

# Costs and key points of producing and applying biochar

Biochar production and application mainly has three types of costs: (1) **costs of obtaining the base material**, which are branches <7 cm in diameter; (2) **biochar production costs**, which include the use of self-transporting boilers; and (3) **field placement costs**, which includes transporting the biochar from the production area to the field and distributing it to the chick litter and chicken feed.

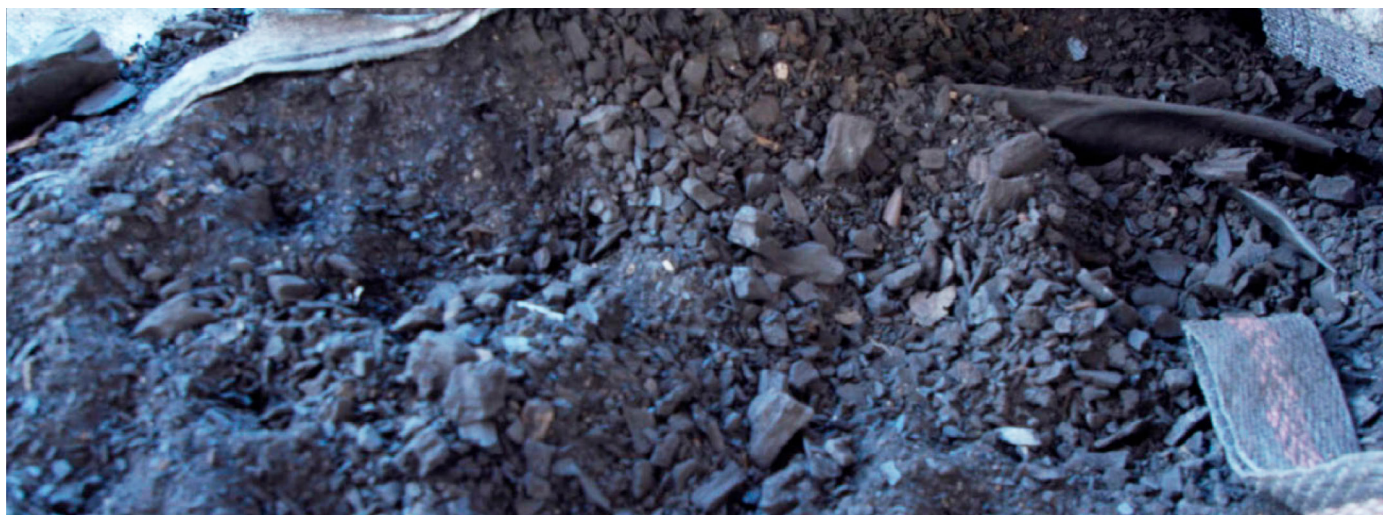


Figure 1. Bag of biochar once produced. Photo: AV Video.

## ■ Quantification of the costs of producing and applying biochar

The quantification of biochar production and application (Figure 1) is based on calculating three different types of costs:

1. **Cost of obtaining the biochar base material.**
2. **Cost of biochar production.**
3. **Cost of biochar application.**

Next, we will describe the different alternatives analysed for each of these processes, indicating the costs they represent and their variability (Table 1).

### 1. Cost of obtaining the biochar base material.

This cost includes cutting the branches that will be used as raw material. All the necessary materials for the cuts (chainsaw, etc.) are already available on the farm, otherwise the corresponding costs should be included. **Branches of <7 cm are obtained from the traditional forestry cuttings that are made in the agro-silvo-pastoral farms.** So its cost can be considered 0, since it is work included in obtaining wood or firewood.

### 2. Cost of biochar production.

Biochar production can be done using different methods. **In the Polyfarming system we make it using self-built transportable boilers.** They are cheap self-built infrastructures with oil drums connected with screws.

