Analyzing Differences in Soil Health Subsequent to Kernza Planting Across Intercropping Sites

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BACKGROUND

- Intensive agricultural practices degrade soil health[1] (ie. loss of stability, decreased carbon storage)
- Soil restoration practices involving perennial crops and polycultures have the potential to restore soil health
  - Specifically, Kernza, a deep-rooted perennial grass, has been shown to greatly aid land regeneration within first year of planting[2]
- Reactive carbon is a form of processed soil C that is closely correlated with the total soil organic C pool[3]
- Reactive nitrogen is a glycoprotein largely produced by the hyphae of arbuscular mycorrhizal fungi (AMF)[4]
- Both reactive carbon and nitrogen have been identified as useful metrics of soil health[3]

QUESTION

How do perennialization and polyculture affect soil health across varying geographic regions?

HYPOTHESIS

- If we subject seven intercropping sites to various crop treatments, then we will observe the **greatest increase in soil health in plots where perennial bicultures have been planted**

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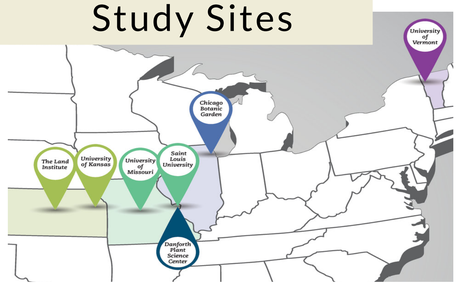
MATERIALS & METHODS

Study Sites



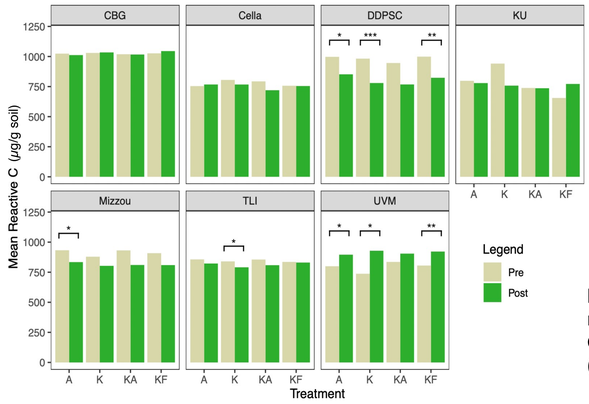
Experimental Design

Soil Analyses

- Soil samples taken before and after row cropping treatments were analyzed using spectrophotometry
  - Reactive C – all sites[3]
  - Reactive N – CBG site only[5]

RESULTS

Soil reactive carbon levels varied between sites and treatments following land conversion.



We found that soil reactive carbon:

- Increased significantly → UVM
- Decreased significantly → DDPSC, Mizzou, TLI
- Did not change significantly → CBG, Cella, KU (Fig. 1)

Fig. 1: Row cropping treatments produced various responses in mean reactive nitrogen levels per site. Columns marked with stars have significant differences (* = $p < 0.05$, ** = $p < 0.01$, *** = $p < 0.001$).

Fertilized Kernza plots exhibited significant decreases in soil reactive nitrogen following land conversion.

- Unfertilized sites, regardless of perennial crop treatment, did not show significant differences in soil reactive N (Fig. 2)

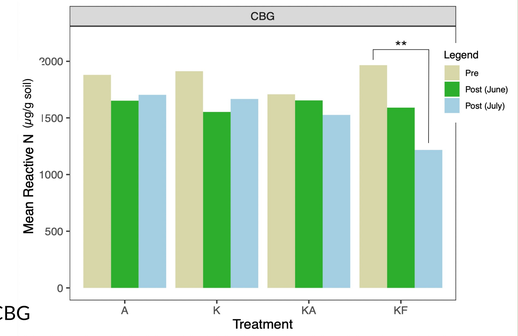


Fig. 2: Mean reactive nitrogen levels per row cropping treatment at CBG site. Columns marked with stars have significant differences (* = $p < 0.05$, ** = $p < 0.01$, *** = $p < 0.001$).

DISCUSSION

- Site characteristics that vary by location could have influenced inconsistent soil reactive C responses across sites[6]
  - Ie. Variations in soil type, soil texture, land use history, and climate
- Fertilization negatively impacts reactive nitrogen levels
  - Plant-mycorrhizal relationships that benefit soil health do not form in presence of fertilizer[7]

FUTURE DIRECTIONS

- Future inquiries into the effectiveness of perennial polycultures in restoration could consider other site traits
  - Consider interactive effects of soil type, soil texture, land use history, and climate on results
- Restoration-focused land management strategies should avoid fertilization, regardless of crop treatment

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