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**Selenium application in two methods promotes drought tolerance in *Solanum lycopersicum* plants by inducing the antioxidant defense system**

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**Abstract**

Selenium (Se) has been reported to mitigate abiotic stress effects on various plant species, including drought. This study aimed at exploring the potential impacts of Se applied at three levels (0, 20, and 40 mM) in two methods (soil addition or foliar spraying) on growth, yield and its quality, physio-biochemical attributes, and components of the antioxidant defense system in tomato plant growing under irrigation water deficit (from 100 % to 60 % of soil field capacity; SFC) during the 2017 and 2018 seasons. For the application of Se to soil, the concentration of Se in the tested soil was also evaluated at the end of the experiments, and the results obtained showed that Se concentration in the soil was significantly increased. Reducing irrigation water from 100 % to 60 % of SFC led to a marked increase in electrolyte leakage (EL) and oxidative stress biomarkers (malondialdehyde; MDA, hydrogen peroxide; H<sub>2</sub>O<sub>2</sub>, and superoxide; O<sub>2</sub><sup>•-</sup>), which associated with increased contents and activities of osmoprotectants and components (enzymatic and non-enzymatic) of the antioxidant defense system. In contrast, growth traits, relative water content (RWC), membrane stability index (MSI), photosynthetic efficiency, Se content, and yield and its fruit Se content were decreased in both seasons. Both 20 and 40 mM Se significantly increased contents and activities of osmoprotectants and components of the antioxidant defense system, which were reflected in reduced EL and oxidative stress biomarkers and increased growth traits, RWC, MSI, photosynthetic efficiency, Se content, and yield and its quality. Compared to foliar spray, better results were obtained with Se application to the soil. The interaction among the three factors; water deficit, Se level, and Se application method was significant. The combination of irrigation at 60 % of SFC × Se application at 40 mM × Se application to soil was preferable, which can be recommended for use to maximize tomato productivity and quality in the dry environment.