BIOCHAR

BACKGROUND, PROCESS & APPLICATION

DRAWN UP BY

BIOCHAR TECHNOLOGIES®

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The removal of CO2 from the atmosphere is one of the mitigation strategies to fight climate change, for which there is huge demand and little supply. One option is biochar, the solid fraction of pyrolysis (the thermochemical transformation of biomass in the absence of oxygen), which has a stable chemical structure, allowing for carbon sequestration in soils for hundreds to thousands of years, generating carbon credits.

Biochar is also an excellent soil conditioner, which remediates and improves its physical (aggregation, structure, porosity, water supply), chemical (pH in acid soils, capacity to supply plant nutrients) and biological fertility properties (biogeochemical cycling, diversity of soil organisms, phytosanity), allowing for increased plant productivity (+25% on average in tropical and subtropical latitutes, i.e., 0-35°) and providing a fundamental tool for the rural sector to cope with the increasing demand for its products in a sustainable manner.

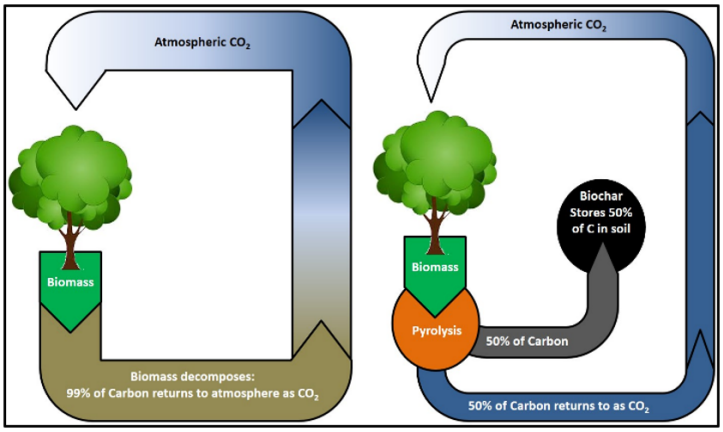
Hence, biochar, using only residues, i.e., materials without value and sometimes deleterious, the management of which is expensive and little effective, promotes the circular economy, removes CO2 from the atmosphere and avoids wildfires, increases forest and agricultural productivity and makes the food production more resilient to climate change.

Terra Preta, an Amazonian soil formed by Pre-Columbian indigenous people, that inspired biochar as an agricultural technology (www.biochar-international.org).

Despite the scientific evidence for these benefits, the practical adoption of biochar is small: adequate production technologies and established agricultural guidelines are lacking, cost and implementation constraints exist, the access to the carbon markets is restricted and expensive and the tested business models have not proven economical viability.

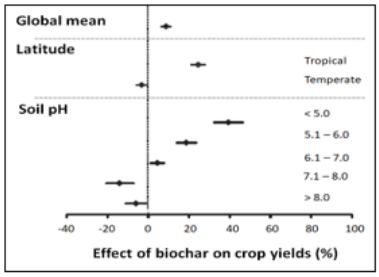
Adopting the concept of the flame curtain it is possible to build simple, easy to operate and cheap pyrolysis kilns, which can be deployed on a mobile platform and used for the production and application of biochar in situ, minimizing the logistic costs of the operation. Such kilns are much less polluting and have the potential to be operationally more efficient than the traditional and widespread kilns used for the production of charcoal in Brazil [1], without the complexity and the investment burden of high technology pyrolysis reactors, very sparsely deployed in practice. The deployment of the production of biochar from agricultural and forestry residues is simpler, cheaper and easier than any other technology proposed for their use.

[1] Biochar, used for agricultural and environmental applications, is produced by the same process as charcoal, which is an energy carrier.



The mechanism of carbon sequestration in soil using biochar (Doane University).

The Brazilian sugarcane industry offers ideal conditions for the deployment of the biochar technology at large scale: (a) Large volumes of suitable organic residues (straw and bagasse) for the production of biochar are available; (b) Vinasse and filter cake are optimal for the enrichment of the biochar and their joint application increases the system's recycling of plant nutrients and reduces the risks and the costs for managing them in a sustainable way. The realization of these elements of the circular economy is especially easy because of the vertical integration of the sugarcane mills;



Market	€ / tCO_{2eq}
Regulated (EU ETS)	63.75
Biochar (Puro.Earth / (NASDAQ)	157.00

Prices of carbon credits in 2021.

Biochar and agricultural yield, showing its especial benefit in the tropical climate zone and for acid soils which prevail there. Bars represent the mean and 95% confidence intervals (Jeffrey et al., 2017).

(c) A conservative estimation based on the scientific literature and on market data indicates that the transformation of about half of all sugarcane straw produced each year by the sector increases its gross product by R$ 17.3 billion (R$ 10.6 billion as agricultural benefits, i.e., the sum of increased yields, reduced agricultural inputs and the valorization of the agricultural land, and 6.7 billion in the form of carbon credits).

Pyrolysis kiln for the production of biochar based on the principle of the flame curtain (https://wiki.opensourceecology.org).