Abstract

Water shortage and salinity are major challenges for sustaining global food security. Using nutrients in the nano-scale formulation including zinc oxide nanoparticles (ZnO NP) is a novel fertilization strategy for crops. In this study, two field-based trials were conducted during 2018 and 2019 to examine the influence of three ZnO NP concentrations (0, 50, and 100 ppm) in eggplant grown under full irrigation (100 of crop evapotranspiration; ETc) and drought stress (60% of ETc). Plant growth, yield, water productivity (WP), physiology, biochemistry, and anatomy responses were evaluated. Drought stress significantly decreased membrane stability index (MSI), relative water content (RWC), and photosynthetic efficiency, thus hampered eggplant growth and yield. In contrast, exogenous ZnO NP to water-stressed eggplant resulted in increased RWC and MSI associated with improved stem and leaf anatomical structures and enhanced photosynthetic efficiency. Under drought stress, supplementation of 50 and 100 ppm ZnO NP improved growth characteristics and increased fruit yield by 12.2 and 22.6%, respectively, compared with fully irrigated plants and non-applied ZnO NP. The highest water productivity (WP) was obtained when eggplant was irrigated with 60% ETc and foliarly treated with 50 or 100 ppm of ZnO NP, which led to 50.8-66.1% increases in WP when compared with non-treated fully irrigated plants. Collectively, these findings demonstrated that foliar spraying ZnO NP gives the utility for alleviating drought stress effects on eggplant cultivated in salt-alkalinity soil.