REU Site: *Plant Biology & Conservation Research Experiences for Undergraduates - From Genes to Ecosystems* (Supported by NSF award DBI-2149888).

· Effects of Kernza-conditioned soil on native · · prairie plants ·

chicago botanic garden
2024 Research Experiences for Undergraduates Program

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Introduction

- Intensive agricultural practices can severely deplete soil health
- Perennialization and polyculture with Kernza have been shown to have beneficial effects on soil health[1]
- There is a lack of knowledge regarding the long term effects of Kernza on the soil microbiome and the plants which follow it

Kernza field, photos by Paula Mohr

Objectives

01. Assess effects over time of Kenza on the soil microbiome
02. See if the soil microbiome from Kernza will support the growth of native prairie plants
03. See if there is a uniform response to inoculum across prairie species

Hypothesis

- Prairie plants grown with experimental soil will have a faster growth rate than those grown with sterilized soil
  - Benefits to plant growth will be greater in biculture compared to monoculture, and will increase with stand age

References

1. Chamberlain, L. A., Aguayo, T., Zerega, N. J. C., Dybzinski, R., & Egerton-Warburton, L. M. (2022, October 6). Rapid improvement in soil health following the conversion of abandoned farm fields to annual or perennial agroecosystems. Frontiers. https://www.frontiersin.org/journals/sustainable-food-systems/articles/10.3389/fsufs.2022.1010298/full

Methodology

Four species of native prairie plant were selected to represent the main plant functional groups found in a prairie, and grown in greenhouse conditions.

Dalea purpurea
Legume

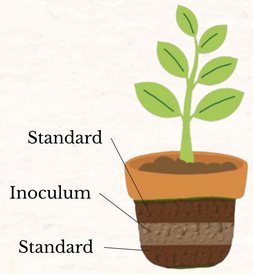
Schizachyrium scoparium
Grass

Lysimachia quadriflora
Forb

Penstemon digitalis
Forb

Species were potted with soil from 6 different Kernza stands. As control, some were planted in sterilized stand soil.

	2 yrs	3 yrs	4 yrs
Monoculture (KZ)	KZ_2	KZ_3	KZ_4
Bioculture (KA)	KA_2	KA_3	KA_4



Plant growth was recorded by measuring height to the highest point once per week; these data points were used to calculate the growth rate of each plant.

Results

- All species demonstrated a positive or neutral response to inoculation with Kernza-conditioned soil
  - Lysimachia growth rate was significantly greater with inoculation from KA3 and KA4
  - Dalea growth rate was significantly greater with inoculation from KA3 and KZ3
  - Growth rate was not negatively affected by Kernza treatment for any species

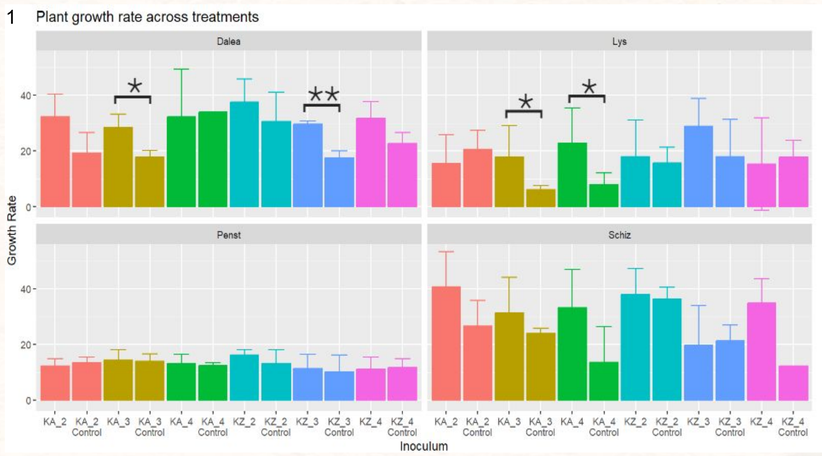


Figure 1, Plant growth rate across treatments, separated by species (Lys= Lysimachia, Penst= Penstemon, Schiz= Schizachyrium)
Bars connected by a bracket were found to have statistically significant differences, and asterisks indicate significance level (* = p < 0.05, ** = p < 0.01)

Discussion

- These results support the hypothesis that planting Kernza in monoculture and biculture may support the development of a soil microbiome which positively impacts the growth of certain, if not all, prairie species
- The lack of uniformity in plant response to inoculation suggests that not all plants would benefit equally from pre-planting Kernza in a restoration site, and the ideal planting treatment may vary by species

Future Directions

- More data collection
  - Spending more weeks recording growth
  - Testing more species
  - Potting combinations of prairie plants
- Sequencing to identify beneficial microbes
- Recreating this experiment in the field

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