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Funktionelle Bedeutung von Mikroorganismengemeinschaften für die Stoffdynamik in Böden

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Hidden miners – The role of microorganisms under cover crops for phosphorus management

Abstract

Phosphorus (P) is a limiting and non-renewable nutrient for which improper management is becoming a threat to food security and an environmental hazard for aquatic ecosystems. Phosphorus is particularly difficult to manage as complex physicochemical processes in the soil leave most P unavailable for crop uptake. Cover crops are a promising tool of agronomic management, which may increase P availability for the following crops through various mechanisms, such as an overall extended root system, greater P mobilization via exudation of organic anions, enhanced P mineralization by phosphatase excretion and microbial interactions. Better understanding of plant-microbial interactions offer the possibility to unravel the potential of cover crops for P management. In the frame of the EU Horizon2020 Project SoilCare we present the results of two studies in SW Germany about P dynamics under cover crops. The first field experiment investigated the effects of cover crop mixtures and no-tillage in a field experiment in the research station Tachenhausen of Nuertingen-Geislingen University, the second one studied the effects of single cover crop species in a low-P field near Rottenburg. The samples were analyzed for PLFA/NLFA content, enzymatic activities (acid and alkaline phospho-monoesterases and phosphodiesterase) and microbial P. The results reveal significant effects of cover crop mixtures on soil microbes, increasing their abundance and activity, as well as shifts in the microbial community structure. The effects were more pronounced near the soil surface and were still detectable more than one year after cover cropping in winter wheat. The microbial abundance, including P_{mic} and the activity of several enzymes of the P cycle were strongly increased in the rhizosphere of the cover crops. The results indicate that, under optimized agronomic management, the use of cover crops and minimum tillage can have measurable positive effects on the cycling of P in temperate agroecosystems.