

Effects of Surface and Subsurface Drip Irrigation Systems with Saline and Non-Saline Water on Sap Flow, Stomata Conductance and Canopy Temperature of Pistachio Trees

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Abstract

To investigate the effects of substituting surface drip irrigation (DI) by subsurface drip-irrigation systems (SDI) on plant responses, a 10 ha pistachio orchard with DI system located in Shahriar, Tehran province, was selected. Irrigation treatments including DI and SDI with saline water and DI with non-saline water (A) were established and plant responses were measured. The salinity distribution results showed that, in DI, at depth of 30-50 cm and distance of 70-100 cm, salts were accumulated. In SDI, salt accumulation was observed in surface layer and in distance of 60-80 cm from the tree. Based on all plant response indicators, treatment A showed significantly more favorable conditions. Unlike treatment A, there was no significant difference in the “canopy temperature” and “canopy-air temperature difference” between DI and SDI. By normalization of environmental-effects on foliage temperature, crop water stress index (CWSI) showed significant differences between DI and SDI treatments. Also, stomata conductance in SDI was significantly greater than DI. Additionally, treatment A had significantly the highest sap flow (SF). Based on SF measurement in 24 hour, there were no significant differences between DI and SDI irrigation systems, but the mean of this index for daylight time and midday, showed significant differences. With equal depth of irrigation water applied to DI and SDI and more favorable salinity distribution in root zone of SDI, this treatment leads to less water and salinity stress. Although the use of subsurface drip irrigation system requires long-term studies, but in view of the observed plant responses and in terms of soil salinity distribution, it is recommended to use SDI in pistachio trees.

Keywords: Crop water stress index, Plant response, Saline water, Salinity distribution, Water and salinity stress

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