Geophysical Research Abstracts
Vol. 19, EGU2017-6245, 2017
EGU General Assembly 2017

pH-dependent phytoavailability and speciation of tungsten (W) in soil affecting growth and N nutrition of soy (Glycine max)

Eva Oburger (1,2), Carolina Vergara Cid (2,3), Julian Preiner (2,4), Junjian Hu (5), Stephan Hann (5), Wolfgang Wanek (1), and Andreas Richter (1)

(1) University of Vienna, Division of Terrestrial Ecosystem Research, Deparment of Microbiology and Ecosystem Scienece, Austria (eva.oburger@univie.ac.at), (2) University of Natural Resources and Life Sciences, Department of Forest and Soil Sciences, Institute of Soil Research, Tulln, Austria, (3) National University of Córdoba, Faculty of Physical and Natural Sciences, Multidisciplinary Institute of Plant Biology, Pollution and Bioindicator Section, Córdoba, Argentina. , (4) University of Vienna, Department of Ecogenomics and Systems Biology, Vienna, Austria, (5) University of Natural Resources and Life Sciences, Department of Chemistry, Vienna, Austria

Tungsten (W) is an economically important transition metal that finds a broad scope of applications ranging from household appliances to high-end technology goods. However, in the past decades, increasing industrial and military use of W-based products (particularly ammunition, as well as drilling, milling and cutting tools) opened new pathways of W into natural systems and raise the need for a better understanding of the behavior of W in the environment. Soils play an important role in controlling the bioavailability of pollutants and their entry into the food web via plant uptake as they serve as filter and buffer systems. However, compared to other trace metals, knowledge about the fate of W in the plant-soil environment is rather sketchy. The chemical alikeness of W and molybdenum (Mo) suggests not only similar, typical anionic behaviour in soil but also a potential negative effect of W on important plant physiological processes that require Mo. We examined how soil pH dependent solubility and W speciation affected biomass production, W and nutrient uptake by soy (Glycine max cv Primus) and the activity of molybdoenzymes involved in N assimilation (nitrate reductase) and symbiotic N2 fixation (nitrogenase). Increased solubility of mainly monomeric W in high pH soils resulted in increased W plant uptake, demonstrating a greater risk of entry of W into the food web in alkaline soils. Symbiotic nitrogen fixation was able to compensate for reduced nitrate reductase activity until W soil solution concentrations became too phytotoxic, indicating a more efficient detoxification/compartmentalization mechanism in nodules than in soy leaves. The increasing presence of polymeric W species observed in low pH soils spiked with high W concentrations resulted in decreased W uptake but simultaneously had an overall negative effect on nutrient assimilation and plant growth, suggesting a greater phytotoxicity of W polymers. Our results demonstrate the importance of soil pH for the toxicological behaviour of W in the plant-soil environment, which has been completely ignored in the past.