Impact of Unequal Distribution of Canal Water on Farm Produce: A Case Study Matli Taluka

Zareen Khan Rind, Ghulam Ali Jariko, Shahabuddin Mughal[*] and Ghazala Umer Baghal

Sindh Development Study Centre, University of Sindh Jamshoro, Pakistan

Abstract: This study seeks to investigate to identify the impact of shortage of water on the tail, end areas of the irrigation network. For the research study 320 respondents were randomly selected and nearly 107 from each category that is large medium and small farmer's respondent. The sample further stratified respondents from all three reaches that is head middle and tail of main semi-irrigation channels and on the water courses level as well to capture the authentic picture of the water availability on each level of irrigation system. The observation of the study and data collected revealed that farmers on the head reaches benefit more from the supply of water from crop production compare to middle and tail reaches and middle reaches have more opportunity of having better irrigation water compare to the tail reaches however, the more sufferers are the tail reach farmers who get less water from crop production. Consequently, this situation cause's absolute poverty to the farmers on the tail reaches of the irrigation water supply channels.

Keywords: Poverty, Irrigation, Agriculture & Crop Production.

INTRODUCTION

Poverty is general lack of basic facilities, or it is economic situation in which people does not have access of certain amount of resources to fulfil their basic needs [1]. It is a multifaceted concept, which includes social, economic, and political elements [2]. Poverty may be defined as either absolute or relative. Absolute poverty or destitution refers to the lack of means necessary to meet basic needs such as food, clothing and shelter [3]. Relative poverty takes into consideration individual social and economic status compared to the rest of society.

According to United Nation, basically poverty is a violation of human rights to get education, proper health, food and people live in miserable condition. It means not having enough resources or income to feed a single person or household members, no access to basic education and health facilities, no proper shelter. It also denies from proper security, situation of feebleness and segregation of individuals, households and communal groups. It gives birth to violence, frustration and crime. It usually infers residing in marginal or vulnerable environments, without access to clean water or hygienic atmosphere

Poverty is basically a rural problem and revolves around the low productivity of the millions of small-scale subsistence farmers [4]. Agriculture is the only source of real income savings and growth, it sets out to bring about and or help bring about increasing production and productivity of the small subsistence farmer. McNamara (1980) [5] also notes that the two principal goals of development - to accelerate economic growth and to eradicate absolute poverty- are intrinsically linked, neither pursuit, taken by itself can lead to sustained successful development. There is a growing notion that if agriculture can be modernized with the provision of irrigation and allied services, the small-scale farmers can produce more than enough to create wealth and reduce poverty, and contribute to national development.

Ghana's irrigation policy is enshrined in the overall national agricultural policy, thus, The Food and Agricultural Sector Development Policy (FASDEP) provides the policy direction as to the development of irrigation. The policy observed that less than 1 % of arable land is under irrigation, and poor management of existing systems further limits their effectiveness. The policy objective therefore is to enhance production potential of the existing schemes by raising productivity of irrigation water from 30% to 80% in the next ten years. This is part of strategies to modernize agriculture to attain food security, especially in regions where food insecurity manifests [6].

LITERATURE REVIEW

Sustainable Development Policy Institute (SDPI) 2014, measured poverty on 6 different parameters that is medical facilities, proper education level, hygiene (sanitation), availability of clean water for drinking, assets belonging to and social justice. Referring to the report people (in Pakistan) earning less than US$1.25 per head are taking less than 2350 calories per day. According to the estimates SDPI 2014, the poverty

*Address correspondence to this author at the Sindh Development Study Centre, University of Sindh Jamshoro, Pakistan; Tel: 92-22-9213191; E-mail: shahabuddin.mughal@gmail.com

incidence not only is varying at provincial level but they also vary within the province by location of its region e.g. poverty in districts Jafferabad and Kachh in province of Baluchistan were 52 per cent which is comparatively higher than other districts of the Provinces. Similarly, in Punjab, Southern part of the province that include Rajanpur, and Dera Gazi Khan districts have poverty line figures to around 45 percent. In KPK the mountains regions of province that included 18 districts were facings with sever poverty. In Sindh, districts such as Tharparkar, Badin, Thatta, Dadu and Sanghar were found to be major poverty hit regions.

