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The flow of low molecular weight organic substances (LMWOS) from roots into the rhizosphere termed exudation represents a significant C loss from plants. However, roots have the capacity to recapture LMWOS from soil. This recapture is in direct competition with soil microorganisms who are capable of decomposing or utilizing most LMWOS within a few hours. Recapture has been shown for some amino acids representing N containing exudates, and it was speculated that direct uptake of organic N by plants from soil may be an adaptation important in cold and wet climates. The recapture and utilization by plants of N free LMWOS such as sugars from soil has not previously been investigated.

The aim of this study was to investigate i) the behavior of glucose in rhizosphere and non-rhizosphere soil, ii) the plant's potential to recapture sugars from soil in competition with microorganisms, and iii) translocation and utilization of the recaptured glucose. Maize plants were grown in special microcosms suitable for separating CO_2 efflux from rooted soil and from maize shoots and allowing root growth in thin tubing representing the rhizosphere. Uniformly labeled ^{14}C-glucose was injected into the rhizosphere and its uptake into plants, upward and downward transport in the roots and soil, evolution as $^{14}CO_2$ from root and shoot compartment, and incorporation into the soil microbial biomass followed. During four days these fluxes were compared with non-rhizosphere soil.

Glucose was rapidly mineralized in soil and the decomposition rate was significantly greater in the rhizosphere in comparison to non-rhizosphere soil. The amount of glucose captured by the maize plants was low ($<10\%$ of the total ^{14}C-glucose added) in comparison to that captured by the soil microbial biomass. Preferential upward glucose transport in the roots showed that the glucose was transported with the main transpiration flow. After upward and downward translocation within the roots, a part of the glucose was released back into the rhizosphere. Only small amounts of the ^{14}C-glucose were translocated to the shoot (0.6% of the total) and the contribution to the shoot respiration was negligible ($<$0.1% of ^{14}C input). The degree of glucose capture by maize roots whilst in competition with soil microorganisms was similar to similar experiments performed for amino acids.

While plant roots have been shown many times to actively take up simple sugars from an external solution, this is the first study that demonstrates this phenomenon in a rhizosphere soil context. However, our study shows that the rhizosphere microbial community is highly effective in competing for the easily available C resources. We conclude that while plant roots can recapture low molecular weight C (N containing and N free) from the rhizosphere, intense competition with soil microorganisms strongly reduce the efficiency of this process.