Use of Biochar technology for recycling organic wastes in agriculture: Sustainable Crop Production

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Abstract— **Biochar, resulting from thermo chemical conversion of biomass, has been observed as an economically low-cost, sustainable method and widely applied in agriculture and Ecology filed. The present tendency about waste management is a crucial point on recycling and the revival of waste as new materials. Biochar in future will be one of the best, technological sound techniques for treatment of solid waste. Traditional agriculture is currently characterized by excessive inputs of chemical fertilizers, pesticides, and herbicides, due to insufficient application of organic fertilizers. The excess use of chemical fertilizers and pesticides has resulted in numerous negative effects on the environment, including water, soil degradation of soil quality and losses of agricultural biodiversity. These soils often show high toxicity and low percentage base saturation .The application of the biochar enriches the soil microorganism, plant growth (size of leaf, height, width and weight) and nutrient content of the yield .The high concentrations of biochar may delay plant growth due to the concentration of soluble salts. As a result, Biochar should be applied at required quantity to produced higher yield. The nutrients content in Biochar vary depending on the waste materials that are being used for the preparation. Studies have shown that biochar produced from crop residues such as corn cob and rice husk, often have low nitrogen and phosphorus contents. If the waste materials are heterogeneous one, there will be wide range of nutrients available in the compost. If the waste materials are homogenous one, there will be only certain nutrients are available. This Review article brings to light the margin of biochar application as an efficient improvement and propose further research directions to make sure the safe and sound use of biochar as adaptation remediation system of polluted soil..**

Keywords— **Biodegradable waste, Pyrolysis, Chemical Fertilizer, Soil, Plant growth,**

I. INTRODUCTION

Use of biochar as a soil amendment presents benefits to crops and nutrient cycling. Organic cropping system frequently has to deal with a shortage of readily available nutrients, and this is in distinction to high input cropping system which relies on soluble fertilizers. Nutrient management plays a key role in improving crop yield with preservation of soil fertility for sustainable production in intensive cropping. Fertilizers are material applied to the soil in order to boost crop yield by given that one or more of the necessary plant nutrients. The significance of organic fertilizer is that it contains slight or no soluble salt and it is applied in a large quantity with no the risk of harmful crop roots and also micro organisms in the soil help to rupture the organic materials into inorganic water soluble forms for plant use. Maize crop production requires heavy fertilizer for an optimum yield in terms of nitrogen. Organic manure has come to supply as one of the most important manure as it consists of higher nitrogen value. Organic had been found to be an important resource in sustainable practices like intercropping. In the present review, biochar is described as an excellent soil amendment and a biocontrol agent which make it the best organic fertilizer and more eco-friendly as compared to chemical fertilizers. Biochar is ideal organic manure for better growth and yield of many plants. It can increase the production of crops and prevent them from harmful pests without polluting the environment. Application of biochar increased seed germination, stem height, number of leaves, leaf area, leaf dry weight, root length, root number, total yield. Studies suggested that treatments of biochar plant growth promoting bacteria can be used for a sustainable agriculture discouraging the use of chemical fertilizers.

II. RECYCLING WASTE

Paddy, sugarcane, groundnut, millets, pulses, etc. are the major crops grown in this district. The production of Agriculture products leads to enormous amount of wastes. The need to recycle organic agricultural wastes is not just for environmental issues but also for economical and sustainable advantages. Reprocess of waste to biochar provides a good option for small and marginal farmers to produce organic manure locally for use in their farms.

A. Agriculture Waste

After harvesting, large amount of agricultural waste are generated and left in the field for natural degradation which takes several months. Fresh organic waste materials cannot be applied to soil until they have been suitably iostabilized, because function of immature organic materials to soil may influence plant growth due to nitrogen malnourishment and production of noxious metabolites These declined are also disposed off simply by burning in the field which results in loss of nutrients as well as causes atmospheric pollution due to the emission of toxic gases. In order to mitigate this problem, agricultural waste was pre-digested and utilized for the production of Biochar. Many studies have evaluated the effect of biochar on plant growth. We performed an examination to recapitulate these results and quantify the impact of vermicompost on plant growth. This analysis allowed us to assess the mean impact of biochar on plant growth. This analysis was also a prospect to identify knowledge gaps and to illustrate recommendation for future research and the use of biochar.

