



# TRAINING MANUAL

## AGROECOLOGICAL ORGANIC AGRICULTURE AND TREE PLANTING IN KENYA





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# 1. ORGANIC FARMING

## ORGANIC FARMING

Organic farming involves the use of naturally available materials in order to keep crops, soil, humans and livestock healthy without using synthetic pesticides or fertilisers.

## ORGANIC FARMING HAS A POSITIVE IMPACT ON:

1. HUMAN HEALTH
2. SOCIO-ECONOMIC ACTIVITIES
3. THE ENVIRONMENT



**Figure 1** - Students harvesting produce from their kitchen garden.



## ADVANTAGES OF ORGANIC FARMING:

- Farmers reduce the cost of purchasing pesticides and fertilisers
- Healthier farm workers
- Improvement to plant growth and physiological activities of plants
- Environmentally friendly
- Does not pollute groundwater
- Food tastes better
- Food lasts longer

## PRINCIPLES OF ORGANIC FARMING

These principles guide the basic way in which organic farming is practiced:

- Soil is a living medium and must be kept healthy
- Diversity must be considered and promoted in and around the farm
- Reduction of environmental pollution, damage and depletive activities on natural resources
- Animals must be reared with due regard to their natural requirements
- A healthy society must be encouraged
- Recycling products and materials is fundamental

*NB: Organic farming is sustainable since it allows long-term production of food.*

# 2. NURSERY ESTABLISHMENT

## NURSERY

A nursery is a protected environment / seedbed for the production of plants before establishing them in the main field.

### NURSERIES ARE ESTABLISHED WHERE:

- Seeds are too small to be sown directly in the main field
- Seedlings are delicate when young hence require extra care
- Management is eased by watering, weeding etc.

### SITE SELECTION

- Near water source
- Close to planting area
- In a secured area
- Lightly shaded and sheltered area

### TYPES OF NURSERY BEDS:

- Raised beds – Suitable in rainy areas
- Sunken beds – Suitable in dry areas
- Movable beds (flats)

## RAISED BEDS

These are seedbeds which are raised about 15cm from the ground level and measure 1.5m by 6m for the standard raised bed.

Using raised beds is one of the most common ways to start a nursery.

Step-by step instructions can be found on the next page.



## PREPARING THE NURSERY

1. Select site and clear grasses and weeds.
2. Measure 1 metre wide and any length – it should be east to west oriented to facilitate light penetration, minimise effects of heat and to welcome light rays.
3. Loosen the soil, add one wheelbarrow of manure and mix thoroughly.
4. Add 4 spades of sand for every 3 metres and mix well.
5. Rake the bed into a uniform size.
6. Make drills or furrows across the bed at 10–15cm apart.
7. Spread seeds thinly and cover with a thin layer of soil.
8. Firm beds by palm after sowing to ensure close contact between soil and seeds.
9. Water after firming the beds.
10. Mulch after the first watering.



**Figure 2 - Measuring**



**Figure 3 - Raking**



**Figure 4 - Ready for planting**



**Figure 5 - Harvest**

# 3. COMPOSTING

## COMPOSTING

Composting is the natural way of turning organic material into valuable plant food. There are multiple advantages of composting. This chapter covers three popular ways to make compost from scratch.

## COMPOST...

- promotes the growth of plants
- improves the rate of nutrient diffusion
- improves soil porosity
- improves the water retention capacity
- attracts and feeds earthworms
- improves the pH (acidity / alkalinity) of the soil
- helps control erosion



**Figure 6** - Compost heap. 'How to' instructions are on the next page.

# 1. THE HEAP METHOD

## HOW TO MAKE A COMPOST HEAP

Add all the materials from bottom to top on the ground in the following order. For example, start by piling the rough materials, then the dry materials and so on. A thermo stick can be used to check the temperature of the compost (see Fig. 7).

1. ROUGH MATERIALS E.G. TWIGS	
2. DRY MATERIALS	DOCTOR
3. MANURE	MAINA
4. TOP SOIL	TOLD
4. GREEN PLANTS/MATERIALS	GRACE
5. ASH OR EGGSHELLS	ALL
6. TOP SOIL	THE
7. WATER	WORDS

