Assessment of Biochar Produced from Biosolids for Agricultural Applications

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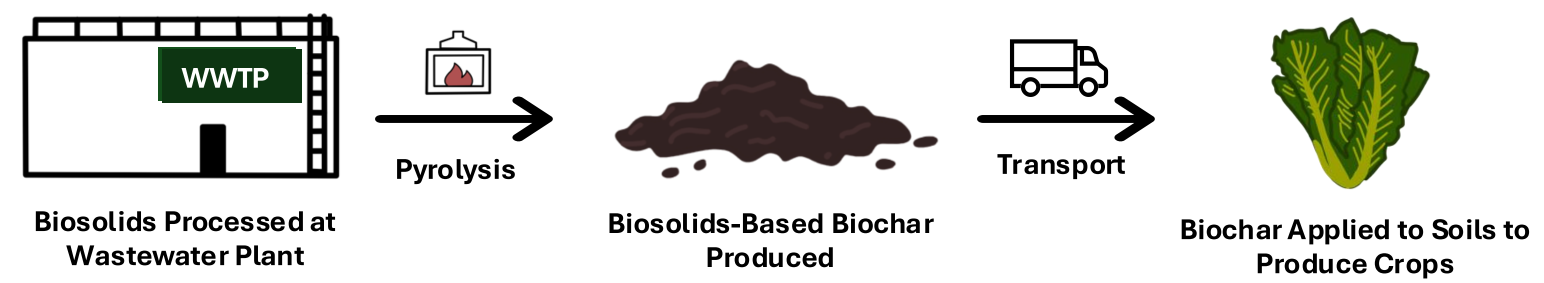
Environmental Problem

Biosolids are a nutrient-rich byproduct of wastewater treatment plants widely applied to agricultural fields to increase productivity. Although biosolids are an effective fertilizer, current wastewater treatment processes fail to remove harmful contaminants, such as PFAS and microplastics which could be absorbed by crops. Recent research has shown that pyrolyzing biosolids (burning them at high temperatures in the absence of oxygen) eliminates these contaminants, creating a **charcoal-like substance called biochar**. This biochar retains many of the nutrients of the original biosolids, without the harmful contaminants, making it a possible viable soil amendment for farmers.



Project Objectives

Grow Agricultural and Native Crops. Apply varying levels of biochar to lettuce, wheat, dogbane, and basket rush and allow them to reach maturity

Analyze Yield and Nutrient Composition. Measure the yield and nutrient content of agricultural crops to determine how they differ between trials

Conduct Cost Benefit Analysis. Use all applicable data from the experiment to conduct a cost-benefit analysis to see whether biochar would benefit farmers

Methods and Results

Measurements of total lettuce and wheat biomass across trials indicated that **adding biochar positively impacted lettuce growth** and had no statistically significant impact on wheat growth (Figure 1). Biochar application also did not significantly impact the nutrient quality of plants. The native plant trials faced significant predation, and biomass could not be analyzed.

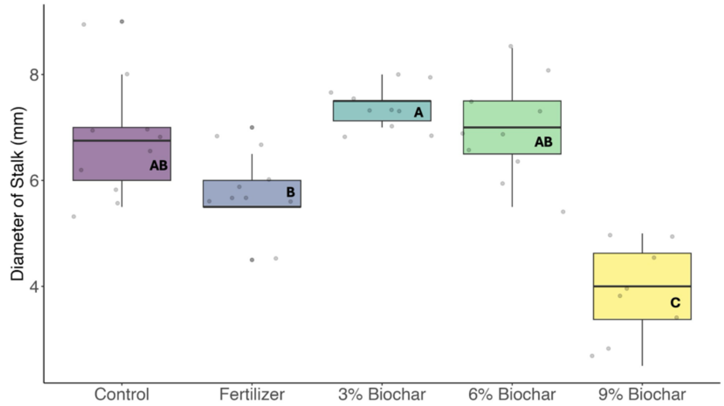


Figure 1. Measurements of Plant Yield for Different Trials. *3% Biochar and 6% Biochar Trials showed increases in growth compared to other trials. Matching letters indicate trials with statistically similar values.*

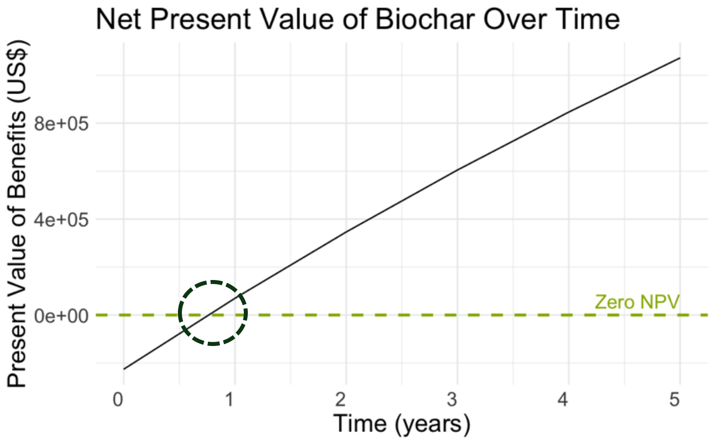


Figure 2. Net Present Value of Biochar over Time. This value was calculated assuming a single implementation cost and total benefits from increased yield as well as fertilizer savings.

Since lettuce is a high-value crop, these **improvements in growth from biochar produce significant revenue increases**. This allows farmers to see results from application within a year (Figure 2). In contrast, a similar analysis for wheat revealed farmers would not see any benefits for over 45 years after biochar application. Since the nutrient data was not significant across trials, this data was not utilized when performing the cost-benefit analysis.

Recommendations and Impact

Conduct Additional Plant Trials

Perform additional trials for agricultural and native plants with larger sample sizes to reproduce results and validate conclusions

Consider Additional Market Factors

Conduct Cost-Benefit Analysis with additional variables such as a carbon market for biochar application to fields and government subsidies

Inform Farmers of Results

Provide farmers with easily accessible results from future studies, including improvements to crop yield and nutrient quality