Rs.2020 and 1981/ha on large and medium farms respectively thus indicating the doctrine of efficiency in production for increased profitability. The results indicate the varied levels of efficiency of farming across the different size groups.

b) Maize: It is seen from the table that the productivity was directly related to farm size. It ranged from 11 to 21 qtl/ha on small and large farms while the same was 13.50 qtl/ha on medium farms. The additional net return was positive (Rs.3895/ha) on large farms alone while it was negative on the other farms thereby suggesting the levels of technical efficiencies with which the farms are operating.

For the system in Toto, the additional net returns were Rs.1433, 1586 and 5915/ha on small, medium and large farms respectively.

III. Three Crop Enterprises

The different crop combinations taken up by various farm sizes are discussed in detail.

a) Castor-Sorghum-Maize: This combination enterprise was operational on 20 per cent each on the marginal and small farms. The data reveals that the additional net return for the enterprise as a whole was more profitable on marginal farms (Rs.4300/ha) as against Rs.1796/ha on small farms. The higher returns that have been realized on marginal farms are perhaps on account of better management practices adopted by them coupled with enhanced resource use efficiency.

b) Castor-Maize-Paddy: This enterprise was confined to 20 per cent of the large farms. The results indicate that the net return accrued was Rs.12591/ha with paddy contributing to almost 48 per cent of the returns.

c) Paddy--Maize-Pigeon pea: The system resorted to by 30 per cent of the large farmers resulted in additional net returns of Rs.18886/ha. The contribution of paddy was maximum (Rs.12340/ha followed by Rs.3566 and 2980/ha with maize and pigeon pea respectively).

IV. Four Crop Enterprise

a) Castor-onion-paddy-finger millet: This system was in vogue to the tune of 10 per cent of the large farmers. The total net additional net return which accrued from the above system was Rs.32487/ha with onion being the major contributor of Rs.18770/ha.

V. Mixed Enterprises

a) Single crop and Livestock (Milch)

This system was confined to only 10 per cent of the Medium farms. The data reveals that the contribution from the ivestock was almost eightfold over the crop enterprise thus indicating the importance of livestock in mitigating the risk. The total returns from the system were Rs.10842 with the contribution from the crop sector being only Rs.1342.

b) Double crop enterprise + Livestock (milch)

The above system was in vogue to an extent of 50 per cent among the small farms and 30 per cent among the medium farms.

Castor-Maize-Buffaloes: It is seen that the total additional net returns realized from the system was Rs.18625 with livestock being the major contributor. The maize crop was a failure due to the prolonged drought after sowing while the productivity of castor was 7 qtl/ha.

Castor-Sorghum-Cow: The total additional net returns accrued from this system was Rs.22740/ha with the contribution from agriculture being less than 25 per cent.

Castor-Paddy-Cow: It is observed from the table that the total returns derived from this system combination were Rs.28581. The contribution from agriculture to the total income was more than 50 per cent.

c) Double crop enterprise+ Livestock (Caprine)

Maize-Paddy-Sheep: This combination was resorted by 20% of the marginal farmers. The data suggests that the system additional returns derived were Rs.14334. The returns

derived from paddy were Rs.8284/ha while there were no additional net returns from maize due to the failure of the crop. It was seen that the risk was minimized by resorting to livestock (sheep in this case).

d) Three crop enterprise + Livestock (Milch)

Castor-Maize-Paddy–Buffaloes: This system operational by 20 per cent of the large farmers resulted in total net additional returns of Rs.14405. The contribution from paddy was Rs.13690/ha, from buffaloes was Rs.9850 while the productivity of castor and maize crops were affected due to biotic stresses thus pegging down the total profitability of the system.

B) Karnataka

The economics of the different farming systems in Gulbarga District of Karnataka state was studied. It was observed that there are three systems in vogue viz., livestock based (4.35 percent), agriculture based (25 percent) and agriculture + livestock based (70.65 percent).

Agriculture based: The two types of systems viz., single cropped (12.5 percent) double crop (6.67 percent) and three crop enterprises (12.5 percent) prevailed across the different farm sizes.

I. Single crop: It was observed that banana and redgram were cultivated on 20 and 30 per cent of the marginal farms respectively. The results suggest that the returns were Rs.50288 and Rs.3905/ha.