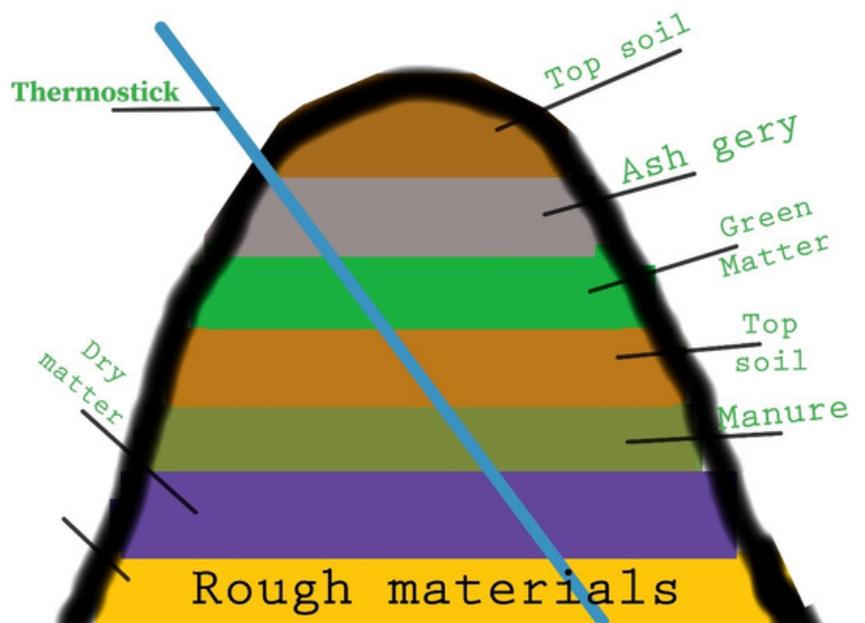


Figure 7 - Compost heap illustration

Learn the saying 'Doctor Maina told grace all the words' for an easy way to remember the order of the materials in the pile.

## 2. VERMICOMPOSTING

### VERMICOMPOSTING

Vermicomposting is the use of earthworms to convert organic waste into nutrient rich fertiliser. Vermicompost is the product of the decomposition of organic waste by earthworms like red wigglers and white worms.

### VERMICOMPOSTING...

- Provides major and micronutrients to plants
- Provides good aeration to the soil
- Improves soil texture and water holding capacity
- Restores microbial population like nitrogen fixers or phosphate solubilizer



Figures 8 & 9 - Vermicomposting

### MATERIAL USED IN MAKING VERMICOMPOST

- Fruits & vegetables
- Coffee grounds
- Grains like bread & cereals
- Eggshells
- Leaves & grass cuttings

### FACTORS THAT SHOWS THE READINESS OF VERMICOMPOSTING

- Should have ambient temperature (25 degrees celsius)
- Should be dark in colour
- Should have odourless smell

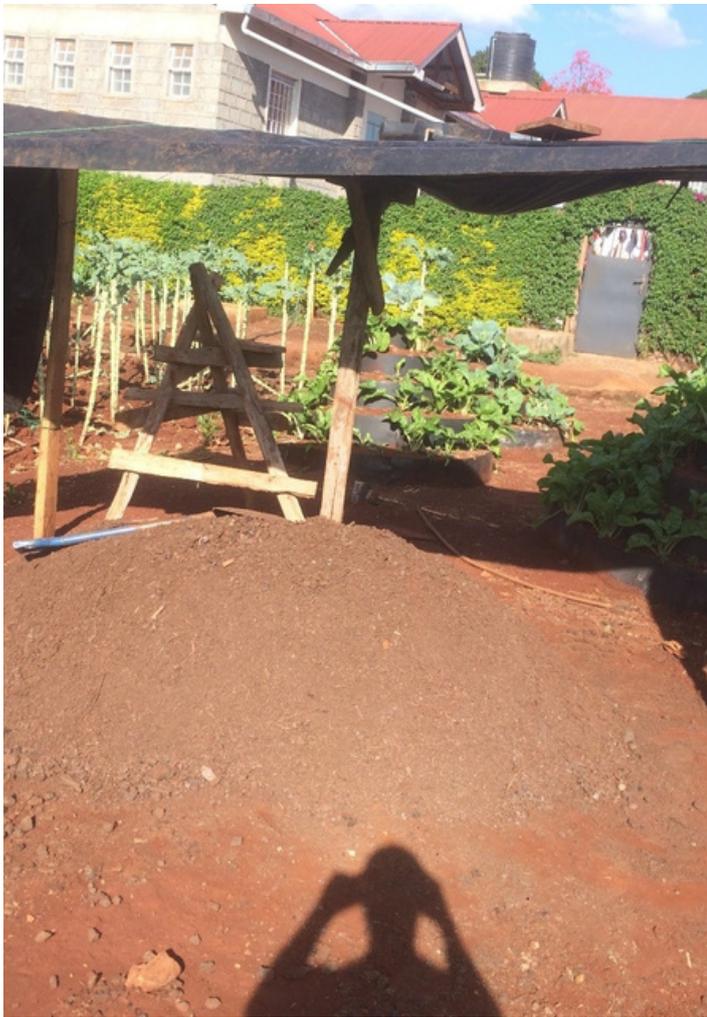
### 3. BOKASHI MAKING

## BOKASHI

Bokashi is a fermented manure used for soil amendment.

