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ANOMALY IN THE USE OF WATER IN A CANAL IRRIGATION SYSTEM—A CASE STUDY

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Water is the basic resource for agricultural production. The availability of water and application of right quantity of water at the right time are vital for profitable results from agriculture. In view of the importance of water for agriculture, development of irrigation has became an issue of inescapable importance in Indian agricultural planning. During different Five Year Plans enormous investments have been made to increase the irrigation potential in the country. In keeping line with the country as a whole, the State of Orissa has also given top priority to develop irrigation in its different Five Year Plans. The Command Area Development (CAD) Agency has been set up in the State since 1975 with the objective of optimising the use of available irrigation water. In this context the present study is undertaken to analyse the use of water and its impact on cropping pattern and crop yield at different locations of a canal irrigation system.

METHODOLOGY

Bamnal Minor Canal in Nimapara block of Puri district, Orissa is taken for the study purpose. This canal is chosen because of completion of On-Farm Development (OFD) work of CAD Agency on this canal.

The canal is divided into three reaches depending upon its Natural Surface Level (NSL). The head reach includes the portion of the canal whose NSL is 20.5′ or above. The length of this part of the canal extends upto eight kilometres from its head. The middle reach covers the portion of the canal above its NSL of 18.5′. Its length lies between 8 and 11 kilometres from its head. The tail reach of the canal covers its NSL of 14′ and above. The length of this part of the canal begins after 11 kilometres from its head upto the end of the canal.

After enumerating the number of villages served under each location of the canal, two villages from each location are selected at random. A complete list of beneficiaries is prepared from each of the selected villages. The beneficiaries are classified into two size-groups according to their size-of operational holdings. The farmers having operational holdings less than one hectare are considered as small farmers and farmers above one hectare of operational holdings are considered as large farmers. Having classified farmers into two size-groups, 20 per cent of the sample households is drawn at random. The number of households selected in each group is proportional to the number of farmers in each size-group. Altogether 120 beneficiaries—

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41 (26 small and 15 large) from head reach, 42 (31 small and 11 large) from middle reach and 37 (29 small and 8 large) from tail reach—are selected for the purpose of study.

The data are collected through personal interview on specially designed schedules during the year 1984-85.

RESULTS AND DISCUSSION

*Cropping Pattern**

The cultivation of paddy (HYV) forms the first order of importance in all the three locations of the canal (Table 1). Between different locations it is observed that the percentage of area under high-yielding paddy is more in the middle reach than either in the head reach or the tail reach. Besides paddy, the cultivation of pulses, potato, groundnut and vegetables is also observed in the study area. But the area cultivated under these crops varies between different locations. The cultivation of vegetables occupies a higher percentage of area in the head reach as compared to either the middle reach or the tail reach. In the middle reach the percentage of area devoted to the cultivation of potato is more than that either in the head reach or the tail reach. In contrast, the percentage of area under pulses and groundnut is higher in the tail reach than that in the head reach and the middle reach.

The cropping pattern thus reveals that due to the availability of adequate water at the head reach and the middle reach the farmers have devoted a considerable proportion of area to labour and capital intensive crops like high-yielding paddy and potato. In contrast, because of inadequacy and uncertainty of water at the tail reach the farmers have cultivated low duty crops like pulses and groundnuts on a larger scale than their counterparts in the other two upper locations of the canal.

Yield Rates

The main objective of the Command Area Development Programme is to enable the farmers to increase their income through higher output. In this context the yield rates of the four important crops like paddy, potato, pulses and groundnut at the three different locations of the canal is analysed (Table II).

The average yield rate of paddy, as is observed from the study, is the highest in the middle reach, 35.60 quintals and the lowest in the tail reach, 30.97 quintals, keeping the head reach in between the two, 33.87 quintals. For potato, the yield rate in the middle reach is higher than either in the head reach or the tail reach. With regard to pulses and groundnut the average yield rate shows an increasing trend as we move down the stream along the canal from the head reach to the tail reach.

An examination of the yield rates among the two size-groups of holdings shows an inverse relationship between the size of holding and yield rate—

* Farmers in the study area do not usually depend on irrigation for their *kharif* crops. So in this study the cropping pattern followed by the farmers during the *rabi* season is taken into account.

TABLE I. CROPPING PATTERN FOLLOWED BY SAMPLE FARMERS AT DIFFERENT LOCATIONS OF THE CANAL

(area in hectares)

Size-group (ha.)	Paddy	Pulses	Potato	Groundnut	Vegetables	Others	Total
Head							
Small	0·50	0·049	0·019	0·013	0·110	0·039	0·73
	(68·49)	(6·71)	(2·60)	(1·78)	(15·06)	(5·36)	(100)
Large	1·036	0·16	0·058	0·053	0·207	0·046	1·56
	(66·41)	(10·35)	(3·71)	(3·39)	(13·26)	(2·98)	(100)
Pooled	0·69	0·08	0·03	0·02	0·14	0·04	1·03
	(67·72)	(8·04)	(3·00)	(2·36)	(14·40)	(4·48)	(100)
Middle							
Small	0·49	0·068	0·038	0·023	0·062	0·019	0·70
	(70·00)	(9·71)	(5·42)	(3·28)	(8·85)	(2·74)	(100)
Large	1·09	0·164	0·17	0·066	0·103	0·027	1·62
	(67·33)	(10·15)	(10·50)	(4·12)	(6·38)	(1·50)	(100)
Pooled	0·64	0·09	0·07	0·05	0·07	0·02	0·94
	(68·08)	(9·57)	(7·44)	(5·31)	(7·44)	(2·16)	(100)
Tail							
Small	0·47	0·153	0·017	0·092	0·037	0·011	0·78
	(60·25)	(19·61)	(2·17)	(11·79)	(4·74)	(1·44)	(100)
Large	0·98	0·519	0·035	0·255	0·038	0·23	1·85
	(52·97)	(28·05)	(1·89)	(13·78)	(2·05)	(1·26)	(100)
Pooled	0·58	0·24	0·02	0·12	0·03	0·02	0·01
	(57·42)	(23·76)	(1·98)	(11·88)	(2·97)	(1·99)	(100)

Figures in brackets are percentages to the total.