B. Growth of Maize Corn (Zea Mays L.)

Biochar production from the Agriculture waste is being used for the growth of maize plant is under observation. Corn (Zea Mays) is a widely consumed cereal crops throughout the world. It is used as a staple food for the peoples of the Tamilnadu and also contributes in animal feed. Application of chemical fertilizers help to overcome the nutrient deficiencies but excess use of these chemical fertilizers reduced the soil fertility by changing soil pH. Corn is particularly tolerant with respect to the pH of soil and it can survive in a range of pH 5.2 and 7.6, optimum corn production was reported between pH 6.5 and 7. Chemical fertilizers needs could be substituted by introducing organic fertilizer, these organic fertilizers helps in increasing crop productivity without affecting soil fertility and pH, because normal soil pH is a lead for improved soil fertility and up take of nutrients by plants. Biochar contains a large mass of easily fermentable organic matter. It is a prime source of major nutrients. This study was carried out to confirm the nutrient availability and maize growth in soil amended to mineral fertilizer and biochar. The experiment was conducted with inorganic fertilizer and biochar amendment for maize crop.

C. Materials and Methods

The experiment was carried out in Virudhachalam Taluk, Cuddalore District, and Tamilnadu. Inorganic fertilizer NPK and Biochar were used. The fertilizer was applied when all maize plants had fully emerged from the soil.

TABLE I
TREATMENT DESIGN FOR MAIZE CULTIVATION

Treatments	**Types of fertilizer**
T1	Control -0.0 t/ha
T2	Inorganic fertilizer(Urea and muriate of potash & Mono ammonium phosphate (12:61:0) and multi-K (13:0:46)
T3	Biochar :7.0t/ha Prepared from Agriculture waste

D. Results And Discussion

The morphological parameters like Colour and Texture of Leaves, Plant Height Measurement, Leaf Area; Harvest was recorded at an interval of 1 week (7 days) for16 weeks in control and experimental groups.

1) *Colour and Texture of Leaves:* The colour and texture of maize is indicated by Pale & thin leaves in control treatment. Green and stout leaves are observed in inorganic treatment, whereas in organic treatment the result is green, stout and broad leaves.

2) *Plant Height Measurement:* Plants were selected randomly from four corners of the plot and their height measured from the ground to the top of the plant using a tape measure (2- 6 weeks) after planting. It is measured at weekly intervals. Potential nitrogen losses due to leaching are higher in the first few weeks after sowing, when evapotranspiration is low and also during this period plant roots are not sufficiently well developed to take up the

available nitrates. These composts provide all nutrients in readily available forms and also enhances uptake of nutrients by plants and plays a major role in improving growth Nitrogen supplied by the organic fertilizers could also have enthused more rapidly growth than in the control. The occurrence of phytohormones in the organic fertilizers was reported to stimulate plant growth. It is thus likely that phytohormones could be the reason of the taller plants in the organic fertilizer treatments compared with the control in the present study.

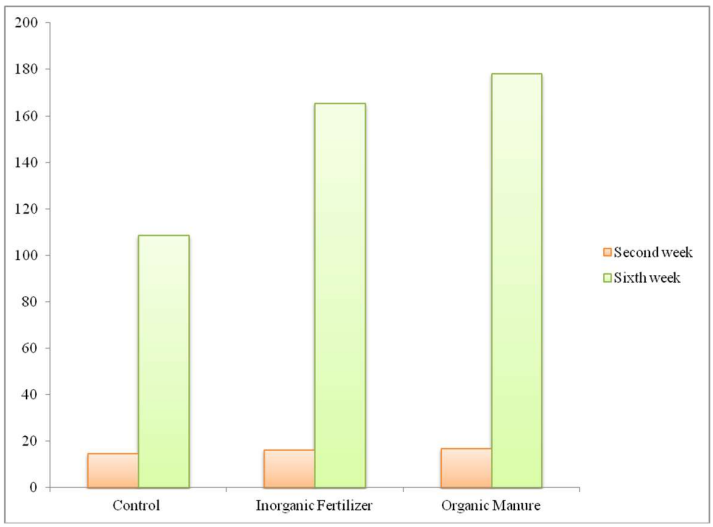

Fig. 1 Effect of Fertilizer on plant height (cm) 2 – 6 weeks after planting

3) *Leaf Area:* Calculate the width and length of maize plant leaves got the leaf area and multiplying out with a constant (0.75) and the average of this gave the leaf area. This was taken from the 2 – 6 week after planting. Maize as a cereal crop loves bright sunlight and the exposure of the leaves to light and the uptake of essential nutrients especially N by the leaves of maize plants. During the experimental period, the leaf area was increased in all the treated plants when compared to the control plants at the end of sixth week. The maximum area was recorded in biochar.

