Using Hydrus-2D model for irrigation scheduling of potatoes crop under subsurface drip irrigation in Central Tunisia

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In the semiarid climate of Tunisian environment, irrigated agriculture uses about 83% of the total water resources. Forecasts for the future predict a greater competition to relocate water for industrial and urban use. It is therefore compulsory to provide auseful guidelines for water management in order to increase irrigation water use efficiency.

Subsurface drip irrigation (SDI), allowinghigh frequencyapplication of small irrigation volumes below the soil surface, has been increasingly considered as a powerful system to enhance irrigation water use efficiency (IWUE), defined as the ratio between crop yield and the seasonal water supplied.

At the same time, deficit irrigation (DI) has shown successful results with a large number of crops in various countries. However, for some crops like potatoes, DI is difficult to manage due to the rapid effect of water stress on tuber yield. Irrigation frequency is a key factor for subsurface drip irrigationscheduling. For the same seasonal amount of water, different water application frequencies can result on different soil wetting patterns and consequently on different crop yield. Despite the need to enhance water use efficiency, only a few studies related to deficit irrigation of horticultural crops have been carried out in Tunisia.

Objective of this paper was to assess the effects of different on-farm irrigation strategies on water use efficiency of potatoes crop irrigated with subsurface drip irrigation in a semiarid area of central Tunisia, with the aim to identify guidelines for a more sustainable use of irrigation water. After validation, Hydrus-2D model was used to simulate soil water status in the root zone, to evaluate actual crop evapotranspiration and then to estimate indirectly IWUE.

Field experiments, were carried out in Central Tunsia (10.5632° E; 35.9191°N; 19 m a.s.l.) during a potatoes cropgrowing season 2014, from January 15 (plantation of tubers) to May 6 (harvesting) in a sandy loam soil. Soil water status was monitored in two plots (T1 and T2) maintained under the same management, except for the irrigation volumes, provided by

means of a SDI system. In particular, irrigation was scheduled according to the average water content measured in the root zone, with a total of 8 watering with duration variable between about one and three hours in treatment T1, and between about half-an-hour and one-hour and a-half, in treatment T2.

Hydrus-2D model was validated by means of the comparison between measured and estimated soil water content at different distances from the emitter, that evidencedRMSE values not higher than 0.036. Then, model simulations permitted to verify that increasing irrigation frequency it is possibility to enhance irrigation water use efficiency, even maintaining limited water deficit conditions during the full development stage subsequent the crop tuberization. The experimental results, joined to model simulations provided therefore useful guidelines for a more sustainable use of irrigation water in countries characterised by semi-arid environments and limited availability of water resources.