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Beneficial effects of naked amoebae (*Acanthamoeba castellanii*) on plant growth, nitrogen uptake and carbon assimilation varies with maize (*Zea mays*) cultivar



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Background

- Nitrogen (N) limits plant growth in most terrestrial ecosystems
- After mineralization, plant residues form a major source of N for plant growth
- Plants invest significant amounts of photosynthates into the rhizosphere, thereby enhancing microbial interactions
- Protozoa foster N uptake of numerous plant species by re-mobilizing N from bacterial biomass ('microbial loop' in soil)

Materials and Methods

Microcosms (Fig. 1):

- containing soil with a natural bacterial community
- $\pm$ axenic soil protozoa (naked amoeba; *Acanthamoeba castellanii*, A)
- with ¹⁵N labelled litter $\rightarrow$ plant uptake of N from plant residues in soil

Plants:

- three cultivars of *Zea mays* (MB862 (MB), Banguy and PR39T45 (PR))
- net CO₂ assimilation rates $\rightarrow$ plant photosynthesis
- harvest after 2 weeks

Treatments:

- 3 cultivars of *Z. mays* $\pm$ *A. castellanii* (n = 4 per treatment)

Research Question

Do cultivars of plant species differentially affect the functioning of the 'microbial loop'?

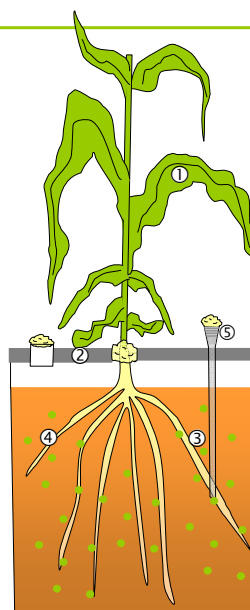
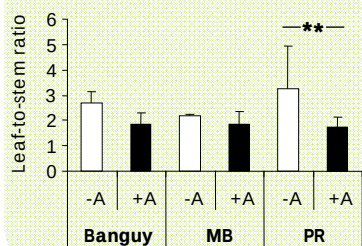


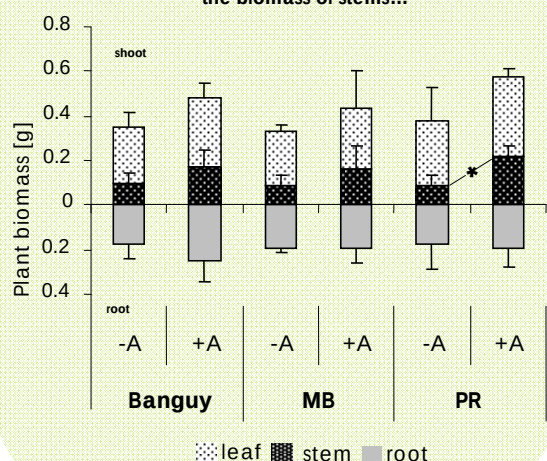
Fig. 1: microcosm set up (1) Shoot of *Zea mays* (2) airtight lid of the microcosm, perforated for plant growth and aeration of soil, sealed with sterile hydrophobic cotton (3) root of *Zea mays* (4) soil mixed with ¹⁵N-labelled litter, autoclaved and re-inoculated with natural bacterial community (5) hypodermic needles inserted in the lid

Results

(4) Protozoa affected cultivar specific structural (stem) and metabolic (leaf) material...

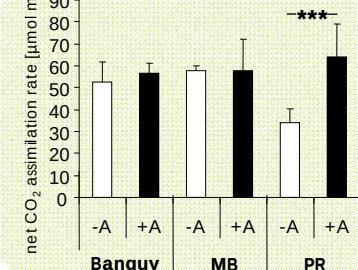


(1) Protozoa increased cultivar specific the biomass of stems...

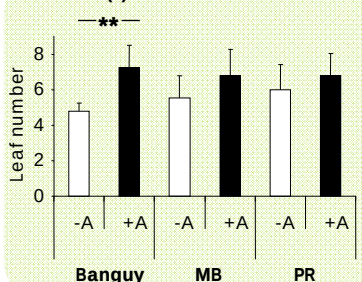


—*— p < 0.05 —**— p < 0.01 —***— p < 0.001

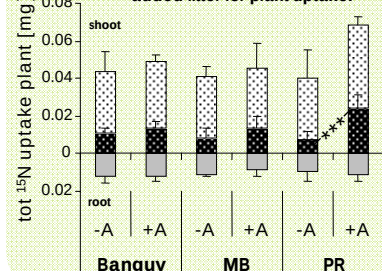
(2) ... by enhancing cultivar specific plant photosynthesis...



(5) ...and numbers of leaves.



(3) ...and the mobilization of N from added litter for plant uptake.



Conclusions

- Protozoa-plant interactions and the 'microbial loop' strongly depend on the plant cultivar
- Cultivar specific plant-microbial interactions in the rhizosphere need to be considered to improve breeding strategies aiming to enhance N uptake and productivity of crops

