

## The effect of metallic selenium and nano on the physiological characteristics of tomato plants

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(Received: 11 March 2016 ; Accepted : 19 June 2017)

### Abstract

Selenium (Se) is an important microelement for plants and has been shown to improve growth under normal and stressed conditions. In this study, effect of Se and nano-selenium (N-Se) on hydroponically-grown tomato (*Lycopersicon esculentum* Mill. cv. 'Halil') on photosynthesis, antioxidant activity and total polyphenolic content was assessed. A factorial experiment with three temperature levels and Se and Nano Se level was designed. All plants were first exposed to Se or N-Se [Se at 0  $\mu\text{M}$  (control), 2.5  $\mu\text{M}$  (Se1), 5  $\mu\text{M}$  (Se2) and 8  $\mu\text{M}$  (Se3)], while N-Se was applied at four levels [1  $\mu\text{M}$  (N-Se1), 4  $\mu\text{M}$  (N-Se2), 8  $\mu\text{M}$  (N-Se3) and 12  $\mu\text{M}$  (N-Se4)]. Plants were exposed to three temperature levels [optimal temperature ( $25.17 \pm 2$  °C day/night = T1), high temperature (40 °C for 24 hr = T2) and low (chilling) temperature (10 °C for 24 hr = T3)]. They were then placed at normal temperature conditions for 7 days and photosynthetic and antioxidant factors were measured. Based on the results, both temperature-related stresses had negative effect on tomato growth. However, under high temperature stress, photosynthetic rate, mesophyll conductance and photosynthetic water use efficiency improved significantly. While, cold stress significantly enhanced transpiration. Most photosynthetic parameters could be improved in the presence of Se and N-Se. In Se1 treatment, under the temperature stress, the best photosynthetic rate, respiration and mesophyll conductance were obtained and plant resistance was enhanced. In N-Se treatments, N-Se1 had the best results of photosynthetic rate, antioxidant and phenol. However, in the absence of stress, the use of Se or N-Se, especially at higher concentrations (i.e., 5 and 8  $\mu\text{M}$ ), negatively impacted photosynthetic rate, internal CO<sub>2</sub> of stomata, mesophyll conductance and photosynthetic water use efficiency. In general, under the low and high temperature stress, the physiological parameters of tomato were improved in N-Se1 treatment.

**Keywords:** Low and high temperature stress, Photosynthetic attributes, Selenium, Nano-Selenium.

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