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ECONOMICS OF CROPPING PATTERN UNDER TANK IRRIGATION IN SOUTH EASTERN DRY REGION OF MYSORE

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Regional Features

The Mysore State can be broadly divided into four agricultural regions, based on soil and climatic conditions, *viz.*, (1) Coastal region (2) Malnad region (3) Transition region (4) Dry region. The dry region is characterised by uncertain, untimely and inadequate rainfall. It is a scarcity region where crop failure is a common feature. From the point of view of cropping pattern the region can be further divided into three sub-groups:

(*i*) *Dry North Region* :—Where the soils are mostly black cotton, and the important crops grown are jowar, wheat, cotton and groundnut.

(*ii*) *Dry Central Region* :—Where the soils are sandy to loamy with poor retentive capacity. Important crops grown in this region are *ragi* and other millets.

(*iii*) *Dry South Eastern Region* :—The region comprises the southern districts of Mysore State mainly Bangalore, Kolar and Tumkur. It is a high lying hilly region where soils are mostly red loams with fairly good moisture retentive capacity. The area is served by a net work of storage tanks, both seasonal and perennial. Tanks are the only source of assured supply of water to crops in the region. *Ragi* is an important crop grown under dry conditions, whereas paddy is commonly grown under tank irrigation. The soil and other environmental factors in this region are capable of producing a variety of food and commercial crops, with advantage, limiting factor being assured water supply. Our present study refers to cropping pattern under tank irrigation in this region.

Objectives

The two objectives set for this paper are (1) to study the economics of present cropping pattern in a region with a view to (a) determining the factors which influence the present pattern; (b) ascertain the productivity of water and labour and the intensity of cultivation to which the land is presently put; and (2) to suggest a most profitable cropping pattern which results in increasing the productivity of these resources and maximize returns.

Design of the Sample

The design of the sample is purposive. Four sample villages, *viz.*, Kare Kattiganur, Siddapur, Allalasandra and Singanayakanahalli of the Farm Management Research Centre, Bangalore where facilities for tank irrigation exist, have been chosen for this study. The tanks have varied capacity of supplying water. Tank in Siddapur is capable of providing irrigation throughout the year. Tank

in Kare Kattiganur is capable of providing irrigation for most part of the year. Tanks in Allalasandra and Singanayakanahalli are capable of providing irrigation for a very short time—from September to December—about three months. The sample covers mainly red soils area capable of growing a variety of crops. Data for this study have been drawn from the records of the Farm Management Research Centre, Bangalore and cover a period of three years from 1959-60 to 1961-62. In all, 240 cases have been studied.

Land Utilization and Cropping Pattern

The size of plots in the four sample villages under tank irrigation is extremely small. Nearly 50 per cent of the plots are below one acre and two-thirds of them below 1.5 acres. The average size of plots comes to 0.72 acres. As the size of plots is extremely small, one way of increasing the profitability of land under tank irrigation is to put it to more intensive use.

Table I presents data regarding land utilisation in 240 cases in the selected four villages of the region.

TABLE I—LAND UTILIZATION PATTERN UNDER TANK IRRIGATION IN FOUR SAMPLE VILLAGES 1959-60 TO 1961-62

Sl. No.	Items	Singana-yakana-halli	Allala-sandra	Kare Katti-ganur	Siddapur	Total
1	2	3	4	5	6	7
1.	Total number of plots under crops	83	51	81	27	242
2.	Number of plots under double crops	—	—	34	10	44
3.	Net number of plots	83	51	47	17	198
4.	Total area under crops	55.16	59.38	36.01	20.11	171.26
5.	Area under double crops	—	—	11.38	8.00	19.38
6.	Net area under crops	55.16	59.38	24.03	12.11	151.28
7.	Percentage of double cropped area	—	—	33.17	40.13	12.81
8.	Percentage of plots under double cropping to total number of plots	—	—	42.08	40.73	22.22
9.	Intensity of cultivation (per cent)	—	—	133.17	140.33	112.81
	Potential					200 Per cent

Out of 198 plots under tank irrigation only 44 plots or 22.22 per cent are under double crops, occupying an area of only 19.38 acres or 12.81 per cent of the net area. Intensity of cropping is 112.81 per cent, which is very low. With the facilities of tank water available to supplement rain water it is possible to raise the intensity of cultivation to nearly 200 per cent.

In a broad sense, the present cropping pattern may be put under three categories :

(i) Mono-culture or raising a single crop of paddy:

This forms by far the largest group. It includes 78.75 per cent of the cases and 87 per cent of the area. This pattern is found in two villages, *viz.*, Singa-

nayakanahalli and Allalasandra where tank water is available for irrigation only for about three months in a year.

(ii) Paddy after Paddy:

This pattern is common in Siddapur, where tank water is available throughout the year. This forms only 3.33 per cent of the cases and 3.98 per cent of the area.

