ROLE OF BIOCHAR IN AGRICULTURE

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To feed its increasing population, India needs to produce 300 million tons of food grains by 2020. Since net cultivated land (142.5 million ha) is restricted and pressure for food grain production is rising, maintaining soil fertility is a top priority for farmers.Biochar and biochar-compost mixtures made from various alternative organic sources have been suggested as a way to improve soil fertility, restore degraded land, and reduce greenhouse gas emissions associated with agriculture.Biochar has been shown to have a beneficial effect on a variety of soil processes, including improving soil biology, controlling soil-borne diseases, increasing nitrogen fixation, improving soil physical and chemical properties, reducing nitrate (NO_3) leaching and nitrous oxide (N_2O) emission, and remediating polluted soils. However, only a small amount of biochar is used as a soil amendment, owing to the fact that the benefits are yet to be quantified, and the mechanisms by which soil quality is enhanced are also unknown.

INTRODUCTION

Biochar varies from charcoal in that it is made from the thermal degradation of organic materials in the absence of oxygen (pyrolysis). It is used as a soil amendment. Bio char helps in maintaining the soil physical health and also maintains the chemical and biological features of natural ecosystem.Artificial fertilizers are used in the majority of agricultural production. Agriculture faces many challenges in the twenty-first century. It must meet the growing population's food and industrial needs while also safeguarding the environment. The world's population was 7.35 billion in 2015, and projections show that by 2050, it will have increased to 9.72 billion. The effectiveness of soil conservation and agricultural productivity strategies depends on maintaining an adequate level of soil organic matter and ensuring effective biological nutrient cycling. These activities include the use of organic and inorganic fertilizers, as well as knowledge of how to adapt these practices to local conditions, with the goal of increasing the agronomic use efficiency of applied nutrients and thus crop productivity. Organic materials' rapid decomposition and mineralization can contribute significantly to global warming, in addition to their repeated application at high dose and cost of application.

BIO CHAR AND SOIL PROPERTIES

In general, biochar is charcoal derived from plant matter and retained in the soil as a means of extracting carbon dioxide from the atmosphere. Rice Husk Biochar used as experimental material. In several places, it is regarded as a waste product from a gasifier plant that burns rice husk for fuel. Rice mills were started by farmers as small-scale businesses. They burn rice husk under controlled oxygen conditions, and the resulting smoke is mixed with diesel to produce smoke diesel aerosol. As a result, the diesel engine's fuel efficiency is high increased in size Rice husk biochar is the remaining unfinished dark black content of rice husk (RHB). Bioavailability and plant uptake of key nutrients both increase in response to biochar application, particularly when additional nutrients are present. Important changes in plant productivity have been made depending on the amount of biochar applied to the soil, but these results are mostly from studies in the tropics. Biochar incorporation into soil is currently being investigated as a way to sequester carbon while also enhancing soil quality, fertility, and agronomic benefits. Biochar in soil, according to several researchers, can last longer and hold cations better than other types of soil organic matter. The exact residence time of biochar in soil is still a point of contention, which has significant consequences for the technology's importance in terms of carbon trading. Biochar's made from biomass have been shown to decompose quickly and slowly.

BIO CHAR AND BIOLOGICAL PROPERTIES

The structure and role of biological organisms in soils is extremely complex, with bacteria, fungi, algae, archaea, arthropods, nematodes, protozoa, and other invertebrates among its diverse inhabitants. In soil environments, microorganisms play a critical role in key processes such as organic matter decomposition, nutrient cycling, and, as a result, plant productivity.Soil microbial communities keep continually changing in response to soil characteristics, climatic and management influences. The addition of biochar brings about improvements to both soil physical and chemical properties such as soil pH, cation exchange potential and aggregation. The inherent properties of biochar, such as surface charge, density, and pore size distribution, which are dependent on the existence of feedstock and pyrolysis conditions, mediate changes in soil properties. As a result, soil that is directly affected by biochar's chemical and physical properties can have an effect on soil-plant-microbe interactions.The relationship between biochar and the soil biota, as well as the effects of this relationship on various soil processes, has yet to be fully described. There is currently a significant gap in our understanding of the interactions between soil biota and biochar. This necessitates a comprehensive and strategic study of soil-biochar dynamics in order to assess the possible implications of a seemingly wonderful product being widely used.

BIO CHAR PHYSIOLOGICAL PROPERTIES

The use of biochar in the soil resulted in a substantial increase in soil ph. suggested that biochar derived from poultry litter promotes liming in soil, resulting in an increase in pH of acidic or neutral soils in experiment suggested that the 20 percent increase in height and 40 percent increase in volume of tea trees was partly due to the biochar's ability to preserve soil ph. Such ability is related to the liming value of the biochar. Biochar made from paper mill sludge was applied at a rate of 10 t ha^{-1} to an acidic soil but not to a neutral soil, resulting in a nearly 30 to 40% increase in wheat height.

BIOCHAR CHEMICAL PROPERTIES

The recalcitrant quality of carbon contained in biochar, which is largely immune to decomposition, could have contributed to the rise in soil organic carbon with biochar application. Also noted was a substantial increase in soil carbon over the control. Biochar application also increased soil organic carbon content, according to the report. Bio availability and plant absorption of phosphorus (P), alkaline metals, and certain trace metals have been shown to increase when biochar is applied to forest soils alongside natural or synthetic fertilizers, but the reason for these increases are still unknown.

APPLICATION OF BIOCHAR ON YIELD OF CROP

Crop response to biochar application rate is critical for developing a long-term carbon sequestration strategy. Another commodity that is being considered for carbon sequestration20 is biochar fertilizer. When added to agricultural soils in conjunction with certain fertilizers, black carbon is said to have major benefits. Aside from the benefits of reduced emissions and increased greenhouse gas sequestration, biochar processing and application to the soil would provide immediate benefits through improved soil fertility and increased crop production.Biochar application improved the response to N and NP chemical fertilizer treatments and increased grain yields at sites with low P availability. Biochar application, on the other hand, reduced leaf chlorophyll concentration, presumably due to a reduction in soil nitrogen availability, implying that biochar application without additional N fertilizer application may reduce grain yields in soils with a low indigenous N supply.

They concluded that biochar application has the potential to increase upland rice production soil productivity in Laos, but that the impact of biochar application is highly dependent on soil fertility and fertilizer management.

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BIOCHAR USED AS LIMING INPUT

The increased K concentration in biochar, when combined with Mg and Ca, acts as a liming agent to neutralize acid soils. Biochar application resulted in a decrease in soil acidity in several studies, according to a meta-analysis of the literature. The 90-day incubation experiments in acidic Ultisol supplemented with four crop residue biochar increased soil pH and exchangeable base cations while decreasing exchangeable Al^{3+}, especially in the case of legume crop residue biochar. In reality, in acidic soils, the biochar amendment improves crop growth and yield significantly.

USES IN COMPOST PRODUCT

Biochar encourages the formation of humic substances (HS), which are usable organic matter and the final compost's most valuable materials. Humic acids (HA), fulvic acids (FA), and humins are only a few of the functional groups found in HS (HU). When HSrich compost is applied to soils, it can have a variety of agronomic effects, such as increasing water and nutrient retention and promoting plant growth.