CALIFORNIA STATE SCIENCE FAIR
2017 PROJECT SUMMARY

Name(s)

Danya Balagopal

Project Number

J1106

Project Title

Recycling Food Waste as Biochar to Sequestering Carbon, Improving Soil Nutrition, and Growth of Plants in Urban Areas

Abstract

Objectives/Goals

This experiment hypothesizes that biochar made of spinach, mushroom and banana (SMB) peel food waste will sequester carbon, increase soil nutrition and plant growth more than similarly pyrolyzed coffee waste biochar or orange peel waste biochar.

Methods/Materials

The objective of the experiment was to measure carbon emissions, monitor soil improvements and measure the growth of plants. Sandy soil laden with food waste simulated a landfill control. A commercial carbon test kit measured carbon dioxide emissions from the different types of food waste biochar that were introduced into sandy soil under a heat lamp. The control for each biochar type was plain sandy soil. The soil nutrition test used the Rapitest soil test kit and measured NPK content in sandy soil when the different types of biochar were added. The final test measured the growth of radish plants using a measuring tape in the biochar amended soil.

Results

The hypothesis was supported. SMB biochar reduced carbon emissions by 3.6%, coffee ground biochar reduced carbon emissions by 2%, and, orange peel biochar reduced emissions by 1% reduction as compared to their respective ambient controls. Soil nutrition was maximized (NPK content) compared to deficient levels in the control. SMB biochar amended soil had the highest plant growth (120mm), followed by orange peel (90mm) and coffee grounds (70mm).

Conclusions/Discussion

The hypothesis was supported. By pyrolyzing urban food waste into biochar, we can reduce 26% of our total global carbon footprint. My experiment proved that food waste that is disposed in landfill increases carbon emissions by 39%. My experiment also proved that SMB biochar reduced the carbon emissions by 21%, coffee ground reduced carbon emissions by 19%, and orange peel reduced carbon emissions by 16%. Additionally, my experiment proved that slow pyrolysis allowed the resultant carbon structures to retain their respective inherent N, P, and K properties associated with the original biomass. By pyrolyzing food waste, we can reduce carbon emissions in two-ways: by sequestering the carbon in the food waste, and by growing plants and trees in degraded soil.

Summary Statement

By pyrolyzing our food waste into biochar, we can sequester carbon, improve soil nutrition to green our urban environment and reduce emissions.

Help Received

None. I designed, built, and performed the experiments myself.