II. Double crop: The different cropping systems prevailing were bengalgram –redgram (10 per cent of marginal farmers), banana-redgram (8.33 per cent of medium farmers) and banana – sugarcane (8.33 per cent of medium farmers).

a) Bengalgram – redgram: It is observed that the net benefit was Rs.11955/ha. The profitability ratio was 2.02 for the system as a whole.

b) Banana – redgram: The results suggest that the net return was Rs.93800/ha from banana and Rs.6438/ha from redgram. The system resulted in a net benefit of Rs.100238 per ha. with the profitability ratio of 4.44.

c) Banana – sugarcane: The results indicated that the net returns realized were Rs.129600 / ha for the system as a whole. The input-output ratio was 2.79.

It is thus evident that the aforesaid cropping system was highly profitable which needs to be replicated in similar agro-ecological situations with similar resources (land, water etc.)

III. Three-crop enterprise: This cropping system was prevailing to an extent of 50 per cent on the medium farms. The major cropping systems were bajra – sorghum – redgram, bengalgram – redgram – wheat, bajra – redgram – sunflower and paddy-redgram-sunflower.

a) Bajra – sorghum – redgram: The results revealed the net benefit accrued for the system was Rs.9803/ha.

b) Bengalgram – redgram – wheat: It is evidenced from the table that the system resulted in accrual of net benefit of Rs.13483/ha.

c) Bajra – redgram – sunflower: This cropping system realized net returns of Rs.8123/ha with the input-output ratio being 1.84.

d) Paddy-redgram-sunflower: The net returns that were realized under this system were Rs.15475/ha.

It can be concluded that the three-crop enterprise resulted in varied levels of profitability ranging from Rs.8123/ha to Rs.15475/ha. It is important that the option of either of the aforesaid systems could be adopted or replicated keeping the water requirement, receding moisture status and the case of management in view.

However, the results suggest that there exists considerable extent of productivity differential which could be bridged through adoption of appropriate technology component, ultimately resulting in enhanced profitability / productivity through increased resource use efficiency.

IV. Livestock based: It is observed that 9.09 per cent of the small farmers and 8.33 per cent of the medium farmers resorted to this sector. Although they possessed land, the fragmented number and the continued shrinkage of the size of the holding passed through generations resulted in unviable unit.

It is observed from the table that the small farmers resorted to dairying. The results revealed that the net benefit was Rs.10420 with the profitability ratio being 1.97. On medium farms, the dairying and utilization towards draught purpose resulted in net benefit of Rs.15925.

V. Mixed Enterprises

As many as three systems viz., single crop enterprise + livestock, double crop enterprise + livestock and three crop enterprise + livestock were prevailing across different farm sizes.

a) Single crop enterprise + livestock: It is observed that 20 per cent of the marginal farmers resorted to this system. Inter-alia, the productivity of redgram ranged from 6-8

qntls. /ha resulting in net returns from rs.1860 – 5930/ha. The contribution of livestock to the net income was to the extent of 48 – 55 per cent.

Table 2. Costs and Returns from Agriculture / Farming Systems in Gulbarga District of Karnataka

Farm Category / Enterprise	% to the respective farm size	Average yield (qtl/ha)	Gross Returns (Rs/ha)	Operational Costs (Rs/ha)	Net Benefit (Rs/ha)	Input Output ratio
Livestock Based						
Small						
Buffaloes	9.09		21120	10700	10420	1.97
Medium						
Bullocks	8.33		10025	6750	3275	1.49
Cows			22400	9750	12650	2.30
Single crop enterprise						
Marginal						
Banana	20	28	76900	26613	50288	2.89
Red gram	30	6	9125	5220	3905	1.75
Single crop enterprise+Livestock						
Marginal						
Red gram	10	6	8250	6390	1860	1.29
Buffaloes			4625	3000	1625	1.54
Bullocks			5250	5125	125	1.02
			18125	14515	3610	1.25
Marginal						
Red gram	10	8	12000	6070	5930	1.98
Bullocks			2750	2500	250	1.10
Cows			19000	12000	7000	1.58
			33750	20570	13180	1.64
Double crop enterprise						
Marginal						
Bengal Gram	10	10	14250	6510	7740	2.19
Red gram		6	9375	5160	4215	1.82
			23625	11670	11955	2.02
Medium						
Banana	8.33	40	120000	26200	93800	4.58
Red gram		6.25	9375	2938	6438	3.19

