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Article

The Use of Spectral Vegetation Indices to Evaluate the Effect of Grafting and Salt Concentration on the Growth Performance of Different Tomato Varieties Grown Hydroponically

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Abstract: Water scarcity has prompted researchers to intensify studies on the optimal use of saline water in irrigating agricultural crops to improve the efficiency of exploiting available water resources. Therefore, this study aimed to use selected spectral vegetation indices to investigate the potential of grafting in mitigating the effect of salinity on the growth of tomato plants grown under a hydroponic system. Three commercial tomato cultivars (Forester-F1, Feisty-Red, and Ghandowra-F1,) and five tomato hybrid rootstocks (Beaufort, Maxifort, Dynafort, Unifort, and Vivifort) were investigated using nutrient solutions at three salinity levels, namely, 2.5 dS m^{-1} (S1, low salinity level), 6.0 dS m^{-1} (S2, medium salinity level), and 9.5 dS m^{-1} (S3, high salinity level). The results showed that Ghandowra-F1 had the best growth performance under hydroponics compared to the other two varieties. The increase in the salinity of the nutrient solution negatively affected the vegetation growth of tomato plants. Low and medium salinity did not show any significant effect on the three tomato varieties, unlike high salinity, which showed a significant negative effect on the vegetative growth of the plant. Thus, it is possible to successfully grow tomatoes in hydroponics using nutrient solutions with a salt concentration of up to 6.0 dS m^{-1}. Although there was a slight improvement in the vegetative growth of grafted tomato plants, all the studied rootstocks showed no significant differences compared to non-grafted tomato plants. This study could greatly contribute to strategies targeting the improvement of tomato production in hydroponics.

Keywords: hydroponics; spectroscopy; vegetation indices; tomato; grafting

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1. Introduction

Water scarcity and salinity are among the most important environmental factors that limit the expansion of agricultural production in arid and semi-arid regions such as Saudi Arabia. This has prompted researchers to intensify studies on the use of saline water in irrigation to increase the efficiency of using available water resources, as well as recycling wastewater, developing crops that tolerate high salinity, and adopting effective water management strategies. Furthermore, grafting plants onto rootstocks that are able to resist the effects of salinity on plant growth and health is also an effective way to reduce production losses due to salinity.