THESIS

EVALUATION OF GROUND WATER FLUCTUATIONS DURING MONSOON

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ABSTRACT

In Pakistan monsoon season usually lasts from July to October and about 65 % of annual rainfall occurs during this period. Most of the irrigated area is brought under rice plantation during monsoon. Water is applied through canal and tubewell water. Rice crops need more water than any other crop grown in Pakistan and most of the time water remains standing in the rice fields .A portion of water applied to the fields is lost through deep percolation and becomes recharge to the ground water system. Similarly the rainfall water is not completely utilized by the crops and some quantity is recharged to the ground water. When there is no rainfall in rice growing area, heavy pumpage is done to fulfil the crop water requirements. This causes the ground water level to fluctuate during the monsoon period. For the water balance of any area it is important to find the contribution to ground water recharge by rainfall, canal water and tubewell water. This study was conducted to determine the rainfall recharge by various available methods and the coefficients of recharge for canal and tubewell water.

The study is based on the field measurements of ground water table hydrograph and its analysis. Data was collected for water table levels, tubewell pumpage, number of fields irrigated on any day, and canal supplies in the study area for a period of 95 days (June 26 to Oct 30, 1999). Daily ground water level was measured by installing two observation wells in the study area. Similarly the number of fields irrigated by either source of irrigation water was noted. Tubewell pumpage was determined from the number of tubewell, their discharge capacity and weekly operating hours.The

discharge capacity of each tubewell was calculated by test run using trajectory method. The operating hours were determined from weekly diesel consumption by each farmer for his tubewll and the fuel consumption per hour determined during test run.

The rainfall recharge was estimated through the methods including Maasland, fix recharge rate, SWATRE and compared with the variable recharge rate method used for this study. A water balance model was developed in EXCEL spread sheet and water table was calculated for each day using rainfall recharge estimated by different methods, measured tubewell pumpage , canal and tubewell recharge. The recharge coefficients of canal, tubewell and rainfall water were estimated by sensitivity analysis by comparing calculated water table with the measured water table levels. These recharge coefficients were varied until a satisfactory match between the measured and calculated water table was obtained.

Only two rainfalls occurred during the study period and ground water rise was high after the rainfall events followed by steady decrease. The total rise in ground water level was about 54 cm in the study period. Rainfall recharge estimated by Maasland method and variable recharge rate method (recharge = 26% of rain) resulted in good match of measured and computed ground water levels. The fixed recharge rate method (recharge = 10% of rain) under estimated the rainfall recharge. Rainfall recharge estimated by using SWATRE model is not dependable as the model could not be adequately calibrated to actual field conditions due to lack of reliable data. The recharge from canal water due to seepage from main and field water courses and

application losses was found to be as 35% of canal supply at the outlet. Similarly the recharge from tubewell water due to seepage from short field water courses and application losses was found to be 25%. The rainfall recharge was determined to be 26%. The tubewell operation as done by farmers does not match fully with the required pumpage to fully meet the evapotranspiration requirements as determined from CROPWAT computer program. The main reason for under irrigation is short canal supplies and high operating cost of tubewells.

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