EVALUATION OF IRRIGATION EFFICIENCY AND SUSTAINABILITY IN THE WARABANDI SYSTEM OF PAKISTAN: A DIAGNOSTIC ANALYSIS OF HAKRA BRANCH CANAL COMMAND

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The agricultural sector in Pakistan is a significant contributor to Pakistan's economy and social welfare. Despite its importance the productivity in the Pakistani agriculture sector is low, and has declined over the past decades. Nearly 85% of agriculture in Pakistan is irrigated. The major driving force behind irrigated agriculture in Pakistan is the large Indus-basin irrigation system, which was developed in the late nineteenth century. Warabandi systems supply a fixed amount of canal water proportionate to the size of the farm. Problems are often caused by poor and inefficient irrigation and crop management. This can result in soil salinization, water logging or declining groundwater levels, depleted soil fertility and a reduction in productivity.

We present a diagnostic analysis of crop water-demand and supply, equity in canal water distribution, groundwater recharge and discharge, plus water-use efficiency in irrigated agriculture. This is applied to the Hakra Branch Canal command area, covering nearly 200 thousand hectares in the Bahawalnagar district of Punjab Province in Pakistan. The analysis is presented at both spatial (canal command, distributaries, head, middle and tail reaches) and temporal (daily, weekly, monthly and seasonal) scales. The results show that canal water supplies are significantly less compared to crop water demands. Further, the analysis reveals that not only are the actual canal water supplied discharges are less than the crop water demand, but also that the design canal water discharges of the distributaries are considerably less than the potential crop water demands. There is also considerable inequity canal water distribution across the irrigation system, as the head-reach distributaries get more canal water per unit area than the distributaries in the middle and at the tail-end of the system. This reveals inequities in the allocation of canal water available. The water-use efficiency and water productivity are low for the whole command area.

This analysis reveals that irrigation management strategies are required to ensure equity, increase productivity and minimize losses in the system. We propose to develop and integrate irrigation scheduling and soil-water-crop modelling with geographical information to further assess and improve the efficiency and sustainability of irrigation practices in the system.

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