OP339

The Ameliorative Effects of Potassium applications on Tomato Plants Growing under Heavy Metal Stress

Mahmut YILDIZTEKİN[1], Atilla Levent TUNA[2], Sultan KÖŞKEROĞLU[2]
[1]Department of Herbal and Animal Production, Koycegiz Vocational School, Muğla Sıtkı Kocman University, Mugla, Turkey
[2]Department of Biology/Graduate School of Natural and Applied Sciences, Mugla Sıtkı Kocman University, Mugla, Turkey
* mahmutyildiztekin@mu.edu.tr

Aim of the study: The major objectives of our study were to determine the interactive efficiency of potassium treatments in restoring the metabolic alterations resulting from heavy metal stress in tomato plants.

Material and Methods: The experiment with tomato (*Lycopersicum esculentum* Mill.) was conducted under glasshouse conditions in Mugla (Turkey) from the middle of February to the middle of June 2011. Seedlings were planted in a mixture of sand and peat in (1:1, v/v) ratio to directly 5 L plastic pots and manually irrigated every other day with a nutrient solution.
On day 14, heavy metal and potassium treatments were initiated by watering Hoagland's nutrient solution containing defined concentration of heavy metals and potassium to seedlings. The basic nutrient solution used in this experiment was a modified Hoagland and Arnon formulation. Heavy metal treatments consisted of $CuSO_4.5H_2O$, $ZnSO_4.7H_2O$, $CdCl_2.H_2O$, $Pb(NO_3)_2$ and $MnSO_4.H_2O$ introduced separately. In the experiment, the treatments consisted of Cu at 250 µM; Zn at 250 µM; Cd at 25 µM; Pb at 250 µM; Mn at 250 µM, the treatments of mentioned metals combined with K (as KNO_3:20mM) and a control comprising nutrient solution without any heavy metals. Each treatment was replicated three times in a randomized block design and each replicate included 3 plants (i.e., 9 plants per treatment). In all of the analyses, leaves were sampled from the mid section of each plant in order to minimize age effect. After three weeks of treatments, leaves were collected. Fresh leaves were analysed for total chlorophyll (TCh), carotenoids, dry-weight (DW), Membrane permeability (EC), relative water content (RWC), proline, malondialdehyde (MDA), superoxide dismutase (SOD), peroxidase (POD), catalase (CAT),hydrogen peroxide (H_2O_2).

Results: All heavy metal treatments caused significant decrease in relative water content and DW% of leaves. The applications of fertilizers with potassium alleviated this adverse effect by increasing leaf relative water content and dry weight under stress conditions. Moreover, K applications significantly ameliorated the photosynthetic pigments concentration under heavy metal stress. All treatments also caused an increase of antioxidative enzyme activities (SOD, POD and CAT), but the application of Zn+K resulted in considerably higher enzyme activities as compared to those plants irrigated with other treatments. Additionally, highest proline content of tomato leaves was found after the treatment of Pb (57.91 nmol g^{-1} FW), while least increase was observed in the Mn+K treated samples (38.63 nmol g^{-1} FW). According to control, Cd+K (14.05 nmol g^{-1} FW) treated samples showed highest value in MDA levels while least value was shown by Mn+K (7.84 nmol g^{-1} FW) treated samples.

Keywords: Antioxidative enzymes, *L. esculentum*, potassium nitrate, heavy metal, proline.