

A practical manual for smallholder farmers

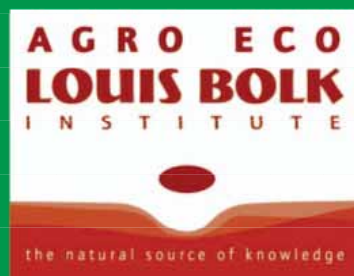
ORGANIC FERTILIZERS

and

BIO - FERMENTS

Improving soil health, quality and crop productivity

Technology in the hands of farmers



A practical manual for small holder farmers

Organic fertiliser

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Coordinations:

Osei Kwame Boateng (MSc), International advisor AE - LBI, Ghana, West Africa
Ing. Kalema Andrew Joseph, Advisor AE - LBI, Uganda, Eastern Africa

Layout & Print:

Print-Tek (printekprints@gmail.com)

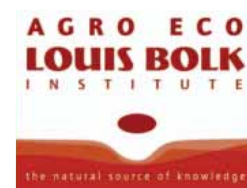
With the collaboration of:

Ntobroso Organic Cocoa Farmers Cooperative
Tano Biakoye Organic Cocoa Farmers Cooperative



For more information, contact:

Agro Eco - Louis Bolk Institute
PMB KA 84 Airport, Accra, Ghana
+233 302 786 097
www.agroeco.net



and

Progreso
Keizersgracht 452
1016 GD Amsterdam
The Netherlands
www.progreso.nl



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INTRODUCTION

The loss of productive forest and agricultural soil due to bad agricultural practices and change of land use, is the main cause of reduced crop productivity and quality together with increased problems of crop pests and diseases. At present, small scale farmers do not have low cost technologies and access to cheap inputs that guarantee better incomes and the sustainability of their crops.

The production of organic compost using effective forest Mountain Micro-organisms (MM) is a demonstrated alternative that will allow or permit small scale farmers to regenerate the fertility of their soils. This technology was implemented for the first time in Japan, centuries ago. They called it “Bokashi”. The practice requires extraction of micro-organisms from good organisms in their natural habitat (natural forest) and are reproduced using inputs and techniques that are easy to understand. These micro-organisms are then incorporated in the preparation of organic solid fertilizers and fermented liquid fertilizers, in order to regenerate soil health and fertility of farms which have been affected by poor agricultural practices and the use of excessive agro chemicals. This puts in action the restoration of an ecological equilibrium in the farms that was once enjoyed by our ancestors.

The right application of organic fertilizers will result in an increase in crop productivity and improvement in the quality of harvested produce, thus contributing to economic development and improvement in the livelihood of small scale farmers.

This manual is a collection of a wide range of experiences from Costa Rica, Colombia, Uganda and Ghana, adapted and easy to implement by small scale farmers. This booklet will serve as a guide in the process of preparation of organic fertilizers based on effective Mountain Micro-organisms.

Understanding the technology

The MM technology regenerates and revives poor soils, reduce incidences of crop pest and diseases and improves productivity and quality of your crops. It can be implemented by all producers whether large, medium, small, conventional or organic.

It is good to prepare and apply the different organic remedies presented in this manual but the most important thing is to understand why you do it.

This technology is based on the four principles of Organic Farming:

1. Health

Organic Agriculture should sustain and enhance the health of soil, plant, animal, human and planet as one and indivisible.

2. Ecology

Organic Agriculture should be based on living ecological systems and cycles, work with them, emulate them and help sustain them.

3. Fairness

Organic Agriculture should build on relationships that ensure fairness with regard to the common environment and life opportunities

4. Care

Organic Agriculture should be managed in a precautionary and responsible manner to protect the health and well-being of current and future generations and the environment.

Plant performance is a reflection of the health status of the soil and so are all the living things. When the soil is sick, it produces stunted crops, poor yields and high prevalence of pests and diseases resulting into hunger, famine and a malnourished population. A healthy and fertile soil produces vigorous crops, high crop production and quality produce and a healthy –happy population.

