How to make biofertilisers

Fermented cow manure

Booklet 2
Acknowledgements

This booklet, first published in 2019, is produced by the Seed and Knowledge Initiative (SKI) and is part of a series about biofertilisers. The booklets share simple methods for farmers to develop biofertilisers using cheap and readily available materials.

You are free to copy and share the information, as long as you acknowledge SKI.

We thank Juanfran Lopez and Carlos Pons for facilitating workshops with SKI partners in Zambia and Zimbabwe, from which these booklets have been adapted.

Written by: John Wilson
Illustrations: Clever Tsingano
Graphics: Luc Brazier
Design and layout: Anna Brazier

(c) 2019 The Seed and Knowledge Initiative (SKI)
About the Seed and Knowledge Initiative

The Seed and Knowledge Initiative (SKI) is a partnership of diverse organisations from southern Africa, committed to secure food sovereignty in the region. SKI aims to strengthen farmers’ own ways of enhancing and saving seed, and their ways of farming.

This partnership of civil society organisations supports approaches that bring biological and genetic diversity into farming, based on both indigenous and scientific knowledge. SKI is interested in seeing farming and value-adding systems that regenerate the soil and landscapes, while benefitting farmers’ well-being, and producing a diverse abundance of nutritious food. All SKI partners want to see farmers that are creatively generating knowledge that they actively share amongst themselves. They see all these factors as the basis of sustainability.
Contents

Introduction to biofertilisers 1
Microbes and soil fertility 2
How to make biofertilisers 4
Making fermented cow manure 5
Storing biofertiliser 10
Using biofertiliser 11
How to make your own yeast 12
Introduction to biofertilisers

Feeding the soil

Healthy soil is the most important part of a productive farm because all plants, animals and people depend on the soil. Improving the soil improves the health of our crops and livestock. They will suffer from fewer pests and diseases and their condition will continue to improve for the future.
To care for the soil, we must understand that it is made of both living and non-living parts. The non-living parts of the soil are formed from broken-down rock and decaying plant and animal material (such as leaves that have fallen on the soil and begun to rot). The living parts are the tiny creatures that live in the soil. Some of these (such as termites, worms and beetles) are large enough for us to see but most are too small to see without a microscope. We call these microbes, and they include millions of tiny bacteria and fungi.

**Microbes and soil fertility**

Microbes are very important for improving soil fertility. They take the non-living parts of the soil and convert them into nutrients that can be used by plants.

Chemical fertilisers, apart from being expensive and hard to access, can kill microbes. This is one of the reasons that they reduce soil fertility in the long term.

A simple and cheap way to improve the fertility of soil is to encourage many beneficial microbes and provide them with ideal conditions. The microbes eat substances, produce nutrients and make them more easily available to plants. Biofertilisers provide an ideal environment and food for microbes to do this.
What are biofertilisers?

Biofertilisers are preparations containing beneficial microbes. These microbes promote plant growth by increasing the amount and availability of nutrients for plants and improving the growth of plant roots. Some are solid such as native microbe mixture or bocashi, (explained in other booklets). Others are in a liquid form. Some (like bocashi) are made in the presence of air (aerobic) and others are made in an environment without air (anaerobic), such as the liquid biofertiliser we describe in other booklets in this series.

Why make biofertilisers?

Biofertilisers have many advantages. They can be made cheaply from local materials, they improve long-term soil fertility, and they contain more nutrients than compost. They are usually quicker to make than compost and can be used to improve the fertility of larger areas of land than if one only relies on compost and manure.

The liquid, fermented biofertilisers can be stored for a year or longer without losing their strength or going off. They can also strengthen plants against pest and disease attacks.
How to make biofertilisers

Most biofertilisers are made using a process called fermentation. Fermentation is the change in a material due to the action of microbes. For example, grains such as millet and maize can be fermented to make mahewu or beer by the action of microbes called yeast. The yeast eats the sugar in the grain mixture and changes the mixture into mahewu or beer (if it is left for many days). Milk can be made into sour milk through the action of microbes called lactic acid bacteria.

When making biofertilisers we create a good environment for beneficial microbes and feed them with the material that they like to eat. This attracts many different microbes that produce nutrients for plants and help to improve the soil.
Making fermented cow manure

Equipment
An airtight container (size depends on how much you want to make)
Bucket
Connector
Nipple
Piping
Plastic water bottle

This is a ‘without air’ (anaerobic) fermentation so you will need a container that can be closed tight to keep air out. The 200L or 60L metal drums which have metal clips on the lids to seal them closed work well. You can also use a 20L bucket with a lid that seals shut.

You also need to make a system that allows the air to escape from the container without being able to flow back in (as shown in the photograph).
Make a hole in the top of the container into which you can put a connector and nipple. Onto this attach piping that then feeds into a bottle with water. This bottle can hang from the side of the container.

