

Impact of Watercourses Improvement in the Upper Chenab Canal System of Punjab, Pakistan

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ABSTRACT

A survey was carried out to determine the impact of watercourse improvement on 11 watercourses improved under the On Farm Water Management Program. The results indicated that there is a time saving of 1 hour 33 minutes to irrigate a hectare after watercourse improvement. Cropping intensity was found to increase by 20% after improvement. Farmers were found to change the cropping pattern to grow crops requiring higher quantity of water. Additional area under the major crops was also observed.

Key Words: Watercourse; Upper Chenab; Punjab; Pakistan

INTRODUCTION

Land and water are the basic resources of agriculture. Of all the inputs for agriculture, water is the most important. Not only the maximum gains in agriculture are achieved through water but it also maximizes the gains of the other inputs such as fertilizer. Pakistan is well endowed with water resources with the result that about three fourth of its cultivated land is irrigated.

The primary and secondary canals of the irrigation system of the Indus Basin are looked after by the provincial Irrigation Department; whereas, the construction of tertiary canals (watercourses) and their operation and maintenance is the sole responsibility of the farmers. Because of inadequate technical skills and lack of motivation of farmers, these watercourses have deteriorated, resulting in excessive conveyance losses.

Various research studies have been conducted to study the extent of conveyance losses. The conveyance efficiency of watercourses was less than 60% before improvement (Corey & Clyma, 1975). Waryam and Rahmat (1980) concluded that the watercourses are improperly designed and operated by the farmers resulting in inadequate supply, so water never reaches the farmer fields. Lowdermilk *et al.* (1978) estimated that on an average 47% of irrigation water is lost during its conveyance from the mogha (outlet) to the field, and the losses range from 33 to 65% at different points on the watercourse.

Keeping above losses in view, the Government of Pakistan launched On Farm Water Management (OFWM) program. The monitoring and evaluation of this program reveals that irrigation efficiency has increased through watercourse improvement. Khan and Sadiq (1987) found that there was high yield per acre on improved watercourses. The yield of wheat, sugarcane and cotton increased by 8.5, 23.5 and 7.4%, respectively. OFWM (1986) reported an increase in delivery efficiency of 21 and

53% of water saving. Tarar (1995) stated that increasing efficiency of water use, while at the same time maximizing return per unit of water must be an over-riding objective when major increase over existing supplies appear unlikely and population rises rapidly. Under the prevailing conditions, no additional surface water supplies are expected in the near future and focus will, therefore, have to be on better utilization of existing supplies and saving of conveyance losses.

The main objective of this study was to evaluate the benefits associated with watercourse improvement as saving in time to irrigate unit area and change in cropping intensity.

MATERIALS AND METHODS

A survey was carried out in the districts of Gujranwala and Sheikhupura of Punjab in the upper Chenab canal system to determine the impact of watercourse improvement on 11 sample watercourses randomly selected out of 33, improved under OFWM program. The cut-throat flume was used to determine the discharge in the watercourses. A questionnaire survey to look into the socio-economic condition of the farmers in the study area was conducted and data were collected through personal contact with the farmers on each selected improved watercourse. On each of the watercourses, the farmers from three farm sizes viz, 0-2.4, 2.4-5.2 and above 5.2 hectares and location of the farms at head, middle and tail of watercourse were interviewed as given in Table I.

Table I. Number of farmers interviewed at watercourse

Farm size (ha)	Head	Middle	Tail
0-2.4	7	6	6
2.4-5.2	8	9	4
Above 5.2	7	10	8
Total	22	25	18

RESULTS AND DISCUSSION

Time saving. Table II shows that the average time consumed to irrigate a hectare on different farm sizes, which are on the head, middle and tail of an average watercourse (average of 11 watercourses studied) before and after their improvement. The analysis reveals that average time taken to irrigate a hectare irrespective of farm sizes is 4 h 34 min, 6 h 40 min and 5 h 18 min, respectively on head, middle and tail of the watercourse before improvement. Similarly average time taken to irrigate a hectare irrespective of farm sizes comes out to 3 h 34 min, 3 h 59 min and 4 h 14 min on head, middle and tail of watercourse, respectively after improvement.

Further analysis shows that the average time consumed to irrigate a hectare irrespective of farm sizes and location on the watercourse comes out to 5 h 31 min before improvement and 3 h 57 min after improvement of the watercourse. It means that there is a saving of 1 h 33 min per hectare on account of watercourse improvement program.

