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EFFECTS OF THREE CARBON SOURCES ON GERMINATION AND SOME GROWTH CHARACTERISTICS OF *VIGNAUNGUICULATA*L WALPS

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ABSTRACT

This study is aimed at investigating the effect of charcoal, sooth and spent oil on the growth of cow-pea (*Vignaunguiculata*L.) with a view to assessing the possibility of increasing the foliage yield of the crop, using charcoal amended soil, The research was carried out in the botanical garden of the Department of Plant Science and Biotechnology, Michael Okpara University of Agriculture, Umudike, Nigeria. The study was carried out using 4 treatments in three replicates. Measured quantities of charcoal, soot and spent oil was mixed with the soil and a control soil without any amendment was set up. Three seeds of Vignaunguiculata L. were planted in each of the buckets. Data on the germination rate, vine length and number of leaves per plant were taken and analyzed. The result of all plants on the charcoal treatment showa significant increasease ($p<0.05$) in both vine length and number of leaves. The result for all plants in the sooth treatment showed that the plants had a reduction in vine length, but showed significant increases ($p<0.05$) in the number of leaves over the plants treated with spent oil. This study has shown that charcoal may increase plant growth due to its carbon content, while the spent oil and sooth may decrease growth.

KEYWORDS: Foliage, Amended Soil, Soot, Charcoal, Biochar & Vine Length

INTRODUCTION

Increasing food crop productivity has become an issue of global concern. With a rapidly increasing Human population in many parts of the world and a spate of decreasing availability of inputs resulting from many factors including climate change, concerted efforts at finding new ways of renewing soil fertility become necessary. Inputs to optimize crop productivity can be applied through soil, and water, and a crop will thrive if all inputs are optimal. The continuing need for increased crop productivity indicates increasing demands on soil fertility world-wide (Wild, 2003). To achieve optimum crop productivity, the soil should be fertile because plants absorb nutrients from this source. This makes the soil an important consideration for plant growth and development. One way to improve soil fertility in both intensive and marginal agriculture is to apply amendments to increase soil organic matter content and health (Sherchan and Karki, 2005; Tiwari *et al*., 2010). In addition, loss of organic Carbon from cultivated agricultural soils has generated interest in C-sequestration (Gami*et al*., 2009). Traditionally, soil amendments have included farmyard manure, composted manure,and poultry manure (Shrestha *et al.*, 2000; Uddin *et al*., 2009). Currently, very little Carbon source material is being used in agriculture in some countries and this may be due to the fact that its agronomic values in terms of crop response and soil health benefits are inadequately quantified (Chan *et al.*, 2007).

The search for novel and inexpensive soil amendment patterns using materials that are easily affordable by rural farmers is the main motivation for this investigation. The aim is to determine the effects of soils amended with grinded

charcoal, soot and spent oil on germination and some growth characteristics of *Vignaunguiculata*L. Walps.

MATERIALS AND METHODS

The experiment was conducted within the premises of Michael Okpara University of Agriculture, Umudike, in the rainforest belt of Nigeria, latitude 05° 28°N ,and longitude 07° 32°E. It has an average rainfall of 2,200 mm and is 123m above sea level. Minimum and maximum temperatures are 22.41°C and 30°C respectively, with total annual mean rainfall of 1,245mm.

Five kilograms of top loam soil were measured into different plastic buckets. The buckets were divided into three groups. In one group 50 cm^3 of spending engine oil was thoroughly mixed with soil. In the second group 1 kg of soot was mixed with the soil, while the last group, had 1 kg of grinded charcoal mixed with soil. Some healthy seeds of *Vignaunguiculata* were planted in the buckets containing the different soil amendments and kept in the screen house. The germination data were collected after 4 days of planting. Subsequently, other growth characteristics such as the number of leaves, vine length, etc., were collected on a bi-weekly basis up to the 8^{th} week of germination. Statistical analysis of the data was done using Analysis of Variance.

RESULTS

The result of the germination test is presented in Table 1 below.

Table 1: Effect of Charcoal, Soot and Spent Oil on Germination of *Vignaunguiculata*

Carbon Source	No of Seeds Germinated	% Germination
CHARCOAL	18	90
SOOT	13	65
SPENT OIL	8	40
CONTROL	19	95

The germination rate of the seeds planted in soil amended with charcoal showed no significant difference with that planted in the control. Compared with the rate of germination of the seeds planted in soot and spent oil with 65% and 40%, respectively, the difference in germination rate among the control and these two carbon sources is significant at P< 0.05.

The result of vine length of *Vignaunguiculata* and the number of leaves of *Vignaunguiculata*, are shown in Figure 1 & 2

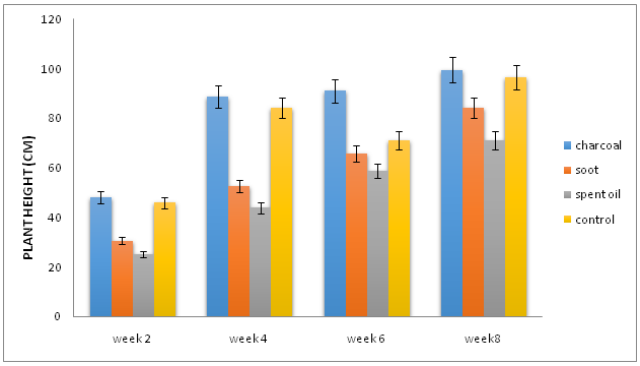

Figure 1: Effect of Charcoal, Soot and Spent Oil on the Vine Length of *Vignaunguiculata* in 8 Weeks after Planting

The data in Figure 1 show the effect of charcoal, soot and spent oil on the vine length of *Vignaunguiculata* in 8 weeks after planting. The vine length of the plant ranged from 25.2 to 48.1 cm in week 2, with charcoal treatment showing the highest growth. In week 4, the length ranged from 43.9 to 88.8 cm. In week 6, it increased range from 58.9 to 91.0 cm. Finally, in week 8, the plant vine length ranged from 71.1 to 99.6 cm. There was no significant difference in treatments containing soot and spent oil. However, between these two treatments and those of charcoal and control, a significant differenceexists exist ($p<0.05$) in the length values.