Healthy soil, healthy plants, healthy products, healthy farmers, healthy consumers; its never too late to rebuild the fertility of your soil, little by little. Act now and tomorrow you will tell a story!

The importance of Micro-organisms

Organic fertilizers are products obtained from the decomposition of organic matter; in this process microorganisms like molds are important because they break down the organic matter thus releasing nutrients for plant growth.

Organic fertilizers can be prepared on farm at a low cost using crop residues, animal dung and other plant materials such as banana stems, leguminous leaves and green grasses.

Mountain micro-organisms (MM) are a collection of various beneficial micro-organisms that are found in virgin soils or forest decomposing organic matter. They are used in the preparation of organic fertilizers in order to speed up the process of breaking down organic matter. The presence of the micro-organisms help in the process of decomposition and hence improve the quality of the final product called organic fertilizer.

Importance of organic fertilizer are:

- Organic fertilizers reduce the dependence on artificial chemical products on different crops.
- They improve the soil, physical structure (soft and loose soil), chemical (increase nutrients), and biological (high population of beneficial micro-organisms) composition.

Mountain Micro-organisms

- Improves yields, soil health, crop productivity and quality of produce.
- Stimulates seed germination and root growth.
- Protects the crops from being attacked by disease causing organisms.
- Are used in the preparation of organic fertilizer, bio-ferments and bio-crop repellents.

PRODUCTION OF SOLID MM

Collection of decomposed forest matter to be used as a starter



Decomposed forest matter can be located under a forest tree where piles of leaves have been decomposed on top of the soil. Look for loose soil with small insects and good smell. Dig 10cm deep and find handfuls of organic matter laced with white patches called micro-organisms. The white laces or the patches can be seen very well during humid condition.

- Put a clean black polythene bag on the floor, clean with water to dissolve or reduce any external attack on the micro-organisms.
- Put the micro-organisms collected from the forest on the spread polythene sheet.
- Shake and remove unwanted materials (debris, roots, big particles, etc).
- Mix well with the soil and spread out on the polythene sheet.



Forest where decomposed forest matter are collected

Refined decomposed forest matter after debris removal

Reproduction of MM

We want to multiply the MM found in the forest to do that you need the following materials:



Decomposed forest matter



Maize or wheat bran/fibre



Molasses



sucrose solution (cocoa sweat)

Ingredients

- 1/4 sack (5kg) of decomposed forest matter
- 10 kg of (Maize/wheat bran)
- 1 litre of molasses and 2 litres of clean water



Adding maize bran to decomposed forest matter to serve as food for the micro-organisms, mix all together, ratio of 2:1 (MM : Maize)



Mix the molasses (a left over material from sugar production) in water (1-2 litres).

Adding molasses solution to the mixture. Molasses is important because it's a source of energy for micro-organisms in order for them to reproduce. You can also use sugarcane juice or, mucilage, a sugar - like solution from cocoa beans during fermentation, normally referred to as cocoa sweat and mix well.



Press the mixture in your palm and release it. If it forms a crumb and releases itself upon small touch, then the mixture content is ok, however if it doesn't form crumbs and releases on its own then you have to add water. When pressed and water comes out, it means the moisture content is too high. Add more feed or fibre to bring it back to the acceptable moisture content. Put the finished product in a transparent container and cover it and keep for 30 days.

Preparation of MM in 30 days



- Put the MM solid mixture in a transparent container with tight lid or cover.
- When placing mixture in a container, shake a bit the container and cover to prevent foreign material to enter.
- Cover the container tightly to prevent air coming in.
- Store it in a cool and dry place for a period of 30 days, Always make sure it is placed under shade without disturbance from animals and insects (goats, dogs, flies, etc).
- Put a weight on top of the bucket to make it more secure. After 30 days it is ready for use.

