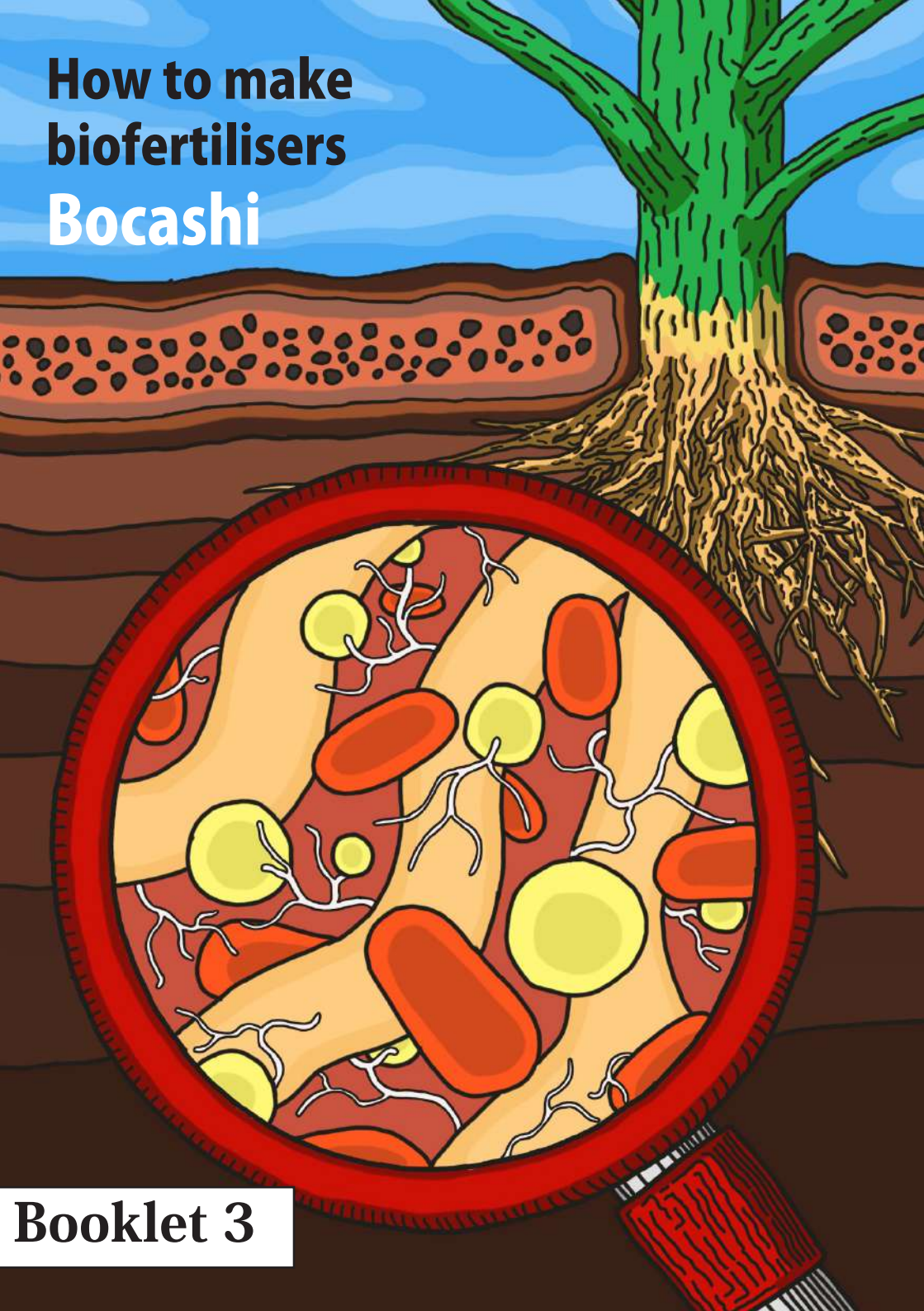


How to make biofertilisers Bocashi





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

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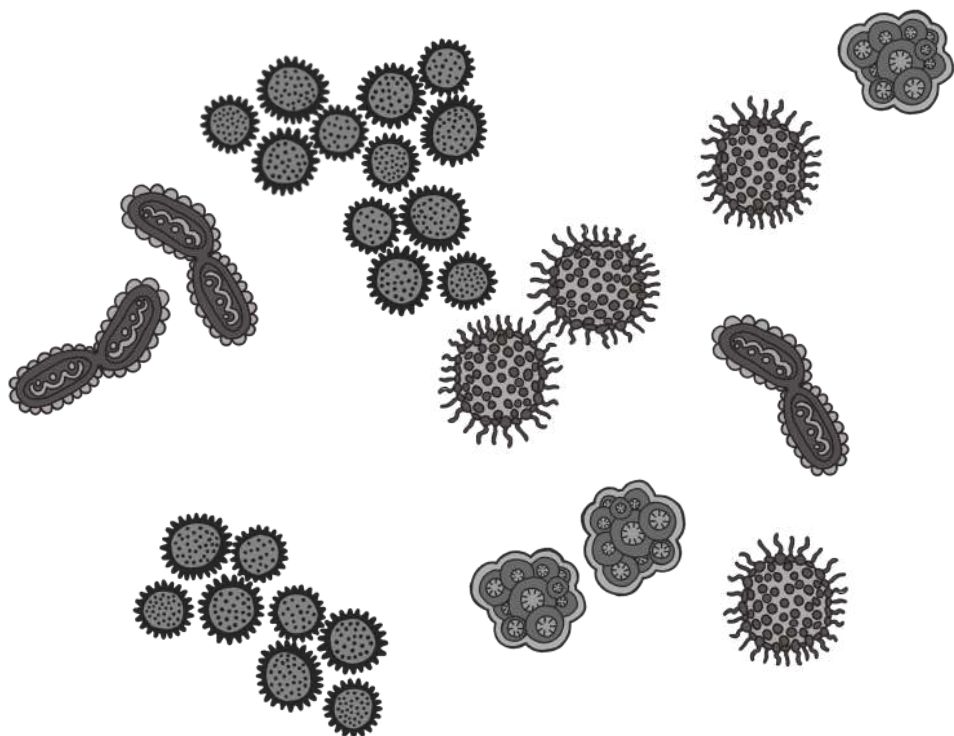
About the Seed and Knowledge Initiative

