

Biochar

Biochar is the name given to charcoal **that is produced from the pyrolysis of biomass of plant origin**. Biochar **improves the physical properties of the soil**, since it has a high organic content, is very resistant to degradation and has high micro- and meso-porosity, which gives it a high capacity to retain water, nutrients and microorganisms.

■ Biochar production

Although biochar can be obtained through the pyrolysis of any type of organic material, in the Polyfarming system the raw material to make it includes **by-products of forest management**, mainly **dry branches** from the cuttings of the previous season.

Biochar can be produced by following different methods. In our case, we propose the use of **self-built transportable boilers**, which are metallic and are cheap to use (**Figure 1**).

The biochar production process **begins with a small fire** inside the reactor, initially it is a combustion characterised by the presence of oxygen. As plant biomass is added, the oxygen in the lower part of the boiler is consumed, **going from combustion to pyrolysis**, which is the reaction that results in coal. When the entire boiler has been filled, the upper part of the pile can reach a high temperature and begin to turn white from the ashes of the combustion itself. At that time the fire **is extinguished with water** and covered, so that oxygen does not enter, and this causes the pyrolysis of the entire pile to take place.

The next day the pile can be uncovered, where the biochar will be found (from pyrolysis) with the ash remains (from combustion). **This pile must be spread on the ground so that it finishes cooling down** and thus avoid further combustion that would transform all the product into ashes.

■ Application of biochar

Biochar can be applied directly to the soil together with other types of improvers such as fertilisers or compost. Sometimes it must be moistened to avoid losses in the air and it being aspirated by the person applying it.



Figure 1. Transportable boiler to produce biochar directly in the forest. Photo: AV Video.



Figure 2. Biochar sample obtained by the pyrolysis of plant biomass. Photo: AV Video



Figure 3. Activation of biochar in chick litter. Photo: Ángela Justamante.

However, for a more efficient use **it is advisable to previously activate the biochar** before incorporating it into the soil, i.e. loading it with nutrients and microorganisms, which is what the plants will use. In our case this activation is carried out using animals. One part is activated by **incorporating it into the composting process of chick litters (Figure 3)**. Another part is activated by incorporating it into the **chickens' food**, whose excrements will end up distributing it over the fields.

■ Biochar benefits for farms

Biochar can represent important benefits for farms, such as:

- **Improvement of the soil structure.** Biochar helps regulate the pH of very acidic soils, improves their physical and chemical properties and can buffer sudden temperature changes.
- **Increased retention of water and nutrients.** Biochar has a high-water retention capacity, which improves irrigation of the roots and allows the capture and retention of nutrients as it reduces losses due to leaching.
- **Stimulation of microbial activity.** In soils where biochar has been applied, microbial activity is stimulated.
- **Improvement of fertilisers and manures.** The use of biochar as an additive in fertilisers and organic manures can bring improvements in their efficiency.
- **Increase in crop productivity.** Biochar significantly increases the agronomic productivity of degraded soils and improves the physiological response of crops to periods of water stress.

■ Benefits of biochar for the environment

Biochar also has important environmental benefits that help combat climate change:

- **CO₂ sequestration.** Biochar contributes to the sequestration of carbon from the atmosphere, as it stores more than three times its weight in CO₂, so that for each kg of biochar more than 3 kg of CO₂ are sequestered.
- **Non-degradable organic carbon sink.** Pyrogenic materials such as biochar have high biochemical stability, so the carbon they contain can remain in the soil for a long time.
- **Reduction of greenhouse gas emissions.** By not burning, the emission of CO₂ is avoided, in addition to reducing the formation of other greenhouse gases such as methane (CH₄) and nitrous oxide (N₂O).