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IMPACT ANALYSIS OF WATER DISTRIBUTION ON INCOME AND IRRIGATION PATTERN IN INDI BRANCH CANAL OF UPPER KRISHNA PROJECT

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ABSTRACT

The study was conducted to know the impact of water distribution on income and irrigation pattern in the Indi branch canal of upper Krishna project command area. The Sample size, comprising of 135 farmers was selected using multi- stage random sampling method. Field level data were elicited for the year 2013-14 through personal interview method. For analyzing the data, tabular analysis, Garrett's ranking and Gini ratio technique were employed. The average income per farm from agriculture was more in the middle reach (Rs. 1, 33, 680.00). In the head reach, 80 per cent of farmers irrigated the field during daytime, and in tail reach 33.33 per cent irrigated night time. Similarly, in the head reach of the canal, 86.70 per cent of the farmers are getting adequate water for irrigation. In the tail reach, 48.89 per cent of sample respondents agreed for wastage of water through canals and 91.10 per cent of farmers in head reach, exclusively dependent on canal water.

KEYWORDS: Head Reach, Middle Reach, Tail Reach, Gini Ratio

INTRODUCTION

The rainfall pattern of India, which is changing in its incidence and variable in its amount and has marked seasonality in many regions, even total precipitation is grossly inadequate for crop growth and is often unreliable as well due to its wide deviation from the normal. In view of such uncertain variations in rainfall, irrigation becomes a critical requirement not only in low and medium rainfall regions in all the crop seasons, but also necessary, even in high rainfall regions, especially as a supplementary source of water in the *kharif* season and a main source for raising of *Rabi*/summer crop. In developing countries expansion of cultivable land being limited, with diminishing returns in agriculture and growing population pressure, exploring the possibilities for achieving significant land-augmenting technical progress offered by the "Green Revolution" technology is of utmost importance. India has ultimate irrigation potential of 140 million hectares comprising 58.5 million hectares from major and medium schemes, 15 million hectares from minor irrigation schemes and 66 million hectares from groundwater exploitation and the gross irrigated area of 86.4 million hectares and the net irrigated area of 63.3 million hectares, respectively (CWC, 2012-13).

In India, among the canal irrigation projects typically representing these features, the Upper Krishna Project in Karnataka is going to become an economic lifeline of chronically drought-hit districts of Kalburgi, Vijaypura, Bagalkot, Yadgir and Raichur in Northern Karnataka. The Upper Krishna Project has been executed in two stages, initially with the World Bank aid comprised of two composite dams across river Krishna near Almatti and Narayanpur to irrigate about one million hectare on full development. Presently, the irrigation potential realized is about 5,76,047 ha (Anonymous, 2012). The problems in the most irrigated command area are associated with its distribution and therefore,

there would be unequal water distribution, and consequently the farmers in the early reaches of the canal systems tend to use more water leaving less water for others in the far ends. The increasing inefficiency of the canal irrigation system is also associated with a highly unequal distribution of water between the head reach and the tail end farmers (Shah, 2001). Consequently, production pattern and farm economy in the command areas of these conditions largely are influenced by variability in the water availability for crops. The main objective of this paper is, to explore the conceptual and theoretical issues involved in irrigation impacts and their distribution across locations, and their implications for equity and poverty reduction strategies in an irrigation system.

MATERIAL AND METHODS

For the present study, among the canal systems, Indi branch canal was selected based on the highest notified area under irrigation. A multistage sampling technique was adopted for the selection of the study area. The sample of 45 respondents was selected randomly each from the head, mid and tail reach making total sample size of 135 farmers. For evaluating the specific objectives designed for study, required primary data were collected from the randomly selected sample cultivators by a personal interview method with the help of pre-tested and well structured schedule. Simple tabular analysis, Gini ratio and Garrett's ranking technique were used to analyze the data collected.

Gini coefficient/Index

Gini co-efficient is also called as co-efficiency of inequality and is a very widely used measure of concentration.

The Gini co-efficient (L) is estimated as follows.

$$G_1 = 1 - \Sigma (X_k - X_{k-1}) (Y_k + Y_{k-1})$$

Where,

X_k - cumulative percentage of the number of the sample farmers up to and including kit class

Y_k-cumulative percentage of income earned by the each sample farms in the study area up to and including kit class

n- Number of sample farmers of the study area.

