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Response of leaf photosynthesis, chlorophyll content and yield of hydroponic tomatoes to different water salinity levels

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Abstract

Tomato (*Solanum lycopersicum* L.) is an important vegetable crop that grows easily under controlled conditions, such as in greenhouses and hydroponics. To overcome freshwater scarcity, researchers are searching for alternatives to groundwater sources such as desalinated water (saline water) for irrigation. High salinity in irrigation water alters physiological functions and crop development, thereby reducing the yield. Best management practices and the use of grafted tomato plants on salt-tolerant rootstocks can alleviate salinity stress. The present study was conducted to address the impact of salinity stress on leaf transpiration (Tr), stomatal conductance (gs), photosynthesis (Pn), leaf chlorophyll content, proline content, and yield of hydroponically cultivated tomato plants. Saline (NaCl) water was used for the preparation of nutrient solution with three salinity levels, electrical conductivity (EC, dS m^{-1}) of 2.5 (control), 6.0, and 9.5. Three commercial tomato cultivars (Valouro-RZ, Ghandora-F1, and Feisty-Red) were used. Both self-rooted plants and plants grafted onto Maxifort rootstocks were transplanted onto a perlite substrate. The recorded data revealed that all studied cultivars were critically affected by higher salinity (≈ 9.5 dS m^{-1}) compared to low (≈ 2.5 dS m^{-1}) and medium (≈ 6.0 dS m^{-1}) salinity levels. The Variations in Tr, Pn, gs, chlorophyll content of leaf, and yield between medium and high salinity trials were reported at 3%, 5%, 9%, 5%, and 7.1%, respectively, whereas no significant differences were observed between low and medium salinities. However, at medium salinity levels, grafted plants performed better in photosynthesis than non-grafted plants. This is due to the accumulation of leaf proline, which maintains osmotic regulation and photosynthetic activity by preventing cell damage at medium salinities. Hence, this study confirmed the use of saline water for growing tomatoes under hydroponic conditions up to an EC of 6.0 dS m^{-1} including the EC of nutrient fertilizers.