# Field Experiment Testing Biochar's Effect on Plant Growth and Yields in Temperate Urban Soils

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## Abstract

Biochar is an organic charcoal used as a soil amendment in nutrient poor, degraded soils. The enhancement of soil structure, water retention capacity, nutrients, and subsequent plant growth is crucial to achieve food security. The MAPA biochar data indicates biochar does not influence crop yields in rural, temperate climate zones and therefor does not support the hypothesis that the crops planted within the plot containing biochar and compost will have the greatest amount of growth and yield.

## Introduction

Soil mismanagement and rapid urban development have destroyed soil health, decreased crop yields, and depleted nutrients in soil. Biochar is an activated carbon made through the process of pyrolysis using biomass such as plant material and can be highly useful when attempting to increase soil quality. By adding organic material and microorganisms to the biochar and then into the soil, the soil has a chance to increase water retention, soil structure, and reduce nutrient loss. Once this occurs it increases efficiency, health, and yield thus providing a better environment to grow crops. Unfortunately, there has been little research conducted on the effect's biochar has on urban soils. Most of the reliable information that discusses the benefits of biochar is related to amending rural soils and focuses on large scale crop production. This could be the cause of a pattern followed that frequently associates degraded soils due to over farming in rural areas. The use of biochar contributed to the improvement of these overused soils. Areas that were once dry, compacted, and bare, had the ability to increase water retention, store carbon, and sustain life.  With this evidence, it can be hypothesized that the same results will occur in urban soils. Urban soils, too, can also be degraded to the point of needing amendments. The benefits of studying biochar's potential use as a soil amendment include improving soil management practices and improving urban soil quality. Improving urban soil quality is important and it is vital that it is done safely. This is achievable since biochar is an organic sustainable soil enhancer. When improved, urban spaces can be utilized for food growth to combat food insecurity in these communities.  This study aims to find if biochar soil amendments can be used to increase the production and yield of food growth in the urban soils of temperate climate zones. We hypothesize that the crops planted within the plot containing biochar and compost will have the greatest amount of growth and yield.

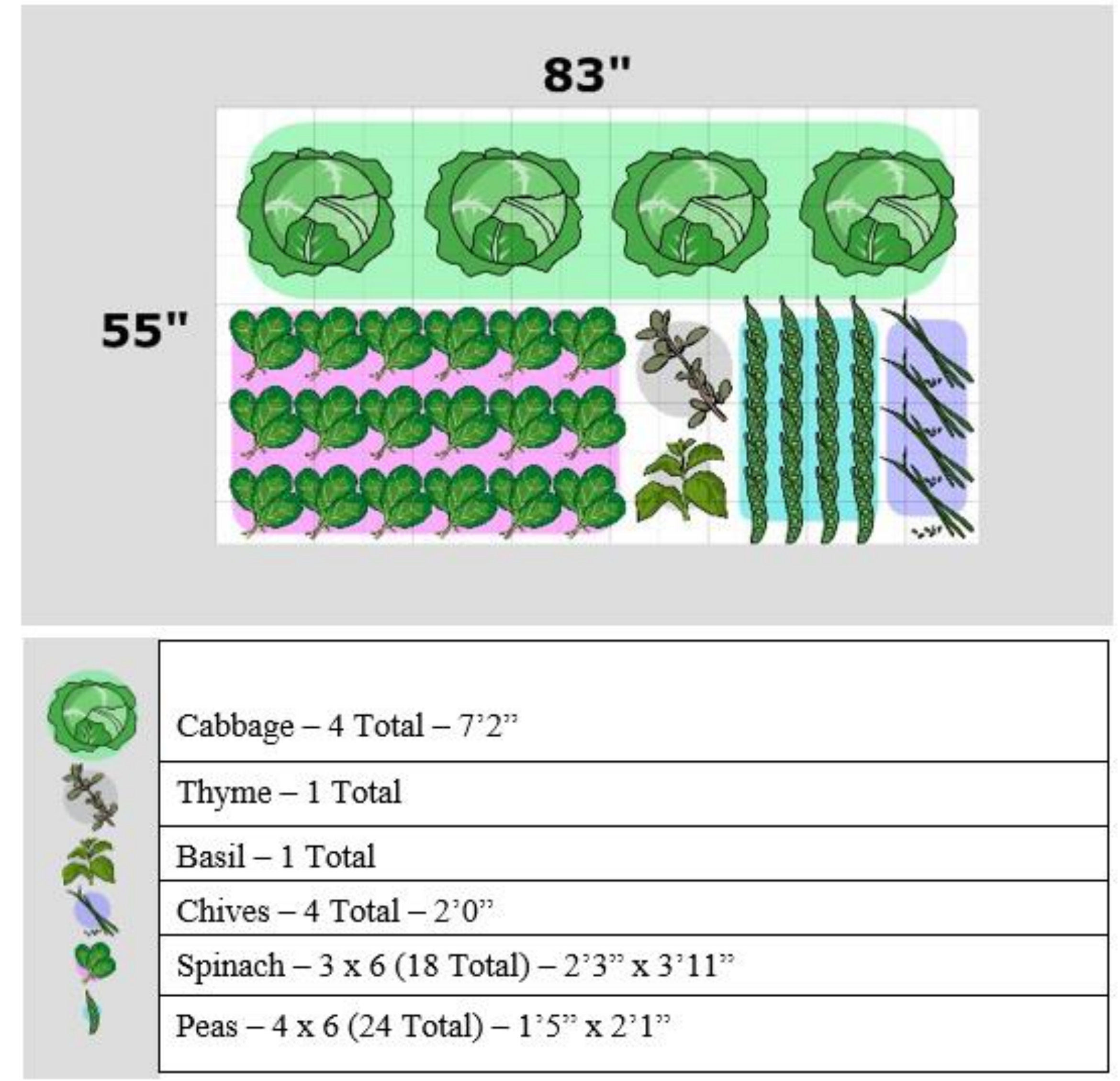
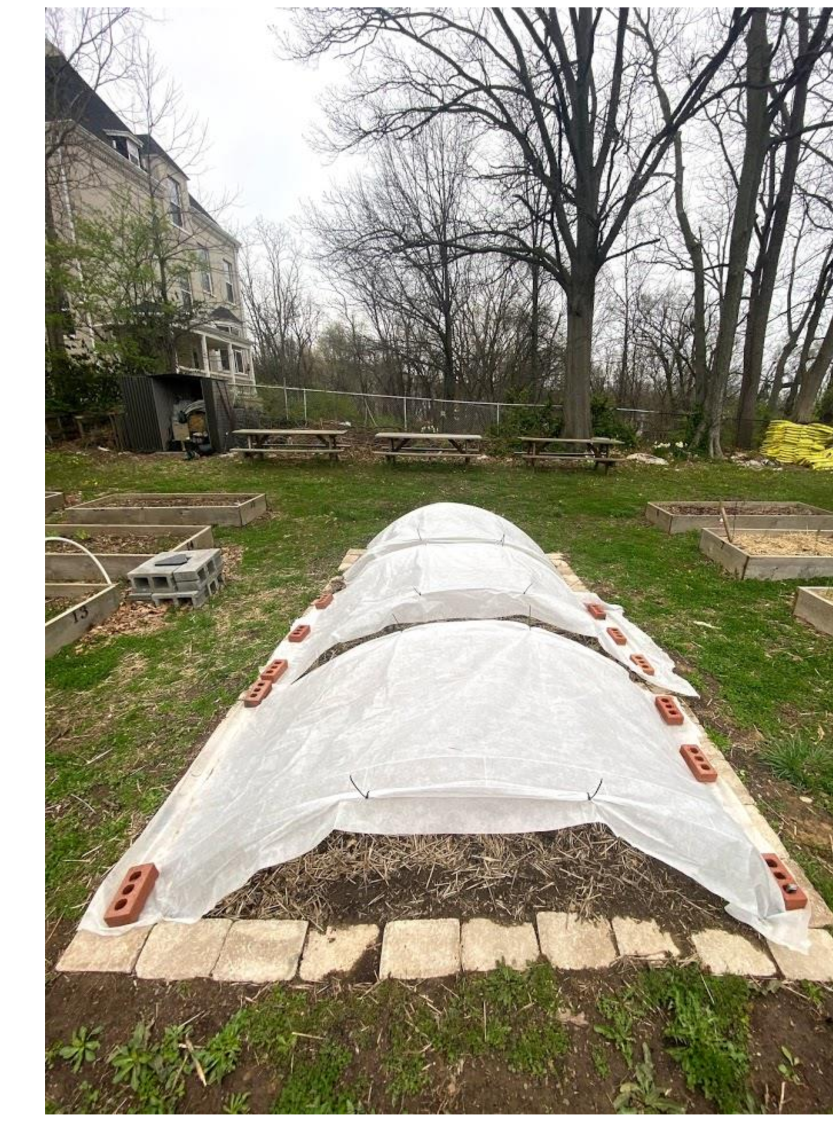



