

Evaluation of Biochar for use in Plant and Soil Restoration

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Introduction

- Biochar is produced from the heating of biomass (pyrolysis) in a low oxygen environment, which results in a carbon rich charcoal.
- The process creates a fine-grained, highly porous charcoal that helps soils retain nutrients and water.
- Biochar can be an important tool to increase food security and cropland diversity in areas with severely depleted soils, scarce organic resources, and inadequate water and chemical fertilizer supplies.
- Additions to soil also increase microbial population and activity.
- This resulting charcoal-like material is a form of carbon capture and storage that has potential to greatly increase the success of restoration projects.



Biochar stove constructed by Rob Diemair using a Barrel and stove pipe fittings. Optimally it burns at 200°C

Aim

- To test the efficacy of biochar in promoting plant growth, specifically to determine if germination rate, plant height and plant mass are increased by biochar amendments to soil
- To determine if the effect of biochar is consistent across several different species of prairie plant (perennial, annual, nitrogen fixing and woody)
- To test these parameters in the greenhouse and in an outdoor research plot
- To test soil chemistry of the outdoor plot to establish baseline parameters for future studies

Method

- Biochar will be made with hardwood pellets using the stove constructed by Rob Diemair.
- The experiment will consist of two parts, one in a greenhouse setting and the other outside using a research plot.

Greenhouse Experiment

- Four different seed types were tested for germination to determine seed viability.
- Seeds were planted in cell packs on a heated workbench that receives periodic automated watering in the Greenhouse at Niagara College.
- Six different treatments were mixed for the experimental process (control, Biochar (5t/ha), fertilizer, and Biochar & fertilizer, Biochar 30%, and Biochar 30% & fertilizer).
- On February 3, 2010 four soil treatments were mixed and planted to initiate the experimental process (control, Biochar (5t/ha), fertilizer, and Biochar & fertilizer).
- On March 1, two additional treatments were mixed and planted (Biochar 30%, and Biochar 30% & fertilizer).

