Plant Litter Traits Control Microbial Decomposition and Drive Soil Carbon Stabilization

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Background/Objective

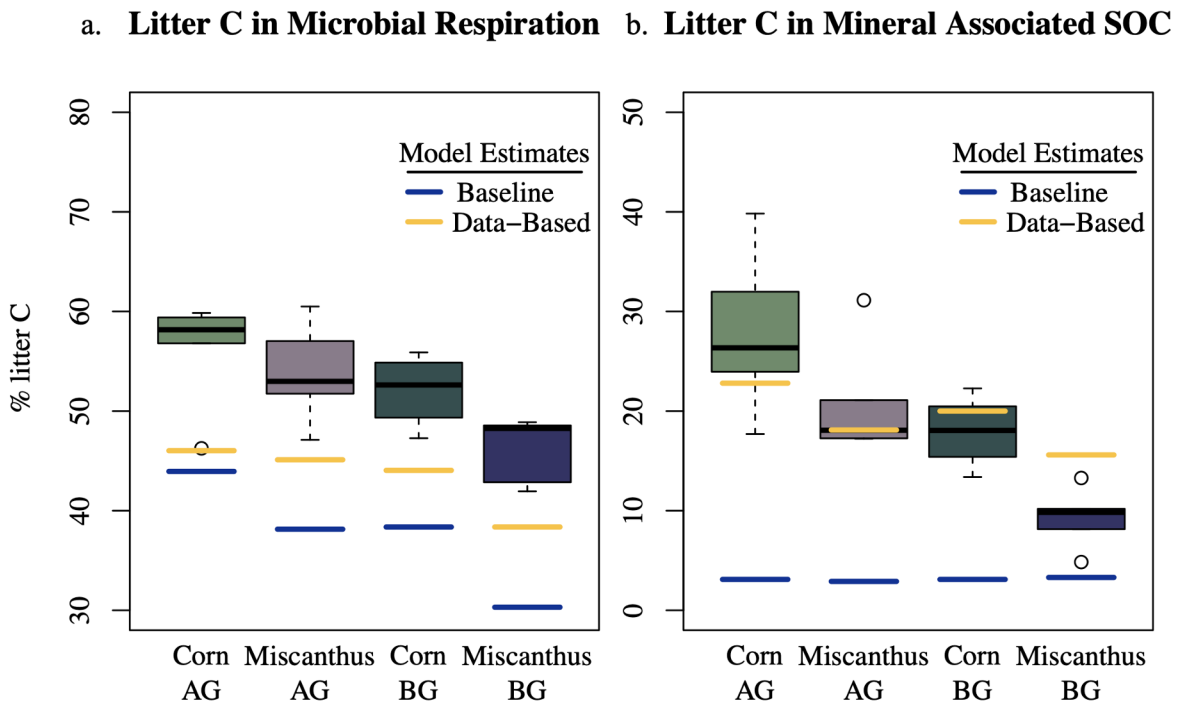
Management of soils for carbon (C) sequestration is limited by current understanding of how plant and microbial traits alter soil organic C (SOC) storage mechanisms. Addressing this uncertainty is particularly important for understanding the C balance of bioenergy agriculture.

Approach

^{13}C-labeled above- and below-ground litters from *Zea mays* (corn) and *Miscanthus x giganteus* (miscanthus) were incubated in field soil. Litter ^{13}C was traced into respiration, microbial biomass, and SOC pools. Data were used to parameterize a microbial SOC model.

Results

Corn litter promoted higher microbial C use efficiency (CUE) and formed 50% more mineral associated SOC than miscanthus. Root litter promoted lower CUE and formed less mineral associated SOC than leaf and shoot litters for both crops. Model estimates of soil respiration and SOC stabilization were improved when model parameters were updated with better estimates of turnover and microbial CUE measurements.



Litter C that is (a) respired or (b) incorporated into mineral associated SOC in the lab (boxplots) vs. CORPSE model estimates using baseline parameters (blue) or data-based parameters (gold).

Significance/Impacts

This work demonstrates that bioenergy crops differ in how litters form new SOC, which can inform model predictions of how bioenergy crops influence climate change.

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