OPTIMAL USE OF SURFACE AND GROUNDWATER RESOURCES FOR THE SUSTAINABLE AGRICULTURAL WATER MANAGEMENT

by

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ABSTRACT

The agricultural sector of Pakistan depends heavily on the canal irrigation system because it is located in an arid to semi-arid climate zone with an annual average rainfall below 250 mm. Out of the total irrigation demands of Pakistan; around 27% are met by surface water supplies and 73% directly or indirectly by groundwater. This situation requires to adoption concept of "Optimal Use" for sustainable management of water resources. In this context, this study formulates an optimal water allocation model for the conjunctive use of surface and groundwater resources in the Lower Gugera Branch command in Punjab. Linear Programming was used to maximize of benefits and minimize salinity by using the different objective functions. The penman-Monteith equation was used to calculate the crop water requirement of major crops being grown in the Lower Gugera Branch command area.

Results indicated that groundwater depletion is slightly less in head zones of canal command in Faisalabad while depletion increases in tail areas of Toba Tek Singh. Crop water requirement showed an increasing trend from head to tail due to fluctuation in temperature and less rainfall as the major factors. Depth to the water table increased yearly is 0.4 to 0.5 m which resulted in the exploitation of groundwater and an increase in salinity level. The highest crop water requirement is near 1306 mm per year in Toba Tek Singh. The results of optimization modeling indicated that an overall NEB of 45.25 million USD against a satisfaction rate of 49% was attained when the objective function of maximization of benefits and minimization of salinity level was considered. In Case of OF2 benefits decreases and 39.1 million USD against satisfactory rete of 22%

was attained. Therefore, the outcomes of the present study may be helpful to develop an optimal approach for the conjunctive use of surface and groundwater resources to maximize the economic benefits and minimize the salinity.