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BIO-FERMENTED FERTILISERS

Giving value to healthy living

Bio-fermented fertilisers

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Lázaro Rodríguez and **José Heriberto Sarmiento**, together with their Farmer's School group of the El Tigre community (Municipality of Jujutla, department of Ahuachapan, El Salvador), were encouraged to change their lifestyle and assist crops through bio-fermented fertilisers.

"Everything about bio-fertilisers was new to us. We've been learning about them through the Farmer's School that Israel Audocio Rodríguez started in 2013.

At one of these meetings we analysed how many minerals I'm getting when I eat a tortilla. If it's made from organic native corn, even better. But if my soil is depleted, what minerals and vitamins can it give to the corn? And it's even worse when we add chemicals.

With this type of home-made fertiliser, the crops grow healthy and we take care of our health and our soil.

This practice gives value to healthy living and is specific to this Farmer's School of the El Tigre community, stemming from cultivating wild microorganisms. And it's giving us good results…".

Purpose of making bio-fermented fertilisers

This alternative permits farming families located on forest floors to return fertility to the soil. They are liquid organic fertilisers produced with wild microorganisms obtained from a process of fermentation and the decomposition of organic matter.

Additionally, it reveals the importance of macro and micro-elements in the different bio-fermentation formulas in the nutrition of a plant.

With the proper application, this type of fertiliser can increase crop productivity and improve harvest quality.

Additionally, it contributes to the financial development of the poorest families in the face of climate change.

Step by step: Producing bio-fermented products

This process has two stages: solid and liquid.

Solid stage

The starting point for foliar or bio-fermented fertilisers is to cultivate wild microorganisms to decompose dry material and produce fermentation in solid organic fertilisers like bokashi and some natural extracts. Through the cultivation of wild microorganisms, we aim to recover the life and health of the soils, facilitate nutrient availability for plants, control microorganisms that cause crop diseases, and biologically control pests.

Reproduction of mountain microorganisms

1. Collect 100 pounds of soil containing wild microorganisms (the equivalent of 45.4 kg) from virgin soil that has never been treated with agrochemical products, where there is abundant vegetation and humidity.
2. Pulverise the material until very fine.
3. Mix the following ingredients in a plastic 220-litre barrel:

- ✔ 2 litres of chlorine-free water, preferably from a river or well.
- ✔ 2 litres of molasses
- ✔ 2 litres of milk whey
- ✔ 5 pounds (2.27 kilograms) of maize flour
- ✔ 1 pound (0.45 kilograms) of baker's yeast

4. Once the 100 pounds of wild microorganism-rich soil has been pulverised, take it out of the barrel to add this liquid mixture to it little by little as you mix it. The objective is to obtain a paste-like mixture that feels sticky when touched.
5. As you deposit this paste in the 220-litre plastic barrel, compact every 15-centimetre layer to avoid the formation of air bubbles. The barrel should not be filled to the brim. Leave a 20-centimetre empty space, then cover and seal the barrel. Leave it like that for 40 days, without allowing air to get in.

This product is called "beneficial mixed microorganism seed in solid state". In this state, it's used to enrich new reproductive processes for microorganisms, bio-fertilisers, natural extracts and compost fertilisers like bokashi.

Activate with water and molasses to use in different ways:

- ✔ Apply directly to depleted soils, 10 pounds per square metre.
- ✔ Apply to vegetable crops, 4 pounds per square metre.
- ✔ Make bokashi. For every 10 quintals (450.4 kilograms) of bokashi, use 10 pounds of solid microorganism seed diluted in about 20 litres of water.

Liquid stage

For this stage, you need 20 pounds of solid stage product and a 220-litre barrel to produce the bio-fermented liquid.

The ingredients for this bio-fermented product are:

- ✔ 190 litres of chlorine-free water
- ✔ 2 litres of molasses
- ✔ 5 litres of milk whey
- ✔ 5 pounds of rock flour or rockdust

1. Mix all the ingredients.

2. Pack the 20 pounds of solid product really well into a very fine sieve cloth and place them inside the plastic barrel.

3. Perforate the lid to insert a ½-inch-wide and 1-metre-long hose. Place the other end in a bottle with three-quarters of water and seal the lid shut. This way the gas produced by fermentation goes out, and you avoid air building up and blowing the lid off.

4. Let ferment for 40 days.

5. After this time, uncover it to see if it's still producing bubbles and doesn't emit a foul odour. This is to make sure it stays in anaerobic conditions and avoid air getting in.

Required tools and materials

- ✔ 1 machete
- ✔ 1 shovel
- ✔ 1 large wooden pestle
- ✔ Sacks or bags
- ✔ 1 x 110-litre plastic barrel with lid
- ✔ 1 x 220-litre plastic barrel with lid
- ✔ 1 metre of ½-inch hose
- ✔ 1 disposable bottle
- ✔ 1 string
- ✔ 3 metres of heavy plastic
- ✔ 2 metres of fine sieve cloth

Costs and difficulties

Ingredients and costs of producing 100 pounds of solid microorganisms

Ingredients	Cost in dollars
100 pounds of microorganisms	$0.0 USD
22 litres of chlorine-free water	$0.0 USD
2 litres of molasses	$1.00 USD
2 litres of milk whey	$0.20 USD
5 pounds of corn flour	$1.00 USD
1 pound of baker's yeast	$3.00 USD
2 days of labour	$10.00 USD
Total	**$15.20 USD**

Note: The production cost of one pound of fermented solid microorganisms is $0.15 USD.

Ingredients and costs of producing 200 litres of bio-fermented fertiliser

Ingredients	Cost in dollars
20 pounds of wild microorganisms	$1.04 USD
190 litres of chlorine-free water	$0.0 USD
2 litres of molasses	$1.00 USD
5 litres of milk whey	$0.50 USD
5 pounds of fine ash	$0.00 USD
5 pounds of rock flour or powder	$0.00 USD
2 days of labour	$10.00 USD
Total	**$12.54 USD**

Note: The production cost of one litre of bio-fermented liquid is $0.07 USD.

Encountered difficulties

- ✔ This product is bottled in recyclable containers. Since it has no official brand or stamp, people are often sceptical of using this product.
- ✔ Though the applications have shown good results, the nutritional content of the micro and macro elements of the final product isn't clear.
- ✔ Since laboratory analysis are expensive, there are no results that endorse the formulas to apply to potato, avocado, citric, legumes, and vegetables such as broccoli and cauliflower.
- ✔ Many companies that produce bio-fertilisers are generating false expectations by not guaranteeing the quality of their products. Not adhering to proper production norms brings the risk of pathogen outbreak or microbe contamination that damage the crops.

Recommendations

- ✔ Technicians, as well as leaders and community promoters, need to understand why and how the chemical process of fermentation works.
- ✔ Know the nutritional input of macro and microelements, and nutritional effect on the different crops.
- ✔ Since the production of bio-fermented fertilisers has two stages, one lasting 40 days and the other 30 days, it's necessary to prepare them long before planting time.
- ✔ Bio-fermented products, like foliar fertiliser, dissolve in water. The dose depends on the stage and type of crop. The dose ranges from half a litre to two litres for every 20 litres of water.
- ✔ Other products are Supermagro and CCHG which include ash, hydrated lime and poultry manure in their ingredients
- ✔ Improvements due to using bio-fertilisers have been observed in maize, sugarcane, coffee and citrus trees.

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