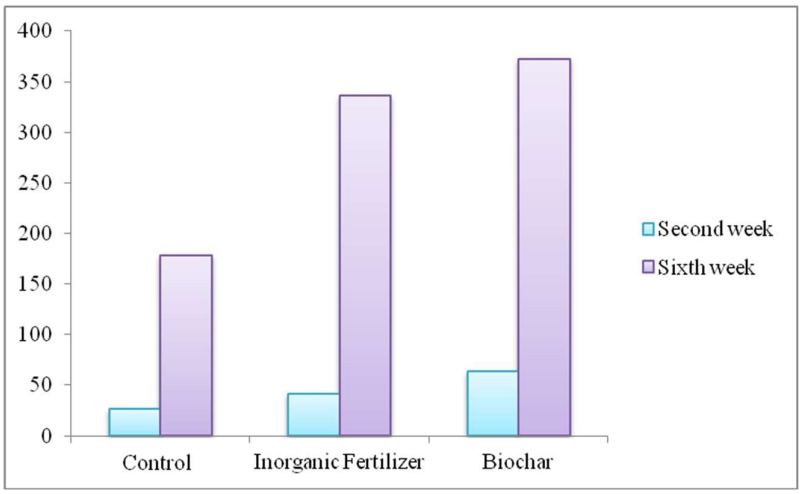

Fig. 2 Effect of Fertilizer on leaf area (cm2) 2 – 6 weeks after planting

4) *Harvest:* The maize cobs were harvested 16 Week after transplanting when all the plant had turned brown and the grains were expected to contain about 14% moisture content The cob sheets were removed and the maize sun dried thereafter, the grains yield was calculated.

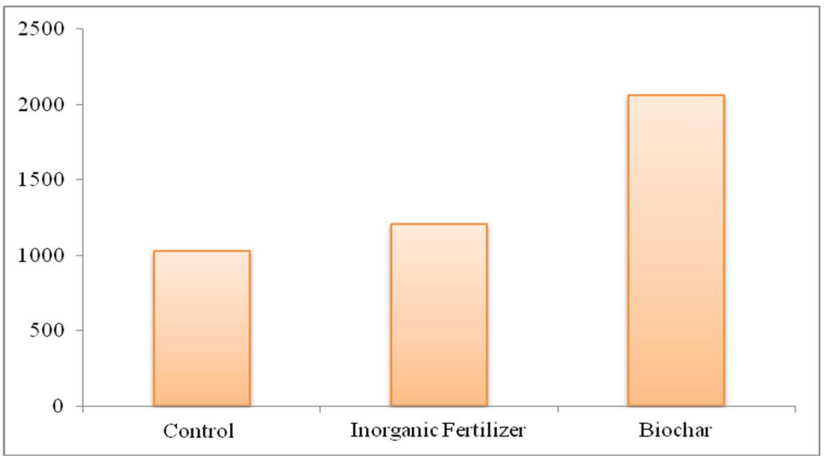

Fig. 2 Effect of Fertilizers on maize grain yield (kg/ha) 16 week after planting

III. CONCLUSIONS

We found significant effects of biochar on plant biomass production. The results of this study showed that biochar treatment showed great potential to increase the performance, growth of maize plant and improvement of soil quality. Maize plants grown in biochar amended soil showed enhanced growth rate when compared to plants treated with chemical fertilizer. These results clearly indicate that biochar can be exploited as a potent biofertilizers. Biochar stimulates to influence the microbial activity of soil, increases the availability of oxygen, maintains normal soil temperature, increases soil porosity and infiltration of water, improves nutrient content and increases growth, yield and quality of the plant. The results of this study positively highlight the importance of organic farming; therefore, biochar may be put to good use as a natural fertilizer for all type of crops for increased production and for sustainable agricultural systems. It is concluded that biochar can be used as a soil amendment for improving soil organic matter and available nutrients and for increasing crop production. It is prepared to supplement this work through field studies on different crops for determining its real value to the farmer.

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