UNDERLYING MECHANISMS DRIVING EARTHWORM-INDUCED INCREASES IN PHOSPHORUS AVAILABILITY

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Phosphorus (P) is an essential nutrient for plant growth. Its availability for plant uptake is often a growth-limiting factor, as many soils are unable to supply it at a sufficient rate. Past fertilization practices have led to large quantities of "residual" soil P that are difficult to access by plants. With decreasing global P fertilizer reserves, it becomes essential to find new ways to make this residual soil P better available to crops. Recent studies by our group showed that P availability can considerably increase in earthworm casts, which might result in increased plant P uptake. However, the exact mechanisms through which this increase of available P occurs remain elusive. In a greenhouse pot experiment we tested whether the presence of the anecic earthworm *Lumbricus terrestris* in a soil with a low P availability resulted in an increase in growth and P uptake by Italian ryegrass (*Lolium multiflorum*) and studied the underlying mechanisms for such an effect. We found that *L. terrestris* significantly increased yield from 164 to 188 g dry matter m^{-2} ($p=0.044$) and P uptake from 0.21 to 0.27 g m^{-2} ($p=0.002$). We also collected earthworm casts and analysed them for water extractable P as well as for most other common ions. Concentrations of total dissolved P as well as dissolved inorganic P in earthworm casts were 7-9 times higher than in bulk soil. In a batch experiment, we showed that the pH increase in the casts (from 5.9 to 8.1) was not the main driver for the increase in P availability. We hypothesize that the main driver was competition for adsorption sites between orthophosphate and the elevated dissolved organic carbon concentrations in the casts. This hypothesis is tested using advanced surface complexation modelling (the CD model), and results will be discussed.