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Yield Response of Grafted and Self-Rooted Tomato Plants Grown Hydroponically under Varying Levels of Water Salinity

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Abstract: To overcome the scarcity of fresh water, researchers have turned to investigating different techniques that enable using saline water to irrigate crops, aiming to increase the efficiency of using available water resources. A glasshouse experiment was conducted to investigate the yield responses of grafted and non-grafted (self-rooted) tomato plants grown hydroponically under three levels of water salinity (2.5, 6.0, and 9.5 dS m^{-1}). Three tomato varieties (Ghandowra-F1, Forester-F1, and Feisty-Red) were grafted onto five rootstocks (Maxifort, Unifort, Dynafort, Vivifort, and Beaufort). The implemented treatments were studied in terms of tomato fruit yield and quality parameters. Although increasing the concentration of salts in the nutrient solution led to a decrease in fruit yield, the moderate salinity level (S-2: 6.0 dS m^{-1}) showed its superiority over both low salinity (S-1: 2.5 dS m^{-1}) and high salinity (S-3: 9.5 dS m^{-1}) in terms of tomato yield parameters. The studied rootstocks did not significantly improve the tomato fruit yield, but the interaction between the grafting combinations and salinity was significant for both production and quality. More specifically, tomato plants grafted onto the rootstocks "Vivifort and Beaufort" rendered the highest yield at a low salinity level (S-1: 2.5 dS m^{-1}) and a moderate salinity level (S-2: 6.0 dS m^{-1}), respectively, while at high salinity (S-3: 9.5 dS m^{-1}), grafting did not improve tomato productivity, irrespective of the rootstock. These results confirm that tomatoes can be successfully grown under hydroponic systems using salinity levels of up to 6.0 dS m^{-1} without sacrificing fruit yield and quality. Among the studied tomato varieties, Feisty-Red was found to be appropriate for hydroponic production. The results also demonstrated that Vivifort and Beaufort rootstocks are suitable for grafting hydroponic tomatoes under low and moderate salinity levels, respectively.

Keywords: hydroponics; tomatoes; salinity; grafting; rootstocks

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1. Introduction

Since salinity and water scarcity are among the main environmental factors that hinder agricultural production in the Kingdom of Saudi Arabia, it has become necessary to investigate the possibility of using saline water in irrigating crops to increase the efficiency of using the available water resources. In this regard, numerous studies have proven the effectiveness of using saline water to irrigate selected crops under specific conditions [1]. The proper use of saline water and the recycling of wastewater, in addition to developing crops with a high ability to tolerate salt, as well as adopting effective water management strategies, are effective practices to increase the amounts of water available for irrigation purposes. Furthermore, another way to reduce production losses in high-yielding crops due to salinity is to graft them onto rootstocks capable of resisting the effect of salinity on plant growth and production [2].

Although grafting aims to reduce the negative effects of various abiotic stresses, salinity stress is given the top priority because it negatively affects the physiological and