			129375	29138	100238	4.44
Medium						
Banana	8.33	48	144000	29000	115000	4.97
Sugar cane		58	58000	43400	14600	1.34
			202000	72400	129600	2.79
Double crop enterprise +Livestock						
Small						
Bajra	9.09	8	3200	2905	295	1.10
Red gram		7	10125	3900	6225	2.60
Cow			9075	6000	3075	1.51
			22400	12805	9595	1.75
Large						
Bajra	10	12.5	6250	3450	2800	1.81
Red gram		7	10500	4790	5710	2.19
Cow			18600	12000	6600	1.55
			35350	20240	15110	1.75
Large						
Bajra	10	13.5	6750	3650	3100	1.85
Red gram		6	9000	3595	5405	2.50
Buffaloes			11700	6000	5700	1.95
Cow			4650	3000	1650	1.55
			32100	16245	15855	1.98
Small						
Bajra	9.09	5	2000	1875	125	1.07
Red gram		8	12000	6300	5700	1.90
Bullocks			5250	5000	250	1.05
Cows			5100	3000	2100	1.70
			24350	16175	8175	1.51
Large						
Banana	10	47.5	142500	28100	114400	5.07
Red gram		4.75	7125	4200	2925	1.70
Buffaloes			35100	18000	17100	1.95
Bullocks			7200	4000	3200	1.80
Cows			9300	7500	1800	1.24
			201225	61800	139425	3.26
Small						
Bajra	9.09	6	2400	1780	620	1.35

Red gram		5	6750	4300	2450	1.57
Buffaloes			18000	10300	7700	1.75
Bullocks			4320	4500	-180	0.96
Cows			29700	18000	11700	1.65
			61170	38880	22290	1.57
Small						
Banana	9.09	50	150000	25500	124500	5.88
Red gram		4	6000	3350	2650	1.79
Bullocks			6000	4800	1200	1.25
Cows			13200	6000	7200	2.20
			175200	39650	135550	4.42
Marginal						
Red gram	10	7	10125	5010	5115	2.02
Sun flower		6	7500	5225	2275	1.44
Bullocks			4850	5400	-550	0.90
Cows			11700	6000	5700	1.95
			34175	21635	12540	1.58
Medium						
Bajra	8.33	10	4000	3120	880	1.28
Red gram		8.75	13125	4390	8735	2.99
Bullocks			6000	5500	500	1.09
Cows			4800	3000	1800	1.60
			27925	16010	11915	1.74
Three Crop Enterprise						
Medium						
Bajra	16.66	11.5	5350	2775	2575	1.93
Jowar (Hisar)		10.5	8100	3698	4403	2.19
Red Gram		4.1	6188	3363	2825	1.84
			19638	9835	9803	1.84
Medium						
Bengal gram	16.66	8	16000	8820	7180	1.81
Red gram		4.5	6750	4975	1775	1.36
Wheat		17.5	13563	9035	4528	1.50
			36313	22830	13483	1.84
Medium						
Bajra	8.33	6	3000	2680	320	1.12
Red gram		7	10500	3850	6650	2.73

Sunflower		3.2	4800	3647	1153	1.32
			18300	10177	8123	1.84
Medium						
Paddy	8.33	18.75	15000	9213	5788	1.63
Red gram		7.5	11250	4150	7100	2.71
Sun flower		4.25	6375	3788	2588	1.68
			32625	17150	15475	1.84
Three Crop Enterprise+Livestock						
Small						
Bajra	9.09	8	3200	2392	808	1.34
Jower		9	6125	3330	2795	1.84
Red gram		6	9000	3250	5750	2.77
Buffaloes			6500	3750	2750	1.73
			24825	12722	12103	1.95
Marginal						
Bengal gram	10	5	9100	6335	2765	1.44
Red gram		5	7500	5060	2440	1.48
Sun flower		5	7500	4540	2960	1.65
Buffaloes			11100	6000	5100	1.85
Cow			6200	3000	3200	2.07
			41400	24935	16465	1.66
Large						
Bajra	10	16.5	6600	2900	3700	2.28
Black gram		5	7500	6450	1050	1.16
Green gram		3	4500	2788	1713	1.61
Bullock			5130	3000	2130	1.71
Cow			9300	5500	3800	1.69
			33030	20638	12393	1.60
Large						
Bajra	10	12	5700	3000	2700	1.90
Jower (Hibrid)		10	4000	2610	1390	1.53
Red gram		5	7500	3970	3530	1.89
Bullock			5400	6000	-600	0.90
Cow			18600	12000	6600	1.55
			41200	27580	13620	1.49

