ORGANIC FERTILIZERS AND PESTICIDES

A PRACTICAL MANUAL FOR SMALL-SCALE FARMERS

JANUARY 2021

This publication has been developed with financial support from Swiss Agency for Development and Cooperation supported by Biovision Africa Trust. It has been developed to aid in increasing uptake of Ecological organic Agriculture practices among small scale farmers as it provides all inputs and requirements that the farmers need in making different kinds of organic pesticides and fertilizers.

The views in this publication do not represent the views of Swiss Agency for Development and Cooperation or Biovision Africa Trust.

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ESAFF Uganda information products are available on the ESAFF Uganda website (https://esaffuganda.org/publications) and the Organic Agriculture website (www.organicuganda.org)

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List of Acronyms

1.	**M.M**	Mountain Microorganisms
2.	**ESAFF**	Eastern and Southern Africa Small-scale Farmers' Forum
3.	**MoFPED**	Ministry of Finance Planning and Economic Development
4.	**USD**	United States Dollar
5.	**Kg**	Kilogram
6.	**L**	Liter
7.	**M**	Meters
8.	**Kg/m2**	Kilogram per Square Meter
9.	**CC**	Cubic Centimeters
10.	**t/ha**	Tons per Hectare

INTRODUCTION

Organic farming is a reliable means of ensuring sustainable ecosystem management and food security with agricultural production activities that take in to account the environmental, social and economical factors that positively contributes towards sustainable production.

Farming was totally dependent on natural processes but with advancements in science and technology, synthetic farming practices have emerged. Synthetic farming is a farming system that uses technology inputs such as pesticides, chemicals and synthetic tools in the production of agricultural food. The prolonged application of farm inputs has degraded the environment and diminished soil fertility. The rise of conventional farm inputs prices, deterioration of the environment, coupled with the increasing population; suggest the probable emergence of an ***"agricultural crisis"***. Environmental protection and eco-balance is a crucial means of preventing environmental deterioration and promoting sustaining human existence on the planet earth.

Environmentally-sustainable organic agricultural practices exclude the use of synthetic farm inputs. An organic farming system creates a sustainable environment and safely maximizes food production and the economy without affecting environmental and human health. It replenishes soil fertility, enhances biodiversity, improves the nutritional quality of food, and creates rural income as well as providing environmental protection.

The value of organic produce globally is estimated at USD 15.6 billion as of 2016. Even with its vintage second position with the number of organic farmers, Uganda meets less than 5% of the global organic market. Organic Agriculture contributes approximately USD 50 million accounting for 17.1% of the value of agricultural exports which currently stand at USD 291.2 million per annum ((MoFPED, 2017/18).

The production of organic compost, organic ferments and pesticides is one of the demonstrated alternatives that will allow or permit small-scale farmers to regenerate the fertility of their soil. The right application of organic fertilizers and pesticides will permit the 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.

ORGANIC FERTILIZERS & PESTICIDES

Organic fertilizers are products obtained from the decomposition of organic matter, in this process effective microorganisms are important because they break down the organic matter thus realizing nutrients for plan growth.

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

Importance of Organic Fertilizers and Pesticides

- Organic fertilizers and pesticides 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 microorganisms) composition.
- Improve yields and the quality of produce.
- Source of food for soil organisms.

ORGANIC FERTILIZERS

EFFECTIVE MOUNTAIN MICROORGANISMS

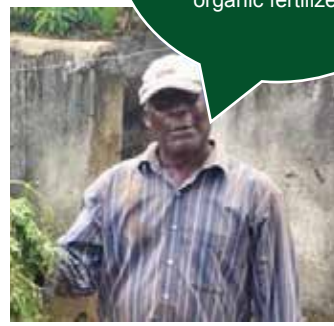
What are Mountain Microorganisms (M.M)?

These are a collection of various beneficial microorganisms 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.

Collecting decomposing material from a natural forest.

If there were no beneficial microorganisms, the process of decomposition would be slow and we would not obtain high quality organic fertilizers



Decomposing forest matter is a natural source of Mountain Microorganism.

