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A Groundwater Model for Canal and Ground Water Management to Enhance Crop Production in Indus River System of Pakistan

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Increasing water scarcity threatens the sustainability of irrigated agriculture and hence the food security of Indus Basin system in Pakistan. Farmers are under pressure to “grow more grains per drop”. Keeping in view this enormous challenge, there is an urgent need to increase water productivity of agricultural production systems. Groundwater development has contributed significantly to food security and reduction in poverty in Pakistan. Due to rapid population growth there has been a dramatic increase in the intensity of groundwater exploitation leading to declining groundwater tables and deteriorating groundwater quality. In such prevailing conditions, the hydrogeologic and economic assessment of escalating groundwater exploitation have become of paramount importance. Keeping this in view modelling conjunctive use of surface-ground water to assess future groundwater trends in the Indus River Basin, Pakistan is of paramount importance. As Pakistan is a water-short country with occasional water surplus periods during the monsoon season, therefore, increasing and optimising water productivity is a priority to meet the future food and fibre requirements of its rapidly increasing population.

To understand these complex issues, ACIAR started a project in October 2008 dealing with Optimising Canal and Groundwater Management to Assist Water User Associations in Maximizing Crop Production and Managing Salinisation in Australia and Pakistan. This project will develop and use, for the first time in the history of canal and groundwater management in Pakistan, the hydrologic-economic modelling tools capable of scenario analysis of water distribution as a function of crop-groundwater-soil mix at farm and "distributary" and "minor" canal levels both in the Lower Chenab Canal (LCC). More importantly, the project will couple Remote Sensing tools and hydrological data with socioeconomic data for developing the surface and ground water supply and demand management options at various spatial scales, for tailoring water sectors adaptations to climate change.

Currently PIDA is involved with 85 FOs for demonstrating improved irrigation practices in the LCC. In some areas of LCC groundwater is fresh and can be used for irrigation by the farmers, while in some other areas especially in the tail reaches of the irrigation system, the groundwater is saline and unsuitable for irrigation. Conjunctive use of surface and groundwater is common in areas with good quality ground water. The tail-end and farmers often get less water due to inequity in access to surface water; they also have poor quality groundwater, such that the use of poor quality groundwater alone for irrigation reduces crop yield and production, caused salinity and thus have serious socioeconomic and environmental implications. These farmers need scientific information for "conjunctive use" of surface and groundwater for optimising their productivity and returns to limited land and water resources. This project has developed surface and ground water model to PIDA for rationalising surface water allocation.

Some initial results of the project including development of hydrological model at the LCC system. This work is also aimed at evaluating surface water availability and the assessment of spatial distribution of groundwater abstractions by considering the present crop water demand.