Chemistry and microbial functional diversity differences in biofuel crop and grassland soils in multiple geographies

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As crop and non-crop lands are increasingly converted to biofuel feedstock production, it is of interest to identify potential impacts of annual and perennial feedstocks on soil ecosystem services. Soil samples were obtained from diverse regionally distributed biofuel cropping sites of switchgrass (Panicum virgatum L.) and sorghum (Sorghum bicolor L.) and nearby comparable sites supporting non-crop perennial grasslands. Soils were analyzed for edaphic properties, microbial gene diversity and abundance, active microbial biomass, and nematode diversity. Sorghum crop soils had significantly higher NO3-N, NH4-N, SO4-S, and Cu levels than comparable non-crop soils. In contrast, few significant differences in soil chemistry were observed between switchgrass crop and corresponding non-crop grassland soils. Active bacterial biomass was significantly lower in sorghum soils than in switchgrass soils. Using GeoChip 4.0 functional gene arrays (FGA), microbial gene diversity was significantly lower in sorghum crop soils than in corresponding non-crop soils. Microbial gene diversity at switchgrass sites varied among geographic locations, but not between crop and non-crop soils. Microbial gene abundance did not differ between sorghum crop and non-crop soils, but was generally lower in switchgrass crop soils compared to non-crop soils. Gene diversity at sorghum locations was negatively correlated with NO3-N, NH4-N and SO4-S in the C and N cycling microbial gene categories. Gene abundance at switchgrass locations was positively correlated with Mn. Our multi-disciplinary results suggest that production of a perennial biofuel crop such as switchgrass has less impact on microbially-mediated soil ecosystem services than cultivation of an annual biofuel crop such as sorghum.