SOIL MICROBES ARE CRITICAL TO MAINTAINING SOIL FERTILITY IN THE GREAT PLAINS

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ABSTRACT

Soil in the Great Plains is known to be susceptible to wind and water erosion due to moisture deficits throughout the region that limit soil organic matter (SOM) accumulation that helps form stable soil structure. Conservation management practices like reduced tillage are emphasized to maintain SOM that provides habitat for soil microbes to perform ecosystem services related to nutrient cycling and soil aggregation to increase resistance to erosion and maintain fertile topsoil. Soils under long-term no-till management in Great Plains states of North Dakota, South Dakota, Nebraska, Colorado, and Texas were used to evaluate how parameters of biological soil fertility influence soil aggregation under reduced tillage. Soil properties (pH, clay content) were related to the following critical assessment measures for SOM dynamics and microbial characteristics: soil organic carbon (SOC), permanganate oxidizable carbon (POXC), β-glucosidase enzyme activity (Bglu), ester-linked fatty acid methyl esters (ELFAME), and water-stable aggregation (WSA). Results showed that SOC and POXC were higher in Northern and Central great plains sites, which was likely because of lower temperatures that reduce SOM degradation and higher clay content that increases surface area for holding SOM. Soil microbial communities had more biomass and enzyme activity in temperate and cool climates based on total ELFAME and Bglu activity. Soil stability as measured by WSA was highest in SD, the location with the highest total ELFAME and Bglu activity. Although some soils had more SOC and POXC than others, these metrics were not the sole determining factor for soil stability. Principal components analysis revealed that ELFAME and Bglu activity were more correlated to WSA than other biological soil fertility metrics, which suggests that soil microbial activity is a critical component to maintaining soil fertility against erosion in the Great Plains.