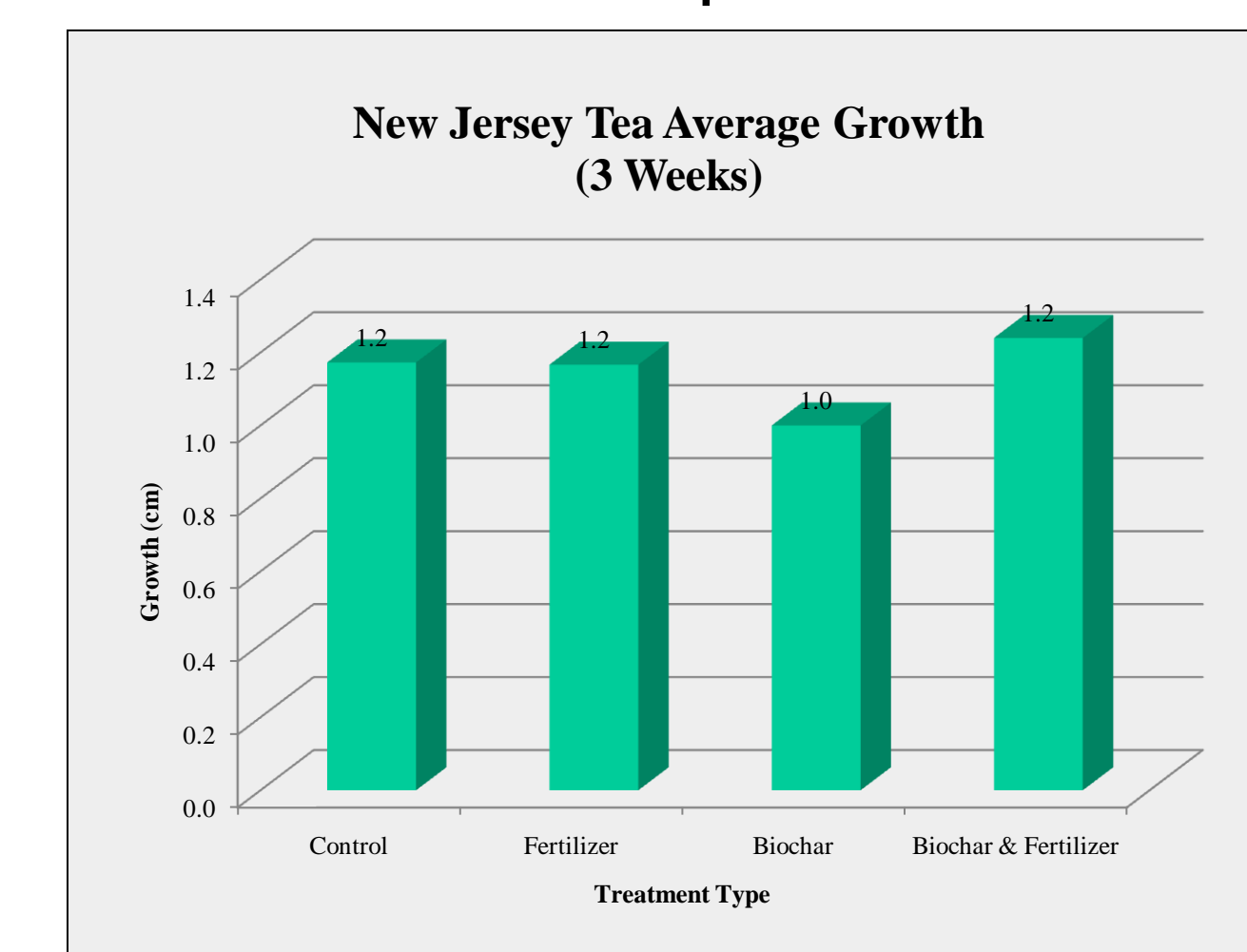
- A total of 432 cells were planted with each treatment receiving at least 18 replicates.
- The layout of the experiment was made random so as not to bias the results.
- Growth is measured weekly. Plant height measurements are taken as well as pictures of representative cell packs.
- After suitable growth, plants will be harvested, oven dried, and weighed to determine total plant mass.