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.

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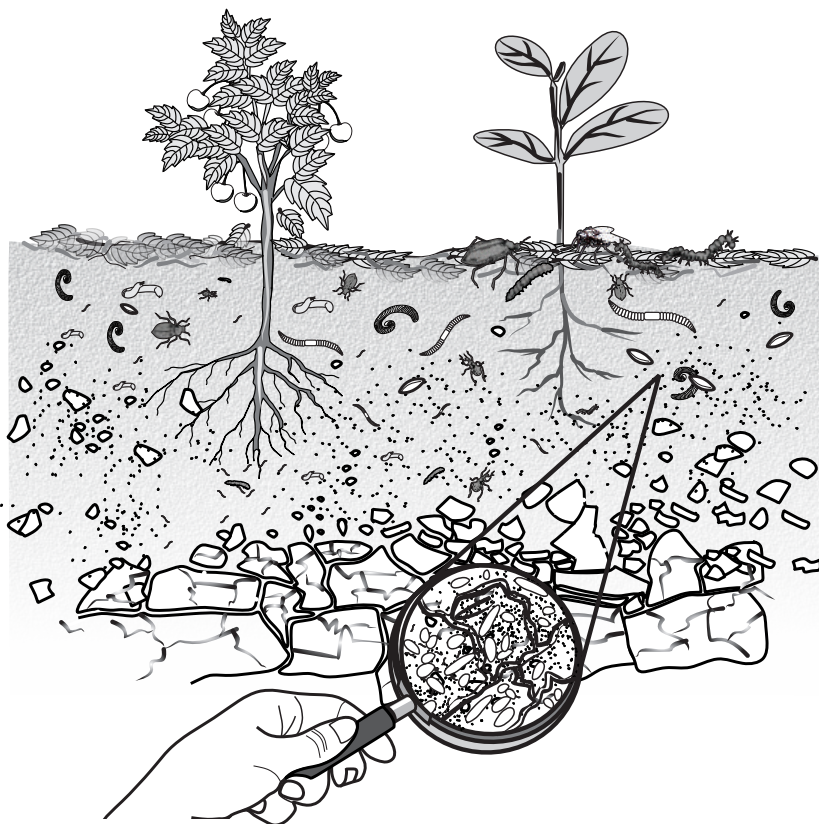
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Introduction to biofertilisers

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.



