Biofertilisers based on reproducing mountain microorganisms

Biofertilisers are high-energy fertilisers prepared from microorganisms of different origins dissolved in water enriched with milk, molasses and minerals, and fermented under anaerobic conditions. **They are used to nourish and strengthen plants** without blocking the biological processes that occur in healthy soil. The forest is the source of mountain microorganisms with which biofertilisers are made.

Obtaining mountain microorganisms

Mountain microorganisms, which are the basis for obtaining the biofertilisers described in this sheet, **are a set of organisms** that are obtained directly from forest humus and that, therefore, are adapted to the application area. They are obtained in a non-selective way, since all the organisms that are in a soil humus sample are reproduced. This sample includes **yeast, fungi, protozoa, and bacteria**.

Mountain **microorganisms are obtained by mixing humus from the forest floor** with rice bran (in equal parts), adding **molasses as an energy source** and, if necessary, **water** to reach adequate humidity. The two important aspects that must be considered for the process to work correctly are: 1) **that the mixture should be made uniformly**, as if the dough were being made for a cake; 2) that the mixture should have the correct **degree of humidity**, which can be verified by the first test: when you take a sample of the mixture with your fist and squeeze it, it should form a solid ball, but when this ball is thrown into the air and it falls on the same hand that has thrown it, the ball must be crumbled into small pieces. Once homogeneous and adequate humidity has been achieved, the mixture is placed in hermetic containers. As the container fills, it must be compacted (you can step on it) so that it contains as little moisture as possible (**Figure 1**). **When the container is full, it is hermetically closed and left for about a month**. The result is **a compact mass with a silo** smell that is stored in the same container.

Figure 1. Compaction of the mixture (humus from the forest floor, rice bran and molasses) to obtain mountain microorganisms. Photo: AV Video.

Biofertilisers from mountain microorganisms

INGREDIENTS

The main ingredients used are:

- **Mountain microorganisms** (yeasts, fungi, protozoa and bacteria): allow the fermentation of the biofertiliser to take place; they are placed in a mesh bag like a large tea bag.
- **Whey**: has the function of reactivating the preparation and providing proteins, vitamins and fats.
- **Molasses**: it provides the necessary energy to activate the microbiological metabolism during the fermentation process.
- **Rock dust**: activates and enriches fermentation as its main function is to fertilise the soil and plants.
- **Ashes**: provide minerals and elements to activate and enrich fermentation.
- **Water**: facilitates the liquid medium where the chemical reactions of anaerobic fermentation are multiplied.

PREPARATION

For the preparation of a standard biofertiliser, the amounts of the different ingredients indicated in **Table 1** are used.

The biofertilisers **are produced in plastic drums with a capacity of about 200 l**, with a metal ring or screw-on lid so that they are

Table 1. Ingredients (and amounts) for the preparation of a standard biofertiliser.

Rock dust	Quantity
Microorganisms	40 kg
Whey	2-4 l (or 20 l serum)
Molasses	4 l
Rock flour	4 kg
Ashes	4 kg
Water	180 l

hermetically sealed and good fermentation takes place. **A hose must be attached to a valve with the end inside a bottle filled with water**, to evacuate the gases that are formed during the fermentation process, preventing the entry of air (**Figure 2**).

The preparation of the biofertiliser consists of the following stages:

1. All the ingredients are put in the 200-l capacity drum at the same time (except for the mountain microorganisms) and are stirred until a homogeneous mixture is obtained. **The mountain microorganisms are placed into a mesh bag** (like a giant tea bag) that is introduced into the mixing water.

2. **The drum is hermetically covered** so that the anaerobic fermentation of the biofertiliser begins, making sure that the gas evacuation hose is not clogged and that the end remains inside a bottle with water to prevent the entry of gases.

3. The container that contains the mixture **is left to rest at room temperature in the shade**, protected from sun and rain.

4. **It is necessary to wait a minimum of 20 to 30 days for anaerobic fermentation** (the drum has already been going for a few days without gas escaping). Then the drum is opened and its quality is checked by its **smell (pleasant acid) and colour (amber brown)**, before use. It should not have a rotten odour or be blue-violet in colour. Its smell should be of fermentation and **its colour should be brown**.

Figure 2. Container to prepare biofertilisers, hermetically sealed with a hose attached to a bottle filled with water to evacuate the gases. Photo: Ángela Justamante.

Storage of biofertilisers

Once the process is finished, the biofertiliser is ready to be applied. Before its application, **the biofertiliser can be packaged in preferably dark containers**, so that the light does not affect it. The product can also be left in the same containers in which it was prepared. The time that biofertilisers can be stored can range from **six months to one year**.

Figure 3. Application of biofertilisers of mountain microorganisms in the orchard. Photo: AV Video.

Application of biofertilisers

The application of the biofertiliser is done **via foliar using a sprayer**. It is applied diluted, in doses that can vary between 2 and 10% (2 to 10 l of biofertiliser in 100 l of water), preferably at the first and last hours of the day, at a rate of a couple of times a week and also after rain.

Benefits of biofertilisers for farms and the environment

- Use of easy-to-find **local resources** (molasses, milk, whey, etc.).
- **Very low investment** in infrastructure.
- **Technology that is easy** for producers to develop.
- **Results** that are observed in the **short term.**
- **Increase in the resistance of plants** against attack from insects and diseases.