Please note the following:

- Write the date of preparation and stick it on the container as a reminder of the initial date.
- Only open the container when necessary and close immediately after removing the necessary content of the MM mixture. Do not disturb the system.



Activating MM before adding it to compost

The MM after preparation and kept for sometime render the micro-organisms dormant and need activation before use. Activated micro-organisms is a mixture of effective solid MM dissolved in water mixed with molasses converting into a solution of beneficial micro-organisms.

Preparation of activated MM

Ingredients

- 3kg of solid MM
- 1 litre of molasses/cocoa sweat or brown sugar
- 20 litres of clean water
- Put portion of solid MM in a porous cloth or clean plastic sack and hang in clean water.
- Add molasses in the water, note that molasses is important because it provides energy to micro-organisms and they reproduce fast.
- Dip the mixture such that molasses is soaked (dissolves well) and remember not to put the mixture in direct sunshine.
- Store in a cool place for 4 days.
- The MM is ready for use from 4th-15th day after preparation. MM is activated after four days

See what you also have in addition after 4 days

1. Between 4-10 days, you get high reproduction of fungi
2. Between 11-15 days, there is high production of bacteria
3. From the 16th day onwards you get high reproduction yeast and the bacteria and other fungi are going dormant again.

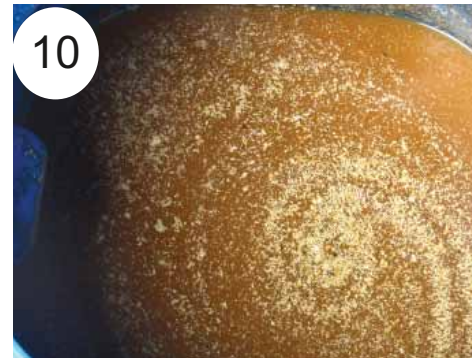


The liquid contains now the beneficial MMs used to prepare organic fertilizers, bio-ferments, bio-insecticide, etc. You can apply the activated MM solution directly, after diluting it with water, on the crops to control pests and diseases. It can also be applied to the soil, around the crop, such that micro-organisms can increase and break down soil organic matter.

MAKING SOLID FERTILIZER (MICROPOST)

Ingredients

1. 1 sack of saw dust
2. 1/2 sack of chopped banana stems
3. 2 kg of wood ash
4. 1 Kg of waste maize bran
5. 1/2 sack of charcoal or carbon dust 1
6. A sack of chicken manure
7. 2 kg of fresh cow dung or 2kg of green leaves
8. 20 Kg of chopped cocoa husks (dried or fresh or a combination of the two)
9. 2 litres of molasses
10. 2 litres of activated MM solution



Nutrient sources

- Nitrogen : young and succulent plant material
- Carbon : old and tough, course plant material
- Potash : cocoa husks

Plate 1-10

Process of micropost production

Normal composting

- Chop all these materials into small particles (as small as you can, smaller size help in faster decomposition)
- Put the inputs in layers and later mix them well.
- Place the materials in the following order(see page 10) and continue the process again until all your materials is exhausted (saw dust, plantain stem, ashes, corn brains, charcoal, poultry manure, cow dung, cocoa husk etc) and start the process all over again until all the materials are finish.
- The heap should not be higher than 1m, nor wider than 2.5m. This heap size is good for ideal temperature and ventilation.

MM technology

- Add molasses to the liquid MM to activate the micro-organism. Mix well and add water during turning of the compost made with micro-organism (micropost).
- Sprinkle gradually to avoid soaking the mixture with the liquid MM. Turn until the mixture is properly mixed.
- After mixing and the moisture content is right, leave the material in a heap-like structure of 1 metre tall, if the quantities permits, cover with banana leaves or fibers for the first 6 days under shelter.
- You can check with a stick or a thermometer in the middle of the heap for temperature.
- After 24 hours of preparation turn it to release heat or reduce temperature.
- From day 1-6 turn 2 times a day.
- From day 7-20 turn once a day.
- From day 7-20, you have to reduce the height of the heap to reduce temperature.
- By 20th day of preparation, the compost (Micropost) is ready for use

Note: You can use the activated MM in your own compost heap as well.