Therefore, **their cost can be considered 0.** If they are bought, their price can be very high. Those used at Planeses have a diameter of 1.75 m and a height of 0.9 m, i.e. a volume of about 2.2 m<sup>3</sup>. Normally, **the boiler is taken to the place where the branches are and not vice versa**, since transporting the volume of branches would be much more expensive than transporting the boiler. Approximately 8-9 m<sup>3</sup> of branches are needed to fill the boiler that we use to produce biochar. **The staff cost of loading the boiler is that of two people for 2 hours:** one drags the branches to the shredder and the other cuts them to size and introduces them into the fire. Later they spend another half an hour putting out the fire and sealing the boiler. The next day, the two workers return and it takes half an hour to uncover the boiler, let the biochar cool down and load it onto the trailer. Around 0.7 m<sup>3</sup> of biochar is obtained in each of these boilers.

### 3. Cost of placing biochar on the ground.

This cost includes transporting the biochar from the pyrolysis area to the farm, and its subsequent treatment in the chick litter and chicken feed.

- In the case of **transport**, the cost depends on the time spent loading the trailer and transferring the biochar to the application area. In the Polyfarming system, the trailer has a capacity of 2 m<sup>3</sup>, so **it takes one trip to transport all the biochar produced in a boiler**, and there is still more than

half the trailer left. It is considered that the farm has a jeep with a trailer, otherwise it is necessary to include the costs of renting it.

- **As regards subsequent treatment, it is important that the vehicle arrives right next to the field**, so that the transport of the biochar by wheelbarrow to the application area is very quick. Biochar is applied to the chick litter and chicken feed, so it is part of other farm work and cannot be considered an added cost.

### ■ Considerations on the optimal strategy for producing and applying biochar

We must consider the following **key points** in the production and application of biochar:

- The branches must be easily accessible, i.e. the **boiler must be placed near a large accumulation of branches**.

- The **branches used must be dry**, from the previous year. In this case, the process is more efficient and faster. **If the leaves are green, they must be burned first** and this causes a significant loss of carbon and minerals.

- Other methods besides boilers can be used in the forest. **The branches can be lowered to the farm and there using a more efficient boiler** that allows the waste heat to be used. But transporting the large number of branches that are necessary causes the costs to go up a lot.

- The use of **biochar can be applied to the chick litter or any composting process** carried out on the farm.

From these considerations, we can establish a series of **simple calculations to estimate the total costs of applying biochar in agricultural farms**. These calculations are based on the content of a biochar boiler. The overall cost is the sum of three costs:

$$C_{\text{total}} = C_{\text{obtaining}} + C_{\text{production}} + C_{\text{placing}}$$

**Obtaining the biochar base material** (to fill a boiler):

$$C_{\text{obtaining}} = 0 \text{ (<7 cm branches are obtained from forest harvesting)}$$

**Biochar production:**

$$C_{\text{production}} = 0 \text{ € (self-built boiler)} + 2 \text{ h x Salary / (hour x worker)} \times 2 \text{ workers (loading a boiler)} + 0.5 \text{ h x Salary / (hour x worker)} \times 2 \text{ workers (sealing of a boiler)} + 0.5 \text{ h x Salary / (hour x worker)} \times 2 \text{ workers (discharge from a boiler)}$$

**Transport and application of biochar:**

$$C_{\text{placing}} = \text{Transport of biochar (depending on distance from the boiler to the farm)} + 0 \text{ (application of biochar in the chick litter or the chick litter)}$$

Parameter	Unit	Value used	Variability and causes
Cost a self-built pyrolysis boiler	€	0	If it is not self-built it can be worth more than €10,000
Volume of branches to fill a boiler	m <sup>3</sup>	13	It depends on the size of the boiler
Time to load a boiler	hour/2 people	2	It may depend on whether the branches are near or far from the boiler, if they are far away this time can be doubled
Boiler sealing time	hour/2 people	0.5	-
Boiler discharge time	hour/2 people	0.5	-
Amount of biochar produced per boiler	m <sup>3</sup>	0.7	It can vary in a range of 0.5-0.9
Time to transport the biochar	hour	variable	It depends on the distance between the boiler and the farm

**Table 1.** Parameters used to calculate the costs of forest harvesting, indicating the values used in Polyfarming and any variability that can occur in these values.