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Phosphorus Uptake Patterns of Norway spruce (Picea abies) Seedlings from Different P-loaded Minerals in a Laboratory Pot Experiment with Silicate Soils

Dingzhu Liao, Luis Carlos Colocho Hurtarte, and Jörg Prietzel
Technical University of Munich, Freising, Germany (ga84rir@mytum.de)

Phosphorus (P) deficiency is becoming a worldwide challenge since it is one of the most common limiting elements to primary productivity and other biological processes in terrestrial ecosystems. P limitation is caused not only due to P resource shortage, but also because of its association with secondary minerals, particularly aluminium and iron. However, plants can thrive in P deficient environment through different strategies. In this study, we aim to investigate the interactions between different initial P species and plants based on a laboratory pot experiment with artificial silicate soils. We prepared both inorganic and organic-P-loaded silicate soils consisting of either ferrihydrite (FH), Al-saturated montmorillonite (Al-MT) or the mixture of FH and Al-MT in a quartz matrix. Mycorrhized Picea abies seedlings were grown in those pots for four months under controlled conditions. At the end of the experiment we analysed the soil physical-chemical parameters (pH,), and above and belowground nutrient concentration. Our results show that soil pH, inorganic phosphorus, carbon and nitrogen concentration were all significantly increased by plant cultivation. Moreover, plants grown in inorganic-P loaded soils had a significantly higher shoot biomass and P content than those in organic-P loaded soils. The mineralogy also affected plant growth, as plants grown under FH loaded soils had a higher total biomass (shoot and root biomass) than those grown on other mineralogy. The P content of both shoot and root of Al-MT loaded soils was the highest among the three types of minerals. In conclusion, plant growth was affected by initial P speciation and soil mineralogy, but also plants presence affected the overall soil physical-chemistry, thus increased P desorption and modified P speciation.