



Irrigation management strategies to improve Water Use Efficiency of potatoes crop in Central Tunisia

Hiba Ghazouani (1,2), Giuseppe Provenzano (1), Giovanni Rallo (3), Amel Mguidiche (2), Boutheina Douh (2), and Abdelhamid Boujelben (2)

(1) Università degli Studi di Palermo, Dipartimento Scienze Agrarie e Forestali, Viale delle Scienze 13, 90128 Palermo, Italy (ghazouani_hibaisa@yahoo.com), (2) Institut Supérieur Agronomique de Chott Mariem (ISA-CM), Département du Génie des Systèmes Horticoles et du Milieu Naturel, BP47, Sousse 4042, Tunisie, (3) Università di Pisa, Dipartimento Scienze Agrarie, Alimentari e Agro-Ambientali. Via del Borghetto 80, 56124 Pisa, Italy.

In Tunisia, the expansion of irrigated area and the semiarid climate make it compulsory to adopt strategies of water management to increase water use efficiency. Subsurface drip irrigation (SDI), providing the application of high frequency small irrigation volumes below the soil surface have been increasingly used to enhance irrigation efficiency.

At the same time, deficit irrigation (DI) has shown successful results with a large number of crop 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 to schedule subsurface drip irrigation because, even maintaining the total seasonal volume, soil wetting patterns can result different during the growth period, with consequence on crop yield. Despite the need to enhance water use efficiency, only a few studies related to deficit irrigation of horticultural crops have been made in Tunisia.

Objective of the 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. 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 water use efficiency (IWUE), defined as the ratio between crop yield and total amount of water supplied with irrigation.

Field experiments, were carried out in Central Tunisia (10° 33' 47.0" E, 35° 58' 8.1" N, 19 m a.s.l) on a potatoes crop planted in a sandy loam soil, during the growing season 2014, from January 15 (plantation of tubers) to May 6 (harvesting). Soil water status was monitored in two plots (T1 and T2) maintained under the same management, but different irrigation volumes, provided by 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 timing ranging between one and three hours in T1, and between about half-an-hour and one-hour and a-half, in T2.

The validity of Hydrus-2D model was initially assessed based on the comparison between measured and estimated soil water content at different distances from the emitter (RMSE values were not higher than 0.036). Then, model simulations allowed to verify that it is possible to enhance irrigation water use efficiency by increasing the frequency of irrigation even maintaining limited water deficit conditions during the full development stage subsequent the crop tuberization. Experimental results, joined to model simulations can therefore provide useful guidelines for a more sustainable use of irrigation water in countries characterised by semi-arid environments and limited availability of water resources.