Step by step process of micropost production



Start with 1 sack of sawdust



Add chopped banana stems



Sprinkle 10kgs of wood ash



Add 1 sack of dry chicken manure



Add chopped green leguminous leaves



Add 1 sack of waste maize bran



Add 1 bag of chopped cocoa pods



Add 1/2 sack of charcoal dust



Repeat the process until all the materials are used up



Mixed activated MM solution with 2 litres of molasses



While mixing, sprinkle solution of activated on MM mixed with 2 litres of molasses



Mix the material well. Keep heap size at 1m high and not more than 2.5m wide



Squeeze mixture in the hands. Should form a ball and no water comes out of the fingers



Mix material, cover with banana leaves. Monitor the temperature



Turn the materials twice daily for the first 6 days and once for the next 7-20 days



Micropost ready for use, after 3 weeks of preparation; put in a bag

Application of micropost organic fertiliser

Micropost gives better results than most chemical fertiliser due to its richer and chemically more balanced composition. Besides its chemical composition, it increases the water retention capacity of the soil and it improves the soil structure.



Apply 6 bags of 50kg of Micropost on 1 acre of a matured cocoa farm

Micropost can also be used to prepare cocoa nursery beds and potting soil substrate

Making liquid fertilizer (Bio-ferments)

Bio-ferment is a fermented liquid organic fertilizer produced from organic liquid material acted up on by Micro-organisms, such as yeast, fungi and/or bacteria.

The liquid organic matter is then transformed into plant elements, vitamins, organic acids and other substances for plant growth.

It is sprayed on crop and the nutrients are absorbed through the leaves immediately.



Tano Organic farmers learning how to prepare quality bio-fermented organic fertilisers using Micro-organisms technology

Advantages of using Bio-ferments

- Provide healthy and strong plants.
- Reduce incidences of plant pests and diseases making the plant more resistant to diseases like black pod.
- Prevent growth of plant pathogenic micro-organisms

Ingredients (Manure catalyst)

- 2 litres of fresh milk or cow milk
- 10 kg of fresh cow dung
- 1 kg of wood ash
- 2 litres of molasses
- 2 litres of activated MM
- 20 litres of clean water



