The significance of sulfur nutrition and metabolism in the detoxification of excessive levels of copper, zinc and molybdenum in plants

Luit J. De Kok, Mariana I.F. Neves, Dharmendra H. Prajapati, Muhammad Shahbaz, Tahereh Aghajanzadeh and C. Elisabeth E. Stuiver

Laboratory of Plant Physiology, Groningen Institute for Evolutionary Life Sciences, University of Groningen, P.O. Box 11103, 9700 CC Groningen, The Netherlands, l.j.de.kok@rug.nl

Copper, zinc, manganese and molybdenum are essential plant nutrients, however, elevated concentrations of these metals in the root environment are potentially phytotoxic and may disturb metabolic functioning and plant biomass production. The primary cause of their phytotoxicity is still largely unresolved. Exposure of plants to excessive levels of toxic metals may interfere with the regulation of uptake, reduction and assimilation of sulfur in plants. They might compete with the uptake and reduction of sulfate (e.g. MoO_4^{2-}) or react with sulfur metabolites and/or induce the formation of sulfur-rich proteins and peptides (e.g. Cu^{2+}, Zn^{+}), which might be involved in metal sequestration in order to avoid disturbance of cellular homeostasis of these metals. The impact of elevated Cu^{2+}, Mn^{2+}, MoO_4^{2-} and Zn^{2+} concentrations in the root environment on physiological functioning and uptake, distribution, reduction and assimilation of sulfur was studied in detail in Brassicaceae. This in order to get more insight into the physiological background of the toxicity of high tissue levels of these essential metals, and the significance of sulfur nutrition and metabolism in their detoxification.