Soil microbial communities and functional diversity in managed cropping systems across the U.S. Great Plains

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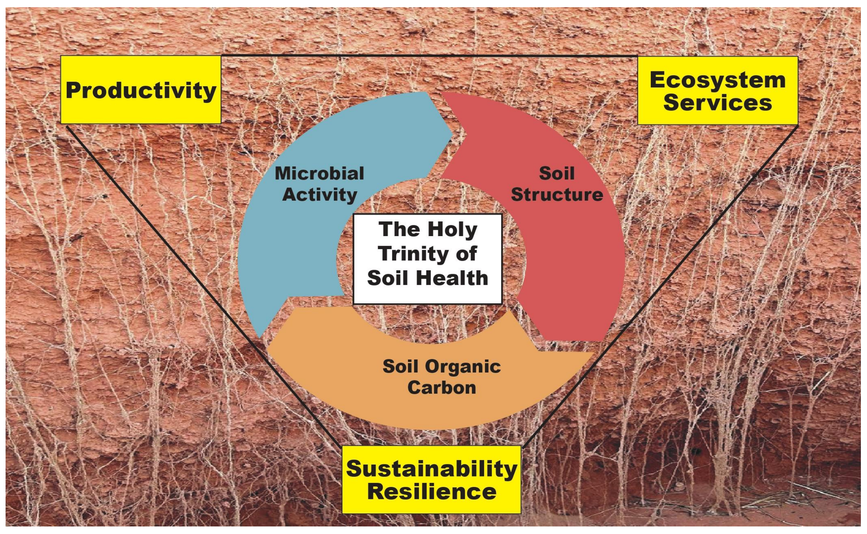
BACKGROUND



Soil health depends on **microbial activity**, **SOC**, and **structure**.

Microbes drive nutrient cycling and ecosystem functioning.

Management alters microbial communities, but responses are context-dependent.

OBJECTIVE

Evaluate how crop rotation intensity, nitrogen rate, tillage, and cover crop integration influence soil microbial community composition and enzyme activity in managed cropping systems across the Great Plains.

HYPOTHESIS

Management practices will significantly alter microbial biomass and community composition.

MATERIAL AND METHODS

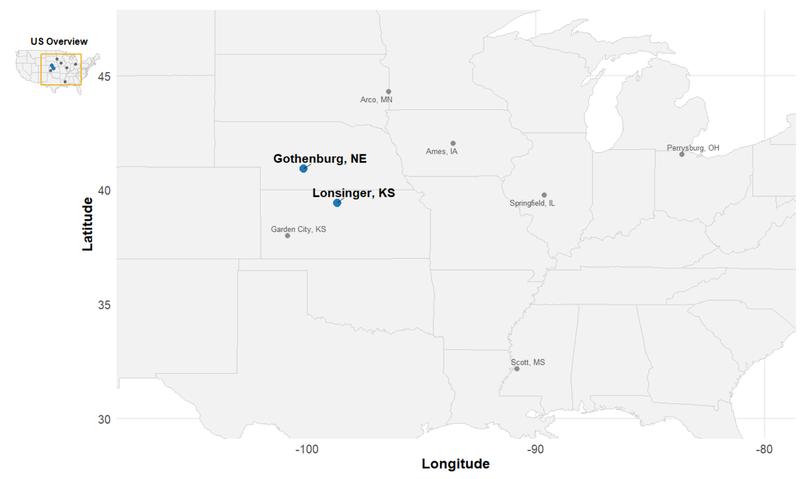
❖ **Soil depth**:
0–5 cm and 5–15 cm

❖ **Measurements**:
Microbial Community by Phospholipid Fatty Acid Analysis
Enzyme Activity: Phosphatase, β-glucosidase, Arylsulfatase, NAG

Soil Assessment

1st — 3rd — 5th

❖ **Experimental Structure**
6 Phases of crop rotation × 2 Nitrogen levels × 2 Tillage systems × 2 Cover crop treatments = **48 treatment combinations**
48 treatment combinations × 3 replications **= 144 total plots**