Large						
Banana	10	50	150000	30000	120000	5.00
Red Gram		7	10500	3470	7030	3.03
Sugarcane		630	63000	47925	15075	1.31
Buffaloes			31200	15000	16200	2.08
Bullocks			22800	18000	4800	1.27
Cows			31000	20000	11000	1.55
			308500	134395	174105	2.30
Small						
Bajra	18.18	10	4000	2775	1225	1.44
Jowar		6.5	5025	2970	2055	1.69
Red Gram		4.875	7313	3288	4025	2.22
Buffaloes			9000	5150	3850	1.75
Bullocks			5775	5050	725	1.14
Cows			10725	6000	4725	1.79
			41838	25233	16605	1.66
Large						
Bajra	10	10	4500	3150	1350	1.43
Jowar		12	6000	3200	2800	1.88
Red Gram		9	13500	4375	9125	3.09
Buffaloes			15600	9000	6600	1.73
Bullocks			4650	5200	820	0.89
Cows			20925	17000	3925	1.23
			65175	41925	24620	1.55
Large						
Bengal gram	10	12.5	23125	10830	12295	2.14
Sesamum		2	5000	2920	2080	1.71
Sugarcane		650	65000	46788	18213	1.39
Buffaloes			11700	8500	3200	1.38
Bullocks			5250	3700	-250	1.42
Cows			9300	5800	3500	1.60
			119375	78538	39038	1.52
Small						
Bajra	9.09	5	2500	2471	29	1.01
Paddy		21	16400	11475	4925	1.43
Red Gram		5	6750	2945	3805	2.29
Buffaloes			6000	3800	2200	1.58
Bullocks			4800	4500	300	1.07

Cows			4950	3000	1950	1.65
			41400	28191	13209	1.47
Medium						
Bajra	8.33	12	4800	3340	1460	1.44
Groundnut		7.45	14900	8725	6175	1.71
Red gram		5.25	7875	4325	3550	1.82
Buffaloes			6980	5200	1500	1.34
Bullocks			3200	3850	150	0.83
Cows			5250	3950	300	1.33
			43005	29390	13135	1.46
Large						
Green gram	10	5	7500	2975	4525	2.52
Jowar		12	9000	3400	5600	2.65
Red gram		6.25	9375	3570	5805	2.63
Buffaloes			5850	4800	1050	1.22
Bullocks			6210	6000	210	1.04
Cows			9300	5800	3500	1.60
			47235	26545	20690	1.78
Small						
Bajra	9.09	8	3200	2625	575	1.22
Black gram		6	9000	2460	6540	3.66
Groundnut		7	13500	8125	5375	1.66
Buffaloes			20000	16200	3800	1.23
Bullocks			8700	7800	900	1.12
Cows			3700	3200	500	1.16
			58100	40410	17690	1.44
Medium						
Jowar	8.33	7.8	6240	2940	3300	2.12
Red gram		6.8	10200	4358	5843	2.34
Sunflower		3.5	5250	3513	1738	1.49
Buffaloes			7950	4500	3000	1.77
Bullocks			2800	3250	300	0.86
Cows			5600	3500	2100	1.60
			38040	22060	16280	1.72
Large						
Jowar	10	10	7250	4310	2940	1.68
Red gram		6.2	9300	4435	4865	2.10

Sunflower		5	7500	4200	3300	1.79
Buffaloes			7850	7100	750	1.11
Bullocks			5265	5500	-235	0.96
Cows			9300	8000	3300	1.16
			46465	33545	14920	1.39
Small						
Bengal Gram	9.09	5	10000	5286	4714	1.89
Red gram		7	9750	4625	5125	2.11
Sun flower		4	6000	3180	2820	1.89
Buffaloes			6000	5250	2000	1.14
Bullocks			3250	4250	-800	0.76
Cows			7260	5800	1460	1.25
			42260	28391	15319	1.49

b) Double crop enterprise + livestock: This system was in vogue to the extent of 21.17 percent for the total sample. There were three farming systems in operation viz., Bajra-redgram-bovines, banana-redgram-bovines and sunflower-redgram-bovines.

