Combining X-ray CT and PET imaging to quantify changes in carbon allocation in Maize with AMF

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November 28, 2022

Abstract

The symbiosis between crops and arbuscular mycorrhizal fungi (AMF) have become an attractive route towards achieving carbon neutral agriculture and reducing the use of chemical fertilizers. Yet, our understanding of how active AMF infections influence the uptake, allocation, and exchange of carbon is limited. Here, we combine X-ray CT and PET imaging to observe and quantify the flow of carbon from leaves to roots to hyphae. Comparison of maize grown with and without AMF allows us to measure changes in the amount of 11CO2 taken up in leaves and subsequently the amount of 11C allocated to below-ground roots. Then, co-registered CT and PET images are used to identify hot spots which may indicate active AMF infection sites. Finally, analysis of 11C kinetics at these hot spots are used to assess the amount of carbon exchanged between maize roots and hyphae. By combining structural and biochemical information, we begin to deepen our understanding of the different types of changes in carbon flow in Maize-AMF systems and how we can improve sustainable agriculture efforts.

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