Variable	Gothenburg, NE	Lonsinger, KS
Mean Annual Precipitation	610 mm	670 mm
Mean Annual Temperature	~10–11 °C	~12–13 °C
Soil Texture	Sandy loam	Silt loam
Texture Composition (%)	~60% sand, 30% silt, 10% clay	~65% silt, 20% sand, 15% clay

RESULTS

Fig. 1. Lonsinger-KS (0-5cm)

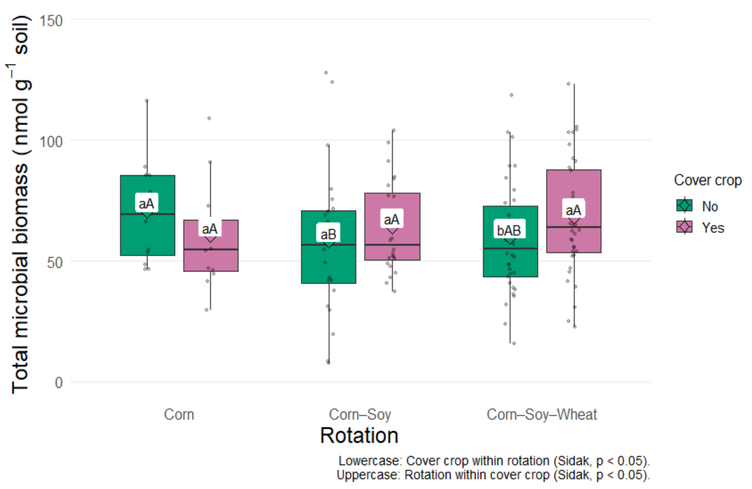


Fig. 2. Gothenburg-NE (0-5cm)

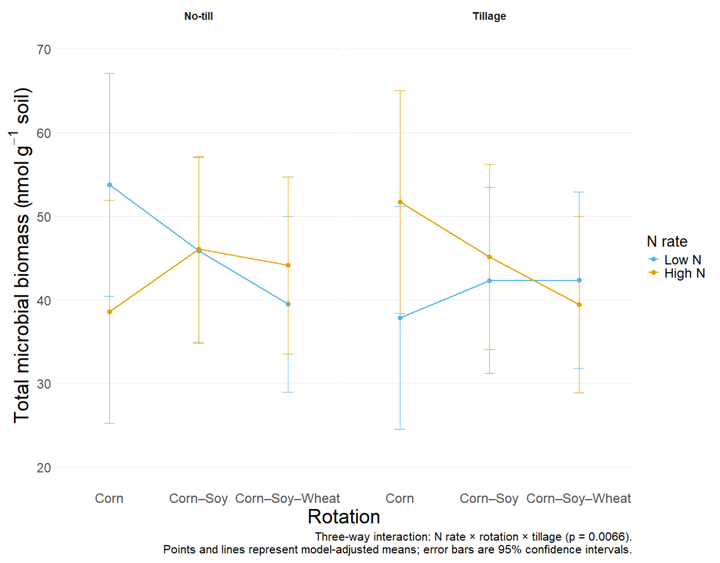


Fig. 3. Lonsinger-KS (0-5cm)

