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CENTER FOR ADVANCED BIOENERGY AND BIOPRODUCTS INNOVATION

Historical Land Management Alters New Soil Carbon Inputs by Annual and Perennial Bioenergy Crops

Background/Objective

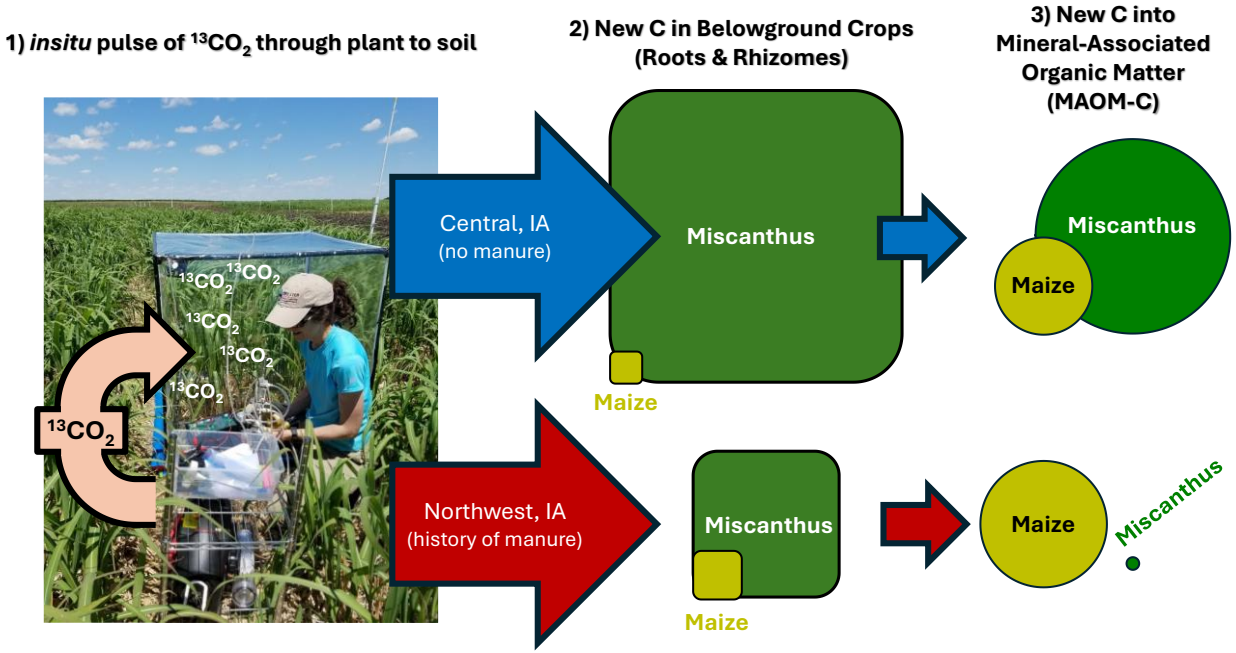
Perennial bioenergy crops show potential to increase soil organic carbon (C). However, belowground C allocation in perennial bioenergy crops is not well understood, nor is the interaction with nitrogen (N) fertilizer or management history. This work compares the belowground C allocation of the perennial bioenergy grass *Miscanthus* × *giganteus* (Mxg) to maize across two sites with different management histories and over two N fertilizer rates.

Approach

In situ $^{13}CO_2$ pulse-chase labeling was used to track C through Mxg and maize at two existing field sites in Iowa, one of which had a history of manure application (Northwest, IA) and with two N fertilization rates (0 & 224 kg N ha^{-1}). Above- and below-ground plant biomass and soil samples were analyzed to determine changes in ^{13}C tissues and soil pools.

Results

Mxg had greater new ^{13}C in total and belowground plant biomass than maize at both sites, but the site mattered when it came to allocation to soil organic matter. At the **Central-IA** site, with more nutrient-limited soils, Mxg transferred 4.5× times more ^{13}C than maize to the mineral-associated organic matter (MAOM). At the **Northwest-IA** site, with a history of manure inputs, maize had a much greater allocation of new, belowground ^{13}C allocated to MAOM.



Mxg allocated more new $^{13}CO_2$ to belowground plant tissues after $^{13}CO_2$ pulse, but site mattered for how that new C was allocated to soil organic matter. NOTE: differences are proportional to size of rectangle or circle.

Significance/Impacts

This work indicates that past management, including manure inputs that affects a site's soil fertility, can influence the net soil C benefits of bioenergy crops.

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