(iii) Paddy after Vegetables:

In this pattern, paddy is raised after a vegetable crop of potato, garlic and beans. This forms 13.76 per cent of the cases and 6.76 per cent of the area. This pattern is found in Kare Kattiganur, where tank water is available for most part of the year.

There are a few cases, where vegetable crops are raised. Paddy is, therefore, an important crop raised under tank irrigation in this area and is grown either under competitive relationship or complimentary relationship with vegetables.

Input and Output of Crops

Table II presents data regarding the quantity of different inputs applied per acre in the cultivation of crops and per acre yields of crops under tank irrigation in the four sample villages of the region.

Crops with varying duration are raised under tank irrigation. The duration of vegetable crops is 60-90 days. They require about 15-20 acre inches of water to mature. Labour units applied are comparatively higher. Manures and fertilizers are commonly used, indicating more intensive methods of raising vegetables. Crop protection measures have been used in stray cases.

Where paddy has been taken as a single crop, '*Punaji* cultivation,' *i.e.*, the crop is sown broadcast in June-July, it is raised under rainfed condition till the tank water is available for irrigation. It occupies the land for 120-150 days. Sown in July it comes to harvest in December. Water applied to *punaji* paddy amounts to 48 acre inches. As compared to vegetables, water requirement of paddy is high and is more than double. The requirement of man-days of labour is comparatively low. Manuring this crop is common, but no fertilizer has been applied and no crop protection measures have been taken.

Where paddy is transplanted, it requires higher doses of labour and water, as compared to *punaji* paddy. Its yields also are more. It however requires lower seed rate. The present levels of yields of these crops reveal the potentialities of increasing output through the judicious use of agricultural resources.

Data on various input costs and gross and net returns per acre in the four selected villages of the region are presented in Table III. Net returns vary according to enterprises. From the point of view of net returns and per rupee of investment, raising paddy after paddy is most profitable, which gives a net return of Rs. 500-700 per acre and a return of Rs. 6.47 to 4.83 per rupee of investment.

Table II presents data regarding the quantity of different inputs applied per acre in the cultivation of crops and per acre yields of crops under tank irrigation in the four sample villages of the region.

TABLE II—PHYSICAL INPUTS AND YIELDS OF CROPS PER ACRE IN FOUR SAMPLE VILLAGES

Items	No. of Cases	Yield (in pounds)	Duration (in days)	Total Acre inches of water	Man-days of labour	Bullock days of labour	Manure (in pounds)	Fertilizer (in pounds)
1	2	3	4	5	6	7	8	9
1. Paddy (Single crop)	189	1543	145	48.12	61.11	25.84	14905	—
2. Paddy after Paddy .. (Double crop) ..	8 (i)	2800	111	57.90	77.53	4.73	2612	—
	(ii)	2430	124	57.90	70.57	9.72	7412	—
		5230			148.10	14.45	10024	
3. Paddy after Potato ..	25							
Potato —I ..		5328	76	20.69	124.44	32.14	5900	264
Paddy —II ..		2190	132	58.56	103.58	39.74		
4. Paddy after Beans ..	5							
Beans —I ..		1716	54	11.43	73.15	19.77	19520	—
Paddy —II ..		1883	137	57.49	105.19	15.73	10500	—
5. Paddy after Garlic ..	3							
Garlic —I ..		856	80	16.96	34.09	32.50	28937	—
Paddy —II ..		1812	124	55.79	85.59	34.84		
6. Other Miscellaneous Vegetable Crops ..	10							
(i) Garlic (Single crop) cases (4) ..		2568	90	16.96	211.85	30.00	5000	180
(ii) Potato (Single crop) cases (4) ..		3836	75	20.69	124.44	32.14	5900	264
(iii) Potato after Potato (Double crop) ..	I)	6120	90	20.69	105.96	55.00	27000	174
cases (2) ..	II)	4800	65	20.69	160.70	30.76	4500	72
		10920			267.06	85.76	31500	296

1. Except in one case, no plant protection measures have been used.

2. Good yield of crops per acre in the sample villages.

(i) *Punaji* Paddy	3400	Lbs.
(ii) Transplanted Paddy	4720	,,
(iii) Potato	7776	,,
(iv) Garlic	1440	,,
(v) Beans	2400	,,

3. Acre inches of water is estimated on the number of irrigations given at an average rate of 2 acre inches per irrigation and includes effective rainfall during crop growing period.

