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Is biochar a solution for food insecurity?

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Introduction

In cooperation with the organization Abokobi Society Switzerlands (ASS) the biochar/compost project tries to assist impecunious farmers in the Tamale / Walewale area in the northern region of Ghana. The soil of these farmers is often overused and low in organic matter and minerals. The biochar/compost project provides the occasion to raise awareness amongst local farmers for sustainable agriculture.

Objective

The main focus on this project was to find out the influence on yield of an agriculturally used soil based on applying biochar in combination with compost and poultry manure in different amounts. The aim was to identify the best mixture of the used soil improvement materials by carrying out a field trial.

What is biochar?

- solid material from the carbonisation of any organic material

What are the benefits of biochar?

- can be used as a valuable soil amendment
- can improve soil function
- can improve water retention capacity of soils
- can increase soil retention of nutrients
- can increase microbiological activity
- can increase buffering and cation exchange capacity
- can increase soil pH

Picture 1: crushed biochar

Picture 2: biochar/compost mixture in 50 kg sacks

Method

Field tests have been carried out since 2009 in the Walewale area and in the year 2011 also in the Tamale area. In 2011 combinations of biochar with other natural fertilizers were tested, such as poultry manure and compost.

Two test areas of 784 m² have been defined and each was devided into 16 plots of 49 m².

Groundnut (Arachis hypogaea) and Guinea Corn (Sorghum bicolor) were used as trial crop.

Seven variants in total were applied to the plots in different amounts (see figure 1). The data were collected from so called defined core zones in each plot.

A1: BC: 1 kg/m²	A2: Co: 1 kg/m²	A3: Co: 0,5 kg/m² BC: 1 kg/m²	A4: Co: 0,3 kg/m² BC: 0,3 kg/m² PM: 0,3 kg/m²
A5: Co: 0,5 kg/m² PM: 0,5 kg/m²	A6: PM: 1 kg/m²	A7: BC: 1 kg/m² Co: 0,25 kg/m² PM: 0,25 kg/m²	A8: reference

Figure 1: plots with the respective soil amendments and added amount
BC - biochar Co - compost PM - poultry manure

Picture 3: test field in Gbilugu; cultivation of guinea corn

Picture 4: test field in Kukuo Yepalsi; cultivation of guinea corn

Picture 5: defined core zone for guinea corn

Results

By using the combination of biochar, compost and poultry manure as an organic soil improvement material the soil quality could be improved and significant higher crop yields could be achieved, without the use of chemical fertilizer.

It was observed that the use of the soil improvement materials increased the soil pH. Regarding the guinea corn it should be noted, that by applying the soil amendments the plant length as well as the panicle length are longer and the panicle weight is higher compared to the reference (see figure 2). Furthermore it can be determined, that the crop yield increased up to factor two (see figure 3). To find out which soil amendment allows the expectation of the highest crop yield ranking points were distributed.

Due to the determined dates the following soil amendments have achieved the highest crop yield:

- mixture of compost+poultry manure+biochar (each 0,3 kg/m²)
- poultry manure (1 kg/m²)
- mixture of compost+poultry manure (each 0,25 kg/m²) and biochar (1 kg/m²)

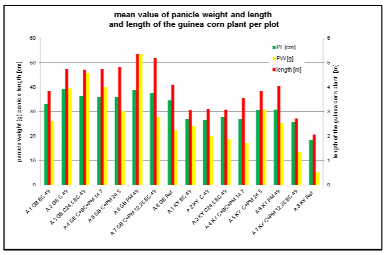


Figure 2: mean values of panicle length (PL), panicle weight (PW) and plant length of guinea corn
test areas: GB-Gbilugu KY-Kukuo Yepalsi
BC-biochar C-compost PM-poultry manure

Conclusions

The results of the field trial carried out indicate that the use of the soil amendments like biochar, compost and poultry manure have a very positive effect on crop yields. Local farmers were shown the new trial results in the field. They were convinced by the positive results of the crop yields.

Those who would also like to improve the soil of their fields, could be given initial aid allowing them to help themselves to improve their dire situation.

The biochar/compost project was continued this year using a special mixture of biochar, compost and poultry manure. This mixture is distributed to twenty local farmers to use it on their agricultural land.

To estimate long term effects by using biochar as an soil improvement material it is important to do long term studies.

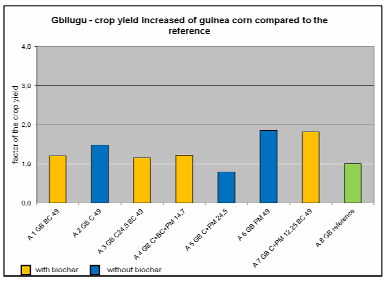
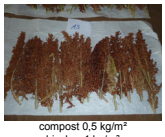


Figure 3: yield increased of guinea corn compared to the reference in Gbilugu

biochar 1 kg/m²

compost 1 kg/m²



compost 0,5 kg/m² biochar 1 kg/m²

compost+poultry manure+biochar each 0,3 kg/m²

compost+poultry manure each 0,5 kg/m²

poultry manure 1 kg/m²

compost+poultry manure each 0,25 kg/m² biochar 1 kg/m²

reference

Pictures 6-13: panicles of guinea corn of any core zone of the respective plot

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