Fresh Milk



Fresh cow dung



wood ash



Molasses



Activated MM



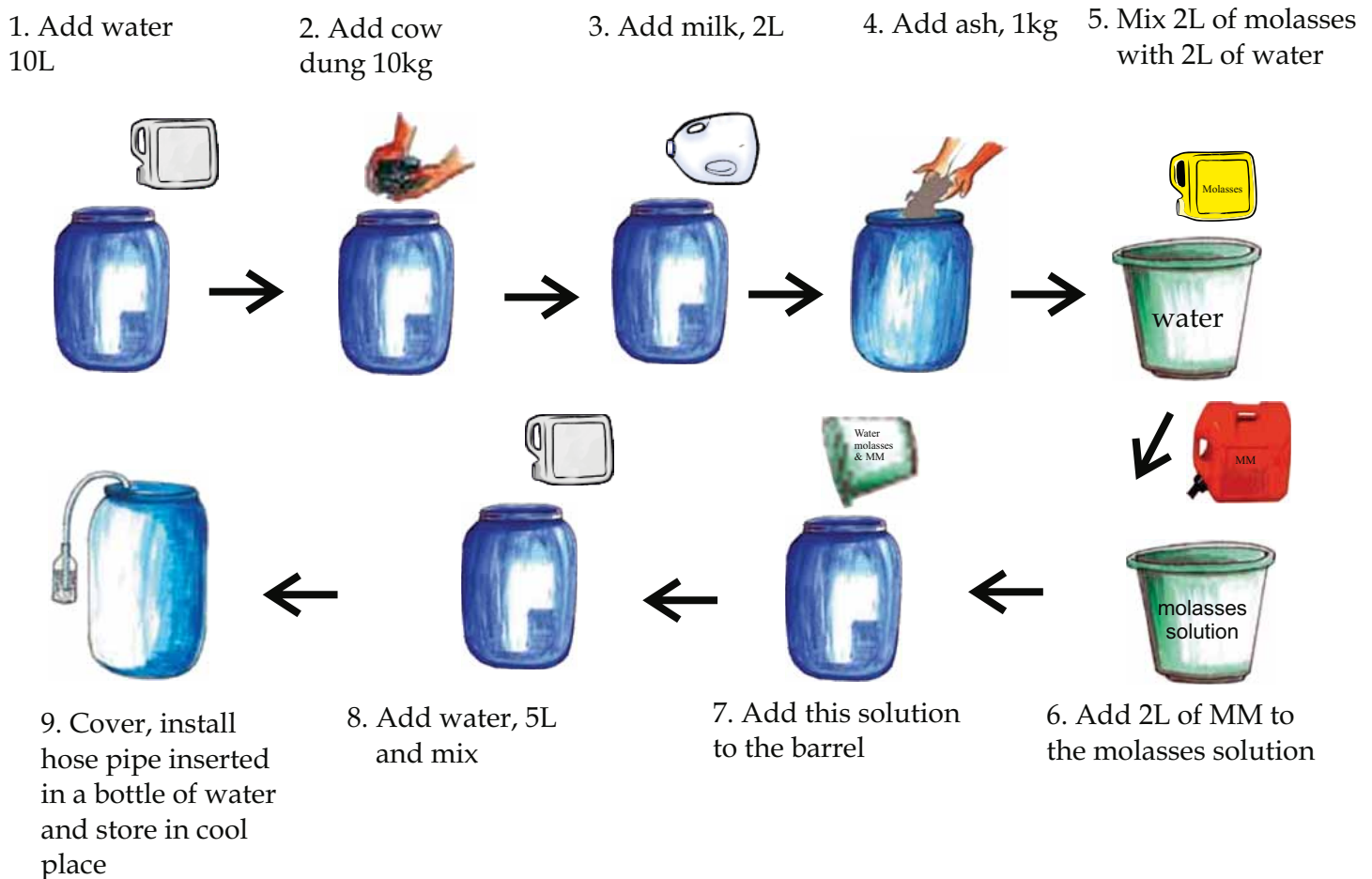
Clean water

How to prepare a Bio-ferment

- Put 2 litres of fresh milk or fresh yoghurt in the a litre plastic drum or container, add 10 kg of fresh cow dung, plus 2 litres of molasses diluted in 20 litres of water. (look at diagram below)
- Stir the mixture well to ensure that it becomes uniform. In case there are small wood particles or other objects, they should be removed.
- You should not add acidic fruit juices such as lemon juice, orange juice, etc.

Note: *The cow dung should be fresh and should not have been in contact too much with direct sunlight. The cow should not have been vaccinated with antibiotics, since this can affect the quality of the result.*

