

Time-dependent phosphate dynamics in reclaimed lignite-mine soils under *Robinia pseudoacacia* L.

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As a consequence of the opencast lignite mining activities in Lusatia/Germany, the cultivation of Short Rotation Coppice plantations (SRC) has been considered as a viable option for reclamation purposes. In this region an area of about 1000 km² has been degraded. Owing to the unfavourable biotic and abiotic properties of the overburden mining substrate, the biogeochemical processes associated with the soil ecosystem development are in the initial phase. The substrate contains very low amount of nutrients, mainly very low total Phosphate (P) content nearly equal to zero. The lack of P is one of the main issues in reclamation of this marginal site. Therefore, the cultivation of perennial SRC with *Robinia pseudoacacia* L. is considered as a supporting measurement for effective soil reclamation. In this context, it is important to understand the dynamics of P in this “initial substrate” to describe the P availability and P sorption/desorption.. Iron/aluminium oxides and organic matter are the soil constituents most strongly affecting the reactions and rate of P sorption and desorption, also in post-mining soils. Therefore the interaction of these oxides and organic matter with P is essential with regard to developing effective nutrient management strategies for marginal sites. The study focused on P sorption and desorption with regard to different development stages of *R. pseudoacacia* L. established in a short rotation coppices on the post mining soils. to describe the P availability (P_{av}) in relation to total P mobility. The hypothesis is that SRC would cause significant changes in soil P dynamics over time in post lignite mining soils. The trees has been planted in between 1995 and 2007, which means that *R. pseudoacacia* L. was in a range of 2 to 20 years old at different sampling times. Soil was sampled in 2008 and 2015 at three depths of: 0-3cm, 3-10 cm and 10-30 cm. To characterize the P dynamics different P forms and P sorption/desorption kinetics were analysed. With increasing age of trees the ratio of available P to total P decreased in tendency for all soil layers. The total P content increased slightly over time in all soil layers. But the amount of Fe and Al oxides increased also over time and therefore the overall P sorption capacity increased, too. Hence, the ratio between available P and total P shifted more to the less available forms of P in soil. Within a period of 20 years, *R. pseudoacacia* L. cultivation on post mining sites increased the contents of available P and total P, repectively. The P sorption increased with time of soil development showing the maximum at the oldest site. Nevertheless, P sorption of these initial post mining soils is still rather low. The results suggest, that the SRC of *R. pseudoacacia* L. on post mining sites have a positive influence on the P dynamics.

References

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