Advancing the Circular Bionutrient Economy

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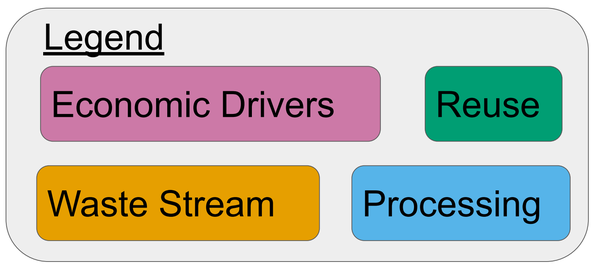
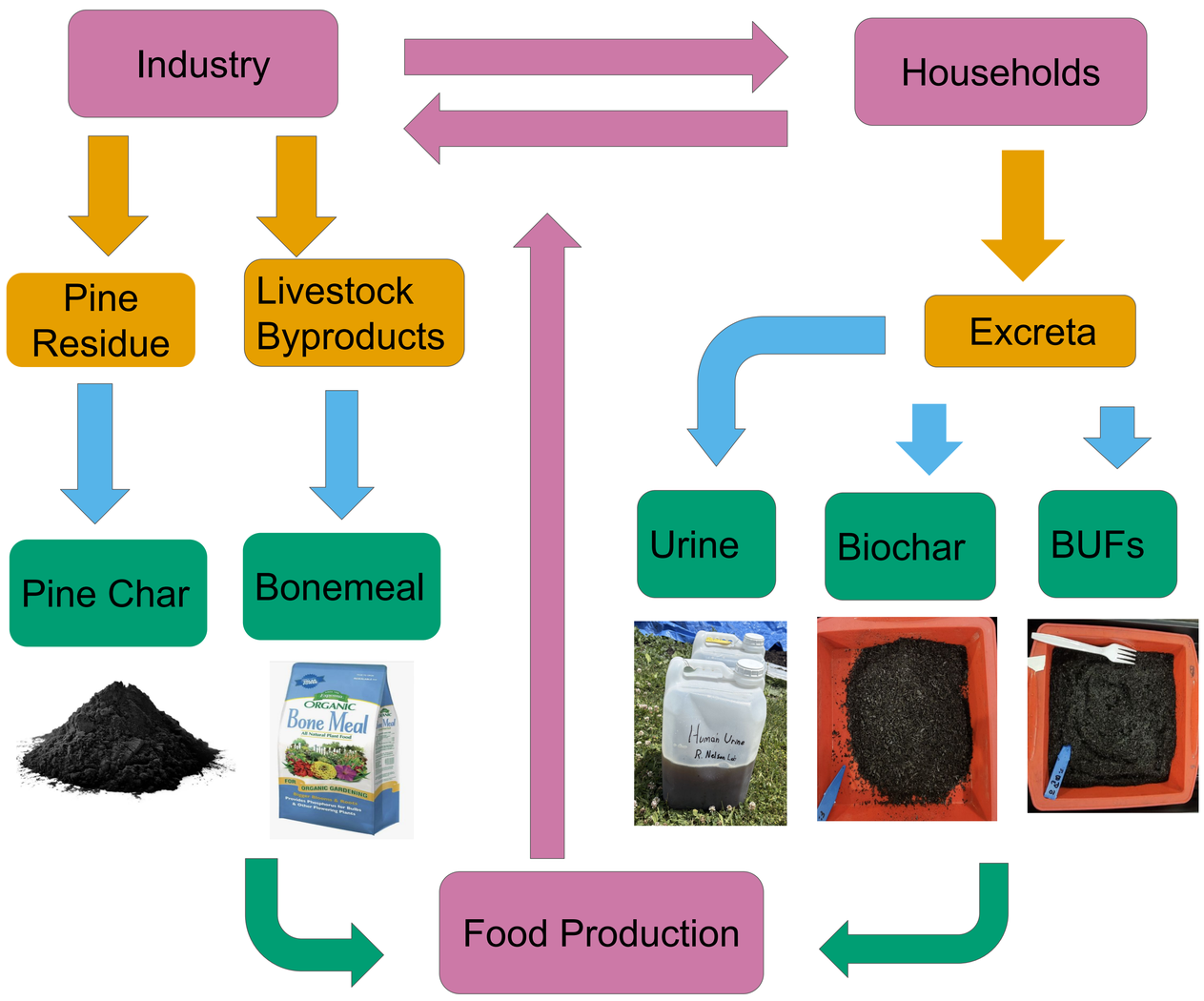
Introduction

- Linear Nutrient Systems
  - Waterways become oversaturated with nutrients from agricultural runoff and excreta, leading to eutrophication (Withers et al, 2014)
  - The production and use of synthetic fertilizers account for 2% of global GHG emissions (Menegat, 2022)
- Project Applications in Kenya
  - Lake Victoria experiences eutrophication from agricultural runoff and wastewater (Nyamweya, 2023)
  - The Circular Bionutrient Economy Association and its affiliated organizations are capturing and recycling human waste and urine into fertilizers
- Laidlaw research supports adoption of circular bionutrient systems by investigating effects of various circular inputs on crop outcomes
  - Is urine an effective top-dressing on open-field farms compared to commercial alternatives?
  - How do soil amendments from organic underutilized resources (OURS), particularly BUF (biochar-based urine-derived fertilizers), compare to commercial products?