The Gini coefficient measures the inequality among income levels. The value of Gini coefficient ranges from 0 to 1. A Gini coefficient of 1 expresses maximal inequality among income groups and '0' express the equality among the income groups.

Garrett's Ranking Technique

Though the water is available for cultivation of crops in the command area, the farmers in the command area are facing problems with respect to growing of crops due to several factors.

Garrett's ranking was used to identify the major constraints involved in cultivation of crops. The information on the constraints faced by the farmers was elicited during the survey work.

Each of the respondent farmers was asked to mention constraints in the order of merit. The order was then converted into percentages by using the formula indicated below.

$$Ij = \frac{100\ (Rij - 0.5)}{Nj}$$

Where

I = Percentage

Rij = the order of merit given by J^{th} individual for the ith constraint.

Nj = Number of factors mentioned by the J^{th} individual.

The percentage so obtained was converted into scores by referring to Garrett's table. The scores of all the respondents for each constraint was summed up and divided by the number of respondents encountering that constraint. The resulting mean scores of each constraint were arranged in a descending order. Then, the ranks were arranged. Data regarding constraints in cultivation of crops in command were collected from the farmers. The data were tabulated to form frequency tables.

RESULTS AND DISCUSSIONS

The analysis of the results found that (Table 1), there was wide variation in the income distribution in the head; middle and tail reach of the canal system. Income from various sources like agriculture, dairy and livestock, business (Hotels, Groceries, Vendors,) and service (Govt. and private jobs) were taken.

The average income per farm from agriculture was more in the middle reach (Rs. 1,33,680.00) than the head (Rs. 1,26,844.44) and tail reach (Rs. 73,211.11), as majority of the sample farmers in the middle reach were growing high income crops like sugarcane and cotton. The average income per farm from dairy (Rs. 6,210.60) and sheep and Goat (Rs. 2,010.52) in the head reach was higher than the middle (Rs. 4,674.03) and tail reach (Rs. 3,499.06). Because the average livestock holding per farm was more and it might be due to the presence of the high irrigated area as it provides more vegetation to the livestock. In the middle reach of the canal system the income from the business was (Rs. 4,666.67) high followed by the tail (Rs. 4,015.52) reach and head roach (Rs. 3555.56) respectively. It may be due to farmers in the middle reach were growing cash crops like sugarcane and cotton with high profit may be interested in the business as subsidiary occupation.

The low income from agriculture (Rs. 73,211.11), dairy (Rs. 3,499.06), sheep and goat (Rs. 1,621.43) was seen in the tail reach of the canal system, whereas the income from service (Rs. 3,532.77) was higher than the middle (Rs. 28, 88.89) and head roach (Rs. 2444.44), respectively. As the much of the area was under rain fed, the income from agriculture was not certain, many of people in tail reach were engaged in service. The percent share of income from agriculture in the total income was more in the middle reach (90.73 %) as majority the farmers were growing high cash crops like sugarcane and cotton. Overall the income from agriculture was Rs. 1, 11,245.18 and from dairy, sheep and goat, business and service was Rs. 4,794.56, 1684.45, 4079.25and Rs. 29, 55.37, respectively. The Gini coefficient of income distribution in the head reach was low (0.36) as the majority of farmers in the head reach were growing only paddy and size of land holding was more or less equal, whereas it was high in the middle (0.43). It might be due to growing of high cash crops like sugarcane and also due to variation in the size of land holding per farm.