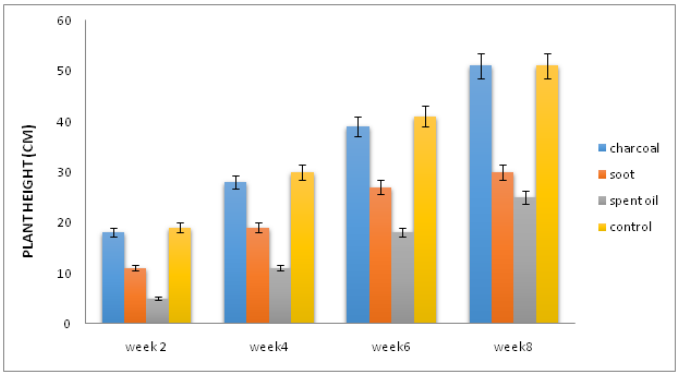

Figure 2: Effect of Charcoal, Soot and Spent Oil on the Number of Leaves of *Vignaunguiculata*in 8 Weeks after Planting

The data in Figure 2 shows the effect of charcoal, soot, and spent oil on the number of leaves of *Vignaunguiculata* in 8 weeks after planting. The number of leaves ranged from 5 to 19 leaves in week 2, with the control had the larger number of leaves. In week 4, the number of leaves ranged from 11 to 30 leaves. In week 6, the number of leaves ranged from 18 to 41 leaves. Finally, in week 8, the number of leaves ranged from 30 to 51 leaves, with charcoal treatment and control showing the highest from the others and the charcoal treatment and control also showed significant differences ($p<0.05$) compared to the other treatments.

DISCUSSIONS

The result obtained from the germination test shows that seeds germinated in charcoal amended soil had a similar effect as those germinated in the control soil. Compared with the germination rates of seeds germinated in soot and spent oil, the effect of the charcoal on germination of Vigna seeds is positive. This result conforms to that of a similar research conducted by Bienie*et al.*, 2013. Their conclusion was that the addition of activated charcoal to growth medium had a positive effect on germination and protocorm size and development of *Zygostatesgrandiflora* (Lindl.) Mansf. In a similar study conducted on corn by Kim (2008), it was reported that plants growing on soils with the addition of charcoal exhibited higher germination rates, a greater number of leaves and grew to be taller. He noted that soils with added charcoal were more alkaline and thus more favorable for corn growth. The results obtained in the present study showed that the three carbon sources: charcoal, soot, and spent oil influenced the growth of cowpea (*Vignaunguiculata*L.) positively and negatively.

Observations on the effect of charcoal treatment on the vine length of *Vigniaunguiculata* showed that the charcoal influence had a significant effect ($p<0.05$) on the length of the vines when compared with the control. This result agrees with a similar research work done by Yilangai*et al.*, (2014) who reported that stem growth was significantly higher in tomatoes (*Lycopersicumesculentus*) grown on SVG beds (with charcoal and covered with the veil)

than traditional beds without charcoal. Biochar usually has the potential of activating soil microorganisms and increasing the water retention capacity of the soil, thereby increasing the photosynthetic rate and consequent increase in growth of plants (Ogbo, 2009; Quilliam*et al*., 2012). Several other studies have reported significant increases in crop yield with biochar.

Observations on the effect of soot treatment on the vine length of *Vignaunguiculata* showed that the soot had a negative influence on the length of the vines. It was observed that the plants showed a significant decline ($p<0.05$) in growth and development when compared with plants in the control. This result is similar to the result obtained from a research by Angela and Berndett, (2012) who reported that the negative effect of soot was manifested in a reduction in grain yield of maize.

The result of the effect of spent oil on the vine length of *Vignaunguiculata* showed that the spent oil had an inhibitory effect on the length of the vines when compared with plants in the control. This result is in agreement with similar work reported by some authors. Agbogidi and Eruotor (2012) stated that spent engine oil affected plant height, the number of leaves, leaf area and biomass of *Jatrophacurcas* seedling and it was concentration dependent. Adenipekun*et al*., (2008)stated that as a result of reduced water availability in the soil, which is caused by spent engine oil on soil, plant height of *Corchorusolitorus*L. (*Tilicaceae*) were affected negatively. Bona *et al.*, (2011) stated that spent engine oil induced a decrease in plant height of *Schinusterebinthifolius* Raddi.

Observations on the effect of charcoal treatment on the number of leaves of *Vignaunguiculata*, showed that the charcoal induced a significant increase in the number of leaves of the plant compared to the plants in the control. This is also in agreement with a similar research work done by Yilangai *et al.*, (2014). As in the vine length result, soot and spent oil treatments showed significant negative effects on the number of leaves when compared to the control.

CONCLUSIONS

This study on the effects of these three carbon sources on germination and some growth characteristics of *Vignaunguiculata* L has shown that the charcoal treatment had a positive influence on the length of the vines and the number of leaves of the plant. The soot and spent oil treatments reduced both germination rate and growth characteristics of the plant. Therefore charcoal, being an inexpensive by-product of wood plants can act as a substitute for unaffordable soil renewed materials to be used by local farmers for the improvement of the soil fertility before planting.

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