TABLE II. AVERAGE YIELD RATES (IN QUINTALS) PER HECTARE OF SELECTED CROPS AMONG DIFFERENT FARM SIZE-GROUPS AT DIFFERENT LOCATIONS OF THE CANAL

Size-group (ha.)	Paddy			Pulses			Potato			Groundnut		
	Head	Middle	Tail	Head	Middle	Tail	Head	Middle	Tail	Head	Middle	Tail
Small	34·64	36·09	31·16	4·39	5·05	5·27	74·48	80·21	69·10	15·23	17·55	18·64
Large	32·56	34·22	30·29	4·22	4·81	5·11	68·19	75·33	66·85	14·41	15·20	16·36
Pooled	33·87	35·60	30·97	4·32	4·98	5·23	72·17	78·93	68·61	14·95	16·93	18·14

the per hectare yield rate of all the four crops taken into account is higher for the small farms than that for the large farms at all the three locations of the canal. The difference in the yield rate between these two size-groups of farms is also seen to be statistically significant (except pulses).

Thus, the yield rates of different crops show wide variations between the reaches and between the size-groups in the canal area under study. The yield rate of high-yielding paddy and potato is higher in the middle reach than that in the head reach and the tail reach. It can be inferred that excess availability of water at the head reach and inadequacy of water at the tail reach have resulted in lower yields of these two crops in both the cases. The yield rate of pulses and groundnut at the tail reach is found to be higher than that at the head reach and the middle reach. The reason for this can be attributed to the fact that as these crops require least amount of water, they are found to be suitable in the tail reach as compared to the head reach and the middle reach. Besides, the higher yield rate of different crops among small farmers over their large counterparts in the study area is due to the application of increased quantity of fertilisers per hectare in the case of the former as compared to the latter.

Use of Irrigation

In order to study the rationality in the use of irrigation for different crops, optimum number of irrigation for three important crops, namely, paddy, potato and groundnut at different locations of the canal is worked out with the help of linear regression analysis. The difference between optimum number of irrigation and existing number of irrigation for different individual crops pertaining to each location and each size-group is analysed.

In the case of paddy and potato, it is observed that the farmers (small and large alike) at the head reach use more number of irrigation than the optimum number. In the middle reach the number of irrigation used for paddy and potato is found to be equal to the optimum number of irrigation. In the tail reach the farmers use less than the optimum number of irrigation for both the crops. This implies that there exists scope for diversion of excess water from the head reach to the tail reach.

With regard to groundnut the farmers at the head reach give more than the optimum number of irrigation required. In the middle reach the farmers give less than the optimum number of irrigation. The number of irrigation given by farmers in the tail reach for the cultivation of groundnut is equal to the desired optimum number. Thus, in the case of groundnut there exists scope for diversion of water from the head reach to the middle reach.

Between the size-groups of farms the study reveals no marked difference in the frequency of irrigation given for different individual crops. Only in the cultivation of paddy at the head reach the large farmers are seen to be using greater number of irrigation than the small farmers.

CONCLUSION

From the foregoing analysis it is inferred that in spite of the working of CAD Agency there exists gross inequality in the use of irrigation water for different crops at different locations of the canal. So the authorities who are in charge of implementing the CAD Programme for efficient utilisation of irrigation water should take necessary measures to do away with this sort of anomaly in the present use of water by the farmers. An awareness of the crucial role of water management among farmers should be created. At this stage steps should be taken to divert surplus water from the head reach to the tail reach. This will enhance the yield rates in both the locations.

TABLE III. 't' VALUES OF DIFFERENCES IN YIELD RATE OF SELECTED CROPS AMONG FARM SIZE-GROUPS AT DIFFERENT LOCATIONS

Crops	't' values			
	Head	Middle	Tail	Pooled
Paddy	4·16*	6·52*	4·07*	5·03*
Pulses	0·19 (N.S.)	0·23 (N.S.)	0·34 (N.S.)	0·21 (N.S.)
Potato	3·81*	4·29*	2·15*	3·48*
Groundnut ..	2·17*	3·32*	3·41*	2·92*

* Significant at one per cent level.
N.S. = Not significant.

TABLE IV. CROPWISE DIFFERENCE BETWEEN EXISTING NUMBER OF IRRIGATION AND OPTIMUM NUMBER OF IRRIGATION AT DIFFERENT LOCATIONS

Crop/Locations	Small farmers		Large farmers	
	Number of irrigation		Number of irrigation	
	Existing	Optimum	Existing	Optimum
Paddy				
Head	8	7	9	6
Middle	8	8	7	7
Tail	5	7	5	7
Potato				
Head	7	6	7	6
Middle	6	6	6	6
Tail	4	6	4	6
Groundnut				
Head	4	3	4	3
Middle	2	3	3	3
Tail	2	2	1	2