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Light affects competition for inorganic and organic nitrogen between maize and rhizosphere microorganisms

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Effects of light on the short term competition for organic and inorganic nitrogen between maize and rhizosphere microorganisms were investigated using a mixture of amino acid, ammonium and nitrate under controlled conditions. The amount and forms of N added in the tree treatments was identical, but only one of the three N forms was labeled with ^{15}N. Glycine was additionally labeled with ^{14}C to prove its uptake by maize and incorporation into microbial biomass in an intact form.

Maize out-competed microorganisms for $^{15}NO_3^-$ during the whole experiment under low and high light intensity. Microbial uptake of ^{15}N and ^{14}C was not directly influenced by the light intensity, but was indirectly related to the impact the light intensity had on the plant. More $^{15}NH_4^+$ was recovered in microbial biomass than in plants in

the initial 4 h under the two light intensities, although more ^{15}N-glycine was incorporated into microbial biomass than in plants in the initial 4 h under low light intensity. Light had a significant effect on $^{15}NO_3^-$ uptake by maize, but no significant effects on the uptake of $^{15}NH_4^+$ or ^{15}N-glycine. High light intensity significantly increased plant uptake of $^{15}NO_3^-$ and glycine ^{14}C. Based on ^{14}C to ^{15}N recovery ratios of plants, intact glycine contributed at least 13% to glycine-derived nitrogen 4 h after tracer additions, but it contributed only 0.5% to total nitrogen uptake.

Our findings suggest that light intensity alters the competitive relationship between maize roots and rhizosphere microorganisms and that C4 cereals such as maize are able to access small amounts of intact glycine. We conclude that roots were stronger competitor than microorganisms for inorganic N, but microorganisms out competed plants during a short period for organic N, which was mineralized into inorganic N within a few hours of application to the soil and was thereafter available for root uptake.