Available online at
www.agrospheresmagazine.com

ISSN: 2582 – 7022

Agrospheres:e-Newsletter, (2022) *3*(1), 19-21

Article ID: 337

Biochar : The Black Gold of Agriculture

Aanchal Kapoor[1*], Saurabh Thakur[1], Anil Kumar[2] and Swapana Sepehya[3]

[1]Ph.D Scholar, Department of Soil Science, CSKHPKV, Palampur, H.P. (176 062), India
[2]Senior Scientist, Department of Soil Science and Water Management, COHF Neri, Hamirpur, Dr YSP UHF Nauni, Solan, Himachal Pradesh, India
[3]Assistant Professor, Department of Soil Science and Water Management, COHF Neri, Hamirpur, Dr YSP UHF Nauni, Solan, Himachal Pradesh, India

Open Access

*Corresponding Author
Aanchal Kapoor*

Article History
Received: 13.01.2022
Revised: 24.01.2022
Accepted: 27.01.2022

INTRODUCTION

Today's agriculture is challenged with the dual task of ensuring food, fodder, fibre and fuel security while also regenerating soil resources for long-term usage. Agricultural crop residues form a major source of biomass in India. An effective strategy to improve soil fertility is to make efficient use of crop residues and other farm wastes by transforming them into an usable source of soil amendment. Biochar has the ability to improve soil fertility and crop yield due to its unique properties. Biochar and biochar-compost combinations prepared from various organic sources have been proposed as a way to improve soil fertility and restore degraded land. Resourceful use of crop biomass by converting it to a useful source is a useful way to manage the fertility of the soil. As a result, the use of biochar is gaining popularity.

WHAT IS BIOCHAR ?

Biochar is a charred by-product of biomass pyrolysis, which involves heating plant-derived material in the absence of oxygen to collect flammable gases. The term "biochar" was coined in the late 20th century and is derived from the Greek words "bios" (life) and "char" (charity) (product of pyrolysis of biomass, as charcoal). The ancient Amazonians used a technique known as "slash-and-char." With slash-and-char, plant material or crop remains were cut, ignited, and buried to smolder (rather than burn), which eventually produced char, now commonly referred to as "biochar". From this ancient method, a new technology has been developed for producing biochar as a means to improve soil fertility and store carbon.

Biochar is pyrolized biomass and is defined as a carbon rich product derived from the heating with limited supply of O_2 of organic materials at 250 - 700° C (Raja kumar and Sankar, 2016). It is a fine-grained and porous substance, similar in its appearance to charcoal produced by natural burning.

PRODUCTION OF BIOCHAR

Pyolysis (heating of biomass) in the absence or near absence of oxygen, is used to make biochar. Pyrolysis and gasification, which entail heating a biomass feedstock under controlled conditions to create combustible synthesis gas ('syngas') and oil ('bio-oil') that may be burned to produce heat, electricity, or combined heat and power, are used in modern industrial bioenergy systems. The solid charred and carbon-rich residue of pyrolysis is biochar, the third combustible product (Sohi *et al.*, 2009). In a controlled process the energy in gas streams from pyrolysis may be recovered by combustion, either in gas turbines or gas engines.

The most essential component affecting the qualities of the resulting biochar, together with pyrolysis conditions, is the feedstock. Many different materials have been proposed as biomass feedstocks for biochar, including wood, grain husks, nut shells, manure, crop residues etc (Gonzaléz *et al.*, 2009). The quality of the biochar readily depends upon the type of feedstock used for its production.

APPLICATIONS OF BIOCHAR IN AGRICULTURE

1. Climate change: To avoid the worst consequences of climate change, we need to significantly reduce global warming emissions and if possible remove existing carbon dioxide from the atmosphere. The effect of biochar additions on trace gas emission is very limited.

2. Interactions with microbial populations: Soil microbes play a vital role in the functioning of soils and provide many essential ecosystem services and beneficial microbes in soil biota. Biochar affects the microbial communities and their symbiotic interactions with plants and improves nutrient use efficiency. It is a carrier material for beneficial microbes in the soil ecosystem and attracts more beneficial fungi and microbes.

