Tagungsnummer
P67

Thema
Kommission III: Bodenbiologie und Bodenökologie

Funktionelle Bedeutung von Mikroorganismengemeinschaften für die Stoffdynamik in Böden

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Titel
Release of phosphorus from soil bacterial and fungal biomass following drying/rewetting

Abstract
Previous work has shown that the drying/rewetting (D/W) of soils mobilizes phosphorus (P), and that the effect of D/W on P release likely depends on the soil microbial community composition. We tested the hypotheses that (i) P release after D/W from fungi is lower than from bacteria and that (ii) gram-positive bacteria are less susceptible to D/W than gram-negative bacteria. We investigated the release of dissolved organic (DOP) and inorganic phosphorus (DIP) from bacterial and fungal biomass after rewetting of an artificial soil that was desiccated to different degrees. For this purpose, sterilized soil amended with growth medium was inoculated separately with one of two bacterial strains (Pseudomonas fluorescens, gram-negative and Micrococcus luteus, gram-positive) or with one fungal strain (Penicillium chrysogenum). The bacterial strains were grown for 7 days, the fungus for 25 days at 50% soil water holding capacity. After the pre-incubation period, microbial biomass P (Pmic) was determined by chloroform fumigation extraction, and soils were desiccated at 20°C for 5 – 8 days until pF 6 (-100 MPa) was reached, while the controls were kept permanently at 50% water holding capacity. At different degrees of desiccation, samples were destructively harvested and soils were extracted with water to measure the release of DIP and DOP. The net release of total dissolved P per unit Pmic following D/W was in the order P. fluorescens >> M. luteus = P. chrysogenum. In case of P. fluorescens, net release started already after desiccation to pF 4 (-1.0 MPa) and increased with further desiccation. For M. luteus and P. chrysogenum, a tendency for net release was only observed after severe desiccation up to pF 6. Our results suggest that the effect of D/W on P release from microbial biomass depends largely on the microbial community composition, with fungi and gram-positive bacteria being less susceptible to D/W than gram-negative bacteria.