***Figure 1*** - This figure displays the layout of crops within the experimental sub-plot. This layout is the same for all three sub-plots. The key identifies each crop and the number and space between them, by, G. E. Ealy, 2021, February 7, https://gardenplanner.almanac.com/app/



## Methods

The experiment takes place from February 19th to April 12th . The Location of the sub-plots are at Mt. Auburn Preparatory Academy (MAPA) 244 Southern Ave. Cincinnati, Ohio. The research sub-plots consists of 1. Control with no soil amendments, 2. Soil amended with biochar, 3. Soil amended with biochar and compost mix. Crops planted include; cabbage, thyme, basil, chives, spinach, and peas. Lettuce, cabbage, and swiss chard were planted in the middle of the experiment to yield crop and germination data in areas where original crops failed. Seedlings were started in moist paper towels on February 21st and transferred into the experimental sub-plots on March 8th .  Data was collected and analyzed on April 12th .

## Results

Average pea height ANOVA yielded a P-value of .06. The height for biochar and compost was 11.79 cm, biocar was 14.30, and control was 13.15. Average pea leaves ANOVA yielded a P-value of .67. The average pea leaves for biochar and compost was 26.76, biochar was 28.38, and control was 28. The germination rate was analyzed for lettuce, swiss chard and cabbage. Cabbage had an equal germination rate across all plots. Swiss chard germination in biochar and compost was 7, biochar was 5, and control was 6. Lettuce germination for biochar and compost was 45, biochar was 46, and control was 27.

## Discussion

This study was conducted to investigate biochar's effect on plant growth and germination in temperate urban soils. Our results indicate that there is no significant difference in plant vigor between the three plots, which led us to fail to reject the null hypothesis. This went against what we expected and what past studies have indicated. Our differing results could have been caused by many factors including using seedlings, limited observation time, and cold weather conditions. In future studies, seeds should be planted during the growing season and be observed for the entirety of the year. Although there were limitations, this research narrows the knowledge gap of biochar's effect on plant growth in temperate urban soils. With this, we can further understand where to use biochar and how it impacts different soils and the plants growing within them.

## References

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