Star Welfare Organization Punjab (SWOP 2012), confirms SDPI's findings, it reveals in its article "*Increasing level of poverty in Pakistan*" that every third person living in Pakistani is living in extreme poverty. For all of us it is quite shocking. Furthermore, the report explains in all four provinces the highest poverty is in Baluchistan with 51 percent and followed by province Sindh With 33 per cent and 31 per cent in Khyber PakhtoonKhuwa. Province of Punjab seems to be well off with only 19 percent people living below poverty line. The data in report shows that that people in Baluchistan, Sindh and KPK are facing grave brunt of deprivation and mostly in rural areas which are not easily accessible due to their geographical situation. Poverty in Punjab province is less as compare to other provinces but still is alarming.

The World Development Report (2008) [7] has observed that agriculture and rural sectors have suffered from neglect and underinvestment over the past two decades, whiles 75% of the worlds poor live in the rural areas, a mere 4% of official development assistance goes to agriculture in the developing countries. In Sub Saharan Africa, a region heavily reliant on agriculture for overall growth, public spending for farmers is only 4% of total government spending, meanwhile, the sector is still taxed at relatively high levels.

The report further asserts that agriculture can provide pathways out of poverty if efforts are made to increase productivity in the staple food sector, and connect smallholders to rapidly expanding high value markets (World Bank 2008) [7].

Ghana's poverty can be described as a composite of both personal and community life situations. On the personal level, it is defined as a situation where basic needs to sustain daily livelihoods is not sufficiently satisfied. At the community level, poverty is manifested in the absence or the low level of basic community services such as health, education, and water and sanitation facilities. Thus, whereas personal poverty is related basically to employment and incomes, community poverty is related to the provision of basic services [8].

Objectives of the Study

1. To assess overall situation of agriculture in relationship to irrigation supplies. Especially, by reaches of irrigation channels and watercourses.

2. To examine the effects of water scarcity on the rural communities by determining variations in the net crop income and standard of living

METHODS OF DATA COLLECTION

For the research study 320 respondents were randomly selected and nearly 107 from each category that is large medium and small farmer's respondent. The sample further stratified respondents from all three reaches that is head middle and tail of main semi-irrigation channels and on the water courses level as well to capture the authentic picture of the water availability on each level of irrigation system.

RESULTS AND DISCUSSION

Table **1** also shows that abandoned land [8] at the tail reaches is significantly higher compare to head and tail reaches in both Kharif and Rabi crop seasons. The data shows that at the tail reaches the abandon land was 17 per cent and 18 per cent in Kharif and Rabi while at the middle reaches itwas10 percent in each season. The lowest abandon land was reported at the head reaches 4 per cent in Kharif and Rabi as well.

Table **2** shows the tenancy system in the study area. The data displays that in all three reaches of irrigation channels there exists self-cultivation, sharecropping and leasing land to others for crop cultivation. It observed that self-cultivation was highest about 46 percent at the tail reach compare to head and middle reaches where self-cultivation was reported 13 and 12 percent respectively. This indicates that due to shortage of water the growers hardly cultivate small part of their land which cannot be shared. Sharecropping tenancy system at head and middle are close that is 78 percent at the head and 76 at the middle reaches. Beside large and middle land holders, even small farmers having about 16 acres of land cultivate crops with share tenancy system, where enough water for irrigation is available.

Table 1:   Land Cultivation Patterns by Reach % in CCA

Component	Land Cultivation	% in Kharif 2012	% in Rabi 2012-13
Head	Crops	87	80
	Fallow	09	16
	Abandoned	04	04
	All	100	100
Middle	Crops	70	62
	Fallow	20	28
	Abandoned	10	10
	All	100	100
Tail	Crops	54	51
	Fallow	29	31
	Abandoned	17	18
	All	100	100
All	Crops	71	64
	Fallow	19	25
	Abandoned	10	11
	All	100	100

Source; Study area survey 2012-2013.