Everything must fit tightly so that air cannot get in and so that the gases in the container can only go out through the pipe.

In Kenya farmers seal their bucket with plastic and old bicycle tyre tubing. Gases will build up and need to be released from time to time.
Ingredients
These are the amounts for a 60L container. If you use a 200L container, use roughly three times these amounts. For a 20L container use a third of these amounts.

Manure: 15–20kg of very fresh cattle manure. You could collect this manure from the kraal early in the morning before the sun dries it out. This manure will be full of microbes from the cattle’s stomach.

Molasses: 750ml molasses or 300g of sugar made into a syrup (dissolve the sugar in a litre of water). Molasses is better but sugar will do.

Milk or whey: 750ml. Ideally use raw milk that has come straight from a cow. Leave the milk to sit overnight then remove the layer of cream that forms before using the milk. Use this milk. You can also use milk bought from a shop. Low fat milk is best. Alternatively, make whey – the liquid formed when you strain sour milk in a cloth over a bucket. If using whey, you should use 1.5L.
**Yeast:** 50g of ordinary baker’s yeast (find out how to make your own yeast at the end of this booklet).

**Minerals:** 2kg of ash, rock dust or bone meal, or a combination of these. Bone meal is finely ground powder made from bones.

**Water:** 40L. Use water from a well or borehole rather than tap water as it should not have chlorine in it. If you only have chlorinated water, put 40L in a container and leave it in the sun for 8 hours. This will remove the chlorine.

**Directions**
Put the cow manure into the 60L container. In a separate bucket mix the milk, molasses, minerals and yeast with a 2L of water.

Add this mixture to the 60L container, stirring well. Fill up with water, leaving a gap of about 10cm at the top.

Put on the sealed top with an air lock attachment that feeds into a bottle with water so that air can escape but cannot go back in.
Allow the mixture to ferment until it stops bubbling - around 30 days. Don’t use the mixture before 30 days is up.

The mix should be an orange/brown colour and should not smell unpleasant. It should have a smell a bit like home brew beer. If it smells bad or off then you should throw it away. The smell is a good test of the quality.
Storing biofertiliser

Keep the fermented biofertiliser in a sealed container. Make sure you seal it well after you have taken what you need for spraying crops. This mixture can keep for a long time, at least a year. If it still smells fine when you open it to take more, then all is well. Keep in a cool place out of the direct sun.

It’s a good idea to put about 100ml molasses into the container each time you open it to keep the microbes happy! Alternatively, after the fermentation, decant the liquid mixture into separate containers such as clean, used plastic milk bottles that can be sealed.
Using biofertiliser

Dilute 1 part fermented fertiliser with 20 parts water. Spray the biofertiliser onto the underside of leaves of vegetables, crops or trees.

Spray in the early morning or late afternoon. This is when the pores of leaves are more open. There is no set recommendation on how often you should spray. Many people use biofertiliser once per week or every two weeks.

This mixture will feed the plant with beneficial nutrients (including hormones, vitamins, organic acids, and minerals). It will also feed the microbes that live on the plants' leaves and in the soil. The mixture will also introduce a variety of microbes into the soil around the plant. It is a very good all round tonic for both the plants and the soil.
How to make your own yeast

**Equipment**
A very clean glass jar
A piece of mutton cloth to cover the jar

**Ingredients**
2kg wheat flour
Sugar
Water - from a well or borehole rather than tap water as it should not have chlorine in it.

**Directions**

**Day 1:** Put ½ cup flour, a tablespoon of sugar and ½ cup water into a glass jar. Mix them together thoroughly. The mixture should be as thick as mahewu. Cover the jar with a piece of mutton cloth (leave the lid off). Leave it in a warm shaded place in your kitchen.

**Day 2:** About 24 hours later (it doesn’t have to be exact), add another ½ cup of flour and as much water as it needs to reach the same consistency as the first day. Mix together and cover with the cloth again. The mixture should have a few bubbles in it by this point.

**Day 3:** The mixture should be looking quite a bit more bubbly. The surface might look frothy. Add another ½ cup of flour and as much water as it needs to reach the same consistency as the first day. Mix together and cover with the cloth.
**Day 4 and following:** Keep adding ½ cup of flour and a little water each day. The mixture should look actively bubbly. By the 5th day the yeast will be ready to use. You can use this for adding to your biofertiliser or even for baking your own bread!

Once your yeast starter is established, you can keep it growing by feeding it every other day. If you aren’t planning to use it more than once a week, it should be kept in a fridge so you don’t have to feed it as often and so it doesn’t grow too quickly.
This booklet gives information about biofertilisers. It provides some simple methods for farmers to develop biofertilisers on their farm using cheap materials.

For more information on these processes you can access some films on our website


This booklet is published with the financial support of Brot fur die Welt and the Swiss Agency for Development and Cooperation (SDC)