Importance of Effective Mountain Microorganisms (M.M)

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

Inputs

- 1/4 a sack of decomposing forest leaves (debris)
- 10 kg of rice/wheat or maize bran
- 1 litre of molasses 3 litres of cleam water (not contaminated)
  Molasses is important because its a source of energy for microorganisms in order for them to reproduce

Production Process

- Mix water and molasses
- Add the mixture to forest debris
- Add the mixture to maize bran in layers
- Mix everything together
- Mixture sholud have optimal moisture
- Test by pressing mixture in hand, no water should come out through the fingers.
- Divide the whole mixture into 2 and put in 2 buckets and compress to remove all air in one bucket. In the other bucket, turn the mixture after every 3 days.
- Keeping turning every 2 days an keep feeling the temperature using a thumb to see if there is warmth.

From this mixture, you can prepare AEROBIC and ANAEROBIC MOUNTAIN MICROORGANISM

Reproduction of M.M

Is a process of reproducing beneficial microorganisms, obtained from a natural forest, by giving them the right conditions for their growth, which will later be used in the preparation of solid and liquid organic fertilizers. They can also be applied directly on the plant leaves to control certain pests and diseases or as a growth booster.

BIO - FERMENTS.

This is a fermented liquid organic fertilizer produced from organic liquid material acted up on by effective forest Microorganisms, such as yeast, fungi and 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.

Inputs used in preparation of Bio - Ferments

- Fresh Milk
- Fresh Cow Dung
- Molasses
- Activated Mountain Microorganisms
- Wood Ash/Maize Bran
- Clean Water

How to prepare a Bio - Ferment

- Add 10 kg of fresh cow dung, plus 2 litres of molasses diluted in 2 litres of water.
- Add 2 kg micro-organisms and 2kg of maize bran.
- Stir the mixture well to ensure that it becomes uniform.
- After mixing, cover the container firmly with a metallic ring fastener to prevent entry of air.
- Store the container under shelter.
- The bio-ferment will be ready for use 25 days after preparation.

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 immediately.
- Mix with water as follows: 1 L of fertilizer with 1 L of clean water or 10 L of fertilizer with 10 L of water in a 20L spray pump and spray on crops.

The bio-enriched fermented fertilizers are chemical products allowed in organic agriculture that when utilized with organic fertilizers provide plants with minerals required for healthy and vigorous growth

Remember that you can use activated effective microorganism solution in all organic fertilizer preparation such as bokashi, bio-stimulants, bio-fermets and organic plant teas, This is also added to compost to decompose and break it down. It should also be applied to the garden where the planting is going to be done.

You can apply the activated Mountain Microorganism solution directly on the crop to control pests and diseases.

It can also be applied to the soil, around the crop such that microorganisms can increase and break down soil organic matter.

COMPOST MANURE

Compost is made by adding layers of different organic materials in a heap. As it rots, the heap becomes compost. Composting is an acceleration of the natural decomposition process for organic waste. Intense bacterial activity is primarily responsible for decomposition; it requires oxygen and releases heat. The resulting compost acts as a supplement and fertilizer.

Materials

- A Long Stick
- Water
- Topsoil
- Dry Grass
- Green Manure

Goat Droppings

Charcoal Wastes

Wood Ash

Green Grass

Cow Dung

Green Plants

Dry Plant Materials

Building the Compost

- Dig a pit of 45cm deep and place the soil on the side
- Put dry sticks at the bottom
- Make a first layer of browns. Pile up to 45cm and sprinkle it with 10 liters of water
- Add a second layer of greens of some 20cm and sprinkle water
- Place a third layer of animal droppings or slurry to provide Microorganisms for decomposition
- Sprinkle ash to add essential minerals and regulate acidity
- Add a fourth layer of leguminous greens i.e., Calliandra, Leucaena or Tithonia
- Sprinkle some 5cm of top soil on this fourth layer
- Keep layering this way until the pile is 1.5 to 2m high. Cover the pile with a thick layer of top soil (about 10 cm)
- Cover the compost pile with dry vegetation such as banana leaves to reduce moisture loss