Table 2:   Mode of Cultivation by Watercourse Reach N= 320

Watercourse	Acres	%	Case	%
Head				
Self	1730	13	42	42
Sharecropped	10200	78	49	49
Lease	1131	09	8	8
All	13061	100	100	100
Middle				
Self	1021	12	44	40
Sharecropped	6535	76	54	49
Lease	1022	12	12	11
All	8578	100	110	100
Tail				
Self	3356	46	52	47
Sharecropped	3340	46	33	30
Lease	525	08	25	23
All	7221	100	110	100
All				
Self	6107	21	138	43
Sharecropped	20075	70	136	42
Lease	2678	09	46	15
Total	28860	100	320	100

Table 3:   Cropping Pattern in Kharif – 2012 Season

Crops	Percent	Area in Acres	Distribution of Crops in %			%
			Head	Middle	Tail	
Cotton	14	4041	66	20	14	100
Rice	42	12122	71	17	12	100
Sugarcane	20	2773	80	14	6	100
Vegetables	1	289	15	26	59	100
Orchards	5	1444	61	37	2	100
Fodder	16	4613	22	41	37	100
Other Crops	2	577	25	40	35	100
	100	28860				

Source: Survey data 2012-2013.

Table 4:   Cropping Pattern in Rabi – 2012-2013 Season

Crops	Per cent	Area in Acres	Distribution of Crops in %			%
			Head	Middle	Tail	
Wheat	56	16162	54	24	22	100
Sugarcane	20	2773	80	14	6	100
Vegetables	1	289	36	53	11	100
Orchards	5	1444	61	37	2	100
Fodder	16	4613	22	41	37	100
Other Crops	2	577	22	63	37	100
	100	28860				

Source: Survey Data, 2012-2013.

Tables **3** and **4** shows cropping pattern in the study area in the year 2012-13. The data in the table reveals that in Kharif 2012 the dominant crop in the areas was rice 42% followed by sugarcane 20% and cotton 16% respectively. In Rabi 2012-13, wheat is the major crop in the study area that is sown on 56% of the total cultivation. The crop of sugarcane is the second major crop cultivated on 20% of the total where as fodder crop was cultivated 16% in the study area.

Table **5** shows cropping intensities by different reaches in two seasons of the year. The data in above

table shows that cropping intensity in Kharif 2012 and Rabi 2012-13 is high on the head reaches followed by middle and tail. This indicates that water supply for crop production from the irrigation channels at head better as compare to middle and tail reach. Similarly, middle reach is better off than tail reach.

Table **6** shows average gross incomes and net incomes of different crops per acre in the research area. The Table indicates that at the head gross and net incomes of cotton, rice, sugarcane and wheat crops are significantly high compare to middle and tail

Table 5:   Cropping Intensities by Reach

Reach	Kharif 2012	Rabi 2012-13	Annual
Head	82	87	169
Middle	69	71	140
Tail	64	65	129
All	71	74	145

Source: survey data 2012-2013.

Table 6:　Average Gross and Net Crop Incomes in Kharif 2012& Kharif 2012-13 Season

Crop	Yield	Price/	Total	Production	Gross	Fixed	Net
	Maunds	Maund	Output	Costs	Income	Costs	Income
Head							
Cotton	40	2100	84000	32140	51860	2500	49360
Rice	88	850	74800	22700	52100	2500	49600
Sugar	930	170	158100	53200	104900	2500	102400
Wheat	35	1150	40250	17830	22420	2500	19920
Kharif Fodder	235	170	39950	8730	31220	1000	30220
Rabi Fodder	220	180	39600	11120	28480	1000	27480
Sunflower	20	2250	45000	18700	26300	1000	25300
Middle							
Cotton	30	2100	63000	32140	30860	2500	28360
Rice	66	850	56100	22700	33400	2500	30900
Sugar	700	170	119000	53200	65800	2500	63300
Wheat	26	1150	29900	17830	12070	2500	9570
Kharif Fodder	180	170	30600	8730	21870	1000	20870
Rabi Fodder	160	180	28800	11120	17680	1000	16680
Sunflower	15	2250	33750	18700	15050	1000	14050
Tail							
Cotton	24	2100	50400	32140	18260	2500	15760
Rice	52	850	44200	22700	21500	2500	19000
Sugar	560	170	95200	53200	42000	2500	39500
Wheat	22	1150	25300	17830	7470	2500	4970
Kharif Fodder	145	170	24650	8730	15920	1000	14920
Rabi Fodder	128	180	23040	11120	11920	1000	10920
Sunflower	15	2250	33750	18700	15050	1000	14050
All							
Cotton	31	2100	65800	32140	33660	2500	31160
Rice	69	850	58367	22700	35667	2500	33167
Sugar	730	170	124100	53200	70900	2500	68400
Wheat	28	1150	31817	17830	13987	2500	11487
Kharif Fodder	187	170	31733	8730	23003	1000	22003
Rabi Fodder	169	180	30480	11120	19360	1000	18360
Sunflower	17	2250	37500	18700	18800	1000	17800

