

## Biochar - A Biofriendly Solution For Stubble Burning

<sup>1</sup>Kommineni Jagadeesh, <sup>2</sup>Vemula Srujana and <sup>3</sup>Gundala Pranay  
<sup>1&2</sup>Ph.D. Scholar, Genetics and Plant Breeding Department, PJTSAU,  
Hyderabad  
<sup>3</sup>Ph.D. Scholar, Genetics and Plant Breeding Department, IGKV,  
Raipur

ARTICLE ID: 10

### Introduction:

The leftover plant materials in the field after the harvest are termed stubbles. It can also be termed as the residue material without any economic value. Among the various food grains consumed, rice and wheat together constitute 30% of the diet uptake which indicates their importance in the food chain of human populations. Among major producers of rice and wheat, India is the second-largest contributor of rice and wheat with an area of 44 million ha under rice and 29.5 million ha area under wheat contributing 101.29 million tonnes of wheat and 175.58 million tonnes of rice annually. In the process of preparing the land for the next cropping season, the stubbles in the field are to be removed. But due to the various constraints like lack of time, unavailability of labour, and high labour wages, the farmers are opting for the easier approach of stubble burning. The cropping pattern of rice-wheat is a major one followed by farmers in the region of Haryana and Punjab. Among various crops, the biomass of stubble produced was higher in the case of paddy and wheat accounting for the major share of stubble burning in India. The major adverse effects of stubble burning are greenhouse gas and particulate matter production which is the root cause of global warming and damage to the ecosystem. The United Nations had projected that the global population is expected to reach about 9 billion by 2050. As the total population is increasing enormously, the population feeding on rice is also increasing at the rate of 1.098% per annum. In order to feed the alarmingly rising population, there is a need for a 60% rise in the production of rice. This brings more area under the cultivation of rice and wheat as the food habits of the major population. This enhances further stubble production leading to enhanced stubble burning. In order to overcome this problem, there is a need for an innovative approach that is also eco-

friendly. This search for a solution resulted in the identification of Biochar as the viable approach to overcome the adversaries resulting due to stubble burning.

Biochar is the material derived from different kinds of biomass which are considered un-useful material. Here it is the stubble material that is used to produce biochar which is possible by burning the paddy and wheat stubbles under a limited supply of oxygen. The factors like high carbon content, easy availability and free-of-cost availability of the stubble material in the field made it one of the most suitable materials for biochar production. The biochar produced is a healthy and economical solution for not only overcoming the menace of stubble burning but also the safe disposal of agricultural wastes.

### **Methods of Biochar production:**

Biochar can be produced by using various thermal treatments like pyrolysis, Carbonization, torrefaction, and gasification.

#### **1) Pyrolysis:**

The decomposition of organic material is carried out under an oxygen-limited environment having a range of 250-900 degrees centigrade temperature is called pyrolysis. The temperature of pyrolysis, nature, and type of biomass used are the major factors impacting the efficiency of biochar production. It is the most used process for its production.

#### **2) Carbonization:**

It is also termed hydrothermal carbonization which is carried out at a temperature of (180-250 degrees centigrade). This process is cost-effective as it is carried out at a low temperature and the product produced is called hydrochar as it involves a hydrothermal process.

#### **3) Gasification:**

It is a thermochemical method by which carbonaceous material is converted into gaseous products together called “syngas” and char is produced as a by-product.

#### **4) Torrefaction:**

It is an emerging technique used for biochar production. In this, the oxygen, moisture, and carbon dioxide present in the biomass are removed using inert atmospheric air in absence of oxygen at a temperature of 300 degrees centigrade. The entire process is carried out in different steps like heating, preheating, post drying, torrefaction and cooling.

### **Factors to be considered for Biochar Production:**



In general biomass from various sources will be used for the production of biochar. In this process, the biochar production is impacted by various factors like feedstocks, the temperature at which it is produced, the size of the particle used for production, heating rate, etc.

- 1) **Feedstocks:** Biomass used for the production of biochar is classified into woody and non-woody biomass. The woody biomass is produced from the forest and tree residues. It is characterized by high calorific value, high density, and less voidage. The non-woody biomass includes our area of interest which is agricultural solid waste along with animal and industrial waste. These are characterized by low calorific value and low density. In the case of feedstocks moisture content of the biomass is one of the major factors which affects the production. The higher moisture content increases the energy needed for biochar production and lowers the production of char.
- 2) **Carbonisation Temperature:** Based on the temperature, the most commonly used process of biochar production pyrolysis is classified into three types i.e., Slow pyrolysis (< 300 degrees centigrade), moderate pyrolysis (300-500 degrees centigrade) and quick pyrolysis (> 500-degree centigrade). The temperatures majorly impact the physiochemical chemical properties like pore structure, structure area, etc.
- 3) **Residence time:** The increase in the residence time at low pyrolysis conditions resulted in a low decrease in biochar yield and at high pyrolysis temperature residence time had little impact on biochar yield.
- 4) **Pre-treatment Biomass:** In the process of enhancing biochar yield, pre-treatment of biomass is carried out which will alter the physicochemical properties of biomass. Similarly, the size of biomass particles is one of the factors that will have to be considered while carrying out the pre-treatment. Among several methods, the baking method increases the carbon content and reduces the oxygen and moisture content of biochar produced.

#### **Unique Properties of Biochar:**

- 1) High surface area.
- 2) High porosity.
- 3) High cation exchange capacity.
- 4) Highly stable.

**Advantages of Biochar:**

- 1) It is biofriendly in nature.
- 2) It is reusable and cost-effective in nature.
- 3) It is easy to prepare in less span of time.

**Applications of Biochar:**

- 1) **Catalyst:** The large surface area of biochar particles established it as a promising catalyst in most prominent activities.
- 2) **Bioremediation:** It is the process by which biological organisms or their derived materials are used for the removal of pollutants from the soil. The properties like high absorption capacity and porosity positioned it as a wonderful material that can be used for bioremediation.
- 3) **Soil Health Improvement:** High carbon content, greater surface area, and the ability to enhance aeration of the soil are the characteristics that had a positive impact on the soil that enhanced the growth of beneficial microorganisms in the soil.
- 4) **Source of Bioenergy:** During the process of biochar production, along with biochar various other by-products like tar, bio-oil and various gases are produced. These materials can be captured and used in bioenergy synthesis.
- 5) **Reduces Impact of Climate Change:** As biochar is the material produced by combustion in an oxygen-limited environment, it becomes the long-term carbon sink which requires a long time for undergoing the chemical transformation. So, the addition of biochar to the soil ameliorates the soil and reduces greenhouse gas emissions from the soil.

**Future Prospects and Conclusion:**

Even after a greater number of efforts on creating awareness among farmers on the devastating impacts of stubble burning on the environment and the agricultural ecosystem, the percentage of stubble had reduced to a significant level. In this process, biochar production has been identified as an eco-friendly and economically viable option for farmers instead of stubble burning. Even though Biochar production has been identified as an alternative to stubble burning, its implementation at the field level is not an easy task. There is a need for the identification of more easy methods of biochar production which can be carried at the individual level and even for very less quantities of biomass, as most of the



farmers are marginal and small-scale farmers. There is a need for policy-based initiatives which will benefit the farmers in monetary terms by adopting biochar production rather than stubble burning.

