Multi-modal Imaging of Plant-microbe Interactions in the Pine Rhizosphere

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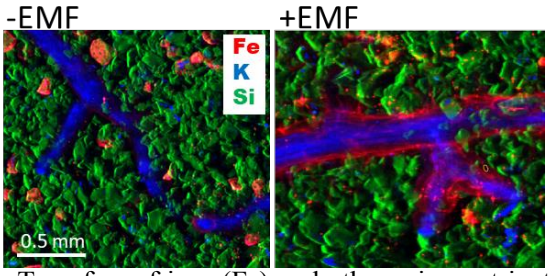

Transfers of iron (Fe) and other micronutrients (e.g., Zn, Cu, Mn) from the soil to the plant root by ectomycorrhizal fungi (EMF) is a critical process in the rhizosphere that enhances primary productivity on marginal soils and influences production cost of biofeedstocks. Our experiment with *Pinus-Suillus* seeks explicit quantification of the (micro)nutrient dynamics across the plant-mycorrhiza-soil interface with the goal of establishing the role of ectomycorrhizal symbiosis in iron acquisition. Microcosms were planted with sand culture supplemented with "point sources" of iron (ferrihydrite coated sand). Live-plant X-ray fluorescence imaging revealed differences between +EMF and -EMF treatments. Microcosms without host-specific EMF contained predominantly unaltered grains of iron-coated sand following 2 months growth while those with EMF contained severely altered grains that had largely 'disintegrated', and roots had fungal sheath enriched with iron. Spatially-resolved X-ray absorption spectroscopy identified an Fe(III) organometallic complex associated with the fungal sheath. Morphological changes to roots were visibly evident for EMF treatments. Attenuation-based neutron radiography and tomography are underway to characterize root architecture and foraging behavior (+Fe/-Fe) in marginal soil.

This abstract is too long to be accepted for publication. Please revise it so that it fits into the column on one page.

Alternate title:
Biogeochemical alteration of iron in the pine (mycor)rhizosphere