Irrigation management based on signals from tensiometers – evaluation of the effect of the "turn on" value on the annual water amounts and yield in Pepper (*Capsicum annuum*) in the Arava

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Abstract

Tensiometers and soil-water content sensors can provide continuous reliable information regarding the temporal and real time changes of the water content within the root-zone. The changes of water content within the soil, result from environmental and vegetal effects on the rate of water uptake by the plants and the deep percolation to deeper depths of the soil. Incorporation of such equipment in irrigation control systems will enable a real time response to a decrease of soil water amounts and to better management of the irrigation, i.e. amounts and frequencies. A field study was carried out in 2006/7 seasons at Israel Zer's farm in Paran, in cooperation with Arava R&D. In this study, the effect of different irrigation quantities on the overall characteristics of the irrigation and yield was evaluated under the same "turn on" matric potential that was transmitted from tensiometers and initiated the irrigation. The results showed that an automated irrigation in the field can supply the required water amounts according to the daily weather changes. The daily average water quantities that were given to the plots decreased together with the shortening of day time and the decrease of temperatures. Irrigation frequency also changed according to the water amount that was supplied once the "turn on" signal was sent from the tensiometer to the irrigation system. The lowest irrigation quantity resulted in shorter intervals between irrigations. Irrigation efficiency was higher in all treatments without affecting yields.

The objective of the 2007/8 experiment was to evaluate the implication of applying the same water amount at different levels of soil-water matric potentials In order to estimate the appropriate range for the "turn on" values, a single water application was given in the afternoon at the end of August 2007. Three potential values were chosen along the lineof the tensiometer reading that represents the change in soil water contentent. The lowest value was 10

milibars above[1] the value once night deep percolation ended, The other two values were 10 milibars difference from each other. An amount of 3.65 mm[(2)] was given each time an irrigation event was triggered. The operation of the automated irrigation treatment started on 1/9/2007. During September and October, irrigation frequency was once a day where only in the lowest "turn on" value treatment there were few twice a day irrigations. The annual water amounts were 989 mm, 962 and 864 in the lowest, medium, and highest "turn on" matric potential values respectively. Total yield was 10 ton dunam^{-1}, 9.3 and 9.2 respectively – all values are not significant from each other.

The highest "turn on" value treatment was the most efficient during the whole season. Most water saving was after the end of November. In this time of the season, water uptake decreases with the decrease of temperatures and the shortening of the day. Also the intervals between irrigations increased.

The advantage of irrigation management based on soil-water measurements is the adjustment of the water amounts and timing to the plants' demands according its size, its growing stage and the weather. The fact that the decrease in the annual water amounts didn't result in a decrease of the yield might be attributed to the appropriate timing of irrigation. Note that the overall water amounts in this season were lower than other years because of the sever frost events that shortened the season by one month.

[1] The potential is the positive figure of the negative pressure values measured in the soil, therefore, the lowest is "above"

[2] 3.65 mm = 3.65 m^3 dunam^{-1} (1,000 m^2)