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The influence of heavy metalions on proline accumulation and resistance of plants to saline stress

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Various biotic and abiotic factors negatively affect plant growth as well as physiological and biochemical processes. It is known that salinity and the high concentration of heavy metals can be a cause of oxidative stress and metabolic malfunctions which in turn significantly reduce the yield of crops.

Molybdenum (Mo) is one of the required microelements for plants since it is included in the active center of various enzymes involved in redox reactions, as well as its low concentrations play a significant role in the growth and development of plants. The activity of Mo-enzymes can be inhibited by substitution of molybdenum by tungsten (W) in the active center of Mo-protein complexes, since they are analogues belonging to the VI group in the periodic table of elements.

We used molybdenum and tungsten-containing solutions to study the effect of heavy metals on the barley. We observed that the stems germination and the growth of the root system improved at the low concentration of Mo, whereas at the low concentration of W the growth of the root system significantly decreased with slight changes in the germination. Deterioration in the root system and the decline of stem growth were found at high concentrations of Mo. A completely negative effect was revealed when plants were grown at a similar concentration of W. Another type of stress was salinity, during which germination significantly decreased, compared with control plants. Interestingly, a combination of these stresses demonstrated positive effect on plant growth in general. We also studied an accumulation of proline, which is a well-known osmoprotector, during above mentioned combined stress. Proline is one of the most multifunctional stress metabolites of plants, performing chaperone, antioxidant and signal-regulatory role. It was found that under the influence of abiotic stresses on plants, the concentration of proline increased significantly.