

RATIONALIZATION OF WATER CONSUMPTION OF TOMATO PLANTS GROWN UNDER SANDY SOIL CONDITIONS

By

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B. Sc. Agric. Sc. (Horticulture), Ain Shams University, 2001

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ABSTRACT

Sameh Mohamed Mohamed El-Sawy: Rationalization of Water Consumption of Tomato Plants Grown Under Sandy Soil Conditions. Unpublished Ph. D. Thesis, Department of Horticulture, Faculty of Agriculture, Ain Shams University, 2016.

Field experiment was carried out during the two growing seasons of 2012/2013 and 2013/2014, in a private farm at Bani Salama region, El-Giza Governorate, Egypt, in order to investigate the effect of deficit irrigation (DI) treatments (100% (control), 85%, 70% and 55% of ET_o (Reference evapotranspiration)), irrigation systems (surface drip irrigation (SDI) and subsurface drip irrigation (SSDI) (with 20cm soil depth)) and foliar application of glycine betaine concentrations (GB) (at 0, 5, 10 and 20 mM/l, applied after 2 and 6 weeks from transplanting date), on vegetative growth, fruit yield and quality of tomato plants (Marwa hybrid) grown under sandy soil conditions.

Results indicated that DI treatments (85%, 70% and 55% of ET_o) significantly decreased the vegetative growth (plant length, number of leaves per plant, total leaves area per plant and fresh and dry weights of tomato leaves per plant), flowering (number of flowers, number of clusters per plant) and fruit yield (number of fruits per plant and total marketable yield) parameters for tomato plants. Where, the highest significant values were obtained by the full irrigation treatment 100% ET_o (control) and the lowest values were noticed with 55% ET_o treatment. Similarly, photosynthetic pigments (chlorophyll a, chlorophyll b and carotenoids), leaf relative water content (LRWC), membrane stability index (MSI), leaves mineral content parameters were reduced with decreasing irrigation water levels. In contrast, there were positive effects on proline content of tomato leaf and some fruit quality characteristics (TSS, total sugars, ascorbic acid content and titratable acidity) for tomatoes, as well as on irrigation water use efficiency (IWUE).

Subsurface drip irrigation system produced the highest significant values for vegetative growth, flowering and fruit yield and quality

parameters, compared to SDI system, as well as the highest significant values for LRWC, MSI and IWUE were observed with SSDI system in the both tested seasons. Results showed that when DI treatments (85%, 70% and 55% ET_o) decreased total marketable yield by (16.05%, 26.73% and 46.61%) and (16.01%, 27.29% and 46.96%), while SSDI system positively increased it by (4.31% and 4.85% and 4.38%) and (2.49%, and 5.54% and 5.80%), in the first and second seasons, respectively.

Foliar application of GB at 10 mM/l ameliorated the negative effects of water stress and produced the highest significant values of vegetative growth, flowering parameters, photosynthetic pigments, LRWC and MSI in the both studied seasons. While, there were no significant differences were realized among the GB treatments on the most of fruit quality characteristics. Results reported that, When DI treatments (85%, 70% and 55% ET_o) decreased total marketable yield by (14.38%, 25.08% and 48.77%) and (14.23%, 24.78% and 47.03%), the foliar application of glycine betaine (at 10 mM/l) increased it by (10.95%, 10.11% and 22.85%) and (12.92%, 9.26% and 20.74%), in the first and second seasons, respectively.

The interaction among DI treatments, irrigation systems (IS) and foliar application of GB illustrated that tomato plants were irrigated by 100% and 85% ET_o with SSDI system and foliar application of GB at 10 mM/l had the highest significant values for vegetative growth, flowering and fruit yield and quality of tomato plants under open field conditions. It was also concluded that the vegetative growth and fruit yield as well as fruit quality of tomato plants which grown under DI conditions, can be enhanced by using SSDI system and foliar application of GB at 10 mM/l.

Key words: Tomato, Deficit irrigation, Irrigation systems, Subsurface drip irrigation, Glycine betaine, Yield, Fruit quality, IWUE, LRWC, MSI.

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