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Abstract

Deficit irrigation water (DW) is one of the main stress factors that negatively affect cotton cultivation. Hence, the identification of cotton cultivars tolerant to DW and sandy soil conditions is particularly needed. Understanding the response of cultivars to DW is essential for estimating water needs. Besides, by understanding the physiological and antioxidant status, reflecting distinct growth, yield, and fiber quality traits under DW, the cultivar tolerant to DW can be identified in the early stage of plant growth. Therefore, two cotton cultivars (Giza 86 and Giza 92, selected for their suitability to the climatic conditions of the study area) were evaluated in this study under two DW regimes (80% or 60% of crop evapotranspiration; ET_c) vs. complete irrigation water (CW; 100% of ET_c as a control). These regimes amounted to 1228 or 922 vs. 1536 mm season⁻¹, respectively, for field trials conducted during the 2019 and 2020 summer seasons. DW (80% or 60% of ET_c) significantly decreased relative water content, membrane stability index, chlorophyll content, plant height, yield components, and fiber quality traits. Otherwise, phenolic compounds, proline contents, as well as antioxidant enzyme activities increased in concomitance with an increase in electrolyte leakage and malondialdehyde content. The harmful effects of the higher DW (60% of ET_c) were more pronounced in both cultivars. However, compared to Giza 86, Giza 92 showed higher performance under both CW and DW regimes, accounting for higher values for all studied traits in the blooming stage. The correlation coefficient showed that most of the physiological traits and antioxidants under study were effective criteria in identifying a high-yielding cultivar under DW in the cotton blooming stage and therefore can be used to select the cotton cultivar more

suitable for the conditions of the study area. Biplot analysis was used to study the relationship between DW and all evaluated traits, as it was found that the most prominent traits were elongation (%) with Giza 92 + 100% ETC, yellowness degree with Giza 86 + 100% ETC, and SOD with Giza 92 + 60% ETC.