Diagram showing preparation of Bio-ferment



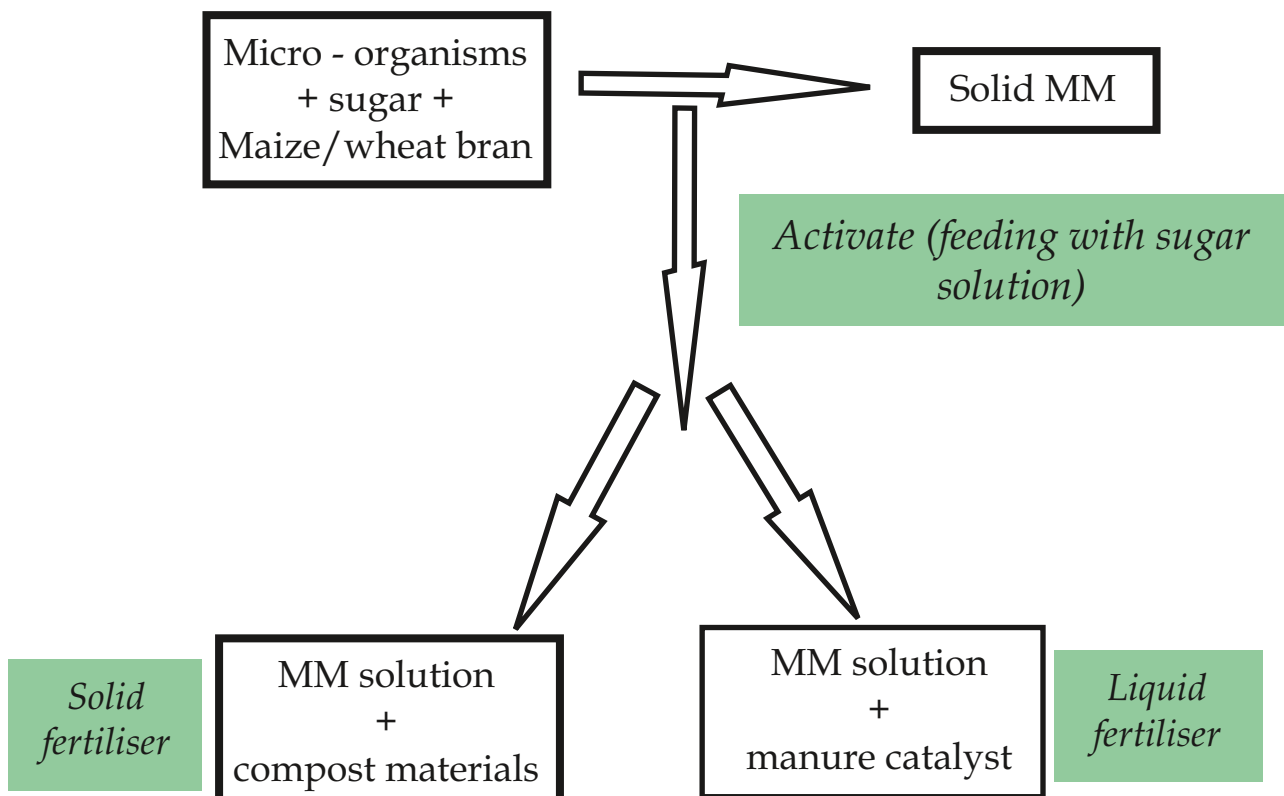
- After mixing, cover the drum firmly with a metallic ring fastener to prevent entry of air.
- Insert the end of the hose pipe in the plastic bottle containing water - it acts a breather for the escape of gases produced inside the drum and also prevents entry of air.
- Gases produced inside the container will escape through the hose pipe forming gas bubbles in the plastic bottle containing water.
- Store the plastic drum under shelter to protect from direct sunlight and rain.
- The bio-ferment will be ready for use 25 days after preparation.
- Use it as liquid fertilizer on your farm



Application of Bio-ferments

- Before use, shake well the container to allow uniform mixing of solution.
- Open the container and measure the quantity of fertilizer you need and cover it again immediately.
- Mix with water as follows: 1 L of fertilizer with 1 L of clean water or 7 L of fertilizer with 7 L of water in a 15L spray pump and spray on crops.

Summary of organic solid & liquid fertilizer production



This book is about improving soil fertility by using improved compost. This manual explains how to collect micro-organisms from its natural environment, reproduce, activate, and prepare both Micropost and Bioferment .

Micropost, made with micro-organisms to speed up the composting, improves soil structure, increases soil life and the water retention capacity.

The Bio-ferment, made from several organic ingredients and active MM, can be sprayed in the farm to get healthy and strong plants and fight against pests and diseases.



With organic fertiliser, we can restore soil fertility, increase crop yields and improve our livelihoods