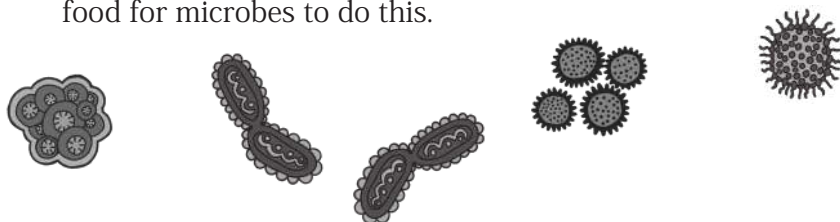
To care for the soil, we must understand that it is made of both living and non-living parts. The non-living parts of the soil are formed from broken-down rock and decaying plant and animal material (such as leaves that have fallen on the soil and begun to rot). The living parts are the tiny creatures 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.





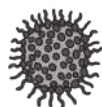
What are biofertilisers?

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.

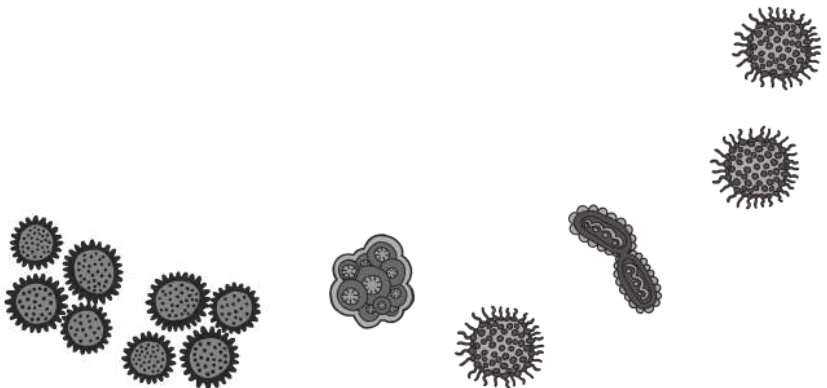
The liquid, fermented biofertilisers can be stored for a year or longer without losing their strength or going off. They can also strengthen plants against pest and disease attacks.



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.

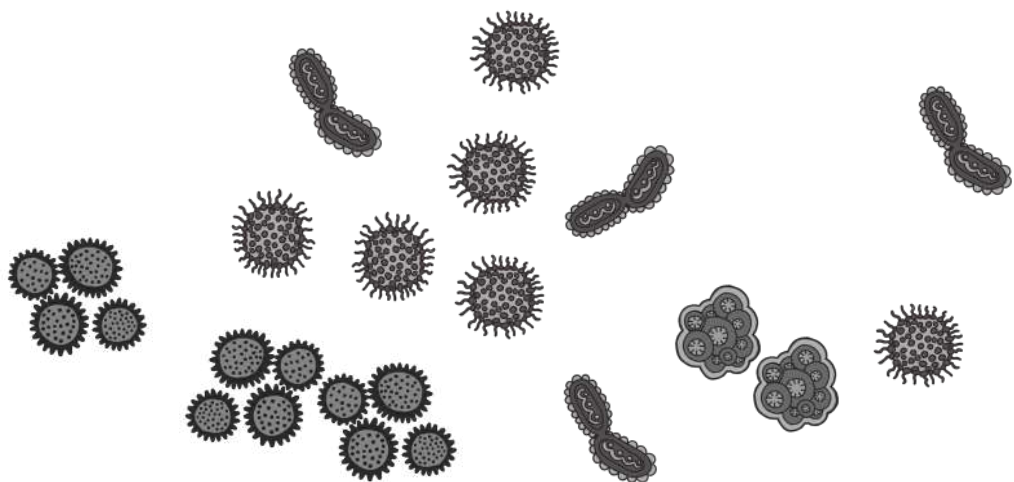


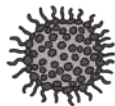
How to make bocashi

Bocashi is a Japanese word to describe a way of fermenting wastes into something productive. There are different kinds of bocashi.

Here we are using bocashi to mean a carefully controlled way of producing half-cooked organic materials ready for use as a fertiliser in 12–15 days. This specific method draws from years of experience with small-scale farmers in Latin American countries.

Making bocashi is a bit like cooking, it is best to follow the recipe until you feel confident with the process. Then you can adapt it as you need. Good quality bocashi can improve the growth of plants and the fertility of the soil. Keep trying it out and you will keep learning to improve the quality of your bocashi!