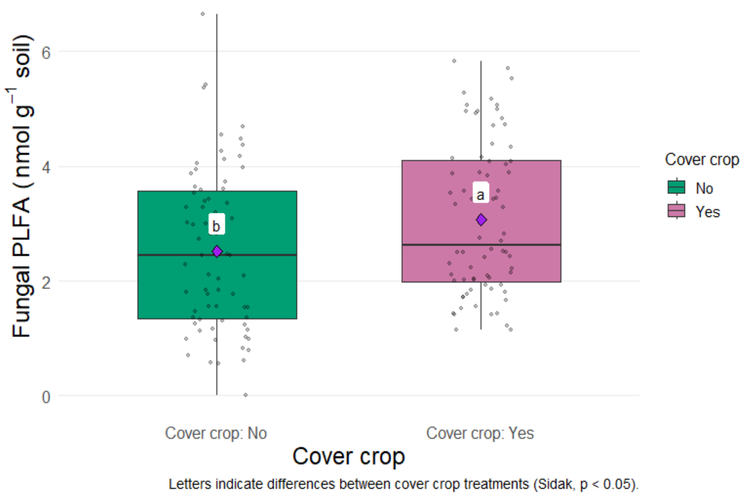


Fig. 4. Gothenburg-NE

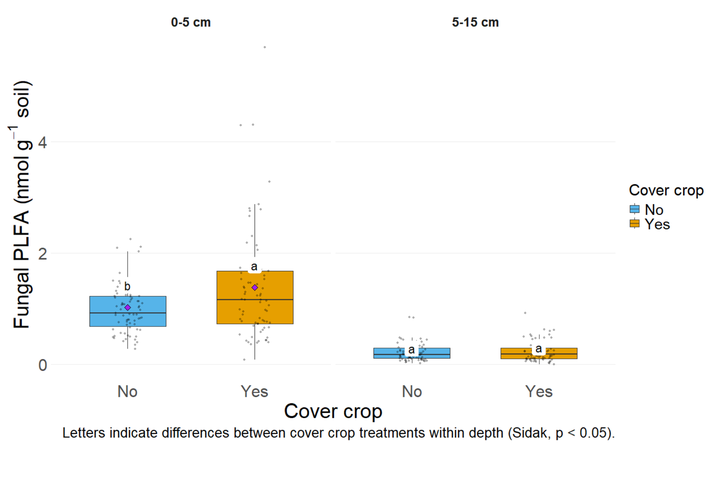
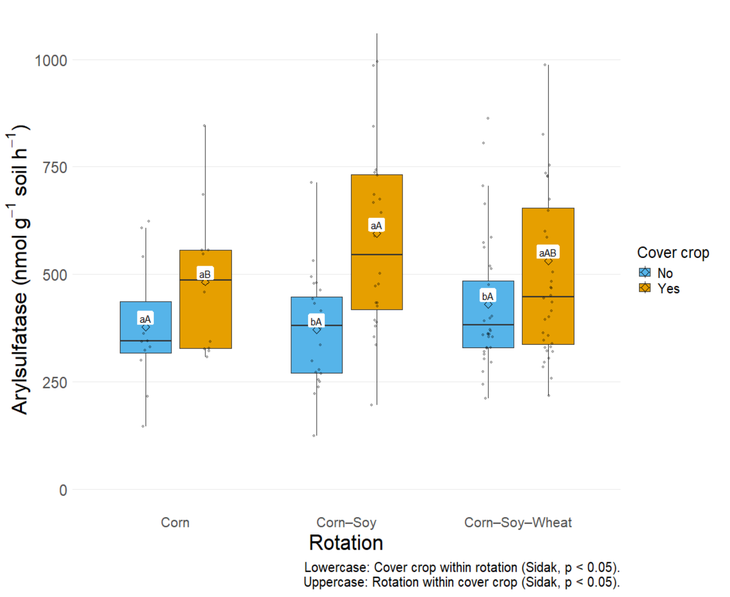


Fig. 5. Lonsinger-KS (0-5cm)

Fig. 6. Gothenburg-NE (0-5cm)



CONCLUSIONS

❖ Microbial biomass varied with rotation and cover crops (Fig. 1).

❖ Biomass responses to N rate varied across rotations and differed between tillage systems at the NE site (Fig. 2).

❖ Cover crops increased fungal biomass, especially in surface soils.

❖ β-glucosidase responded to rotation × tillage interactions (Fig. 5).

❖ Arylsulfatase was generally higher under cover crops (Fig. 6).

ACKNOWLEDGEMENTS

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