Table 1: Income Distribution Pattern across Canal Reaches in IBC Command (Per Farm)

Reach	Income Source	No. of Households	Average Income (Rs.)	% Share	Gini-Coefficient
Head	Agriculture	45	1,26,844.44	89.92	0.36
	Dairy	19	6,210.60	4.40	
	Sheep and Goat	8	2,010.52	1.43	
	Business	3	3,555.56	2.52	
	Service	2	2,444.44	1.73	
Mid	Agriculture	45	133680	90.73	0.43
	Dairy	16	4,674.031	3.17	
	Sheep and Goat	2	1,421.40	0.96	
	Business	3	4,666.67	3.17	
	Service	3	2,888.89	1.96	
Tail	Agriculture	45	7,3211.11	85.24	0.42
	Dairy	10	3,499.06	4.07	
	Sheep and Goat	5	1,621.43	1.89	
	Business	5	4,015.52	4.68	
	Service	5	3,532.77	4.11	
Overall					0.40
	Agriculture	135	1,11,245.18	89.17	
	Dairy	45	4,794.56	3.84	
	Sheep and Goat	15	1,684.45	1.35	
	Business	11	4,079.25	3.27	
	Service	10	2,955.37	2.37	
	Total		**1,24,758.81**	**100.00**	

In case of irrigation pattern (table 2), analysis of the data revealed that the sample respondents followed a different pattern of irrigation practices in the head, middle and tail reaches of the canal system. With respect to the time of irrigation, the majority of farmers (80 %) in the head reach irrigated the fields during day time, whereas as it was, 64.44 per cent and 44.44 per cent in the middle and tail reach, respectively. It was mainly due to farmers in the head reach were located close to the main canal and had greater access and control over water first than the farmers in mid and tail reaches. Irrigation during the night was seen more in the tail reach (33.33 %) as compared with head (11.11 %) and middle reach (26.67 %). Because, they often did not get the water during the day time due to greater control of water resources by head and mid reach farmers in the command where the bulk of the water released in the main canal was being used them. Hence, the farmers experienced acute shortages of irrigation water throughout the cropping seasons. These results were in line with an anonymous (2004). Similarly, irrigation during both day and night was also seen more in tail reach (22.22 %) as compared with head (6.67 %) and middle reach (13.33 %).

Thus, it is could be seen that tail end farmers were worst affected in terms of water availability. Into the canal system from head reach to tail reaches, the adequacy of water for irrigation was found to be unequal. The majority (86.70 %) of the farmers in the head reaches and middle reach (55.56 %) was getting adequate water as their fields were located close to the main canal. Whereas in the tail race, only 26.67 could get adequate irrigation water, while the remaining farmers did not get the adequate water. They also opined that the farmers in the head and mid reach use excess water for water intensive crops and in addition to this the poor management of the irrigation systems, especially the field irrigation structures resulting into a considerable wastage of water that goes to the natural drains/streams. Conflicts for canal water were also more in the tail reach (33.33 %), in contrast with the head (13.33 %) and middle (20.00 %) reach, due to high water constraints for irrigation. In the head reach the majority of the sample respondents (91.10 %) were using exclusively

canal water for irrigation. On the other hand, 44.44 per cent farmers in the mid reach used a combination of canal and bore well (conjunctive use) water. As a considerable proportion of the area (20.80 %) in the middle reach was under sugarcane crop, where, combination of canal and ground water was used. The tail reach farmers (17.78 %) had alternative irrigation source through bore wells. On the other hand (26.67 %) majority of tail reach farmers were irrigating their fields by lift from canal and streams or natural streams.

Table 2: Pattern of Irrigation Practice and its Adequacy across Canal Reaches in IBC

Timing of Irrigation	Head Reach		Mid Reach		Tail End	
	No. of Farmers	%Farmers	No. of Farmers	%Farmers	No. of Farmers	%Farmers
Irrigation during day	36	80.00	27	64.44	20	44.44
Irrigation during night	5	11.11	12	26.67	15	33.33
Irrigation during both day and night	3	6.67	6	13.33	10	22.22
Adequacy of irrigation water	39	86.7	25	55.56	12	26.67
Wastage of water through canals	8	17.8	13	28.89	22	48.89
Conflicts for canal water	6	13.3	9	20.00	15	33.33
Source of irrigation		0.0		0.00		
Exclusively Canal	41	91.1	24	53.33	25	55.56
Combination of canal and Open/Bore well	2	4.4	20	44.44	8	17.78
Lift from canal/stream	2	4.4	6	13.33	12	26.67

With respect to the problems faced by the farmers in the command area (Table 3), some of the important factors considered in the analysis were water logging and salinity problems, timely and inadequate supply of water, wastage of water (leakage from main canal/distributaries/FICs), and lack of awareness of recommended crops, severe pest and disease attack, labor non availability/scarcity, lack of technical guidance and marketing problem of produce.

