CALIFORNIA STATE SCIENCE FAIR
2010 PROJECT SUMMARY

Name(s)

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Project Number

S2008

Project Title

Biochar: A Viable Method for Soil Improvement, Water Conservation, and Carbon Sequestration

Abstract

Objectives/Goals

The objective of this experiment was to determine the effect of biochar additives on plant growth, soil water retention, soil bulk density, and soil pH when mixed in varying concentrations.

Methods/Materials

Soils with varying concentrations of biochar were tested for impact on plant growth over a period of six weeks. The control group contained only nutrient poor sandy loam. The experimental groups consisted of charcoal mixed thoroughly into the soil in amounts of 5%, 10%, 25%, 50%, 75%, and 100% by mass. Nine sugar pea plants were planted in soil test group and measured for height and leaves over three, six-week trial periods. The plants were assessed for health by a biomass test. The soils were then analyzed for bulk density, water retention capability, and pH. These tests served as quantitative measures of soil improvement.

Results

Overall, a definitive pattern of plant growth emerged that correlated to the amount of charcoal in the soil. Plants grown in soils with charcoal grew at times 90% better than the plants grown in the control soil. Soils with higher concentrations of bone charcoal did not allow plants to germinate, however. On average, plants in the 25%, 50%, and 75% oak charcoal soils grew faster and larger. In the bone charcoal group, plants in the 5% and 10% soils were the fastest growing. Charcoal also proved to increase water retention capacity greatly, in one instance by 95% in 75% charcoal mixtures. Biochar also improved pH levels and reduced bulk density.

Conclusions/Discussion

The results indicate that charcoal had a profound impact on soil improvement. Biochar improved soil bulk density, water retention, and pH, which in turn would positively impact plant growth. Practical agricultural applications include a natural fertilizer, increased water retention and thus less water usage to grow crops, and a possible application in carbon sequestration fields. In the future, the experiment will test a larger diversity of plants, large scale application, and the possibility of creating a cycle of carbon sequestration.

Summary Statement

The experiment tested the ability of biochar to stimulate plant growth while improving soil quality observed through quantitative measures such as bulk density, water retention, and pH levels.

Help Received

Mrs. Elaine Gillum and Mrs. Erin Schumacher provided insight, gave support, and proof read work; Dr, David Laird narrowed scope of research; parents allowed experiment to be conducted on their property.