Effects of Biochar and Compost Amendments on Nutrient Availability in Two Urban Soils

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INTRODUCTION

- Biochar is a carbon-rich, porous material produced by charring organic material (Fig. 6).
- Biochar and compost additions may impact nitrate and phosphate availability in soil, heavily influencing plant growth.
- We aimed to identify the effect of wood biochar and/or compost additions on available nutrients in two contaminated urban soils with very different properties - from Sterling Community Farms (SCF) and Duke Farm (DF).

METHODS

Preparation

- Brown mustard (BM) and Lacinato kale (LK) were grown in greenhouse pot experiments with either urban soil (Fig. 1). There were 6 different soil treatments: control, compost, 1% biochar, 2% biochar, compost & 1% biochar, and compost + 2% biochar. Each treatment has 5 duplicates.
- After the growing season, nutrients were extracted from the soil using 1M KCl solution.

Nitrate

- Nitrate concentrations were determined using the VCl3 and microplate reader method (Doane and Horwath, 2003).

Phosphate

- Phosphate concentration was determined using EPA Method 365.2 (Molybdate blue method).

Figure 1. Greenhouse pot experiments growing Brown mustard and Lacinato kale in two different urban soils, with various treatments.

RESULTS

Phosphate

- SCF soil has significantly higher phosphate than DF soil.
- In DF soil where Brown Mustard was grown (Fig. 2), addition of compost or biochar led to lower available phosphate than the control soil.
- In SCF soil where LK was grown, only the biochar applied at 1% showed a significant decrease in phosphate.

Nitrate

- Mean N-NO3 was significantly lower in SCF soils than DF soils (Figs 4, 5).
- Addition of compost led to higher NO3-N.
- The addition of biochar correlates to a decrease in available NO3-N (Figs 4 & 5).

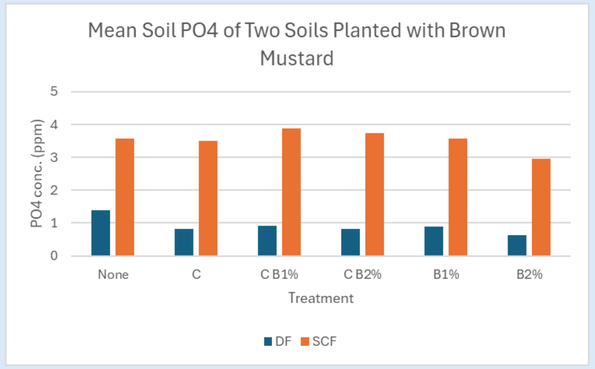

Figure 2. Bar graph showing the mean phosphate concentrations of Sterling Community Farm (SCF) and Duke Farm (DF) soils planted with Brown mustard (BM).

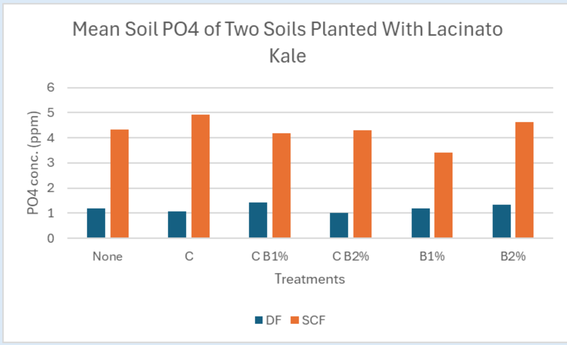

Figure 3. Bar graph showing the mean phosphate concentrations of Sterling Community Farm (SCF) and Duke Farms (DF) soils planted with Lacinato kale (LK).

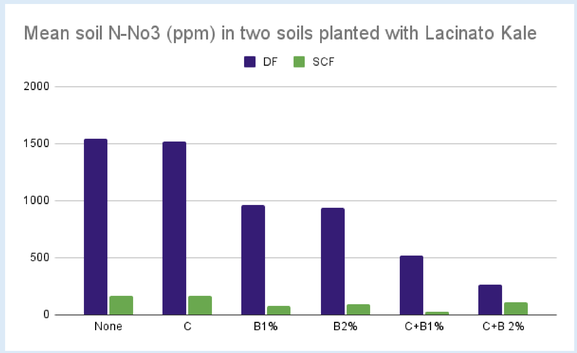

Figure 4. Bar graph showing the mean nitrate concentrations of Duke Farm (DF) and Sterling Community farm (SCF)) soils that grew Lacinato kale (LK).

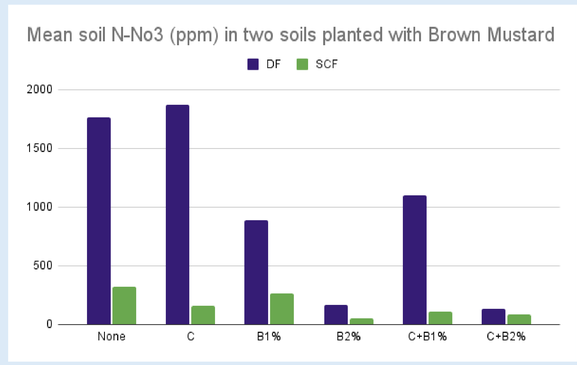

Figure 5. Bar graph showing the mean nitrate concentrations of Duke Farm (DF) and Sterling Community Farm (SCF) soils that grew Brown mustard (BM).

Works Cited

Doane, T.A. and W.R Horwath. 2003. Spectrophotometric determination of nitrate with a single reagent. Analytical Letters 36: 2713-22.)

DISCUSSIONS

The decreased nitrate, and to lesser degree phosphate, by adding biochar may be explained by two possible reasons:

(1) biochar helps retain nutrients and make them less extractable or available. These nutrients can be more slowly released for plant use, but not quickly released in our experiment.

(2) increased plant growth of plants due to addition of biochar (needs to be verified), which would remove those nutrients.

Figure 6. Electron microscope image of a biochar sample. Figure from Jillian Young Lorenz, 2013. "Portfolio analysis of carbon sequestration techniques and barriers to adoption." *University of Western Australia*.

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