i) Bajra-redgram-bovines: It is evidenced that this farming system was prevailing on 27.27 percent of the small farms, 8.33 percent of the medium farms and on 30 percent of the large farms. The results revealed the farm size-productivity scale neutrality thus indicating the varying magnitude of efficiency levels in farming. It is further observed that the livestock contribution played an important role in the income generation activity.

ii) Banana-redgram-bovines: The farming system prevalent on 9.09 per cent on small farms and 10 percent on large farms resulted in net returns of Rs.135550 and Rs.139425 respectively on the aforesaid farms.

iii) Sunflower-redgram-bovines: This system prevailing on 10 per cent of the marginal farms realized net returns of Rs.12540.

It is seen that there existed different efficiency levels in the productivity of agriculture across different farm sizes. The livestock played a vital role in supplementary to the total income realization.

c) Three crop enterprise + livestock: As many as 11 different farming systems prevailed across the different size groups.

i) Bajra-jowar-redgram-bovines: This system was operational on 27.27 per cent of the small farms and on 20 per cent of the large farms. The results indicated that the profitability was Rs.12103 with one livestock component and Rs.16605 with three livestock components on small farms while on large farms it was Rs.13620 and 24620

with single and three livestock components respectively.

ii) Bengalgram-redgram-sunflower-bovines: This system was prevalent on 10 per cent of the marginal farms. The net returns accrued were Rs.16465 with the aforesaid system.

iii) Jowar-redgram-sunflower-bovines: This farming system was prevalent on 8.33 and 10 percent of the medium and large farms respectively. The study indicated that the medium farms had enhanced profitability out of the large farms (Rs.16280 on medium farms as against Rs. 14920 on large farms. Scale neutrality of productivity as well as direct relationship with farm size was prevailing thus indicating the different levels of efficiency(s) operating on the above farms.

iv) Bajra-blackgram-greengram-bovines: This system was in vogue on 10 percent of the large farms. The data revealed that the total net returns accrued from the system were Rs.12393.

v) Banana-redgam-sugarane-bovines: The results indicated that the system which was operational on 10 percent of the large farms provided net returns of Rs.174165.

vi) Bengalgram- sesame-sugarcane-bovines: This system prevailed on 10 per cent of the large farms and led to system net returns of Rs.39038.

vii) Bajra-paddy-redgram-bovines: It is observed that the net return realized for the aforesaid system being operational on 9.09 percent of the small farms was Rs.13209.

viii) Bajra-groundnut-redgram-bovines: This farming system was operational on 8.33 per cent of the medium farms. The results indicated that the net return realized for the total system was Rs.13135.

ix) Greengram-Jowar-Redgram-Bovines: The results revealed that the net returns for the total system were Rs.20690 which was operational on 10 percent of the large farms.

xi) Bajra-blackgram-groundnut-bovines: It is observed that this farming system was prevailing on 9.09 per cent of the small farms. The net return accrued from the system was Rs.17690.

x) Bengalgram-redgram-sunflower-bovines: This farming system was operated by 9.09 per cent of the small farms. The net returns realized were Rs.15319.

It can be concluded from the analysis on the different farming systems operated across the various farm sizes that there has been the diversification aspect followed to mitigate risk. Livestock has also played a major role in adding to the net returns realized by the farmers. The crop mix of cereals-pulses-oilseeds followed in varying magnitude reflects the sustainability in terms of income realization.

It is important that the yield differential between the realized yield and the attainable

yield has to be bridged or enhanced so as to achieve productivity and profitability. This calls for proper input mix for enhanced resource-use efficiency.

3. Tamil Nadu

The economics of the different farming systems operational in Salem district of Tamil Nadu are discussed in this section. It is seen that the two major systems viz. agriculture based and agriculture + livestock based farming systems are in vogue.

I. Agriculture based

Agriculture based: It is seen that single crop and three crop enterprises was prevailing in the sample.

a) Single crop enterprise: This was limited to 9.09 percent of the medium farms. The results indicate that the sesame yield was 5 qtls. /ha providing net returns of Rs.3960/ ha.

b) Three-crop enterprise: Sesame-sorghum-tomato system when practiced by 8.33 percent of the small farmers resulted in net returns of Rs.9970/ha while sesame-groundnut-sorghum cropping system prevalent on 9.09 per cent of the medium farms realized net returns of Rs.18070/ha.

