Plant and Biogeochemical Controls on the Switchgrass Microbiome: Perspectives from a fine-scale time series

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Project Goals: Short statement of goals. (Limit to 1000 characters)

Nitrogen (N) is the most commonly limiting nutrient for plants, especially in marginal lands. These lands are unsuitable for food crops because of low productivity and vulnerability to environmental stress. The introduction of perennial bioenergy cropping systems (PBCS) in marginal lands can improve whole system N use efficiency and N retention, while also contributing to energy sustainability without competition with food. However, little is known overall about N-cycling and associated microbial function in marginal land biofuel cropping systems. As part of a project studying Microbial-Mediated Perennial Rhizosphere Nitrogen Transformations (MMPRNT), we have begun to characterize N-cycling microbial communities and associated plant and soil biogeochemical properties in six marginal land sites in Michigan and Wisconsin. Sites are part of the DOE Great Lakes Bioenergy Research Center (GLBRC), and including different cropping systems (switchgrass, prairie, control) and fertilized and unfertilized plots. A unique aspect of this study is the temporal resolution at which we measured properties; at our focal site, we looked at these properties in 2-week time intervals, at another site on a monthly basis, and at all sites 1x/season.

We found that overall, site was the strongest factor explaining microbial and biogeochemical dynamics, but that microbial communities and soil nitrogen pools varied widely on relatively short temporal scales. For instance, microbial community composition varied as much over time as it did in fertilized and unfertilized plots in a single site. Fertilizer affected soil and microbial characteristics after being applied in spring, but we saw surprisingly few long-term effects of this treatment on soil or plant traits. An improved method for measuring free-living N fixation revealed that N-fixation is occurring in switchgrass, and may be especially prominent near senescence. These field data will complement other lab and greenhouse mesocosms and field manipulations in our project, which will be used to parse out mechanisms for many of these patterns.

References

1. Bowsher, A, Sarah Evans, Lisa K. Tiemann, Maren L. Friesen. 2017. Effects of soil nitrogen availability on rhizodeposition in plants: a review. *Plant and Soil.* https://link.springer.com/article/10.1007/s11104-017-3497-1

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