Circular Nutrient Economy





Methods

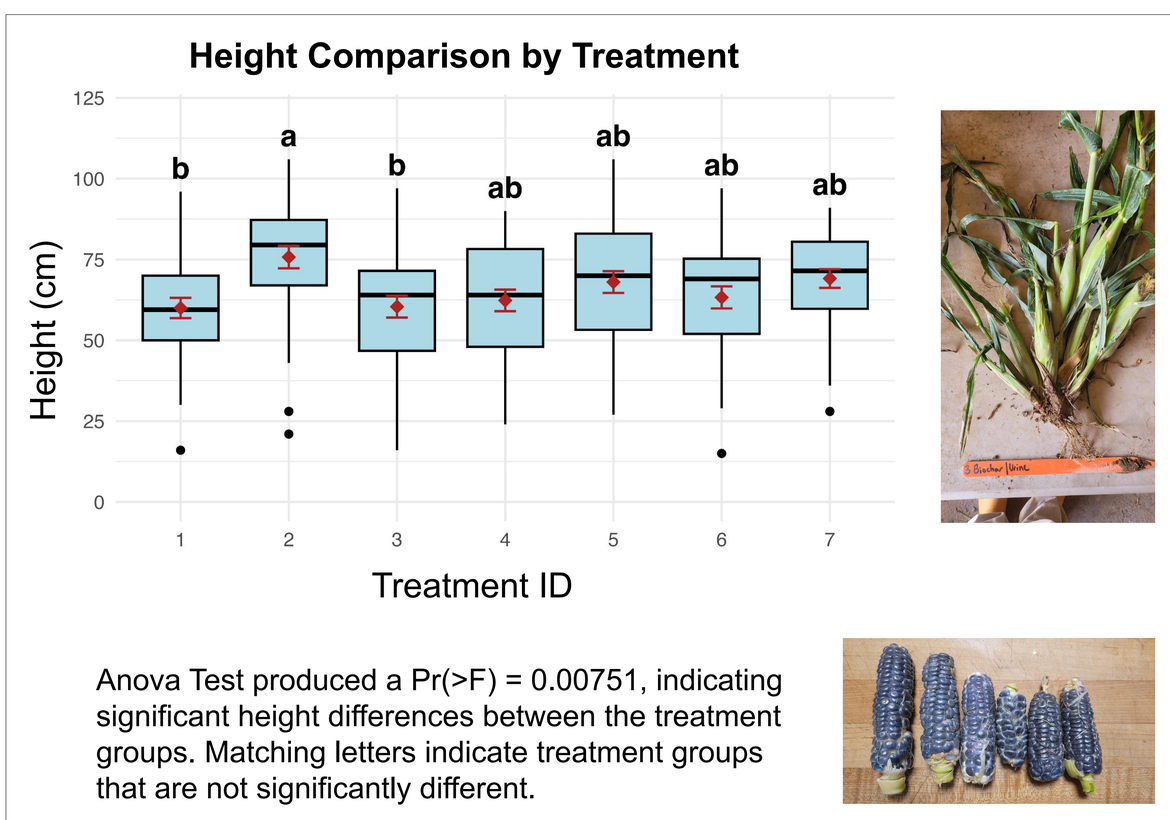
- Blue Jade Dwarf Sweetcorn planted on field (34x58m)
- 7 treatment groups
- Response Variables: Germination Rate, Height, SPAD, and Yield

Treatments

#	Starter amendment	Top-dress
1	Blank control	None
2	Gene's starter mix (10:20:20)	Conventional
3	Pine char	Urine
4	Pine char	Conventional
5	Pine char + 10:20:20	Conventional
6	BUF	Urine
7	BUF+ potash + bonemeal (10:20:20)	Urine

Results

- Significant differences found in Height among treatment groups from measurements collected on August 7th, 2026
- Seed Germination and SPAD measurements collected on July 16th, 2026 are not significant



Anova Test produced a Pr(>F) = 0.00751, indicating significant height differences between the treatment groups. Matching letters indicate treatment groups that are not significantly different.

Conclusion

- Treatment 2 (commercial fertilizer and top dressing) enhanced height significantly more than the worst performing groups: Treatments 1(the blank control) and Treatment 3 (pine char with urine top-dressing).
- There is no statistically significant difference in height of corn plants between commercial soil amendments and top-dressing compared to circular alternatives.
- This indicates that urine as a top-dressing combined with the soil amendment BUF and the combination of soil amendments BUF+, potash, and bonemeal are viable alternatives to the conventional fertilizers tested.
- Further investigation into harvest yield is currently being undertaken.

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