Outdoor Research Plot

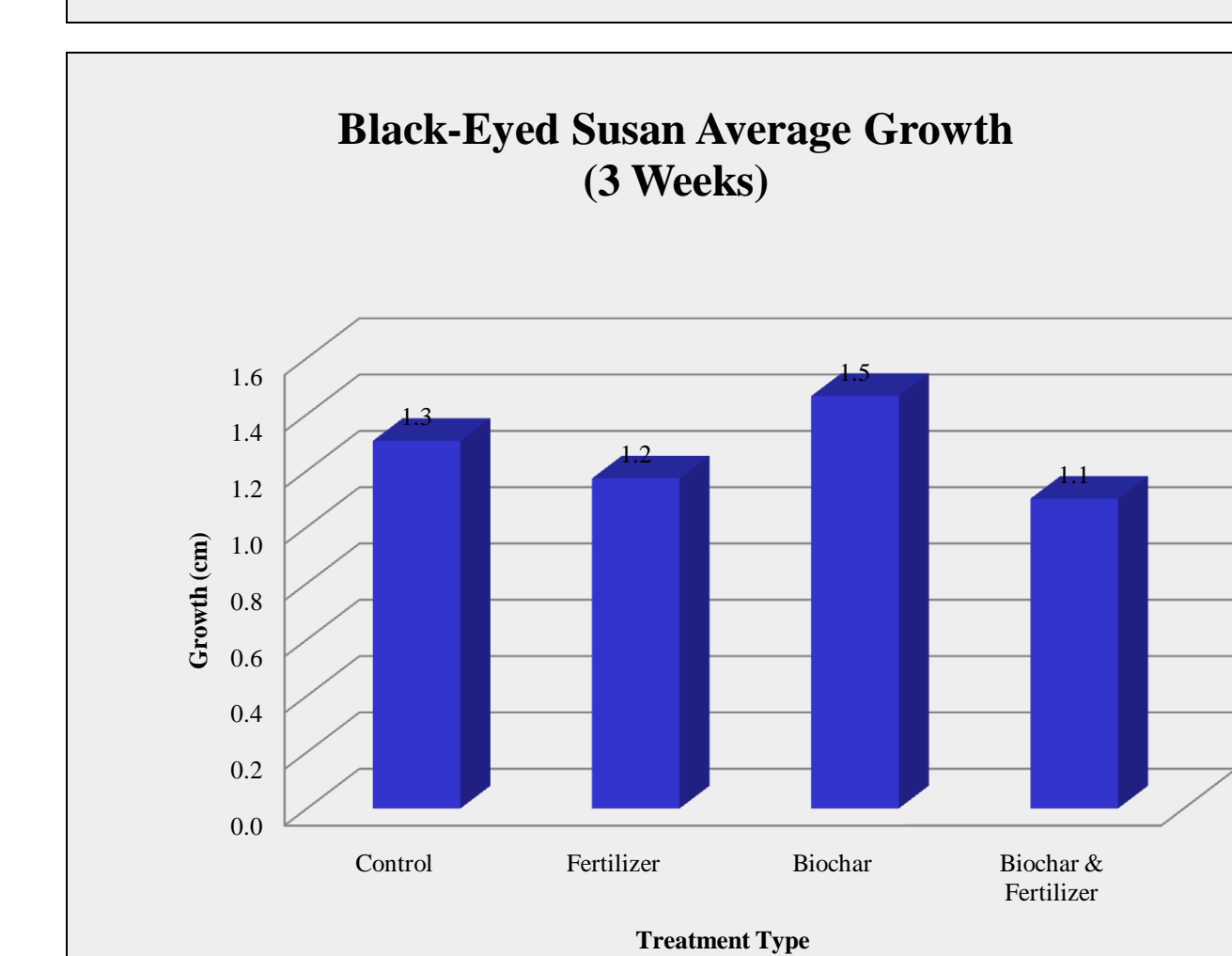
- Research Plots will be prepared on client's (Rob Diemair) property by Ecosystem Restoration students from Niagara College.
- Plot consists of a berm segregated into sections and labelled with wooden stakes.
- A soil analysis will be taken as a benchmark for the experiment.
- Each treatment will receive its own quadrant.
- Each quadrant will be further segregated into four additional sections, using prairie species seeds (Black-eyed Susan, New Jersey Tea, Big Bluestem and Black Oak).
- Once monitoring has begun, height measurements and pictures will be taken periodically.
- A soil analysis will be conducted for comparison.