Storage

- Store compost covering it with polythene or banana leaves
- Compost can be stored for three up to six months

Managing Decomposition

1. Decomposition starts three days after piling
2. Drive a long-pointed stick at an angle to check the decomposition, The stick should be left in the pile and only removed once a week
3. When you pull out the stick from the pile, it should be warm and moist, but not whitish
4. Sprinkle 20 liters of water on the pile every three days during the dry spell
5. After two to three weeks, turn the pile. Compost is ready after six to nine weeks, depending on the type of the materials used

Compost Use

Compost use depending on development stage, compost may be used:

- It can be mixed in with the top soil during digging
- It can be put in a ditch around the crops and covered with soil
- It can be used in a double dug bed, or added to the soil of a kitchen garden, sack mound, permanent planting basin.

Depending on its intended purpose, compost is used and dosed as follows:

- For rice farming.
- Basal manuring: spread (at least 10 t / ha) for the 1st ploughing.
- Maintenance manuring: spread in the rows before weeding (about 5 t / ha)
- For vegetables: 25 to 30 kg per 10 m² bed or rack, spread on the soil before ploughing. If quantities are low, reduce the doses and pinpoint around recesses (a double handful).
- For rain fed crops: 10 to 20 t / ha spread on the soil before ploughing or added locally.

ORGANIC PESTICIDES

BIO - REPELLANT OR BIO - INSECTICIDE

It is an organic product used to control crop pests and insects such as caterpillars, piercing and plant sucking insects, coffee berry borer, scale insects and a number of other pests that attack crops. It also prevents plants from being attacked by fungal diseases.

Preparation Inputs

1). Mix the ingredients well after chopping

- 1 kg of garlic
- 1 kg of hot pepper or red eye bird chilli
- 1 kg of onion
- 2 kg of Ginger
- 40 litres of clean water
- 3 litres of local alcohol or waragi
- Aromatic plant leaves such as marigold, lemon grass, citrus leaves, etc
- 3 litres of molasses
- 3 litres of activated Mountain Microorganisms

2). After mixing all the inputs in a container, cover the container tightly.
3). No air should enter into the mixture.
4). Store the container in a cool and dry place fora period of 15 days. Can last for 1 year when kept and stored well.

Garlic Leaves

Onions

Lemon Grass / Chisubi

Garlic Tuber

Ginger

Citrus Leaves

Hot Pepper

Marigold

Molasses

Spraying bio-insecticide on vegetables

Application

- Use 250cc of bio-repellant in 20 L spray pump and spray on the crops attacked.
- Apply after seed germination
- Can also apply the insecticide each time you see pests attacking your crops

Uses

1) Increases plant resistance to pests and diseases
2) Prevents pests' problems in field crops and Ecto-parasites in animals
   Repel insects

BIO - INSECTICIDE

Inputs

- Ocimum basilicum - Basil (Kakubansili)
- Garlic Leaves (Vegetative type)
- Onion leaves
- Spring onions
- Mentha sp (Nabugila)
- Tobacco
- Lemon grass
- Plectranthus caninus - Scaredy Cat Plant (Kimankulata)
- Phtytolacca dodecandra - African soap berry (Luwoko)
- Red paper (bird's eyes)
- Ash
- Urine
- Tephrosia
- Kitchen soot

Luwoko

Nabugila

Garlic Leaves

Munyare

Tobacco Leaves

Hot Pepper

Kakuba Nsuri

Onions

Tephrosia /Muluku

Kimankulata

Preparation

1) Cut and pound the ingredients
2) Put the pounded ingredients and wood ash into a container
3) Mix 2 liters of water with all the above ingredients
4) Add urine (2cups), kitchen soot (2 cups), 1 cup of chilli, 6 cups of neem leaves, 7 onion bulbs, 2 garlic bulbs and 1 cup of ash
5) Leave it to ferment for 1 week
6) Stir twice a day, once every morning and once every evening
7) Alternatively boil them in water for 20 minutes
8) If the urine is fresh then keep for 21 days




Application

1) Before applying, filter with a strainer or cloth
2) Dilute each liter of the pesticide with one liter of soapy water
3) Apply where there are pests, on the leaves, stalks and around the base of crops. First prune the banana plant till the base
4) Mix and apply to the pruned plant up to 2 feet
5) To strengthen mix ash and charcoal dust and apply at a distance of 2 feet
6) Cover with soil with dry mulch
7) For preventive spraying, you can further dilute the pesticide with 3 liters of water for every one liter of pesticide

BIO - STIMULANT

It is a product that is used to stimulate the growth and development of the plant. It is applied to weak plants and retarded plants - those that take time or delay in their growth.

