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Effects of different on-farm management on yield and water use efficiency of Potato crop cultivated in semiarid environments under subsurface drip irrigation

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In Tunisia the amount of water for irrigated agriculture is higher than about 80% of the total resource.The increasing population and the rising food demand, associated to the negative effects of climate change,make it crucial to adopt strategies aiming to improve water use efficiency (WUE). Moreover, the absence of an effective public policy for water management amplifies the imbalance between water supply and its demand. Despite improved irrigation technologies can enhance the efficiency of water distribution systems, to achieve environmental goals it is also necessaryto identify on-farm management strategies accounting for actual crop water requirement.
The main objective of the paper was to assess the effects of different on-farm managementstrategies (irrigation scheduling and planting date) on yield and water use efficiency of Potato crop (Solanumtuberosum L.) irrigated with a subsurface drip system, under the semi-arid climate of central Tunisia.
Experiments were carried out during three growing seasons (2012, 2014 and 2015) at the High Agronomic Institute of ChottMariem in Sousse, by considering different planting dates and irrigation depths, the latter scheduled according to the climate observed during the season. All the considered treatments received the same pesticide and fertilizer management.
Experiments evidenced that the climatic variability characterizing the examined seasons (photoperiod, solar radiation and average temperature) affects considerably the crop phenological stages, and the late sowing shortens the crop cycle.It has also been demonstrated that Leaf Area Index (LAI) and crop yield resulted relatively higher for those treatments receiving larger amounts of seasonal water. Crop yield varied between 16.3 t/ha and 39.1 t/ha, with a trend linearly related to the ratio between the seasonal amount of water supplied (Irrigation, I and Precipitation, P) and the maximum crop evapotranspiration (ETm). The maximum crop yield was in particular obtained for a value of this ratio equal to 1.45. Moreover, when increasing the seasonal pluviometric deficit (P-ETm) and therefore the irrigation depth (I), standard deviations of crop yield tended to decrease, as a consequence ofthe more uniform soil water content in the root zone.
In terms of agronomic water use efficiency (AWUE),differences among the investigated treatments varied in a quite narrow range,due to thecombined effects of seasonal precipitation and atmospheric water demand on irrigation depths and crop yield.On the other hand, when considering irrigation water use efficiency (IWUE), more relevant differences between treatments were observed,being the higher values of IWUEgenerally associated to the lower irrigation depths. However, to define the best irrigation management strategy it is necessary, from one side, to consider the availability of water and from the other, to perform aneconomic analysis accounting for the cost of water and the related benefits achievable by the farmer.