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Evaluation of Irrigation Efficiency at Different Spatial Scales in a Sub-unit of the Khorezm Irrigation and Drainage System Located in the Lower Amu Darya River Basin

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Abstract

A study was conducted to assess the irrigation efficiency at different spatial scales in the Shomakhulum Water Users Association (WUA) situated in the Khorezm region, Uzbekistan. Arid climate in the region dictate the need for irrigation of crops using water from the Amu Darya River. Growing overall water deficiency, problems with timely and sufficient water supplies jeopardises crop production and threatens livelihood of the rural population. Among the solutions is an adjustment of the existing network, for which an assessment of the performance of the irrigation system is needed. For the assessment, conveyance losses, application efficiency and the overall irrigation efficiency were estimated in this study. Ponding tests were conducted to assess the conveyance losses, six sites with different soil texture, groundwater levels and the network hierarchy, were selected. The tests showed that the losses in the inter-farm and intra-farm canals were in the range of 2–4% and 2%, respectively. The highest losses of 10–18% were in the field canals. The comparatively low losses in the intra-farm canals are due to shallow groundwater levels in the vicinity of the canals and the siltation in the canal beds in spite of the higher hydraulic gradients between groundwater levels and inter-farm canals' full supply levels. For the field application efficiency, two farms with an area of 14 ha and 10.1 ha were selected. These farms differed in soil texture, groundwater levels and cropping pattern (cotton-winter wheat and cotton). The water losses were higher in first farm (60%) compared to the second one (50%). The irrigation efficiency was estimated in the range of 33–36%. To calculate the overall efficiency for the whole WUA, the water entering into the WUA was monitored at different inlets. The total inflow supplied to the WUA was 0.03 km³ versus the requirement of 0.01 km³ calculated by Surface Energy Balance Algorithm (SEBAL). Thus, the overall system efficiency estimated was 29%. This study showed that there is a huge scope for water saving within the irrigation system to efficiently cope with current and future water shortages.

Keywords: Irrigation Efficiency, SEBAL, Uzbekistan