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Spectral Monitoring of Salinity Stress in Hydroponics Tomato Plants

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Abstract

In Saudi Arabia, irrigation water is mainly obtained from aquifers and is mostly characterized by moderate to high levels of salinity. Hence, information on crop response to salinity stress is of great importance for optimal irrigation and fertilizer management. The most common methods used to assess instantaneous plant stress states are physiological or laboratory measurements, but they may be costly, destructive, and time-consuming. One rapidly developing alternative method for detecting plant stress is spectroscopy, which relies on light energy absorbed by plants. Therefore, this study was conducted to investigate the response of hydroponics tomato plants to salinity stress using spectroscopy. The growth performance of three tomato (*Solanum lycopersicum*) cultivars (Valouro-RZ, Ghandowra-F1 and Feisty-Red), grown in a hydroponic glass greenhouse, was examined under three salinity levels (2.5, 6.0 and 9.5 dS m^{-1}). Although 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, 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 statistically significant, in the total tomato fruit yield was recorded under salinity2 compared to salinity1 (2.5 dS m^{-1}) for Valouro-RZ (6.76%) and Feisty-Red (6.79%). The results of this study indicated that the Valouro-RZ and Feisty-Red tomato cultivars can be successfully grown under hydroponics using irrigation water of up to 6.0 dS m^{-1} salt concentration without sacrificing the total fruit yield.

Keywords: Electromagnetic spectrum, salinity stress, spectroscopy, tomato