II. Agriculture + Livestock based: This system comprised of double crop and three crop enterprise with livestock component(s).

a) Double crop with livestock

i) Double crop enterprise + bovine: It is seen from the table that sorghum-onion-cow when practiced by marginal farmers (percent) resulted in net returns of Rs.13900 while the same with groundnut-sesame-cow was Rs.12137. The sesame-sorghum-cow-buffaloes system on marginal farm provided net returns of Rs.18904 while sesame-groundnut-cow-buffaloes on medium farms realized net returns of Rs.15368.

ii) Double crop enterprise + caprine: This system (paddy-tomato-goat) operational on marginal farms (10 per cent) resulted in net returns of Rs.8250.

iii) Double crop enterprise + bovine + caprine: It is seen that sorghum-onion-cow-goat system realized net returns of Rs.13195 on marginal farms while groundnut-sesame-cow-goat on medium farms resulted in net return of Rs.10682. In case of sesame-groundnut-cow-sheep system, the net returns were Rs.20190. With respect to paddy-sorghum-cows-sheep-goat practiced on marginal farms, the net returns were Rs.21330.

iv) Double crop enterprise + poultry: Sesame-tomato-poultry system when operated by 14.28 percent of the large farmers resulted in net returns of Rs.9540.

v) Double crop + bovine + poultry: It is seen from the table that the net returns accrued under the sesame-sorghum-cow-poultry system was Rs.10725.

Table-3. Costs and Returns from Agriculture / Farming Systems in Salem District of Tamil Nadu

Farm Category / Enterprise	% of farmers to total under the respective farm size	Average yield (qtl/ ha)	Gross Returns (Rs/ha)	Operational Costs (Rs/ha)	Net Benefit (Rs/ha)	Input-Output Ratio
Single Crop Enterprise						
Medium						
Sesame	9.09	5	10750	6790	3960	1.58
Double Crop Enterprise + Bovines						
Marginal						
Sorghum	10	6	6000	2750	3250	2.18
Onion		60.00	30000	23500	6500	1.28
Cow			12500	8350	4150	1.50
			48500	34600	13900	1.40
Marginal						
Groundnut	10	10	18000	11840	6160	1.52
Sesame		3.0	8550	5463	3087	1.57
Cow			11540	8650	2890	1.33
			38090	25953	12137	1.47
Marginal						
Sesame	10	2.25	6638	4629	2009	1.43
Sorghum		6.0	6000	2210	3790	2.71
Cow			10525	7250	3275	1.45
Buffaloes			26280	16450	9830	1.60
			49443	30539	18904	1.62
Medium						
Sesame	9.09	3.5	9100	6730	2370	1.35
Groundnut		10.0	21000	14128	6873	1.49
Cow			12150	9205	2945	1.32
Buffaloes			12600	9420	3180	1.34
			54850	39483	15368	1.39

Double Crop Enterprise + Caprine						
Marginal						
Paddy	10	36	19800	15440	4360	1.28
Tomato		65.00	16250	12560	3690	1.29
Goat		0.00	700	500	200	1.40
			36750	28500	8250	1.29
Double Crop Enterprise +Bovines+ Caprine						
Marginal						
Sorghum	10	4	4000	2255	1745	1.77
Onion		58.00	29000	21800	7200	1.33
Cow			12600	9250	3350	1.36
Goat			4600	3700	900	1.24
			50200	37005	13195	1.36
Medium						
Groundnut	9.09	10	18500	14825	3675	1.25
Sesame		4.0	8800	5893	2907	1.49
Cow			19200	15300	3900	1.25
Goat			400	200	200	2.00
			46900	36218	10682	1.29
Medium						
Sesame	9.09	4	9000	5450	3550	1.65
Groundnut		12.5	24375	15180	9195	1.61
Cow			11475	8380	3095	1.37
Sheep			15000	10650	4350	1.41
			59850	39660	20190	1.51
Marginal						
Paddy	10	42	23100	15480	7620	1.49
Sorghum		3.3	3300	2565	735	1.29
Cow			28800	19475	9325	1.48
Sheep			9000	5750	3250	1.57
Goat			1000	600	400	1.67
			65200	43870	21330	1.49
Double Crop Enterprise + Poultry						
Large						
Sesame	14.28	4	12000	7160	4840	1.68
Tomato		65.00	16250	12050	4200	1.35
Poultry			500		500	
			28750	19210	9540	1.50