Bocashi recipe

Ingredients



7 sacks **manure**: you can use any kind of manure. A mixture of manures is best and it is better if the manure is dry. Manure provides nitrogen and other nutrients and is also a source of microbes.

7 sacks **dry matter**: this can be husks from processing small grains, maize stover, dry leaves or even sawdust. A mixture of materials is best. What's important is that the dry matter is cut up or broken up into small pieces. It is easier to turn the heap if all materials are small.

5 sacks **soil**: Soil is a good source of microbes for bocashi. It should be clay soil or have a high clay content.

1 sack **biochar** (optional): Biochar provides a very good environment for microbes. You can make bocashi without biochar but biochar will give you a higher quality bocashi.

1 sack **bran**: Bran is the material that is taken off when grinding grain into flour. It is used for stockfeed. You can use rice, wheat or maize bran. In a bocashi heap bran is very good food for the microbes.

5L **molasses**: Molasses is a good energy source for microbes. If you can't get molasses you can use 2kg sugar made into syrup (dissolve the sugar in water) but molasses is better and cheaper.

500g **yeast**: Baker's yeast is available in some shops. Yeast speeds up the fermentation process and helps the microbes to multiply fast.



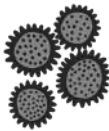
You can also make your own yeast – see the recipe at the end of this booklet.

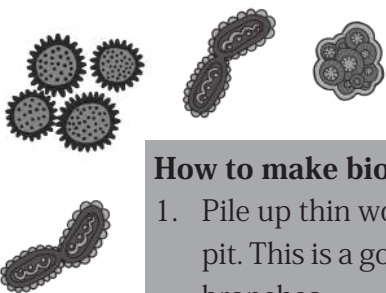
Minerals: These can come from ash, or bone meal, or finely ground rock dust. Generally, the more colour in the rock dust, the more minerals it contains.

You can use a mixture of minerals and you can apply them at the beginning or after the bocashi is 'cooked'.



Water: This should be water that has no chlorine in it. If you only have water with chlorine in then you can leave it in the sun for a day to remove the chlorine. Getting the right amount of water is one of the tricks to making high quality bocashi. You can only add water on the first day of making the bocashi. You should never add water after that.





How to make biochar

1. Pile up thin woody branches and twigs in a shallow pit. This is a good way to get rid of unwanted thorny branches.
2. Burn the branches/twigs until the smoke thins then cover with 2cm of soil.
3. Let the branches/twigs smoulder until they are black.
4. Put the fire out and collect the biochar.

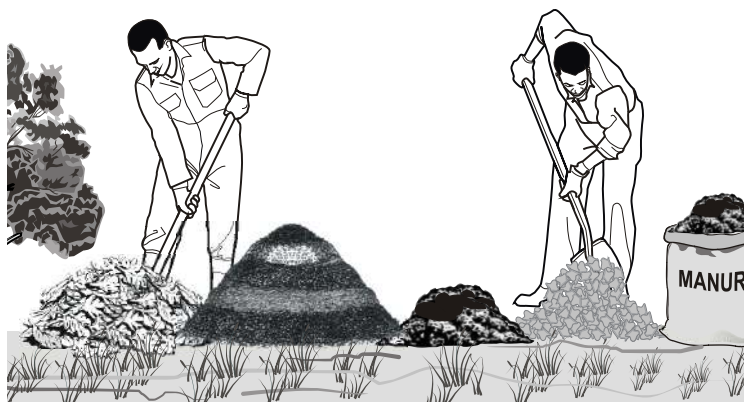
Directions

Choose a place that is in the shade and protected from rain. In the dry season make bocashi under a shady tree. In the rainy season you will need to make some kind of cover to keep the rain off the heap.

Just as you do in a compost heap, build a bocashi heap in layers a few centimetres thick. Do this first without adding water, except for the water that you put with the molasses and yeast.

