Abstract

Soil salinity and waterlogging are the two most common problems limiting crop production in irrigated agriculture in middle and south of Iraq. Poor water management and irrigation water leakage from the irrigation canals have caused the groundwater table to raise over approximately 74 % of the irrigated areas in Iraq.

Computer simulation models are known to be the most attractive tools to assess hydrological or environmental situations in irrigated and drained lands. As such, crop-water-environment-models like salinity simulation and prediction models have been increasingly applied to assess the short and long-term impacts of water management options on the land/water productivity and the environment. The conceptual deterministic analysis is based on available theoretical knowledge (i.e. physical expression) in the form of mathematical equations, formulas and models describing relations between magnitudes. These contain magnitudes that are to be calculated (the output, also called variables), and magnitudes that need to be known beforehand (the input, also called parameters). The method of analysis is called deterministic because each set of input data produces one set of output.

In this study the lumped parameters conceptual model (Saltmod) has been chosen. Saltmod considers the average soil moisture and salt concentration within the upper soil zone in steady state flowing representation. The equations are solved numerically over the time period at growing season. The model performs water balance in unsaturated and saturated soil layers.

In order to setting up such kind of water management model, a pilot area in Misan sugarcane fields is chosen to represent the local (agro-) hydro conditions data fore the period from 1975 to 2001 .Then a period of twenty years with various practices is applied in order to predict the effects of water and salt movement in different soil zones in this area.

Misan Sugarcane Fields with an area of about 5750 ha, lie on right and left of AL.Majar- AL.Kabeer canal, branching from Tigris River in the south Tigris basin in Iraq. Due to the high rate of initial soil and water salinity in the area as well as the low rainfall and high rates of evaporation (i.e. semi arid region) a subsurface drainage system was suggested, designed and installed in this area during the period from 1961 to 1974 for the purpose of reclamation of the cultivated land.

The model predicts that:

1. Leaching efficiency of root zone as it defined with three arbitrary values, 0.65.0.75 and 0.90, then by matching the corresponding results of soil salinity (i.e. predicted with observed output data); is found to be near 0.90.

2. The annual natural drainage value was found by using the actual seasonal average depth of the water table as well as the drain discharge, then by setting different drain discharges in the model and comparing the results of computations to observed values in the pilot area. An annual natural drainage was found (0.012).

3. In spite of the existence of drainage system, the root zone soil water salinity will be increased to 5.76 dS/m (i.e. decisiemens per meter) from an initial value of 4.48 dS/m during the first season, then to 6.06 dS/m, 6.20 dS/m and 6.16 dS/m in the second, third and fourth seasons respectively at the end of the first 10 years, noticing those first and fourth seasons are the seasons of ripening period.

4. Salinity of soil moisture in the transition zone above and below the drain level is observed to increase due to salts leaching from root zone into the transition zone. Furthermore, the limited amounts of rainfall in the region did not allowed for more leaching effects in a depth larger than the depth of root zone at the rainfall seasons.

5. Soil water salinity in the aquifer is observed to be stable over the years due to leaching scarcity from root and transition zones into the aquifer.

6. The simulated depths to water table in all the four seasons in entire period indicated that, in first season, the water table is expected to be at 1.16 m below ground level, then it remains at 1.11m in the second season, 0.89 m in the third season and finally at 1.19m in the fourth season.

7. The simulated amounts to subsurface drainage water in all the four seasons in entire period indicated that, the drainage water amounts is expected to be 0.031m, 0.04m , 0.105m , and 0.016m in the first, second, third and fourth seasons respectively.

8. The simulated seasonal rates of drainage water salinity in the field for all the four seasons in twenty years period indicate that in the first season, the water salinity is expected to be about 2.75 dS/m in the first predicted year and increase continuously to the rate of 4.4 dS/m in the

twentieth year.

9. In order to diminish the rates of predicted salinity in the crop area that has been surely happen due to the change in river's water salinity, a fraction of 60% of the present value must be added to the requirement of irrigation water.