Inputs

- 3 kg of stinging nettle (Kamyu or Omwenyango)
- 7 Litres of activated effective Mountain Microorganisms
- 7 Litres of molasses
- 50 Litres of clean water

Stinking Nettle

Molasses

Preparation

- Chop 3kg of stinging nettle plant
- Dissolve 7 L of molasses in 15 L of clean water
- Add the solution of molasses to a container or plastic drum
- Then add 7 L of activated Mountain
- Microorganisms to the drum followed by 3kg of chopped and crushed stinging nettle.
- Add the remaining balance of water (35 L) to the plastic drum. The drum should not be filled to the top, leave a space between water and the top cover for accumulated gases produced inside the drum during fermentation process.
- Cover the container and insert the hose pipe in a plastic bottle to allow escape of gases and leave store in cool dry place for 15 days.

Application:

- Use 250cc of bio-stimulant product in 20 litre spray pump and spray on the crops that show signs of retardation or slow growth.
- For nurseries: plough in 5 to 8 kg /m2 of bed, then after sowing, uniformly spread a fine layer 0.5 kg / m2.

PUSH - PULL TECHNOLOGY

Push–pull technology is an intercropping strategy for controlling pests by using repellent ***"push"*** plants and trap ***"pull"*** plants. For example; cereals like maize are often infested by stem borers. This technology preserves the environment as it limits the use of artificial inputs and chemicals.

Requirements

- Cereals
- Napier grass
- Desmodium

Napier Grass

Desmodium

Preparation Procedure

Land Preparation

- Clear the land during the dry season.
- Plough and harrow land until the soil has no large lumps) before the onset of the rains.
- Desmodium/Brachiaria seeds are small; therefore, the soil should be carefully prepared so that it is as fine and clean as possible, to maximize germination.
- Measure out the push-pull plot to a maximum size of 50 x 50 m.
- If you wish to layout a push-pull plot on land that is larger than 50 by 50 m, then measure out those pieces of land into plots of maximum 50 × 50m size.
- If the land is less than 50 by 50 m, the Push–pull technology will still work; however, do not plant push pull in plots less than 15m, as Napier grass will have a shading effect on the maize crop.

Planting the push-pull crops

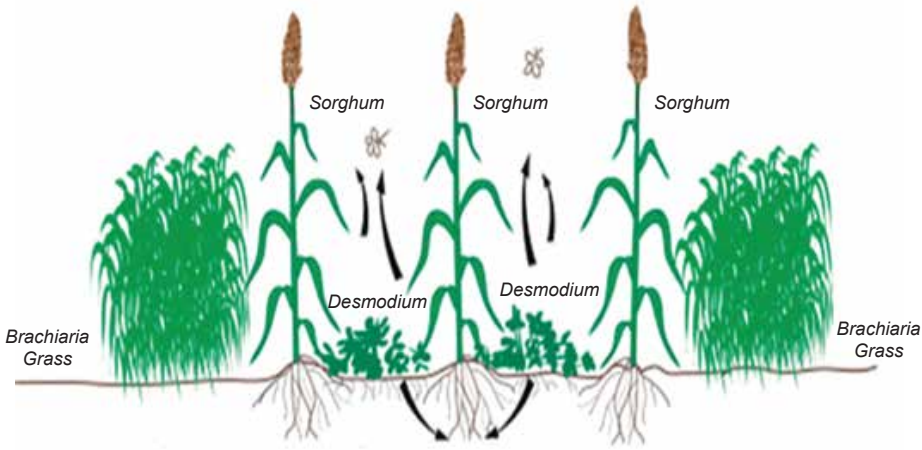
- Plant Napier grass (use clean and healthy planting material, preferably Napier stunt disease resistant cultivars in a border around the maize plot.
- Plant at least three rows of Napier all round the maize field. The spacing should be 75 cm between rows and 50 cm between Napier grass plants within a row.
- In the first year, plant Napier grass before the rains so that it has a start on the maize. The stem borer moths will like the larger Napier grass for laying their eggs even more than the maize.
- Plant your maize in the field already surrounded by Napier grass.
- Ensure that the 1st row of maize is 1m away from the inner row of Napier grass.
- The recommended spacing for maize is 75 cm between rows and 30 cm between hills in a row.
- Plant two maize seeds per hole and then thin to one plant per hill after the first weeding.