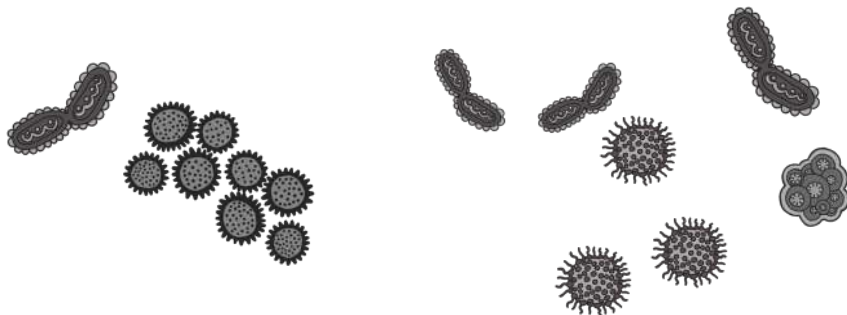
Adding layers

Start by making a layer of dry matter. Add a layer of manure and then layers of soil, biochar and bran. In a separate bucket, mix 5L water with the molasses and yeast and stir well. Sprinkle some of this onto the heap after each set of layers.



Continue making sets of layers sprinkling the water/ molasses/yeast mixture onto them until you have used up all the materials. When the bocashi heap is completed it should not be more than about 1.2-1.5m high.

You may need to lower the height of the heap as the days go by, depending on what happens to the temperature.





Turning the heap

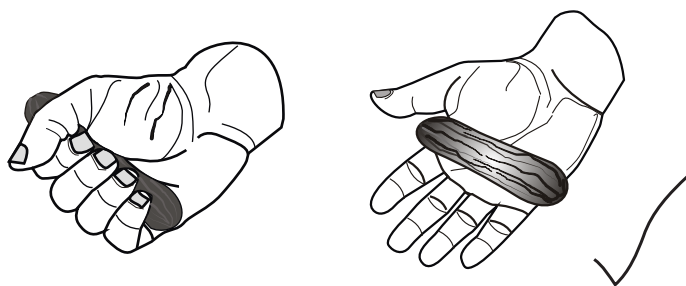
Next turn the heap so that all the layers become mixed together. As you are turning, sprinkle more water onto the heap. Be careful that you don't add too much water. We recommend turning the heap 3 or 4 times until you have the right amount of water. By then all the materials will be very well mixed.

Testing the water content

Getting the right amount of water is important. To test whether you have added enough water, take a small fistful of the mixed bokashi material in your hand and squeeze it.



If water comes out between your fingers you have too much water.



If the material can't form a sausage shape when you roll it in your hands, then you have too little water. Do this test in a few different parts of the heap.

If there's not enough water, turn the heap again and sprinkle more water. If you have too much water, add more soil to the heap as you turn the heap again. Try to avoid having too much water — it is better to have too little water than too much. After the first day you must not add more water to the bocashi.

Managing the bocashi heap

You will probably need to turn your heap twice per day for the first 4 days or so depending on the temperature reached. Test the temperature by putting your hand into the heap. If you can leave your hand in there for about 10 seconds without burning your hands, (but only just), then the temperature is correct. For most people this will be about 55°C. The heap should not be hotter than this. If you have to remove your hand quickly then the heap is too hot.

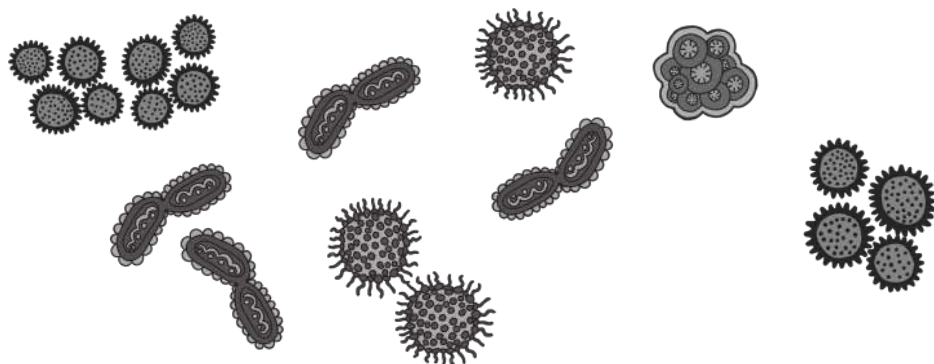


A well-made and well-managed bocashi heap should not smell unpleasant and should not attract flies.

For the first four days, if the temperature stays up at around 50-55°C then turn the heap in the morning and evening. If the heap is too hot, then you should lower the height of the heap. If you think it is too wet and perhaps smelling off, then add more soil. Keep a written record of what you do to help you learn and become a better bocashi-maker.

