



The influence of arbuscular mycorrhizae on root precision nutrient foraging of two pioneer plant species during early reclamation

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The influence of arbuscular mycorrhizae on root precision nutrient foraging of two pioneer plant species during early reclamation

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Abstract

On many post mining sites in the Lusatian Mining District (East Germany) soil heterogeneity consists of sandy soil with embedded clay-silt fragments. Those clays silt fragments might act as nutrient hotspots. Arbuscular mycorrhizal fungi in an infertile ecosystem could enhance a plant's ability to selectively forage for those nutrients and thus to improve plants nutrient supply. In our study we investigated whether silt-clay fragments within a sandy soil matrix induced preferential root growth of *Lotus corniculatus* and *Calamagrostis epigeios*, whether arbuscular mycorrhizae influenced root foraging patterns, and to what extent selective rooting in clay silt fragments influenced plant growth were addressed in this research. Soil types were sterile and non-sterile sandy soil and clay-silt fragments. Treatments were with and without arbuscular mycorrhizae, with and without soil solution, and soil solution and mycorrhizal inoculum combined. Root biomass, root density and intraradical fungal alkaline phosphatase activity and frequency were determined in fragments relative to sandy soil. Furthermore, temporal relationship of number of roots in fragments and plant height was assessed. *Lotus corniculatus* showed strong selective rooting into fragments especially with those plants treated with commercial cultivated arbuscular mycorrhizae; *Calamagrostis epigeios* did not. Without arbuscular mycorrhizae, *L. corniculatus* growth was significantly reduced and selective rooting did not occur. Selective rooting induced significant growth spurts of *L. corniculatus*. Roots in fragments had higher fungal alkaline phosphatase activity suggesting that mycorrhizal efficiency and related plants phosphorus supply is enhanced in roots in fragments.

The application of cultivated arbuscular mycorrhizal fungi significantly and quickly influenced root foraging patterns, especially those of *L. corniculatus*, suggesting mycorrhizae may also enhance the ability of other plants to selectively forage for nutrients and could therefore play an important role in early plant establishment on infertile reclamation sites.