Source: Survey data 2012-2013.

reaches of the water channels. Similarly, on the middle reaches the gross and net incomes per acre of above mentioned crops are high compare to the tail reaches of the water channels. These variations show that allocation of water on the head, middle and tail is inequitable. The respondents at the tail of the channels reported that the shortage of water decreases the yields of the crops. Particularly, High Yield Varieties (HYV) and hybrid seed of cotton, rice and sugarcane need more water compare to the traditional crop seed varieties. If required water is not supplied to the crops that will adversely effect on the yields, subsequently, total production decreases and the incomes of the farmers. Thus unequal distribution of water causes poverty among the farmers at the tail end of the irrigation water supply channels.

Regression Analysis

For achieving objective and hypothesis four, i.e., "There is a significant relationship between reach, production, gross and net income. Such that, increase in yield per acre will increase in the said variables", Linear regression analysis is performed.

The regression model is designed to asses crop yield influenced by reach of watercourse, crop production, gross and net incomes. The equation for the regression analysis and outcome of results is given as under:

$$Y = a + bx1 + bx2 + bx3 + bx4....e$$

Where,

Y   =   Crop yield in maunds per acre

bx_1 =   Reach of watercourse dummy Head= 0; 1= otherwise

bx_2a =   Crop Production in maunds

bx_3a =   Gross Income in Rupees

bx_4 =   Net incomes in rupees

Table **7** shows multiple comparisons is based upon the post-hoc test LSD (Least Square Difference). The

LSD test reveals that exactly where the difference is present at the designated as Head, Middle and Tail reaches (represented with 1,2, and 3 respectively). Looking at the column mean differences with asterisks (*) (i.e. significance value p<0.05) it suggests that only group 1 (i.e. Head) and group 3 (i.e., Tail) are statistically significant from one another in terms of dependent variable yield. Group 2 (i.e., Middle) did not differ significantly from either Group 1 or 3.

Results based on ANOVA test in table 7.10 and 7.11 helps to examine that weather there is difference in Net Income for reach of watercourses at Head, Middle and Tail, represented as 1,2 and 3 respectively. Specifically looking at table 7.10, the sum of squares (i.e., represents a measure of variation or deviation from the mean) is 41590635803.950, with df (degree of freedom) 2. Sum of square value suggests huge difference between outcomes of net income at three levels of watercourse reaches. Furthermore, the sig. value is also less than 0.05 with F-value of 48.796, and suggests that mean difference was really significant at all three levels.

For examining exact location that on which level of watercourse net income varies, multiple comparisons based upon the post-hoc test LSD (Least Square Difference) has been computed. Looking at the Table **9** at the column mean differences with asterisks (*) (i.e.

Table 7:   Multiple Comparisons

Dependent Variable: Yield						
Least Square Difference (LSD)						
(I) Reach	(J) Reach	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
1	2	50.791	32.652	.121	-13.39	114.98
	3	73.319*	29.203	.012	15.92	130.72
2	1	-50.791	32.652	.121	-114.98	13.39
	3	22.528	28.624	.432	-33.74	78.79
3	1	-73.319*	29.203	.012	-130.72	-15.92
	2	-22.528	28.624	.432	-78.79	33.74

*The mean difference is significant at the 0.05 level.

Table 8:   Net Income

ANOVA					
	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	41590635803.950	2	20795317901.975	48.796	.000
Within Groups	177284558720.155	416	426164804.616		
Total	218875194524.105	418			

Table 9:   Dependent Variable: Net Income

					95% Confidence Interval	
(I) Reach	(J) Reach	Mean Difference (I-J)	Std. Error	Sig.	Lower Bound	Upper Bound
LSD						
1	2	16024.895*		.000	10587.46	21462.33
	3	24437.859*	2473.920	.000	19574.92	29300.80
2	1	-16024.895*	2766.180	.000	-21462.33	-10587.46
	3	8412.965*	2424.890	.001	3646.40	13179.53
3	1	-24437.859*	2473.920	.000	-29300.80	-19574.92
	2	-8412.965*	2424.890	.001	-13179.53	-3646.40

*The mean difference is significant at the 0.05 level.

