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Phosphorus kinetics in reclaimed lignite mine soils under short rotation coppices in NE Germany

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In Germany, the establishment of short rotation coppices (SRC) for production of woody chips for bioenergy increased considerably during the last years. In recultivation of mining sites one of the widely used fast growing tree species is black locust (*Robinia pseudoacacia* L.). As a fast growing tree it can be used for biomass and bioenergy production as well as can improve soil quality. The phosphorus (P) dynamics in new *R. pseudoacacia* forest stands would be a reletionship between the tree's ability to extract P from soil and the soil's ability to supply P in bioavailable form. The objectives of our work were to evaluate the influence of SRC on the P sorption capacities in post lignite mining soils and to investigate the soil total organic P (P_{org}) and plant available P under different development stages of *R. pseudoacacia*. In the presented sorption experiment, P solutions were reacting with the soil for a specific period after which the concentration in the solution was measured and the amount of sorption was calculated. The post-lignite mine soils with sandy overburden substrate were sampled at three different depths: 0-3, 3-10 and 10-30 cm from different rotation stages of *R. pseudoacacia*: 2-, 3-, 4-, and 14-years old plantation (R2, R3, R4, and R14, respectively). The results showed that in the topsoil P sorption capacities were higher. The oldest site R14 showed the highest sorption capacity, removing ca. 80 mg P kg^{-1} and the lowest sorption was found for the R2/R3 site ca. 25 mg P kg^{-1}. The amount of P_{org} in the soil increased with increasing age of *R. pseudoacacia* in all layers ($P<0.01$). In the topsoil layer P_{org} ranged from 17.7 to 85.5 mg kg^{-1} at R2 and R14, respectively. The same trend was noticed as well for soil total P (STP) content. The highest STP at all depths was for R14 site and ranged from 102 to 129 mg kg^{-1}. Moreover, the increasing age was found to promote an increase in the available P, as the largest fraction was measured in the oldest forest stand – R14 (8.03 mg kg^{-1}). However, the amounts of available P were very low compared to the recommended amounts in soils for normal plant growth. The results suggest that 14 years of *R. pseudoacacia* cultivation on post mining sites have a positive influence on the P dynamics in the nutrient poor soils. Nevertheless more research is needed on the long-term effects of SRC.