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Use and Productivity of Water in Head Region of a Canal Irrigation System – An Economic Approach

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ABSTRACT

The study aimed at the optimal water use at farm level in Narasapur canal irrigation system in West Godavari district of Andhra Pradesh, revealed that the irrigation intensity and cropping intensity were more in the large sized farms. The per cent of area under wet crops was more if canal constituted as main source of irrigation. In the case of tube well irrigated farms, the per cent of area under irrigated dry crops also increased. Irrigation intensity and cropping intensity were more in farms which were adjacent to the water resources. The number of installation of tube wells increased with increase in the distance of the farms from the outset of the supply channel.

Key words : Canal Irrigation, Productivity of Water

Water is a limited resource, its efficient use is very vital and basic to the very survival of the ever increasing population. Every effort must be made to make the best use of available water to make possible a high level of continuous production per unit volume of water, per unit area of cropped land per unit time. In India, canal irrigation systems were designed and being operated with the aim of providing a certain amount of water per hectare to meet the crop water requirements.

In general, location of field determines the availability of water to the farmer. The location of field is reflected in the cropping pattern because the farmers who are adjacent to the water resources are able to grow high water demanding crops than the farmers at a distant location (Palanaswami, 1980). The size of the farm will also influence the cropping pattern, irrigation intensity etc. An attempt has been made to study the pattern of water use and productivity of water for middle region in Narsapur main canal irrigation system in West Godavari District of Andhra Pradesh. The data required for the study were obtained during the year 1995-96.

MATERIAL AND METHODS

The total length of the Narsapur main canal irrigation system was divided into three regions namely head, middle and tail based on the distance from the off-take point. In middle region one distributor with a command area of 100 ha. and more but less than 500 ha. was selected for the study. From the chosen distributor, 40 beneficiaries were selected randomly. The water used by the farmers and time taken to irrigate the crop was compiled by fixing a V-notch at different locations. For the purpose of analysis, all forty farmers were post-stratified into two groups according to size of holding and three groups based on the distance of their field location from the outlet of the supply channel. Simple average and percentages were worked out for size group wise and distance wise cropping pattern (Hellegerial *et al.,* 2007). Cobb-Douglas production function of the following was used for estimating the water used efficiency (Palanaswami and Thornton 1981).

$Y = ax1^{b1} x2^{b2} \ldots\ldots X_n^{bn}$

Y= Gross returns in rupees per ha
X1= Irrigation water in ha-cm
X2=Labour cost in rupees
X3=Seed cost in rupees
X4=Manure cost in rupees
X5=Fertilizer cost in rupees

RESULTS AND DISCUSSION

The pattern of water use generally depends upon the availability of water, the area to be irrigated, the kinds and varieties of crops grown, season and the cropping pattern.

(A) Size Group- wise cropping patterns

It could be observed from the Table 1, that the total area, irrigated area and irrigation intensity were high in second size group i.e. greater than 1.80 ha. It is due to the presence of more number of tube wells.

The size group-wise crops grown with canal as main source of irrigation (Table 2) revealed that the proportion of wet cropped area and irrigated dry

Table 1. Size group-wise cropping pattern

Size groups (ha.)	Total No. of farmers	No. of tube wells	Total area	Irrigated area	Irrigation intensity
0-1.80	24	4	38.22	33.01	86.36
>1.80	16	8	68.18	64.10	94.01
Total	40	12	106.40	97.11	91.27

Table 2. Crops grown with canal as main source of irrigation

Size groups (ha.)	Wet crop		Irrigated dry		Irrigable area (ha.)
	Area (ha.)	Area (%)	Area (ha.)	Area (%)	
0-1.80	14.89	45.11	18.11	54.89	33.01
>1.80	38.94	60.76	25.15	39.24	64.10
Total	53.83	54.68	43.26	45.32	97.11

Table 3. Crops grown with tube well as main source of irrigation

Size groups (ha.)	Wet crop		Irrigated dry		Irrigable area (ha.)
	Area (ha.)	Area (%)	Area (ha.)	Area (%)	
0-1.80	3.67	11.11	29.34	88.89	33.01
>1.80	12.32	12.32	51.78	80.78	64.10
Total	16.47	16.47	81.12	83.53	97.11

Table 4. Distance-wise cropping pattern

Distance of field location (km.)	Total No. of farmers	No. of tube wells	Total area	Irrigated area	Irrigation intensity (%)
0-1.00	9	2	39.08	38.19	97.72
1.01-2.00	17	6	33.88	30.41	89.75
2.01 & above	14	7	33.44	28.51	85.23
Total	40	15	106.40	97.11	91.27

Table 5. Distance-wise crops grown with canal as main source of irrigation

Distance of field location (km.)	Wet crop		Irrigated dry		Irrigable area (ha.)
	Area (ha.)	Area (%)	Area (ha.)	Area (%)	
0-1.00	27.11	70.99	11.08	29.01	38.19
1.01-2.00	17.56	57.73	12.85	42.27	30.41
2.01 & above	11.54	40.48	16.97	59.52	28.51
Total	56.21	60.29	40.90	39.72	97.11

