IMPACT OF WATERCOURSE IMPROVEMENT ON THE STEADY STATE AND TRANSIT LOSSES

Qurban Ali Awan, Arshad Ali, M. Munir Bajwa, Qazi A. Rehman & Asaf Sarwar
University of Agriculture, Faisalabad

Watercourse losses were studied on a watercourse No. 52810-L located at Shahkot distributory. The conveyance losses were found 41% comprising 19.5% on main watercourse and 21.5% on farmer's branches. Improvement of only main watercourse reduced the losses from 19.5% to 9.75% but in the unimproved farmer's branches, the losses were increased from 21.5% to 24.5%. After the improvement of total system, i.e. main and farmer's branches a saving of 50% of losses was observed. The component of deep percolation was not affected much, which was 10% before any improvement and 7.26% after improvement of complete watercourse system. The study suggested the renovation of complete watercourse system including main as well as farmer's branches.

INTRODUCTION

Watercourses are important link that carry water from the mogha to farmer's field. Due to the improper design, operation and poor maintenance these watercourses have been found resulting on an average wastage of 40% of irrigation water (Ashraf *et al.*, 1977). These losses have been considered as one of the main source of inflow to rising groundwater table in the canal command area. Watercourse improvement technology developed recently was expected to increase water supply by about 50% besides depressing the problem of waterlogging and salinity in the country. This necessitated to study the evaluation of watercourses before and after their improvements. Awan (1983) and Ali *et al.* (1978) studied water losses in different components of farm watercourse system. However, they did not investigate as to where the lost water was actually going. In addition, they did not study the results after improvements. This study was particularly conducted to evaluate the watercourse losses in the main as well as farmer's branches under the unimproved and improved situations.

MATERIALS AND METHODS

The study was conducted on watercourse No. 52810-L located on Shahkot distributory, district Sheikhupura (Table 1). The study was undertaken under three situations: 1. When watercourse was unimproved; 2. When main watercourse was earthen improved; and 3. When farmer's branches were also improved. During the study, all the water (tubewell and canal), which entered in conveyance system and passed from main watercourse into farmer's branches and from farmer's branches into the field being irrigated, was measured during three to seven warabandi rotations. These rotations were taken during evaluation of pre-improvement as well as post-improvement situation.

Discharge was measured with the help of cut-throat flumes one permanently installed at the head, the second at the end of main watercourse being utilized and third

at the upstream 'nakka' through which water was flowing into the field. In this way, water passed through all three flumes was measured for the period of study.

watercourse banks, the dead storage left on the bottom of channel after completion of irrigation, water seepage during the period when water was moving from one field to

Table 1. Basic data regarding watercourse No. 52810-L

Culturable command area	222.67 ha
Main* watercourse length	5010 m
Farmer's branches length	23395 m
Total channel length	28405 m
Per cent main watercourse	17.64
Length of watercourse per hectare	127.56 m
Number of operators	57
Average irrigated holding size	3.90 ha
Annual cropping intensity	132.7%
Mogha design discharge	42.5 L sec^{-1}
Average discharge during study	29.72 L sec^{-1}
Tubewell discharge	32.02 L sec^{-1}
Soil texture	Silt loam

*Main watercourse means the community watercourse which is property of Government and also called 'Sarkari Khal'.

The flume flow rate data were plotted as discharge verses time and total volume was calculated with the help of planimeter. This way, total volume of water passing through each point over a given time was determined. This allowed direct volumetric calculations of the losses as well as conveyance efficiencies in each section of the watercourse. Transit losses were taken as the difference between the actual measured water loss and the losses which would have occurred if the system flowed constantly at steady-state. These were calculated by taking the difference between the product of rotation turn time utilized in irrigating a field and steady state flow rate into the field and the actual volume of water which entered the field. These included excess water infiltration which wetted dry the next and losses resulting in short term 'nakka' breaks and watercourse breaches.

RESULTS AND DISCUSSION

It was observed that with the improvement of main watercourse only, watercourse losses reduced from 41% comprising 19.5% in main watercourse and 21.5% in farmer's branches to 34.25% comprising 9.75% in main watercourse and 24.5% in farmer's branches (Table 2). With the improvement of main watercourse only, water saving of about 9.75% was observed but the losses in farmer's branches were found to be enhanced from 21.5% to 24.5%. Later after the improvement of main as well as farmer's branches total watercourse losses were found to be further reduced to 21.25% com-

prising 9.75% in main watercourse and 11.5% in farmer's branches.

provement and reduced to 3.45% after the improvement of main as well as farmer's

Table 2. Percentage reduction in watercourse losses as affected by various stages of improvement

Description	Before improvement	After improvement of main watercourse		After improvement of main watercourse and Farmer's branches	
	Waterloss (%)	Waterloss (%)	Percentage reduction (C2-C3/C2	Waterloss (%)	Percentage reduction (C2-C5/C2)
(1)	(2)	(3)	(4)	(5)	(6)
Main watercourse	19.50	9.75	50.00	9.75	50.00
Farmer's branches	21.50	24.50	-13.95	11.50	46.51
Total loss	41.00	34.25	16.46	21.25	48.17
Steady-state losses	34.00	25.75	26.26	15.90	53.20
Evaporated from saturated portions of side fields along watercourse	13.00	10.00	23.08	3.45	73.46
Evaporation through vegetations and trees	10.00	7.00	30.00	4.24	57.60
Deep percolation	10.00	7.75	22.50	7.26	27.40
Evaporation from watercourse surface	1.00	1.00	0	0.95	5.00
Transit losses	7.00	8.50	-21.43	5.35	23.71
Dead storage	1.70	1.00	41.18	0.82	51.76
Breaches and bund breaks	2.85	3.70	-42.82	1.38	51.58
Wetting of dry watercourse	2.45	3.8	-55.10	3.15	-28.57

Maximum reduction in water loss was observed through evaporation from the saturated portions of side field along the watercourse which were 13% before any improvement and reduced to 3.45% after the improvement of main as well as farmer's branches. The component of deep percolation was least affected with 10% before any improvement and 7.26% after the improvement of main as well as farmer's branches.

In addition, the components of transit losses, i.e. dead storage, breaches, bund breaks and wetting of dry watercourse were observed to be reduced from 7% to 5.34% after complete watercourse improvement.

The results though represent a very small sample but clearly indicate the necessity of improving the entire watercourse system including the main as well as farmer's branches for capturing the potential benefits of the improved water management technology.

REFERENCES

Ashraf, M., W.D. Kemper, M.M. Chaudhry, B. Ahmad and Tom Trout. 1977. Review of watercourse loss measurements in Pakistan. Tech. Pub. No. 71. MREP-WAPDA and WMRP-CSU, USA.

Awan, Q.A. 1983. Impact of watercourse improvement on the operational analysis of watercourse losses. Annual Progress Report 1982-83, WMRP, UAF.

Ali, R., M. Ashraf, T. Trout, W.A. Mohsin, M. Ahmad, N.A. Anwar and M.U. Khan. 1978. Operational irrigation evaluation of three watercourse systems. Pub. No. 1, Survey and Research Organizations, WAPDA, Lahore.