TABLE III—INPUT COSTS AND RETURNS (IN RUPEES) PER ACRE UNDER TANK IRRIGATION IN FOUR SAMPLE VILLAGES

Items	No. of cases	Human Labour	Bullock Labour	Seeds	Manure	Fertilizer	Total Cost	Gross Returns	Output-Input Ratio	Net Returns
		Value Rs. nP.	Value Rs. nP.	Value Rs. nP.	Value Rs. nP.	Value Rs. nP.	Value Rs. nP.	Value Rs. nP.	Value Rs. nP.	Value Rs. nP.
1	2	3	4	5	6	7	8	9	10	11
(1) Paddy (Single crop)	189	61.11	36.05	10.33	59.60	—	167.09	462.96	2.77	275.89
(2) Paddy after Paddy										
I	8	77.53	5.91	6.00	10.45	30.00	129.89	840.00	6.47	710.18
II		70.57	12.15	5.33	29.65	33.12	150.82	729.00	4.83	578.18
		148.10	18.06	11.33	40.10	63.12	280.71			
(3) Paddy after Potato (Double crop)	25									
Potato — I		124.44	40.27	288.00	23.60	35.00	189.54	852.48	4.50	662.94
Paddy — II		103.58	49.67	7.16	—	—	160.41	657.00	4.20	496.59
(4) Paddy after Beans (Double crop)	5									
Beans — I		73.15	24.61	22.50	78.00	—	121.04	205.92	1.70	84.88
Paddy — II		105.19	19.66	6.50	42.00	—	131.77	564.77	4.30	433.13
(5) Paddy after Garlic (Double crop)	3									
Garlic — I		34.09	40.62	85.50	116.00	—	161.37	385.20	2.39	223.83
Paddy — II		85.59	43.55	7.00	—	—	136.14	543.60	3.99	407.47
(6) Other Miscellaneous Vegetable Crops	10									
(*i*) Garlic (Single crop)		211.89	37.50	66.50	20.00	24.00	359.89	1165.00	3.24	805.11
(*ii*) Potato (Single crop)		124.44	40.17	192.00	23.40	—	380.01	613.76	1.61	235.75
(*iii*) Potato after Potato										
I		105.96	68.75	272.00	108.00	23.20	577.91	1749.33	1.55	623.90
II		161.71	38.45	320.00	18.00	9.36	547.52			
		267.67	107.20	592.00	126.00	32.56	1125.43			

N.B. (1) Net return is taken as a criterion for the intensive use of land. (2) Total costs refer to only direct costs—cash and non-cash. (3) Water is not charged, as tank water is supplied free of cost. (4) Prices of the products have been worked out on the basis of the average farm prices prevailing during the period. Except in one case, no plant protection measures have been used.

This pattern is possible only in villages like Siddapur, where water is available for irrigation throughout the year. As the two crops of paddy cover nearly 10 months, for higher returns, the possibility of raising two vegetable crops and a crop of paddy or a crop of sugarcane needs consideration. Where paddy is taken after vegetable crop under complimentary relationship, paddy after potato gives highest net returns, and a return of Rs. 4.30 per rupee of investment—a return of Rs. 4.50 to 4.21 in each case. Raising a single crop of paddy is least paying. It has a net return of only Rs. 275.89 and a return of Rs. 2.77 per rupee of investment. As this cropping pattern is largely practised, the possibility of establishing a new pattern by raising two short duration crops such as groundnut and irrigated *ragi* deserves careful consideration. Sown in June-July, groundnut comes to harvest in September, when there is possibility of water being available to irrigate one crop. If irrigated *ragi* is planted in September-October it will come to harvest by December. This crop will be raised during the period when water is available in tanks. This also helps considerably in increasing the area under tank irrigation, as this crop requires only about 20 acre inches of water to mature.

Of the present patterns, paddy after paddy gives maximum return per unit of labour, which comes to Rs. 10. In the pattern of raising paddy after vegetable crops, paddy after garlic gives higher returns than paddy after potato and paddy after beans. Raising a single crop of vegetable is approximately as paying as a single crop of paddy.

As to returns per unit of water applied, it is most paying to raise paddy after the first vegetable crop. Use of water in raising paddy after garlic and potato is more profitable. Raising paddy after paddy as well as raising a single crop of paddy is not as profitable. Water used on these crops is least paying.

Conclusion

It is possible to increase the net returns of the present cropping patterns through new investments in fertilizers and pesticides, etc. Fertilizer experiments conducted in the region show that it is possible to nearly double the yields through the application of optimum doses of fertilizers. Judged by any standard, mono-culture or raising a single crop of paddy which is the predominant pattern, is not paying. It is possible to maximise the returns, through introducing a pattern of double cropping, like groundnut and irrigated *ragi*. This will enable the farmers to put their land under more intensive use, increase productivity of labour and employ labour for a greater part of the year. This is also helpful to farmers to make more productive use of available water. The new pattern will at least double the productivity of water and substantially increase the returns to land and labour. In the absence of any data on the new cropping pattern suggested, it is difficult to project precisely possible returns to the resources used.