From the 5th day, turn the heap once per day. Keep checking the temperature — it should start gradually reducing. Continue turning the heap once per day until the temperature becomes the same as the surroundings. This will usually be after 12-15 days after the heap was first made. You can now use the bocashi.

Try to use bocashi soon after you make it as it will be strongest. It's not a good idea to store bocashi for longer than about a month. Store the bocashi in a shady, rain-free spot.



Using bocashi

You can use bocashi in a number of ways. It is half-decomposed organic matter and the decomposition will continue to happen in the soil. This will stimulate lots of microbial activity. Bocashi is like a nest for microbes.

Bocashi can be applied to crops and is an excellent promoter of general soil health.

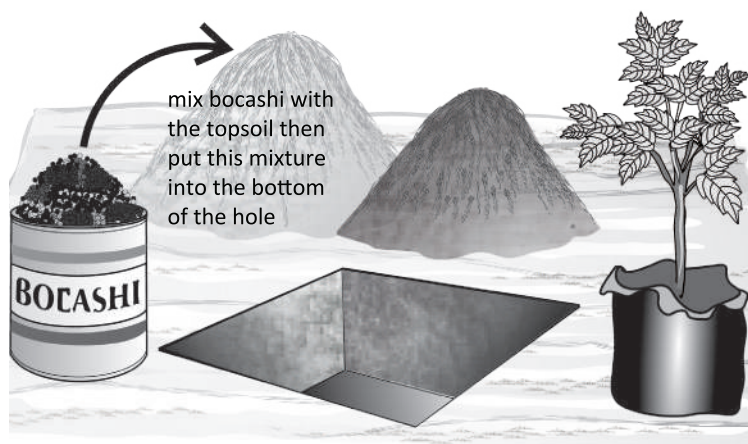


Vegetables: Bury handfuls of bocashi in the following amounts in the soil near where you transplant or sow vegetables. It is better that the young plants' roots don't come into direct contact with the bocashi.

- Leaf crops (such as rape, kales, lettuce): one handful of bocashi.
- Crops with a head (such as cabbage, cauliflower): 2 handfuls.
- Crops with ongoing harvest such as tomatoes and egg plants: 3 handfuls.

Keep feeding plants with this amount of bocashi every two weeks.

Fruit trees: When planting fruit trees, dig a hole of 80cm x 80cm x 80cm, separating the top and bottom soil. Mix about 5kg bocashi with the top soil and put this mixture into the bottom of the hole. Put the bottom soil back on top. Water and leave for a month before planting the fruit tree into the planting hole.



For fruit trees that are already growing, dig a shallow trench about 10cm deep around the tree, pour around 5-10kg bocashi into the trench and cover with soil. Repeat this each year as you feel it is needed.



Field crops: Bury one handful next to each plant station. The recommended rate per hectare for general application of bocashi is 8–10 tonnes.

Nursery: Mix 1 part bocashi and 4 parts of soil to fill seedling containers. The nursery is one area where it is better to use older bocashi that you have stored for about 2–3 months.

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 $\frac{1}{2}$ cup flour, a tablespoon of sugar and $\frac{1}{2}$ 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.



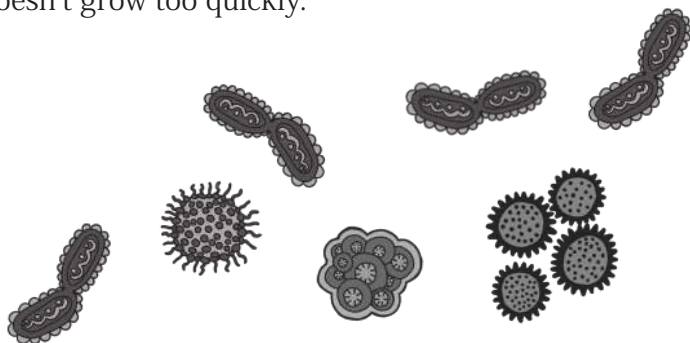
Day 2: About 24 hours later (it doesn't have to be exact), add another $\frac{1}{2}$ cup of flour and as much water as it needs to reach the same consistency as the first day. Mix together and cover with the cloth again. The mixture should have a few bubbles in it by this point.

Day 3: The mixture should be looking quite a bit more bubbly. The surface might look frothy. Add another $\frac{1}{2}$ 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 $\frac{1}{2}$ 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

www.seedandknowledge.org



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

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