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Tracing the flow of plant carbohydrates into the rhizosphere

Gerd Gleixner
Max Planck Institute for Biogeochemistry, Jena, Germany (gerd.gleixner@bgc-jena.mpg.de)

We investigated the flow of 13C labeled CO_2 from plant sugars in leaves, stems and roots into rhizospheric organisms, respired CO_2 and soil organic matter in order to better understand the role of the plant-microorganism-soil-continuum for ecosystem carbon cycling. We compared trees and grassland species that had different sugar transport strategies, storage compartments, community compositions and environmental stresses. We used short but highly enriched 13C pulses at controlled CO_2 concentrations and temperatures that avoided non-physiological plant responses. We used compound specific 13C measurements of sugars and phospholipids (PLFA) to calculate the carbon turnover of plant sugars and rhizospheric microorganisms. Our results unexpectedly identified transport limitations in the root-shoot carbohydrate transfer, diurnal variations in label respiration and community effects in the carbon transfer to microbial groups. Our results highlight that sophisticated experimental setups and analytical techniques are necessary to gain new knowledge on ecosystem carbon cycling under climate change.