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Altering Plant Carbon Allocation to Stems Has Distinct Effects on Rhizosphere Soil Microbiome Assembly, Interactions, and Potential Functions in Sorghum

Background/Objective

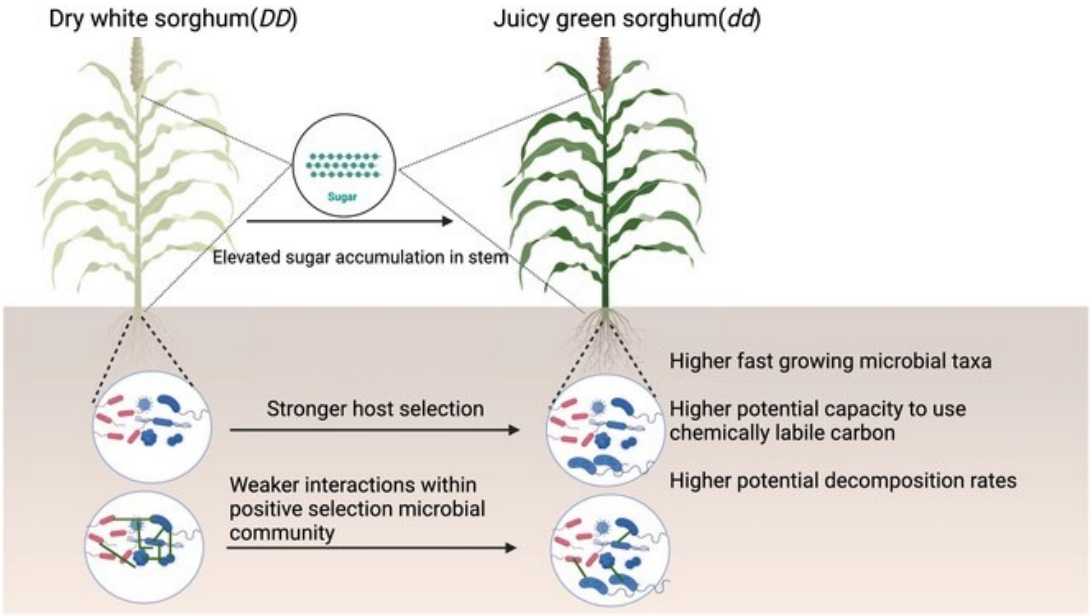
- Shifting plant carbon (C) allocation from leaves to stems is key to improving utility for bioenergy and bioproducts applications.
- The sorghum D locus controls a trait for sugar accumulation, with enhanced C allocation in stems of juicy green (*dd*) sorghum, but reduced C allocation in dry white (*DD*) sorghum.
- The aim of this study is to determine the impact of altered stem sugar accumulation on the belowground microbiome, an as-yet unresolved question.

Approach

Bulk and rhizosphere soils were sampled from juicy (*dd*) and dry (*DD*) sorghum grown in Urbana, IL in 2020. Plant tissue samples were also analyzed to assess C allocation. Total genomic DNA was extracted from soil samples and sequenced, followed by data analysis.

Results

Juicy green (*dd*) stems were associated with stronger selection in the rhizosphere microbiome assembly, where microbial communities tended to be faster growing with potential functions that would promote higher capacity to use chemically labile C sources and potentially result in higher decomposition rates. Juicy green rhizosphere microbiomes also formed weaker interactions than those in dry white sorghum.



Conceptual diagram showing microbial assembly, interactions and potential functions under Dry white (*DD*) (left) and juicy green (*dd*) (right) sorghum rhizosphere soil.

Significance/Impacts

This is the first study to comprehensively relate stem C allocation to soil microbial community assembly, interaction, and function. Furthermore, this study suggests future bioenergy crop modifications should consider the impacts on belowground microbial communities and resulting consequences for sustainability.

Ji et al. 2024. "Altering Plant Carbon Allocation to Stems Has Distinct Effects on Rhizosphere Soil Microbiome Assembly, Interactions, and Potential Functions in Sorghum." *GCB Bioenergy*. DOI: 10.1111/gcbb.13148.