Journal of King Saud University – Science 35 (2023) 102515

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Contents lists available at ScienceDirect

Journal of King Saud University – Science

journal homepage: www.sciencedirect.com

Original article

Impact of water salinity levels on the spectral behavior and yield of tomatoes in hydroponics

ElKamil Tola [a], Khalid A. Al-Gaadi [a,b], Rangaswamy Madugundu [a,*], Virupakshagouda C. Patil [c], Nikolaos Sygrimis [d]

[a] Precision Agriculture Research Chair, Deanship of Scientific Research, King Saud University, Riyadh 11451, Saudi Arabia
[b] Department of Agricultural Engineering, College of Food and Agriculture Sciences, King Saud University, Riyadh 11451, Saudi Arabia
[c] K.J. Somaiya Institute of Applied Agricultural Research, Sameerwadi, Karnataka 587316, India
[d] Department of Natural Resources Management and Agricultural Engineering, Agricultural University of Athens, Athens 11855, Greece

ARTICLE INFO

Article history:
Received 28 September 2022
Revised 17 November 2022
Accepted 15 December 2022
Available online 26 December 2022

Keywords:
Hydroponics
Electromagnetic spectrum
Spectral reflectance
Salinity
Grafting

ABSTRACT

In Saudi Arabia, irrigation water is mainly obtained from aquifers and is mostly characterized by moderate to high levels of salinity. Hence, detailed information on crop response to salinity is of great importance in order to optimize irrigation and fertilizer management. Therefore, this study was conducted to evaluate the effect of salinity and grafting on the spectral behavior and yield of three tomato (*Solanum lycopersicum*) cultivars (Valouro-RZ, Ghandowra-F1 and Feisty-Red) grown in a hydroponic glass greenhouse. Three salinity levels (2.5, 6.0 and 9.5 dS m^{-1}) were used in this study. For the three tomato cultivars, the increase in salinity level was associated with an increase in the spectral reflectance in the Visible, Red-Edge and NIR regions of the electromagnetic spectrum. However, Valouro-RZ and Feisty-Red cultivars showed no significant differences in the spectral reflectance in the Visible range between salinity1 (2.5 dS m^{-1}) and salinity2 (6.0 dS m^{-1}). Slight reduction, but not significant, in the total fruit yield was recorded under salinity2 compared to salinity1 (2.5 dS m^{-1}) for Valouro-RZ (6.76%) and Feisty-Red (6.79%). For salinity3 (9.5 dS m^{-1}), significant reductions in total fruit yield were recorded compared to salinity1 (Valouro-RZ: 31.77%, Feisty-Red: 33.53%). Ghandowra-F1 cultivar was found to be the most salt tolerant among the studied tomato cultivars, where a significant reduction was observed in the total fruit yield only when the salinity increased from 2.5 to 6.0 dS m^{-1} (10.85%) and 9.5 dS m^{-1} (30.63%). Grafting on Maxifort rootstock showed neither a significant effect on the spectral response nor a significant yield improvement; hence, no positive change in salinity tolerance, due to grafting, of the studied tomato cultivars. Therefore, further research on rootstock and fruit variant combinations for the feasibility of grafting for salinity tolerance is necessary. The results of this study indicated that the Valouro-RZ and Feisty-Red tomato cultivars could be grown successfully under a hydroponic system using irrigation water of up to 6.0 dS m^{-1} salt concentration without sacrificing the total fruit yield while taste may improve.

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1. Introduction

The Kingdom of Saudi Arabia (KSA) is located in a very harsh natural desert environment without rivers or lakes with an average annual rainfall of <100 mm, which results in a severe water shortage in the country (Ouda, 2013). The rapid development in the KSA during the last two decades, in addition to the high living standards of the population, have led to drastic changes in the water needs of irrigated agriculture, which consumed about 88 % of the available water (Gabr et al., 2020). However, the high rate of depletion of aquifers has forced the KSA to phase out the production of water-intensive crops, and strongly encourage crop production under controlled environment (e.g. greenhouse farming). Other effective strategies, to face the scarcity of good quality water, include all agricultural practices to make use of available resources, such as using saline water to irrigate crops (Alomran et al., 2012).

* Corresponding author.
E-mail address: rmadugundu@ksu.edu.sa (R. Madugundu).

Peer review under responsibility of King Saud University.

Production and hosting by Elsevier

https://doi.org/10.1016/j.jksus.2022.102515
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