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Determination of Water Conveyance Loss in the Menemen Open Canal Irrigation Network

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Abstract: The aim of this research was to determine water conveyance loss in the open canal irrigation network that serves the irrigation areas on the right and left banks of the Menemen Plain, in the lower part of the Gediz Basin. The research was carried out in the main, secondary, and tertiary canals. Water conveyance loss in the canals was measured by the inflow-outflow method, while water velocity was determined using a current-meter. Statistical relationships between canal types, canal shapes, and seepage loss were also investigated. The water conveyance loss at the main canal level was between 0.5% and 1.3% ($0.0071\text{-}0.0126$ l s^{-1} m^{-2}) per 1 km in the left bank main canal, and between 0.6% and 8.6% ($0.0024\text{-}0.0361$ l s^{-1} m^{-2}) per 1 km in the right bank main canal. The average loss was 3.0% (0.0141 l s^{-1} m^{-2}). At the secondary canal level the average water conveyance loss for the trapezoidal canals on the left bank was 2.0% (0.0615 l s^{-1} m^{-2}) per 100 m and for the concrete flumes on the right bank it was 4.0% per 100 m. Average conveyance loss at the tertiary level on the left bank was 7.0% (0.0598 l s^{-1} m^{-2}) per 100 m for the trapezoidal canals and 5.1% per 100 m for the concrete flumes. For the concrete flumes on the right bank the figure was 6.5% per 100 m. Based on the statistical analysis, there was no significant difference for seepage loss between secondary and tertiary canal types ($X_{secondary} = 18.600^a \pm 4.404$ and $X_{tertiary} = 9.173^a \pm 3.199$), but there were statistically significant ($P < 0.05$) differences in seepage loss between the canal shapes (trapezoidal and concrete flume) ($X_{trapezoidal} = 21.892^a \pm 3.664$ and $X_{concrete\ flume} = 5.881^b \pm 4.025$). On the other hand, the interaction between canal type and canal shape was significant ($P < 0.05$). It was noted that the average seepage loss of the trapezoidal secondary canal was much higher than the average seepage loss of the trapezoidal tertiary canals. Moreover, the reduction in the average seepage loss of the concrete flume secondary canal was lower than the average seepage loss of the concrete flume tertiary canals. The results showed that overall water conveyance loss in open canals increased in comparison to the average values measured 30 years ago, and that water conveyance loss was higher than the average value set for both the open canal irrigation networks of Turkey and the accepted value of water conveyance loss for open canals. This revealed that, overall, maintenance and repair work on the conveyance canals were not sufficient.

Key Words: Conveyance loss, seepage, irrigation network, open canal, Menemen