Double Crop Enterprise + Livestock+Poultry						
Marginal						
Sesame	10	3.25	9750	4675	5075	2.09
Sorghum		4.0	4000	2355	1645	1.70
Cow			12760	9205	3555	1.39
Poultry			450		450	
			26960	16235	10725	1.66
Three Crop Enterprise						
Small						
Sesame	8.33	4	10000	4930	5070	2.03
Sorghum		4.4	4000	2850	1150	1.40
Tomato		70.00	17500	13750	3750	1.27
			31500	21530	9970	1.46
Medium						
Sesame	9.09	5	12500	5140	7360	2.43
Groundnut		12.0	23400	15615	7785	1.50
Sorghum		7.0	7000	4075	2925	1.72
			42900	24830	18070	1.73
Three Crop Enterprise+Bovines						
Marginal						
Sesame	10	3	8400	6357	2043	1.32
Groundnut		8.0	14000	12500	1500	1.12
Sorghum		5.0	5000	2300	2700	2.17
Cow			9650	6780	2870	1.42
			37050	27937	9113	1.33
Small						
sesame	8.33	3	8250	5495	2755	1.50
Groundnut		10.0	17000	13920	3080	1.22
Sorghum		5.5	5500	2950	2550	1.86
Cow			28350	17400	10950	1.63
			59100	39765	19335	1.49
Three Crop Enterprise+ Bovines +Caprine						
Large						
Paddy	14.28	40	22000	16573	5428	1.33
Sesame		4.5	11250	6885	4365	1.63
Groundnut		11.5	24725	14360	10365	1.72
Cow		8.00	19680	12580	7100	1.56

Goat			3500	1700	1800	2.06
			81155	52098	29058	1.56
Three Crop Enterprise+ Bovines +Poultry						
Marginal						
Paddy	10	45	25425	17571	7854	1.45
Sorghum		7.2	7200	2743	4458	2.63
Onion		60.00	28800	24750	4050	1.16
Cow			12350	7450	4900	1.66
Buffaloes			28800	20480	8320	1.41
Poultry			500		500	
			103075	72994	30082	1.41
Small						
Sesame	8.33	2	5700	4250	1450	1.34
Sorghum		6.2	3500	2600	900	1.35
Tomato		75.00	18750	13510	5240	1.39
Buffaloes			19400	12550	6850	1.55
Poultry					125	
			47350	32910	14565	1.44
Large						
Paddy	14.28	37	20350	16950	3400	1.20
Sorghum		7.5	7500	4730	2770	1.59
Tomato		85.00	13530	21250	7720	0.64
Cow			7600	8895	1295	0.85
Poultry			400		400	
			49380	51825	15585	0.95
Three Crop Enterprise+ Bovines +Caprine						
Medium						
Paddy	9.09	39	23205	16615	6590	1.40
Sesame		4.0	9000	6785	2215	1.33
Tomato		75.00	18750	12520	6230	1.50
Cow			21000	12950	8050	1.62
Sheep			1500	1085	415	1.38
			73455	49955	23500	1.47
Marginal						
Sesame	10	3.4	10030	5163	4867	1.94
Sorghum		5.0	5000	2165	2835	2.31
Tomato		70.00	17500	12100	5400	1.45

Cow			11580	9180	2400	1.26
Sheep			15000	11000	4000	1.36
			59110	39608	19502	1.49
Small						
Groundnut	8.33	12	21000	13415	7585	1.57
sesame		2.8	7975	4930	3045	1.62
Onion		62	31000	25700	5300	1.21
Cow			9360	6800	2560	1.38
Sheep			3000	2000	1000	1.50
			72335	52845	19490	1.37
Small						
sesame	8.33	2.5	7500	4530	2970	1.66
Groundnut		9.0	16200	13165	3035	1.23
Sorghum		7.8	6000	2900	3100	2.07
Cow			20800	16400	4400	1.27
Sheep			4500	2500	2000	1.80
			55000	39495	15505	1.39
Three Crop Enterprise+Livestock+Caprine+Poultry						
Small						
Sesame	8.33	3.75	10313	4730	5583	2.18
Sorghum		45.0	4500	2920	1580	1.54
Onion		80	40000	34250	5750	1.17
Cow			18540	13840	4700	1.34
Sheep			4500	4000	500	1.13
Goat			1100	750	350	1.47
Poultry			400		400	
			79353	60490	18863	1.31
Medium						
Groundnut	9.09	10	18000	15190	2810	1.18
Sesame		5.0	11375	7790	3585	1.46
Fodder sorghum		6.0	6000	3125	2875	1.92
Cow			26900	17340	9560	1.55
Sheep			5850	4250	1600	1.38
Goat			1250	500	750	2.50
Poultry			750		750	
			70125	48195	21930	1.46

