Tagungsnummer
V173

Thema
Kommission III: Bodenbiologie und Bodenökologie

Bodenorganismen-Pflanzen Interaktionen

Autoren
A. Andrino[1], J. Boy[1], R. Mikutta[2], C. Schneider[1], G. Guggenberger[1]
[1]Institut für Bodenkunde Hannover, Hannover ; [2]Martin-Luther-Universität, Institute of Agriculture, Halle-Wittenberg

Titel
Mobilization of phosphorus from secondary minerals by the arbuscular mycorrhiza Rhizophagus irregularis and consequences for carbon sequestration in soils

Abstract
Phosphorus can be a major limiting factor for plant growth due to its slow diffusion and high degree of immobilization in soils. Understanding the strategies evolved by plant-symbiont couples increasing P uptake is crucial, under the aim of adopting the involved mechanisms by modern sustainable agriculture. This study aims to explore whether tomato plants mycorrhized with the arbuscular mycorrhizal (AM) fungi Rhizophagus irregularis have the ability to mobilize P from secondary minerals and organic sources. Our hypothesis was that AM-bearing plants will invest more carbon to their fungal symbiont in case P must be exploited from less accessible P sources. For this, we carried out a time course experiment (91 days) with split-chamber mesocosms ensuring the mobilization of P by the mycorrhizal partner only. Orthophosphate (OP) and phytic acid (PA) in their free state and adsorbed to goethite (GOE-OP; GOE-PA) have been offered to the host plant. According to our knowledge, this is the first report where an organic P source bonded to a secondary mineral has been tested as a plant P source via the mycorrhizal P uptake pathway.
The PLFA 16:1?5c is known to be part of the membrane constituents and it is considered a good AM biomass estimator (Olsson and Wilhelmsson 2000). In our study it correlated positively with incorporated P and the AM plant root activity (arbuscules %) for all provided P sources.
Additionally, those AM plants which accessed OP and GOE-OP also showed a positive significant correlation of the arbuscules percentages, with the incorporated P, the PLFA 18:1?7c, and in case of GOE-PA also with the PLFA 18:2?6,9. These two PLFA biomarkers have been previously found in R. irregularis hyphae (Olsson et al. 2002) and might indicate that AM fungi modified their fatty acid composition in the hyphae during the mobilization of P from the different P sources.
As fungal energy storage we also measured the NLFA 16:1?5c. It was significantly higher for both P sources bonded to goethite compared to free OP and PA. These results point towards different C investment to uptake of P though the mycorrhizal pathway having a direct consequence for the carbon sequestration in soils.

Literatur
Olsson PA, Van Aarle IM, Allaway WG, et al (2002) Phosphorus Effects on Metabolic Processes in Monoxenic Arbuscular Mycorrhiza Cultures. Plant Physiol 130:1162-1171. doi: 10.1104/pp.009639.
Olsson PA, Wilhelmsson P (2000) The growth of external AM fungal mycelium in sand dunes and in experimental systems. Plant Soil 226:161-169. doi: 10.1023/A:1026565314345.