

Costs and key points of producing and applying Bocashi-type organic fertiliser

The production and application of Bocashi-type organic fertiliser mainly has three types of costs: (1) costs of the ingredients to produce Bocashi-type organic fertiliser, there are up to ten different ones; (2) production costs of the Bocashi-type organic fertiliser, which includes the time it takes to turn the entire mass first with a shovel and then with a grower until it is mixed; and (3) the costs of applying Bocashi-type organic fertiliser to the ground, which includes the time spent applying it to crops.

■ Quantification of the costs to produce and apply Bocashi-type organic fertiliser

The quantification of the production and application of Bocashi-type organic fertiliser (Figure 1) is based on calculating three different types of costs:

1. Cost of ingredients to produce Bocashi-type organic fertiliser.
2. Cost of preparing the Bocashi-type organic fertiliser.
3. Cost of applying Bocashi-type organic fertiliser to the field.

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

1. Cost of ingredients to produce Bocashi-type organic fertiliser. The main ingredients and quantities used to make 100 kg of Bocashi-type fermented organic compost are: self-produced charcoal (13.7 kg, €0), self-produced manure (27.4 kg, €0), rice husk (27.4 kg, €0.09/kg), rice bran (1.2 kg, €0.2/kg), molasses (1 l, €0.5/l), forest humus (1.2 kg, €0), common soil (27.4 kg, €0), rock and ashes meal (1.2 kg, €0) and water (in a variable quantity in order

to homogenise the humidity of all the ingredients of the compost). These values are indicative, they only indicate the proportions for the different ingredients.

2. Cost of preparing the Bocashi-type organic fertiliser. The ingredients are mixed by turning the entire mass with a motor grower until mixed. Once finished, it is turned twice a day during the first three days with a shovel (approximate time 0.5 h every time). Afterwards, it is spread to about 30 cm in height and turned over with a rototiller once a day (10 min each time) until 15 days later, when the Bocashi-type organic fertiliser is finished.

3. Cost of applying Bocashi-type organic fertiliser to the soil. This cost includes the time spent applying it to crops. Just before transplanting, at the base of the hole where each plant will be placed, an amount between 50 and 100 g of Bocashi-type fertiliser (depending on the needs of the crop) is applied and covered with soil before planting the plant. The time spent performing this action can be half a minute per plant, including the entire process.

From these considerations, we can establish a series of simple calculations to estimate the costs global production and application of organic fertilizer Bocashi type in agricultural land. The overall cost is the sum of three costs:

$$C_{\text{total}} = C_{\text{ingredients}} + C_{\text{preparation}} + C_{\text{application}}$$

Ingredients for making Bocashi-type organic compost (to produce 100 kg of compost):

$$C_{\text{obtaining}} = 13.7 \text{ kg} \times \text{€} 0/\text{kg} \text{ (charcoal)} + 27.4 \text{ kg} \times \text{€} 0/\text{kg} \text{ (manure)} + 27.4 \text{ kg} \times \text{€} 0.09/\text{kg} \text{ (rice husk)} + 1.2 \text{ kg} \times \text{€} 0.2/\text{kg} \text{ (rice bran)} + 1 \text{ l} \times \text{€} 0.5/\text{l} \text{ (molasses)} + 1.2 \text{ kg} \times \text{€} 0/\text{kg} \text{ (forest humus)} + 27.4 \text{ kg} \times \text{€} 0/\text{kg} \text{ (soil)} + 1.2 \text{ kg} \times \text{€} 0/\text{kg} \text{ (rock and ashes meal)}$$

Production of organic fertilizer Bocashi type:

$$C_{\text{production}} = 0.5 \text{ h / turn} \times 6 \text{ turns} \times \text{Salary/hour} \text{ (turning the mix with a shovel for the first three days)} + 0.15 \text{ h/turning} \times 12 \text{ turns} \times \text{Salary/hour} \text{ (turning the mix with a walking tiller until day 15)}$$

Application of organic fertilizer Bocashi type:

$$C_{\text{application}} = 0.83 \text{ h} \times \text{Salary/hour} \text{ (half min. per plant, application for 100 plants)}$$



Figure 1. Bocashi-type organic compost. Photo: Marc Gràcia.

■ Considerations on the optimal strategy for producing and applying Bocashi-type organic fertiliser

We must consider the following **key points** for the production and application of Bocashi-type compost:

- One of the main advantages of Bocashi-type fertilisers is that the **materials they are made from are widely known by producers**, easy to obtain locally and at a very low cost.
- There are many types of organic fertilisers and, within the Bocashi-type, **the ingredients and quantity of each one can vary considerably**.
- Bocashi-type organic fertiliser can be applied to the **bottom of each hole, but also in the rows of crops**.

Parameter	Unit	Value used	Variability and causes
Amount of charcoal to produce Bocashi-type compost	kg/100 kg	13.7	There are many ways and ingredients to prepare Bocashi. This is one of them.
Amount of manure to produce Bocashi-type compost	kg/100 kg	27.4	There are many ways and ingredients to prepare Bocashi. This is one of them.
Amount of rice husk to produce Bocashi-type compost	kg/100 kg	27.4	There are many ways and ingredients to prepare Bocashi. This is one of them.
Amount of rice bran to produce Bocashi-type compost	kg/100 kg	1.2	There are many ways and ingredients to prepare Bocashi. This is one of them.
Amount of molasses to produce Bocashi-type compost	l/100 kg	1	There are many ways and ingredients to prepare Bocashi. This is one of them.
Amount of forest humus to produce Bocashi-type compost	kg/100 kg	1.2	There are many ways and ingredients to prepare Bocashi. This is one of them.
Amount of common soil to produce Bocashi-type compost	kg/100 kg	27.4	There are many ways and ingredients to prepare Bocashi. This is one of them.
Amount of rock flour to produce Bocashi-type compost	kg/100 kg	1.2	There are many ways and ingredients to prepare Bocashi. This is one of them.
Amount of water to produce Bocashi-type compost	l/100 kg	variable	Variable volume to homogenise the final mixture
Time to turn the mixture with the shovel	h	0.5	It has to be done twice a day during the first three days
Time to turn the mixture with a grower	h	0.15	It has to be done once a day until day 15
Time to place the Bocashi-type compost in the planting hole	h/100 seedlings	0.3	0.2-0.4

Table 1. Parameters used in the calculation of the costs of the production and application of Bocashi type fertilizer, indicating the values used in Polyfarming and the possible variability that can occur in these values.