b) Three Crop Enterprises with livestock:

i) Three crop enterprise + bovines: It can be evidenced from the table that the net returns ranged from Rs.9113 on marginal farms to Rs.19335 on small farms with sesame-groundnut-sorghum-cow system.

ii) Three crop enterprise + bovines + caprine: It is observed that the paddy-sesame-groundnut-cow-goat system in vogue on 14.28 per cent of the large farms resulted in net returns of Rs.29058.

iii) Three crop enterprise + bovine + poultry: There were three combinations / systems operational in the study zone.

i) Sesame-sorghum-tomato- bovine -poultry: This system was existing on 8.33 percent of the small farms. The net returns realized by the system were Rs.14565.

ii) Paddy-sorghum-onion- bovine -poultry: This system resulted in net returns of Rs.30082 on marginal farms.

iii) Paddy-sorghum-tomato- bovine -poultry: It is seen from the table that this farming system resulted in net returns of Rs.15585 on large farms.

iv) Three crop enterprise + bovines + caprine: It is observed that the net returns accrued on medium farms with paddy-sesame-tomato-cow-sheep farming system were Rs.23500 while that with sesame-sorghum-tomato-cow-sheep was Rs.19502 on marginal farms.

In case of Groundnut-sesame-onion-cow-sheep system, the net returns realized on small farms were Rs.19490 while the same with sesame-groundnut-sorghum-cow-sheep was Rs.15505 on the same category of the farms.

v) Three crop enterprise + bovine + caprine + poultry: This system was prevailing on 16.66 and 9.09 per cent of the small and medium farms. It is seen that with sesame-sorghum-onion-cow-sheep-goat-poultry farming systems, the net returns realized were Rs.18863 on the small farms. With groundnut-sesame-tomato-sorghum-cow-sheep-goat-poultry farming systems, the net returns accrued on medium farms were Rs.21930.

Conclusion

The study has revealed the prevalence of different farming systems in vogue across farm sizes and states. It can be concluded that the following farming systems faired well in all the four categories of the farmers with different combinations of enterprises as mentioned below

Summary of the farming system providing the maximum economic returns

State	Farm size			
	Marginal	Small	Medium	Large
AP	Mz-P-Cp (Rs.14334)	C-Mz-B (Rs.18625)	C-P-B (Rs.28581)	Mz-P-Pu (Rs.18886)
KA	Pu-B (Rs.13180)	Bj-Pu-Gn-B (Rs.17690)	So-Pu-Su-B (Rs.16280)	Pu-Bn-Sc-B (Rs.174105)
TN	P-So-O-B-Pl (Rs.30082)	Gn-Se-O-B-Cp (Rs.19490)	P-Se-V-B-Cp (Rs.23500)	P-Se-Gn-B-Cp (Rs.29058)

Mz: Maize, P: Paddy, B: Bovine, C: Castor, Cp: Caprine, Pu: Pulses, Bj:Bajra, Gn: Groundnut, So: Sorghum, Su: Sunflower, Sc: Sugarcane, Bn:Banana, O:Onion, Pl: Poultry, Se: Sesame, V: Vegetables

The major components of the farming system were found to be the cereal crops, oil seeds, bovines, caprines, vegetables and fruits. The farming systems being operated by the farmers were specific to each agro-climatic zone. However it was observed that a combination of enterprises in the farming system has proven to be economical as against only agriculture based production systems. Accordingly, it is necessary for the R & D Organizations like ZRS's and KVKs to study the economic performance of the existing farming systems and design, test and develop economically feasible farming system models in different agro climatic zones for diffusion to the farming community.

Reference

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