Labour savings. It was observed that before improvement of watercourses two men were required to irrigate the fields and a great difficulty was faced to control the water in order to get into the field as there were a lot of trees, shrubs and silt deposits on the watercourses. After improvement of the watercourses, one man could easily irrigate the fields and also feel pleasure in doing his job by just opening the lined

nakkas (structure) and walking on the well prepared banks of watercourses which are free from snakes, vegetation and kinks. Accordingly, there are 50% labour savings to irrigate a hectare on account of watercourse improvement.

Increase in cropping intensity. Table III shows that the average cropping intensity on different farm sizes, which are on the head, middle and tail of watercourse before and after improvement. The analysis shows that cropping intensity on an average farm size is 115.13, 121.65 and 115.40% on the head, middle and tail of the watercourse, respectively before its improvement and 138.21, 151.77 and 132.49% after improvement.

Further analysis indicates that cropping intensity on an average farm size irrespective of the distance from the outlet was 117.40% before improvement and 140.80% after improvement. An increase of 19.95% in cropping intensity was recorded on account of watercourse improvement.

Change in cropping pattern. It was observed during interview with the farmers that with the improvement of their watercourse they have shifted to the crops with high delta of water like rice and sugarcane. Forty four out of the 65 farmers interviewed, reported a change of cropping pattern from the crops with low to high delta of water; whereas, no change in cropping patterns was observed on the remaining 21 farms. This indicates a significant change in cropping pattern due to additional water on account of watercourse improvement.

Fertilizer application. Fertilizer applied was on an average of 2.74 bags per hectare before improvement of watercourse

Table II. Average Time Consumed to Irrigate a Hectare on different Farm Sizes at Head, Middle and Tail of Watercourses (Average of 11 Watercourses in Hours and Minutes)

Farm Size (ha)	Before Improvement						After Improvement					
	Head		Middle		Tail		Head		Middle		Tail	
	H	M	H	M	H	M	H	M	H	M	H	M
0-2.4	4	31	6	18	4	44	3	30	3	42	4	07
2.4-5.2	4	31	5	53	5	26	3	30	4	07	4	16
5.2 and Above	4	31	7	44	5	43	3	42	3	07	4	19
Average time taken to irrigate a hectare irrespective of farm size	4	34	6	40	5	18	3	34	3	59	4	14
Average time taken to irrigate a hectare irrespective of distance from outlet (average of Head, Middle and Tail)	5 hours 31 minutes						3 hours 57 minutes					
Time savings to irrigate a hectare after watercourse improvement	1 hour 33 minutes											

Table III. Average Percentage Cropping Intensity on Different Farm Sizes at Head, Middle and Tail of Watercourse (Average of 11 Watercourse)

Farm Size (ha)	Before Improvement			After Improvement		
	Head	Mid.	Tail	Head	Mid.	Tail
0-2.4	125.85	134.44	137.50	144.85	163.77	150.37
2.4-5.2	107.40	128.11	108.70	136.20	149.55	127.10
5.2 & above	112.14	102.40	100.00	133.57	142.00	119.92
Total	345.39	364.95	364.20	414.62	455.32	397.39
Average Cropping intensity irrespective of farm size	115.13	121.65	115.40	138.21	151.77	132.46
Average cropping intensity irrespective of distance from outlet	117.40			140.80		
Percentage increase in cropping intensity due to Watercourse improvement	19.95					

and 3.58 bags per hectare after its improvement. Fertilizer applied on an average for sugarcane, rice, maize and wheat crops before and after watercourse improvement have been shown in Table IV. Assuming that half of the increase in yield is attributed to the additional use of fertilizer, it can safely be said that the remaining half i.e. 13.15% is due to more availability of water for crop through the watercourse improvement.

Table IV. Average fertilizer applied in bags before and after improvement of watercourse

W/C No.	Crops	Before Improvement	After Improvement	Percentage Increase
1	Sugarcane	2.74	3.58	30.63
2	Rice	2.42	2.92	20.41
3	Maize	1.75	2.57	46.48
4	Wheat	2.69	3.73	38.53

CONCLUSION

It was concluded that there is a considerable time saving to irrigate a hectare after watercourse improvement. Cropping intensity was also found increased by 20% after watercourse improvement and farmers are changing cropping patterns to grow crops requiring high delta of water.

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