Abstract

The application of saline water sources combined with reducing water consumption during crops growing seasons will have an important role in adjustment with the water crisis. In this regard, applying a suitable water management aimed at sustaining crops under osmotic stress and water deficit and also taking into account environmental considerations can cause food security. Thus, in this research, the influence of partial root zone drying irrigation by using the diluted sea water on plant growth characteristics, quantitative and qualitative properties of the product and irrigation water use efficiency of sunflower was investigated. Also, the effects of different irrigation management on the spatial and temporal distribution of soil salinity by using field evaluations and simulation with HYDRUS-2D model was studied. Sunflower cultivation was conducted under surface drip irrigation system in 2014 and 2015 growing seasons in Agricultural Sciences and Natural Resources University of Sari. The treatments included full irrigation with fresh water (FI), full irrigation with saline water (SI), full irrigation with alternative use of saline and fresh water (FSI), partial root zone drying irrigation with fresh water (PRD_1), partial root zone drying irrigation with saline water (PRD_2) and partial root zone drying irrigation with alternative use of saline and fresh water (PRD_3). The results showed that significant difference was not found between the treatments of PRD1, PRD3 and FSI compared with FI in most growth characteristics and quantitative and qualitative properties of the product in both years. During two cropping seasons, the highest yield observed in control treatment with values of 4706 and 4367 kg/ha, respectively. SI and PRD2 treatments had the lowest level of yield in both years. The maximum water use efficiency was obtained from PRD1 with values of 1.12 and 1.13 in two years. The highest percentage of oil was achieved from PRD2 with 51% and PRD3 with 62% in 2014 and 2015, respectively. The SI treatment had the lowest amount of oil in both years. The maximum oil yield observed in the PRD1 and FI. Also, HYDRUS-2D model simulation results indicated the high ability of the model to simulate the distribution of salinity in the root zone under different treatments. The RMSE values changed from 0.12 to 1.01 dS m^{-1} for salinity simulation that this implies a good agreement between observed and simulated values. According to the results of simulation, the PRD treatments compared to similar full irrigation, despite a 25% of water saving, showed better performance on the spatial and temporal distribution of salinity. As well as, the alternative use showed better results than saline water to reduce salinity in the root zone. Finally, according to the results of two years study, it could be concluded that in the water crisis condition and the need to use efficient methods, PRD3 by maintaining yield and acceptable spatial and temporal distribution of salinity is recommended as the optimal management. In addition to saving fresh water resources, quantitative and qualitative losses of the product are minimized.

Keyword: Partial Root-zone Drying Irrigation, Seawater, Sunflower, HYDRUS-2D.

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Effects of Partial Root-Zone Drying Irrigation Management with the Use of a Combination of Sea Water on Quantitative and Qualitative Characteristics of Sunflower (*Helianthus annuus L.*) (Case Study: Mazandaran Province)

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