Table 10: Gross Income of Sample Respondents

ANOVA					
	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	41552597372.385	2	20776298686.192	47.419	.000
Within Groups	182268813285.372	416	438146185.782		
Total	223821410657.757	418			

significance value p<0.05) it suggests that all three groups 1, 2 and 3 (Head, Middle and Tail reaches) are statistically significant from one another in terms of Net Income. Specifically largest difference was observed between reach level at 1 and 3 (i.e. Head and Tail), such that mean difference was -24437.859.

Similar to the Net Income, difference in Gross Income for reach of watercourses at Head, Middle and Tail, represented as 1, 2 and 3 respectively are computed and are presented in Table **10**. Specifically looking at the sum of squares (i.e., represents a measure of variation or deviation from the mean) is 41552597372.385, with df (degree of freedom) 2 it is much similar like results of Net Income. Sum of square value suggests that there was big difference between outcomes of gross income at three levels of watercourse reaches. Furthermore, the sig. value is also less than 0.05 with F-value of 47.419, and suggests that mean difference was really significant at all three levels.

CONCLUSION AND RECOMMENDATION

Poverty prevails in each and every country, the different among them is its intensity and percentage of people living below poverty line. At world level Sub-Saharan countries of Africa and South-east Asia and South Asia facing more poverty among masses compare to other countries.

Poverty in Pakistan is looming high from last ten years. The causes of poverty in Pakistan are bio-dimension, natural and man-made activities. Pakistan is based on agro-economy. According to Federal Bureau of Statistics 2010 more than 60% of people directly or indirectly depending on agriculture and allied activities.

The mode of cropping shows that share tenancy system is common and in majority in all three reaches that head, middle and tail. In the tail reaches the self-cultivation bit higher as compare with head and middle reaches.

The cropping intensity is also on the head of the channel is high compare to middle and tail. This shows that more land on the head of the channel brought under cultivation in each crop season i.e. Kharif and Rabi season. During survey it was also reported that the agricultural land that is not cultivated due to many reasons. The main reason as reported was lack of irrigation water for crop production. More follow land and abandoned land was reported on the tail reaches of both main water supply channels and at the watercourse levels. Finally, it was also mentioned that requirement of water for various crops vary from sowing to the maturity. The most turns of water is needed for sugarcane as it stands in the field for 14 to 18 months, followed by rice and cotton crops. The least

requirement of water is to fodder, sunflower and OSR crops which are mostly grown on the tail reaches of the water channels where there is acute shortage of water supply.

Average gross incomes and net incomes vary significantly between all three reaches of the water supply irrigation channels. The observations in the study area indicates that at the head gross and net incomes of cotton, rice, sugarcane and wheat crops are significantly high compare to middle and tail reaches of the water channels. Similarly, on the middle reaches the gross and net incomes per acre of above mentioned crops are high compare to the tail reaches of the water channels. These variations show that allocation of water on the head, middle and tail is inequitable. The respondents at the tail of the channels reported that the shortage of water decreases the yields of the crops. Particularly, High Yield Varieties (HYV) and hybrid seed of cotton, rice and sugarcane need more water compare to the traditional crop seed varieties. If required water is not supplied to the crops that will adversely effect on the yields.

It is suggested that correcting inequity in water distribution and delivering a reasonable volume of water to the tail end of the system is critical for sustainability of the livelihoods and the proposed interventions needed to correct the water supply to all three reaches of the channels. For this, both at secondary water supply channels and field level (watercourses) need better operation and maintenance.

It is observed that there are dual problems which deprived the farmers of tail reaches from water availability. One, as it is already tail of the water channel, naturally water's shortage is obvious. The second main reason of shortage is that zamindars at head and middle reaches draw more water from distries/minors illegally by collusion with irrigation staff. Therefore, it is strongly recommended that concern irrigation official need to pay more attention with reference to monitoring the system outlets are not tempered and make sure the tail reaches are getting required water for crop production.

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