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Complementary function of arbuscular mycorrhizal fungi and protozoa fosters nitrogen acquisition of plants (*Plantago lanceolata*)



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TECHNISCHE UNIVERSITÄT DARMSTADT

BACKGROUND

- Arbuscular mycorrhiza (AM) ameliorate the supply of mineral nutrients to plants in exchange of photosynthetically fixed carbon (C);
- Protozoa release mineral nitrogen (N) from consumed bacterial biomass ('microbial loop');
- Mineral N may be taken up by both, AM mycelium and plant roots;
- Protozoa enhance root growth and AM increase C allocation belowground, both potentially foster the 'microbial loop' processes.

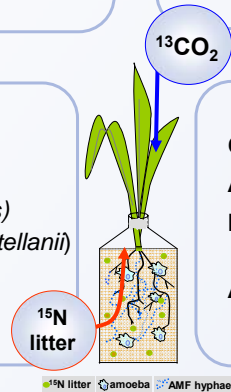
QUESTION

- Do protozoa and arbuscular mycorrhizal fungi interact to foster plant N uptake from soil organic matter?

MATERIALS & METHODS

Microcosms:

- containing soil with a diverse bacterial community
- + / - axenic arbuscular mycorrhiza (*Glomus intraradices*)
- + / - axenic soil protozoa (Amoeba; *Acanthamoeba castellanii*)
- with ¹⁵N labelled litter → plant uptake of N
- ¹³CO₂ pulse labelling → plant C allocation

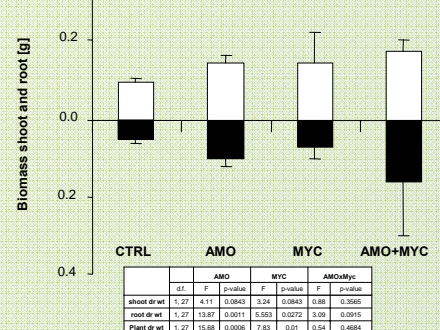


TREATMENTS

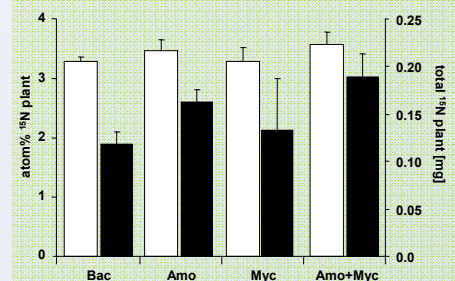
- CTRL : diverse bacterial community in soil
- AMO : Amoeba and diverse bacteria in soil
- MYC : Plants inoculated with arbuscular mycorrhiza (AM) and diverse bacteria in soil
- AMO+MYC : Plants inoculated with AM, soil with diverse bacteria and amoebae

RESULTS

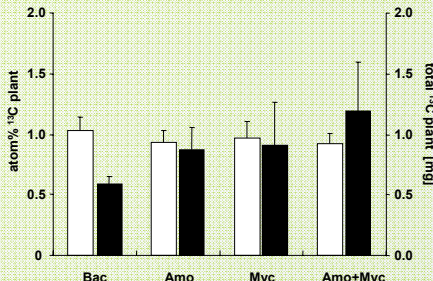
(1) Protozoa and AM additively increase plant biomass...



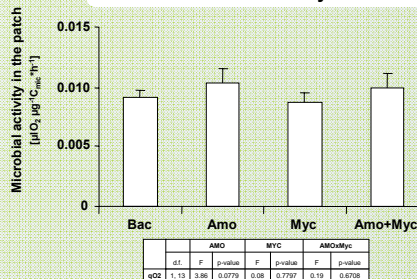
...and the mobilization of N from added organic matter for plant uptake.



(2) ... by enhancing recently fixed C pool in the plant.



(3) Protozoa, but not AM increase microbial activity...



CONCLUSIONS

- AM fungi additively increase the effect of Protozoa on plant growth, recently fixed C assimilation and ¹⁵N uptake;
- Protozoa promote the mobilization of N from added organic matter in soil by enhancing microbial activity in the rhizosphere;
- The presence of AM fungi contributes to plant N nutrition, most likely through transport of mobilized N;
- Root and hyphal interactions need to be studied separately to unravel the mechanisms in N uptake and C partitioning in the amoeba-mycorrhiza-plant-symbiosis.

For more information please see presentation by A. Rodriguez, R. Koller, C. Robin, K. Rosenberg, S. Scheu, M. Bonkowski, Microbial foodweb interactions in the mycorrhizal plant *Plantago lanceolata*

Friday 12.20–12.40h