3. Carbon stabilization and sequestration: Carbon sequestration refers to the process of storing carbon in soil organic matter and therefore removing carbon dioxide from the atmosphere. The potential of utilizing biochar to sequester carbon in the soil has received significant research attention in recent years. The inherent properties of biochar, as determined by feedstock and pyrolysis conditions, interact with environmental factors such as precipitation and temperature to determine how long biochar carbon is held in the soil.

4. Methane emission from soil: Biochar can be used as a soil amendment. However, it generally possesses unique physicochemical properties and complex organics, which could affect soil methanogenesis and may decrease the methane emissions from the soil.

5. Soil physical properties: Application of biochar in the soil improves the water holding capacity, water retention and aggregate stability of the soil. Its bulk density is much lower than that of mineral soils; therefore, its application can reduce the overall bulk density of the soil. It has a very porous nature and thus its application to soil will improve soil aeration.

6. Cation exchange capacity (CEC) of the soil: The CEC of the fresh char is not very high but the char that has resided in soil for hundreds or thousands of years has been shown to have much higher CECs in many studies. So, incorporation of biochar in the soil can increase the CEC of the soil and thereby increasing the nutrient use efficiency.

7. Soil fertility: Application of biochar improves soil fertility by boosting soil pH and water holding capacity, attracting more beneficial fungi and microorganisms, improving cation exchange capacity and retaining various nutrients in soil.

8. Crop yield and crop productivity: Biochar application in agricultural fields as a soil amendment promotes plant growth. Long-lifespan biochar carries extraordinary agronomic benefits for crop productivity in a sustainable manner. Generally, the increased crop yield and nutrients uptake might be mainly due to direct nutrient additions from the applied biochar containing various nutrients depending on the type of feedstock.

METHOD AND RATE OF APPLICATION OF BIOCHAR IN THE SOIL

1. Application methods: Biochar is applied to soils can have a considerable impact on soil processes and functioning, including aspects of the behaviour and fate of biochar particles in soil and the wider environment. It should be applied near the soil surface in the root zone, where the bulk of nutrient cycling and uptake by plants take place. Different methods of the biochar application include:

- Broadcasting (By hand)
- Using a tractor propelled lime spreader
- Deep banding of biochar in rhizosphere
- Line trenching and backfilling
- Mixing of biochar with other solid amendments
- Mixing of biochar with liquid manures

2. Application rates: Several studies have reported the positive effects of biochar application at the rate 5-50 t ha^{-1} on crop yields, with appropriate nutrient management. The frequency of the application depends on the target application rate, the availability of the biochar supply, and the soil management system. Due to its recalcitrance nature, single application of biochar can provide beneficial effects over several growing seasons in the field. The beneficial effects of applying biochar to soil improves with time.

CONCLUSION

Biochar is a black, carbon-rich solid substance made by pyrolyzing waste biomass and it not only solves the agricultural waste management dilemma but it also improves soil characteristics and stimulates beneficial microbial diversity in the soil. Biochar improves the soil fertility and agricultural productivity by enhancing soil characteristics, increasing plant nutrient availability, and so on. As a result, using biochar is proving successful to boost soil fertility and crop yield and is an effective strategy for mitigating climate change.

REFERENCES

Rajakumar R and Sankar J. 2016. Biochar for sustainable agriculture- A review. *International Journal of Applied and Pure Science and Agriculture* **2**:173-84.

Sohi S, Lopez-Capel E, Krull E. and Bol R. 2009. Biochar, climate change and soil-A review to guide future research. *CSIRO Land and Water Science Report* **5**:17-31.

González J F, Román S, Encinar J M. and Martinéz G. 2009. Pyrolysis of various biomass residues and char utilization for the production of activated carbons. *Journal of Analytical and Applied Pyrolysis* **85**:134-41.