"Pull"

Volatile chemicals produced by border plants attract stemborer natural enemies

"Push"

Volatile chemicals produced by intercropped plants repel stemborers and attarct their natural enemies



Chemicals secreted by Desmodium roots control Striga and deplete. Striga seed bank in the soil

Desmodium roots fix atmospheric nitrogen in the soil; shoot and roots biomass increase soil organic matter

How the Push - Pull Practice Operates

Source:
Push- Pull a novel farming system for ending hunger and poverty in Sub - Saharan Africa

Benefits of Adopting a Push-Pull Strategy

When you adopt the push-pull strategy you will;

- Increase maize and sorghum yield by 25-30% in the areas where stem borers are the only problem. Where both stem borers and striga are problems, you can double your maize yields.
- Protect your crop from army fall worm invasion and damage.
- Increase the supply of cattle feed from harvesting Napier grass and desmodium.
- Increase the quality of animal feed by increasing protein from desmodium.
- Fix nitrogen into the farm soil by desmodium legume, so you save on fertilizer costs.
- Protect soil from erosion, as desmodium acts as a cover crop.
- Retain soil moisture, as desmodium acts as mulch.
- Earn money from the sale of desmodium seed at an attractive price of US$ 30 to US$ 40 per kg.
- Make more money from increased milk production and sales due to the quality feeds of brachiaria/Napier and desmodium.
- Protect maize from strong winds, by surrounding it with the Napier grass.

CONCLUSION

ESAFF Uganda recognizes that Ecological Organic Agriculture has potential to sustainably feed the population while restoring the degraded agricultural ecosystems including loss of biodiversity. This is mostly because organic agriculture enhances small-scale farmers' ability to live in harmony with nature and to derive economic benefit from their land and increase total land productivity, enhance ecosystem health and services, more resilient to the changing climatic conditions, significantly contributes to climate change mitigation as well as contributes to attainment of multiple SDG goals and Uganda's vision 2040.

We believe that this training guide will motivate and increase the uptake of Ecological Organic Agriculture among small scale farmers as it highlights mainly the entire process of producing organic fertilizers and pesticides using inputs or ingredients that are around their homes and at a very low cost.

Acknowledgement

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Read our publications on **www.organicuganda.org**

About ESAFF Uganda

Eastern and Southern Africa Small-scale Farmers' Forum (ESAFF) Uganda exists to create a platform to bring together small-scale farmers into a farmer-led advocacy movement to influence policies and practices at the local and national level and contribute through ESAFF to policies and practices at regional, continental and global levels. ESAFF Uganda is a small-scale farmer-led advocacy movement formed to facilitate processes through which small scale farmers' development concerns can be solicited, articulated and ultimately addressed through policies and programs. ESAFF Uganda focuses on advancing economic empowerment, agroecology and food sovereignty.

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ECOLOGICAL ORGANIC AGRICULTURE

Eastern and Southern Africa Small Scale Farmers' Forum

ESAFF - UGANDA

"Small Scale Farmers Speaking For Themselves"

Plot 266, Muvule Avenue, Buye - Ntinda, Kampala | +256 414 699 623

P.O Box 34420 Kampala | coordinator@esaffuganda.org

www.esaffuganda.org

ESAFF Uganda | @ESAFFUG | ESAFF Uganda TV