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Aboveground Rather Than Belowground Productivity Drives Variability in *Miscanthus* × *giganteus* Net Primary Productivity

Background/Objective

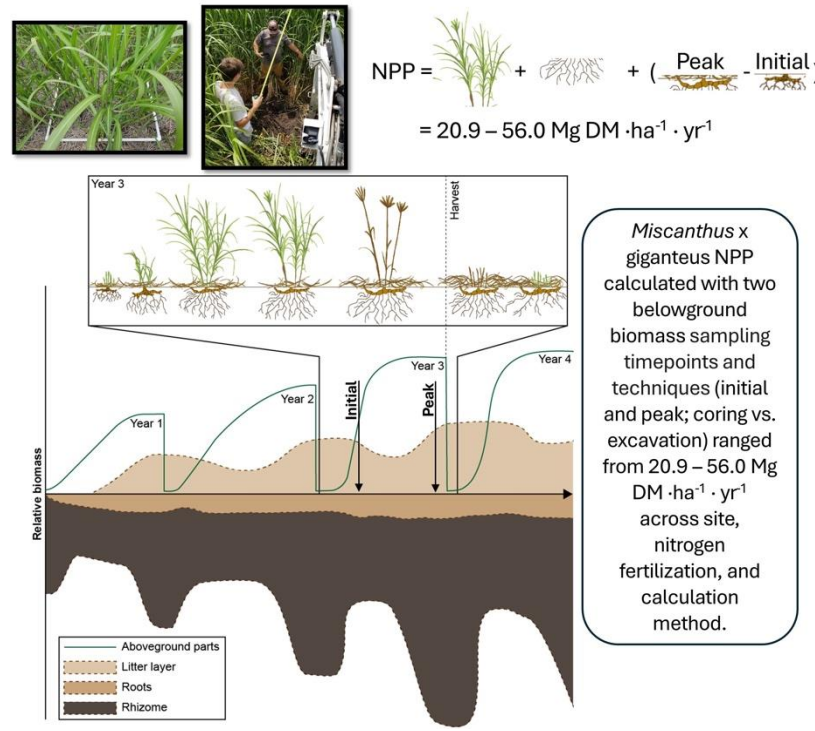
Quantifying the carbon (C) uptake of the perennial grass, *Miscanthus* × *giganteus (M* × *g),* in both aboveground and belowground structures (e.g., net primary productivity (NPP)) and differences among methodological approaches is crucial. Many estimates of *M* × *g* productivity focus on aboveground harvestable yields and do not directly address belowground biomass in this perennial crop. Our objectives in this study were to directly measure *M* × *g* NPP and to evaluate the effect of nitrogen fertilization, location, and method of rhizome biomass collection.

Approach

To more accurately constrain the amount of carbon taken up by *M* × *g* in both aboveground and belowground plant parts, we calculated the NPP of mature *M* × *g* at three sites with three nitrogen application rates using collections of aboveground and belowground biomass at two time points during the growing season.

Results

We found that aboveground *M* × *g* NPP ranged from 15.4 Mg DM ha^{-1} $year^{-1}$ to 36.4 Mg DM ha^{-1} $year^{-1}$ and belowground *M* × *g* NPP ranged from 4.4 Mg DM ha^{-1} $year^{-1}$ to 19.6 Mg DM ha^{-1} $year^{-1}$. *M* × *g* NPP varied across sites, fertilization, and calculation assumptions. Aboveground NPP (yield) was on average 68.7% of the total NPP. Root-to-shoot ratios at peak biomass decreased with nitrogen application rate, from an average of 1.9 for 0 N plots to 0.89 for 224 N fertilized plots.



Growth and partitioning of NPP in *M x g* using approximations of relative biomass pools and their accumulation.

Significance/Impacts

Overall, these results show that the range of mature *M* × *g* NPP is driven by aboveground productivity, influenced by nitrogen application and site. Our results provide useful data to constrain agro-ecosystem models and provide crucial insights for future perennial belowground sampling. These estimates help improve our understanding of *M* × *g* carbon sequestration potential and will improve the representation of *M* × *g* in agro-ecosystem models.

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