Biostimulants and Biofertilizers

In organic production, it is necessary to use technologies to improve the balanced nutrition of plants through the stimulation of biological and chemical processes.

Biofertilizers are any substance or microorganism that causes an improvement in biological or chemical processes occurring in the plant or soil, being applied directly or indirectly.

With the aim of improving the physicochemicalcharacteristics of the substrate, the quality and health of the plant, we areenriching the microbiota of the soil. This is an improvement in the availability and absorption of soil nutrients.

There is a wide range of agricultural biotechnologies within whicthish we can highlight:

Aerobics: In this case, the microorganisms used are adapted to high levels of oxygen; the most common example is compost.

Fermentation: In this case the microorganisms used are anaerobes or facultative, i.e., adapted to very low or zero oxygen levels. In this category, we can mention EM (efficient microorganisms) and biofertilizers.

Vermiproducts: In this category, we can find products from the stabilization of organic matter by means of worms. Among the most common examples are humic and phulvic acids of worm leachates.

Biofertilizers: They are products of biological origin generally digested by EM, containing sufficient levels of nutrients such as Nitrogen, Phosphorus, Potassium, or Micronutrients. In many situations, these products are enriched with materials such as phosphate rock, red potassium clay, poultry manure or sugar processing waste.

How do they work?

It is initially necessary to distinguish between biostimulants and biofertilizers, considering that, in both cases, the exact definition of the mode of action of these is relatively difficult because they contain an amalgam of multiple organisms with different modes of action. Influenced by several factors such as the climate, the site at which EM were collected, the stage of the year and the crop in which they are being used.

Biofertilizers are applied to the soil or plant, ., When applied to the soil they enrich the content of organic matter, because they contain organic carbon, which is used in the metabolism of soil microorganisms,

preventing soil microorganisms from deteriorating the organic matter existing at the site. TWhisch is used to carry out its metabolic processes, gradually reducing the organic matter content of the batch.

As for the absorption of nutrients, biofertilizers provide large molecules that need to be metabolized before they can be absorbed by plants, so they are part of the soil solution. By direct application to the plant, absorption occurs foliarly, mostly taking micronutrients, or nutrients available by enriching bioferments with mineral raw materials.

Biostimulants act in various forms, due to all the different organisms present. Among the main effects caused by biostimulants are:

- Increase nutrient absorption due to a raise in mineralization through MS.
- Increase in the root area favored by beneficial bacteria present in the inoculant agent.
- Associations with mycorrhiza fungi and nitrifying bacteria, which have a positive effect on nutrient absorption.
- Increased resistance to salt by means of protective compounds secreted by microorganisms or an increase in the production of these compounds naturally.

Considerations

It is essential to consider that because these products are built with multiple ingredients the direct effect of each of these depends on the plant-climate-soil system. It is highly recommended to perform field proofs prior to their implementation as part of the fertilization program. Sometimes the effect of biotechnology may not be as expected, for example, enzymes or metabolites can stimulate vegetative development, but this may not be the desired effect for cultivation.

It is important to consider that these products are high in carbohydrates, so their overuse can have consequences such as increasing the incidence of harmful bacteria.

Recommendations

- Use non-chlorinated water.
- Use clean equipment to prevent cross-contamination.
- Insure an anaerobic environment.
- Enrich biofertilizers based on the nutritional requirements of the crop.
- Use materials endorsed by OMRI®, if you have an organic certification.

Recipe 1 EM Solid (Used as a base, for biofertilizers or for biostimulants)

Recipe

rice bran	*2 Kg*
molasses	*5 L*
high-fiber green grass	*15 Kg*
inoculant of EM	*25 Kg*
700 liters barrel with lid	*1*

Procedure

- **Step 1**
  Collect litter with presence of whitening materials (harmless with EM), usually found in broadleaf forests, in the first layer of the soil horizon.

- **Step 2**
  Cut the green grass into pieces of approximately 2 centimeters and remove the larger material that could delay the decomposition process.

- **Step 3**
  Mix all solid ingredients, dispersing the inoculum throughout the mixture**.**

- **Step 4**
  Mix 5 liters of molasses with 10 liters of water, and apply to the mixture with the use of a backpack pump or a watering can to hydrate the mixture evenly. Mix all ingredients during the hydration process to ensure a consistent moisture content.

- **Step 5**
  Introduce the mixture into the barrel and seal it to prevent oxygen from entering for the fermentation process for 30 days prior to use.

Bio-Phosphorus

Procedure

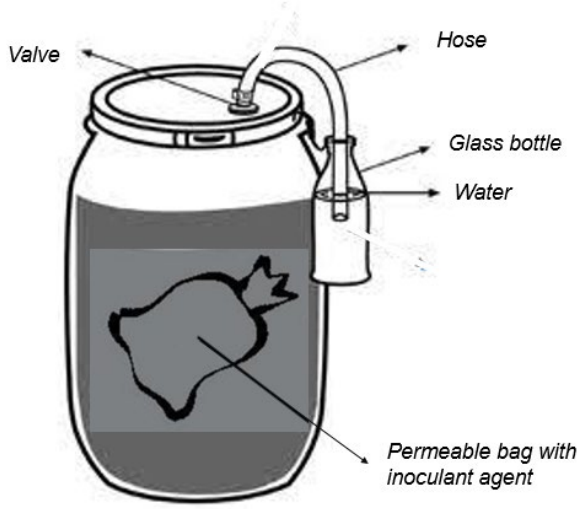
- **Step 1**
  Dilute 5 liters of molasses in the barrel with 80 liters of water.

- **Step 2**
  Add the ash into the barrel and mixture until homogenizing the solution

- **Step 3**
  Add 12 kg of phosphate rock to the barrel mixture and incorporate it.

- **Step 4**
  Make a tea with the solid EM, and insert it into the barrel to be used as an inoculant agent.

- **Step 5**
  Seal the container, leaving a gas outlet via a valve connected to a hose, inserted into a bottle with water, to prevent oxygen from entering. Fill the rest of the barrel with water. Leave to rest 21 days prior to use.



Recipe

non-chlorinated water	*95 L*
rice bran	*12 Kg*
Molasses	*5 L*
solid EM (inoculant of EM)	*7.5 Kg*
ashes	*1 Kg*
phosphate rock	*12 Kg*
700 liters barrel with lid	*1*

References

Gillespie, G. (2018). Bioferments, Biostimulants & Biofertilizers . Soil Land Food Ecological Agriculture .

Merfield, C. N. (2013). Understanding biostimulants, biofertilisers and on-farm trials. Lincoln, New Zealand: The BHU Future Farming Centre: 13

Authors

Robert Cook, Ph.D. Andre' Brock,
Ph.D. Brenda Tubana.