Effects of controlled drainage on environmental hazards (case study Ran drainage project)

Verdinejad V.R.[1], Sohrabi T. [2], Ebrahimian H.[1],Akram M.[3], Liaghat A.M. [4], Parsinejad M.[4]

1.PhD Students, Dept. of Irrigation Eng., University of Tehran, Iran
2. Professor, Dept. of Irrigation Eng., University of Tehran, Iran
3.Excellent Counsellor in Irrigation and drainage, Absaran consulting engineers, Tehran, Iran
4.Assistant Professors, Dept. of Irrigation Eng., University of Tehran, Iran

College of Agriculture and Natural Resources
Faculty of Soil and Water Engineering

Department of
Irrigation and Reclamation Engineering

Introduction

Controlled drainage is one of the essential solutions to manage the quantity and quality of excess water and decrease the environmental hazards. Qualitative experiments salinity of the drainage water in Ran region drainage project system is very high ranging from 47.6 to 110.7 dSm^{-1}. The aim of this research was evaluation of DRAINMOD-S for simulating water table management in Ran project located in the north of Iran for a controlled drainage.

Methodology

The project is located at Behshar city, between 36°45' and 36°48' latitude and 53°40' to 53°41' longitude. Average annual precipitation and mean annual temperature are 577 mm and 16°C, respectively and its climate is semi-Mediterranean. The selected experimental site for was between S3PD14 and S3PD15 laterals. Depth, spacing, diameter and average length of laterals are 1.5 m, 75 m, 125 mm and 440 m, respectively. The drainage outflow and depth to water table were measured during 4 months period from November 22 to March19. Soil salinity was measured on samples depths of 0-25, 25-50, 50-75, and 75-100 and 100-150 cm before August, 2006 and after April, 2007 rainfall period. Because of the shotage of water for irrigation, crops were grown under dry farming in the project. Therefore, optimal use of rainfall caused to increase yield production. The growing season was from March 20 to September 20. Sensitivity analysis indicated that applying of controlled drainage in April, May and September has the most influence on yield. The objective of this study was to investigate the effect of different weir depths on yield, contamination and reduction of drainage water volume. Weir depths were taken from 15 cm to 150 cm (15 cm interval).

Results and Discussion

DRAINMOD-S was run to simulate the applied water table management systems for the same study periods. The reliability of the model was evaluated by comparing measured and predicted values of the daily ground water table depth, cumulative outflow and soil salinity. Good agreement was found between measured and predicted values. Absolute value of deviations from Drainmod predictions ranged from 4.1 to 8.4 cm, 0.48 to 0.78 mmday-1 and 5.7 to 6.3 dSm-1 for ground water table depth, drain outflow and soil salinity, respectively (soil salinity was very high so prediction of the model was acceptable). The results of different scenarios of controlled drainage indicated that of 35% optimal relative crop yield was obtained when water table was kept at a depth of 75 cm (Fig. 3). The main reason for crop yield reduction, in addition to soil salinity, was water stress under dry farming conditions. Average relative barley yield in this region was reported to be about 32 percent of potential yield (1.61 ton/hectare). As shown in figure 4 with increasing weir depth, the rate of discharge volume is increased. The reason for the different variation of discharge volume in the three months was shown the occurrence of rainfall (consequently water table depth). Measured amount of monthly rainfall in April, May and June were 97.5, 29.9 and 1.5 mm, respectively.

The model indicated the potential for long-term simulation and scheduling of water table management under semi arid conditions of Iran (Behshahr). With regard to different scenarios of controlled drainage, the optimal water table depth for obtaining maxiumum yield was equal to 75 cm. The results Also indicated that discharge volume depended on weir depth and rainfall.

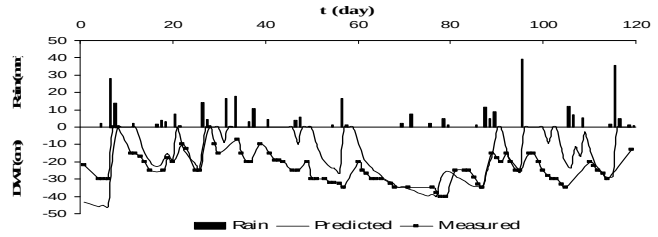

Fig. 1: Comparison of observation and predicted water table and rainfall quantity in the measurement period

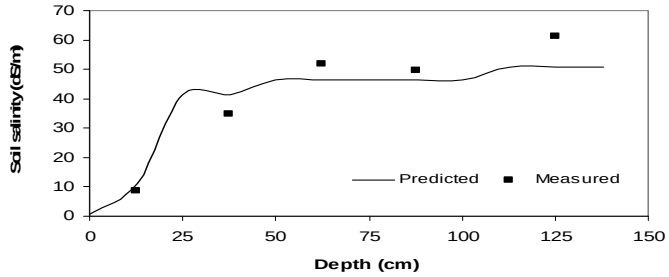

Fig. 2: Comparison of observation and predicted soil salinity in different depth

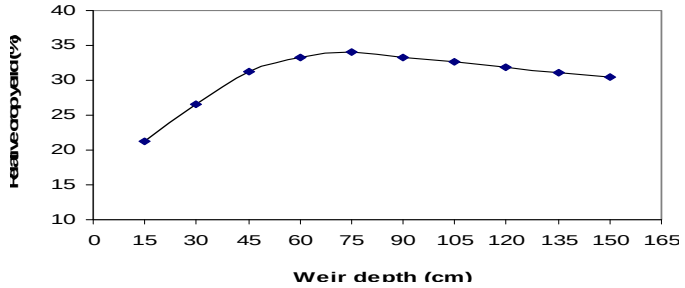

Fig. 3: Variation of relative crop yield relative to different weir depth

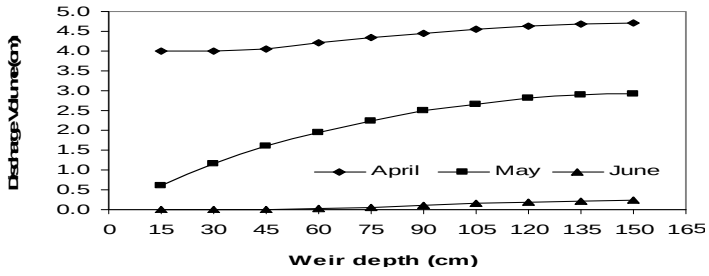

Fig. 4: Variation of discharge volume relative to different weir depth