Results

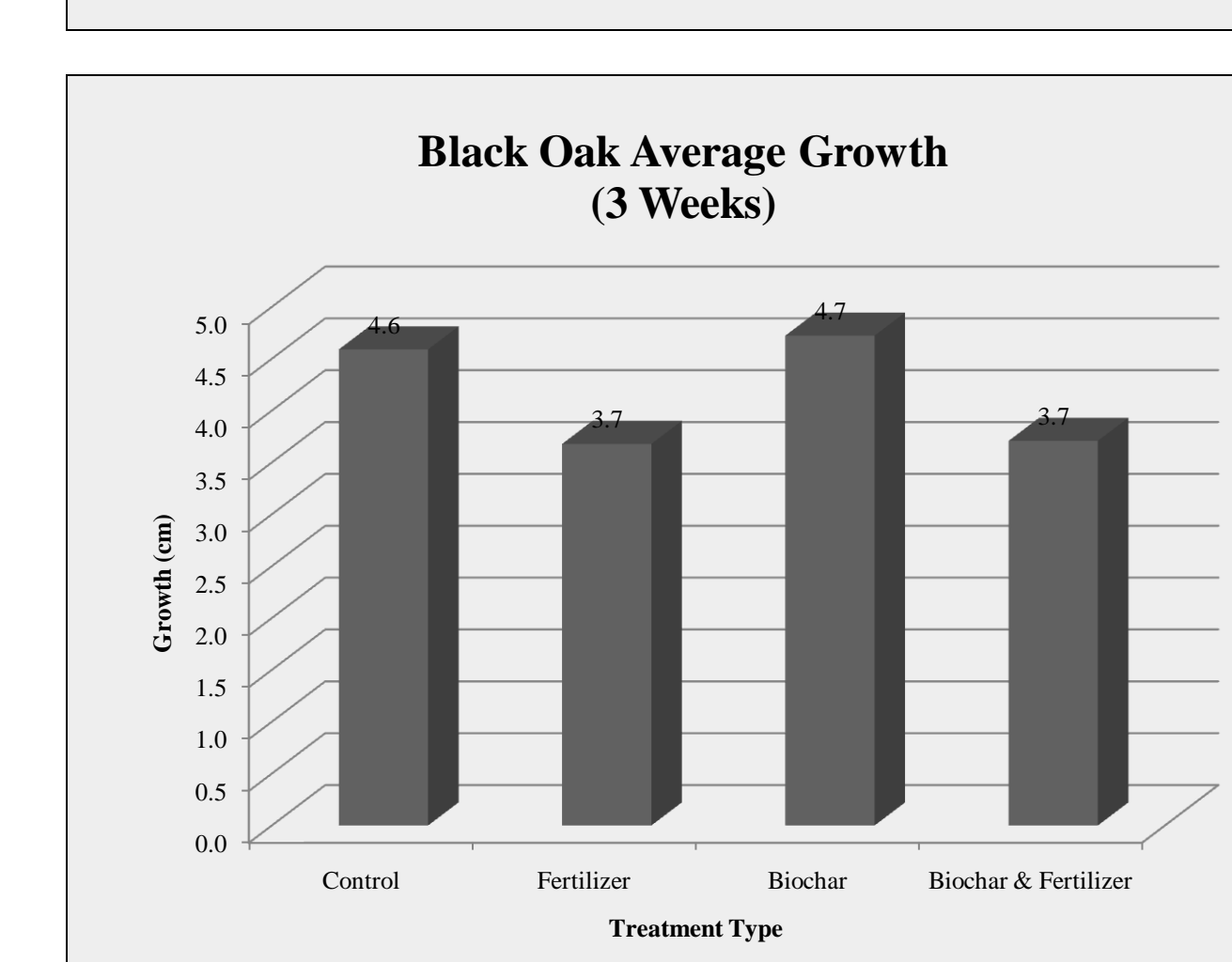
- Preliminary results have shown Black-Eyed Susan and Black Oak to have the greatest growth in biochar media.
- Plants in media with fertilizer have not had any improved growth at this time.
- Big Bluestem had low germination rates resulting in insufficient data collection.
- Data still remains to be collected concerning total plant mass.
- Results have yet to be recovered from the outdoor research plot.



The average growth of New Jersey Tea was 1.2 cm for all treatment types, except biochar which had average growth of 1.0 cm



The average growth of Black Eyed Susan was between 1.1 and 1.5 cm where biochar had the greatest growth and biochar & fertilizer had the least



The average growth of Black Oak was between 3.7 and 4.7 cm where biochar had the greatest growth (followed closely by the control) and fertilizer and biochar & fertilizer had the least amount of growth

Representative Photos of Plant Growth as of Week 3



Photos were taken using a Panasonic Lumix on March 12, 2010 to visually represent growth seen in each treatment.

Conclusion

- Biochar has performed well in preliminary results but insufficient data has been collected at this time.
- Biochar has had the greatest growth in two out of three of the acceptable trials.
- Field trials will commence after the spring thaw (March 24, 2010).
- The two new treatment types are expected to produce results within the next 3 weeks.

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