Roots Selectively Decompose Litter to Mine Nitrogen and Build New Soil Carbon

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Background/Objective

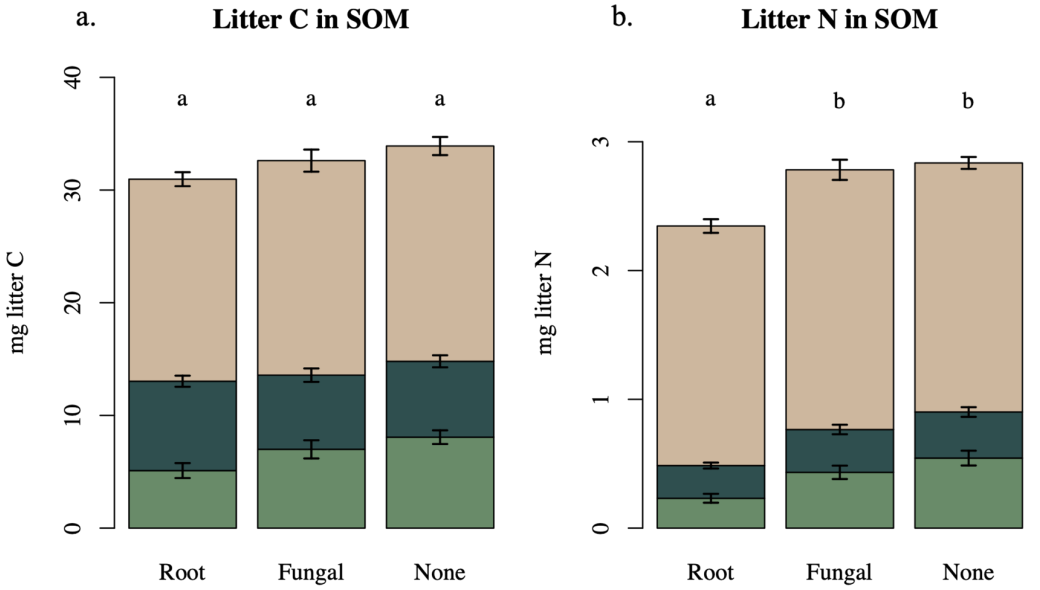
- The ability to optimize the sustainability of bioenergy agriculture through retaining soil carbon (C) and efficiently recycling nitrogen (N) is limited by uncertainties in how C and N cycle between pools of soil organic matter (SOM).
- This study helps shed light on some of these uncertainties by examining how living roots and fungi drive litter decomposition and promote new SOM formation.

Approach

Isotopically enriched litter was incubated in soil cores that allowed root ingrowth (root), excluded roots but allowed fungal ingrowth (fungal), or excluded both root and fungal ingrowth (none) in established *Miscanthus x giganteus* (miscanthus) plots. After one growing season, soil cores were destructively harvested, and the fate of litter was traced into different SOM pools to uncover how roots and fungi altered litter decomposition and litter retention in SOM.

Results

Roots stimulated litter decomposition but balanced this loss by transferring C into aggregate-associated SOM (heavy particulate organic matter (POM)). Roots selectively mobilized N from litter without additional C release.



Litter C (left) and litter N (right) recovered in the light POM fraction (light green), heavy POM fraction (dark blue), and MAOM fraction (brown) of SOM for root and fungal ingrowth (root), root exclusion and fungal ingrowth (fungal), or root and fungal exclusion (none) soil cores.

Significance/Impacts

The findings that miscanthus roots simultaneously prime N-release from litter without additional C release and transfer C into a more persistent form of SOM suggests that these perennial grasses could improve bioenergy sustainability by building soil carbon with lower fertilization demands.

Ridgeway et al. 2023. "Roots Selectively Decompose Litter to Mine Nitrogen and Build New Soil Carbon." *Ecology Letters*. DOI:10.1111/ele.14331.