



# BEST PRACTICE GUIDE FOR BIOCHAR PRODUCTION IN MEDITERRANEAN AGROSILVOPASTORAL SYSTEMS

**LIFE REGENERATE (LIFE16 ENV/ES/000276)**



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## Best practice guide for biochar production in mediterranean agrosilvopastoral systems

### What is biochar?

Biochar is a **stable form of carbon** obtained from the **transformation of organic waste biomass**. The system in which this transformation takes place is mainly characterized by the minimal presence of oxygen (pyrolysis) and the high temperatures (between 500° and 700°) that the system reaches. Due to these two characteristics, the transformation of wood into biochar does not experience much loss of carbon, which is stored in the final product. This characteristic makes biochar to be considered a carbon sequestration element.



Picture 1. Result of Biochar production.  
Own source.

### What are its benefits?

Biochar is a very beneficial element for agrosilvopastoral systems that boosts the **circular economy** by transforming waste into high-value resources and generates **carbon sequestration**, avoiding its transformation into CO<sub>2</sub>.

Biochar benefits include:

#### Livestock:

- It serves as **bedding for livestock**, **reducing unpleasant smells, humidity** and the presence of **insects**.
- As **manure treatment** reducing decomposition and the presence of pathogens.
- **Mixed with cattle feed** (in very low doses) it can have **positive effects** combating the alteration of the stomach **microbiota** and improving the absorption of proteins and amino acids.

#### Agriculture:

- Improvement of roots development of plant species thanks to the **retention of water and nutrients** that biochar provides. This generates a decrease in the risk of plant mortality and an increase in growth speed.
- Biochar increases the **fertilizer efficiency** and improve pasture quality.

#### Soil:

- Biochar reduces **soil compaction** and anaerobic soil condition. It **improves soil structure** and serves as a **water and nutrient store** for plants.

- Increase of **water retention capacity** of the soil and **prevents water losses**.
- It **increases the porosity** and the amount of oxygen, which **stimulates the activity of the microorganisms** present in the soil.
- This increased microbiota activity **facilitates nitrogen fixation** in the soil and transforms soil organic matter into **assimilable minerals** for plants.
- By enhancing the development of microorganisms, biochar can **immobilize toxic substances and other metals** present in the soil.
- Biochar increases significantly and stably soil **carbon sequestration** for centuries.

### How to produce biochar?

Biochar can be produced using different organic wastes or subproducts such as **pruning wastes** or other organic wastes containing carbon.

To transform pruning and wood waste into biochar, a deep cone-shaped oven is usually used to produce charcoal over an open fire. In 2014, specialists from the Ithaka Institute created **the Kon-Tiki oven**, an oven that seeks to reconnect with the ancient knowledge and work of fire making and combine it with the intelligent design of modern thermodynamics. This oven has the capacity to **produce between 700 and 1000 litres** of biochar in about **4 to 5 hours**, and its cone shape allows a continuous swirling current that guarantees a very pure burning and low smoke emissions. In addition, a flexible metal sheet can be added all around the cone which acts as an insulator and stabilizes the fire.

#### Elaboration process:

##### 1º Turn on

Ignite part of the pruning and wood waste inside the oven and add the remaining biomass during the first hour.

##### 2º Burn

Wait until everything is burned and the larger pieces of wood have decreased in size. In the meantime, mix it with a stick. It may take 2 or 3 hours.

##### 3º Turn off

To turn off the biochar, fill the oven with water, wait for it to cool down and then empty it through the bottom pipe.

##### 4º Dry

To help the biochar dry, it can be spread inside the oven structure itself.



Picture 2. Pictures of the biochar production process. Source: Emilia Cordero (2015).

**Biochar** is not a fertilizer, it is a **soil structuring** and needs to be **activated** before it is added into the soil to prevent current soil nutrients and water from being adsorbed by the biochar, making them unavailable to the crops. Biochar can be activated with microorganisms (e.g., **fresh manure**, **milk whey**, etc.) to obtain the maximum benefits and provide the soil with microbial activity to increase plant survival and support ecosystem regeneration. Biochar can also be applied as bedding for animals in stables or in feedlots.

### How biochar can be applied?

The method of application of biochar is very easy and simple. In the case of a new plantation, it can be **incorporated into the planting hole** before the plant is placed (Picture 3). It can also be **mixed** with some type of fertilizer or **compost** to improve the quality of the substrate and the beneficial effects of both products. It is important **to wet the biochar well to saturate it** with water and to complement it using other type of fertilizer or compost to enhance its effect.



Picture 3. Biochar applied in a planting hole.  
Own source

When incorporating biochar on established plants, it can be **incorporated into the soil** by opening **superficial furrows** in the surroundings of the plant's radical system and then covering them, or **directly** applied on the **surface** on the soil.

In order to avoid biochar losses by runoff, it is recommended to avoid its application in areas of watercourses or high slopes (when the product is applied superficially).

### References

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