Carbon allocation to ectomycorrhizal fungi and bacteria colonising granite

FAHAD Z, MAHMOOD S AND FINLAY RD

Department of Forest Mycology and Plant Pathology, Uppsala BioCenter, Swedish Univ. Agricultural Sciences, Uppsala, SE-75000, Sweden (*correspondence: zaenab.fahad@slu.se)

Ectomycorrhizal fungi have been postulated to mobilize essential plant nutrients directly from minerals through organic acid exudation. [1].

Laboratory microcosms were used to study mycorrhizal mycelial colonisation of granite substrate, release of organic acids, mobilisation of mineral elements and their uptake by *Pinus sylvestris* seedlings under two levels of N deposition. The effects of the mycelium were assessed by comparison with control treatments in which the mycelium was physically disrupted. Patterns of carbon allocation to different microbial taxa colonising the granite were assessed using stable isotope probing.

Colonisation of granite substrate by ectomycorrhizal mycelium resulted in significant production of organic acids after 12 weeks in comparison with uncolonised granite controls. After 24 weeks lower concentrations of a wider spectrum of organic acids were found in the treatment with intact mycelia. Significantly greater concentrations of Fe and Mn were found in the soil solution in mycelium-colonised compartments than those not colonized by mycelium, but no statistically significant effects were found on concentrations of other elements, or on plant biomass.

[1] Finlay RD et al., (2009). *Fungal Biology Reviews* **23**: 101-106.

Energy crop production on mining and smelting impacted arable land - A non-phytoremediation approach

W. FAHLBUSCH*, B. SAUER AND H. RUPPERT

Geosciences Center & Interdisciplinary Center for Sustainable Development, University of Goettingen, Goldschmidtstr. 1, D- 37077 Göttingen, Germany (*correspondence: wfahlbu@gwdg.de)

Up to 10% of the arable land in Germany is potentially contaminated by heavy metals [1]. These areas comprise flood plains of rivers, industrialized areas and also soils in the vicinity of smelter facilities e.g. in the Harz Mountains in Germany, where sulfidic polymetallic ores were mined and processed for at least 2000 years. This mining impacted land faces contamination with several elements (As, Cd, Cu, Pb, Sb, Tl, Zn). Conventional remediation techniques like excavation of the soil are often not economic. The removal of the toxic elements with hyperaccumulating plants (phytoremediation) is also not satisfying because of their commonly low yield. It would take thousands of years to reach acceptable low contamination levels.

Instead of phytoremediation we recommend to produce high yield crops with low uptake of heavy metals to leave the pollutants in the soil. The plants can be used in biogas facilities. To identify crops with a low metal uptake we measured plant and soil concentrations and the mobile/ exchangeable fraction of heavy metals in a variety of polluted soils. An unpolluted soil was used as a reference. Soil material adhering to crops was mathematically corrected using titanium in the soil as a reference element [1].

These low contaminated crops can be used for biogas generation in fermentation facilities without impairing the gas output. Furthermore, the residues of the biogas production can be returned as organic fertilizer to the fields where the plants were harvested. All important nutrients are recycled back to the fields (except nitrogen) and the maximum permissible values for heavy metal in farm fertilisers can be abided. Energy crops with a low uptake of cadmium are for instance the maize cultivar Padrino, the rye cultivar Vitallo and the barley cultivar Christelle. In contrast, amaranth, sunflower and the energy beet Kyros should not be cultivated on contaminated soils for bioenergy production due to their high cadmium uptake [1].

[1] Sauer *et al* (2013) *Bioenergy Production as an Option for Polluted Soils – A Non-phytoremediation Approach*. In Ruppert *et al* (Eds.): Sustainable Bioenergy Production - An Integrated Approach. Chapter 14, Springer, Dordrecht, (in print).

DOI:10.1180/minmag.2013.077.5.6