Water logging and salinity problems got assigned the rank I in the head reach, as it was mainly because of excess irrigation and poor drainage and the result was in line with Vashishtha, (2007), whereas it was V and VIII in the middle and tail reach, respectively. Timely and inadequate supply of water got assigned rank myself in the tail race, as they faced scarcity of water and it ranked VII and IV in the head and middle reach, respectively. Similarly, Wastage of water got assigned rank II in the tail race, due to poor maintenance of canal structures which lead to seepage losses. These results were in line with the Karla *et al (*2001); whereas it ranked V and III in head and middle reach. Awareness on recommended crops in the canal command as opined got rank V in tail reach, VI and VII in the head and middle reach, respectively.

In respect of severe pest and disease attack, middle reach ranked I as there was an infestation of early shoot and root grubs in the sugarcane and sucking pest infestation in cotton crops, whereas it ranked II in head reach as there was an incidence of stem borers and brown plant hopper pest in paddy and diseases like stem rot and a blast. In cotton, there was also disease incidence of bacterial wilt and sucking pest. Non availability of sufficient Labors was found in the agriculture operations during the peak period in the command area, and it ranked II in the middle reach as there was no availability of labor, found for sugarcane planting and harvesting, whereas it ranked III at the head and IV in the tail reach, respectively. In the command area, it was noticed that there was a lack of technical guidance among the farmers, as they applied high pesticides and fertilizers to the field and it ranked IV in head roach, VI both in the middle and tail reach, respectively. Marketing of produce ranked VIII in all the races, because of nearby existence of local markets and APMCs.

Table 3: Problems Faced By the Sample Farmers in the Command Area

Sl. No.	Problems	Head (N=45)		Middle (N=45)		Tail (N=45)	
		Garette Score	Rank	Garette Score	Rank	Garette Score	Rank
1	Problem of Water logging and salinity problems	73.20	I	47.10	V	33.25	VII
2	Timely and inadequate supply of water	35.20	VII	56.90	IV	80.60	I
3	Wastage of water	52.40	V	66.10	III	65.24	II
4	Non awareness of recommended crops	46.90	VI	30.29	VII	40.35	V
5	Severe pest and disease incidence	70.80	II	71.20	I	60.27	III
6	Labor non availability/scarcity	62.60	III	69.50	II	56.56	IV
7	Lack of technical guidance	53.60	IV	34.61	VI	35.15	VI
8	Marketing problem of produce	33.80	VIII	32.58	VIII	30.67	VIII

CONCLUSIONS

The analysis of the results of the present study indicated that, there was unequal income and water distribution across the races in the Indi branch canal command area. The income of middle reaches farmers is higher than the head and tail reach. Along with agriculture, farmers are engaged in other income generating activities like dairy, sheep and goat rearing. There is necessity for regulating the canal system through the farmers' association, which will bring down the unequal distribution of income and water across the canal reaches.

REFERENCES

1. Anonymous, 2004, Proceedings of National workshop on tail-lenders and other deprived in the canal irrigation system. Ahmedabad. p. 8.
2. Anonymous, 2012, Annu. Rep. 2012, Command area development authority, Bheemarayanagudi
3. Anonymous, 2012, Annu. Rep. 2012-13, Central Water Commission, Government of India. p. 2.
4. Kalra, B.S., Wadkar, S.K., Sarangi, A., Singh, D.K., Chaturvedi, A and Singh, S.P., 2001, Farmers' perception on water management and land degradation in the tail reach of Western Yamuna canal command. *J.of Rural Development*, NIRD & PR, Hyderabad.,33 (3), 343-350
5. Shah, Anil C (2001), 'The Deprived in a Command Area of an Irrigation System', Development Support Centre, Ahmedabad (mimeo)
6. Vashishtha, P.S., (2007), Tail Enders and other Deprived in an Irrigation System in Haryana - Executive Summary, in Jharwal and R. S. Deshpande (Eds.), Glimpses of Indian Agriculture, Academic Foundation, New Delhi.