Table 6. Distance-wise crops grown with Tube well as main source of Irrigation

Distance of field location (km.)	Wet crop		Irrigated dry		Irrigable area (ha.)
	Area (ha.)	Area (%)	Area (ha.)	Area (%)	
0-1.00	6.88	18.01	31.31	81.99	38.19
1.01-2.00	4.95	16.29	25.46	83.71	30.41
2.01 & above	3.90	13.80	24.61	86.20	28.51
Total	15.75	16.20	81.38	83.80	97.11

Table 7. Results of Regression Analysis on Paddy Crop.

Particulars	Variables	Bi	S.E.	t-value	Significant level
Gross return (Rs.)	Y				
Irrigation water (ha.cm)	X1	0.08156	0.0449	1.8161	NS
Labour cost (Rs.)	X2	0.06332	0.0402	1.5716	NS
Seed cost (Rs.)	X3	0.04210	0.0189	2.2264	**
Manure cost (Rs.)	X4	0.08735	0.0251	3.4679	*
Fertilizer cost (Rs.)	X5	0.15452	0.0349	4.4203	*

R1 = 0.65 * = Significant at 1 per cent level N = Number of samples

N = 40 ** = Significant at 5 per cent level NS= Non significant

Table 8. Marginal Value Product to Opportunity cost for Paddy Crop.

S.No.	Particulars	MVP	OC	MVP/OC
1	Irrigation water (X1)	7.46	1.00	7.46
2	Labour (X2)	0.65	1.00	0.65
3	Seed (X3)	1.79	1.00	1.79
4	Manure (X4)	2.27	1.00	2.27
5	Fertilizer (X5)	1.88	1.00	1.88

crops area 54.68 and 45.32 per cent respectively. An increase in the percentage of wet crops was found as the size of farms increased by a decrease in the percentage of irrigated dry crops.

Crops grown with tube well as main source of irrigation (Tasble 3) indicated that the per cent of irrigated dry crops were more in both size groups and also it accounts 83.53 per cent of area (Palanisami and Thornton, 1981).

(B) Distance-wise cropping pattern

The cropping pattern was also influenced by the filed location and it's distribution from the supply channel. The distance was measured with respect to the location of the field from the outlet of the supply channel. The distribution of area based on the supply channel was presented in Table 4.

From the above Table, it was observed that the irrigation intensity was reduced as the distance of the farm from the source of water increased (Shareef, 1989).

Distance-wise crops grown with canal as mainsource of irrigation was presented in the Table 5. From the above Table, it was noted that as the irrigation distance increased percentage of wet cropped area was decreased and the percentage of irrigated dry crops are increased.

The distance-wise crops grown with tube well as main source of irrigation was presented in the Table 6.

It could be observed from the table that area under irrigated dry crops were more with tube-well as main source of irrigation.

II Water Use Efficiency

Water use efficiency could be studied more reliably with the help of marginal productivity analysis. A perusal of Table 7 revealed that the regression coefficients of irrigation water and labour was not found significant at 5 per cent level, even though the coefficients show positivie sign. This might be due to the fact that the farmers have already used these input to a point beyond which the additionalinputs had not contributed to rice yield significant at I per cent level. This would indicated that for very increase in one rupee of manure and fertilizer the gross value of output could be increased by 0.08735 per cent and 0.15452 per cent respectively.

The Table 8 indicated that the ratio of marginal value product to factor cost was found to be higher than unity for irrigation water, seed, manure and fertilizer indicating scope to increase the these inputs in order to obtain higher returns and profits.

In conclusion, it can be stated that irrigation intensity and cropping intensity were more in the large sized farms. The per cent of area under wet crops was more if canal constituted as main source of irrigation. In the case of tube well irrigated farms, the per cent of area under irrigated dry crops were more predominant. The study revealed that as the distance of the farm increased, the area under irrigated dry crops also increased. Irrigation intensity and cropping intensity were more in farms which were adjacent to the water source. The number of installation of tube wells increased with increase in the distance of the farms from the outlet of the supply channel.

The analysis of water use for paddy crop at different locations indicated that water use was more at the starting point of the supply channel and less at the tail point of supply channel. This situation calls for rationalization of water distribution. The Government of Andhra Pradesh has already established Water Users Associations (WUA's) whose members are elected democratically. These associations are further to be strengthened. There should be a coordination between WUA's and the rural panchayats. Warabandi system of water allocation was following since several decades which needs proper implementation. The farms size and location wise analysis revealed that the productivity of wet and irrigated dry crops were higher, wherever irrigation from canal and tube well water existed. This suggested large scale ground water development to supplement the canal water. Further, farmers also need a continuing programme of information, guidance and education on water management and irrigated agriculture under the existing irrigation systems.

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