## INGREDIENTS FOR MAKING BOKASHI AND THEIR FUNCTIONS

<b>MANURE</b>	<ul style="list-style-type: none"><li>-Acts as inoculant for microbes</li><li>-Adds minerals</li></ul>
<b>SOIL</b>	<ul style="list-style-type: none"><li>-Holds minerals</li><li>-Brings local microbes</li></ul>
<b>RICE HUSKS/COFFEE HUSKS</b>	<ul style="list-style-type: none"><li>-Helps in soil texture/structure</li><li>-Holds moisture and improves aeration</li><li>-Husks is a source of silicon that aids in building soil structure, hence it reduces soil erosion</li></ul>
<b>WHEAT/RICE BAN</b>	<ul style="list-style-type: none"><li>-Food for microbes</li><li>-Source of vitamin B</li><li>-Good for fermentation</li></ul>
<b>CHARCOAL DUST</b>	<ul style="list-style-type: none"><li>-Home for microbes</li><li>-Retains humidity and nutrients</li><li>-Holds minerals</li><li>-Good for root development</li><li>-Aids oxygen availability</li></ul>
<b>ASH/ROCK DUST</b>	<ul style="list-style-type: none"><li>-Good source of minerals</li><li>-Regulates PH</li><li>-Helps to hold moisture</li></ul>
<b>MOLASSES</b>	<ul style="list-style-type: none"><li>-Source of energy</li><li>-Food for microbes (yeast)</li><li>-Adds minerals</li></ul>
<b>YEAST</b>	<ul style="list-style-type: none"><li>-Sets the right temperature for the microbes</li><li>-Aids in fermentation</li></ul>
<b>WATER</b>	<ul style="list-style-type: none"><li>-Medium for microbes to live in</li></ul>



**Figures 10 & 11** - Examples of bokashi manure prepared by school children

## **PROCEDURE FOR MAKING BOKASHI**

1. Pour the sawdust, soil, manure, wheat bran, charcoal dust and ash into a container or a shaded area on the ground.
2. Water the layers with a solution of water, molasses and yeast.
3. Repeat this process until all materials are used.
4. Thoroughly mix the materials and continue to water.
5. Turn the mixture twice a day for three days, after which turn it once a day for ten days.
6. The bokashi manure will be ready for use after 15 days and should not be kept for more than 30 days.

## 4. LIQUID MANURE

### LIQUID MANURE

Liquid manure is a mixture of animal waste and organic matter used as an agricultural fertiliser, sometimes diluted with water.

### MATERIALS FOR MAKING LIQUID MANURE:

- Drum / bucket
- Cow dung or goat / poultry / sheep / pig manure
- Ash
- Sack
- Water
- Wooden rod



Figure 12 - Liquid manure demonstration

### PROCEDURE FOR MAKING LIQUID MANURE

1. Pour water into a bucket.
2. Add cow dung manure and ash to the sack and tie the sack top tightly.
3. Tie it onto the wooden rod and submerge it in the drum.
4. Leave it for 14 days before it's ready for use.

### APPLICATION OF LIQUID MANURE

Apply half or one litre of liquid manure around the stem of the crop of every vegetable.

# 4. AGROFORESTRY

## AGROFORESTRY

Agroforestry is a land use management system in which trees or shrubs are grown around or among crops or pastureland.

## TREES GROWN IN AN AGROFORESTRY APPROACH CAN...

- Fix nitrogen
- Provide humus from root and litter decomposition
- Conserve water
- Act as wind breakers
- Provide shade
- Conserve soil

## TYPES OF AGROFORESTRY

1. **Agrisilvicultural systems** involve a combination of crops and trees, such as home gardens.
2. **Silvopastoral systems** involve a combination of forestry and grazing of domesticated animals on pastures, rangelands or farms.
3. **Agrosilvopastoral systems** involve a combination of trees, crops and domesticated animals.

## CHARACTERISTICS OF TREES FOR AGROFORESTRY

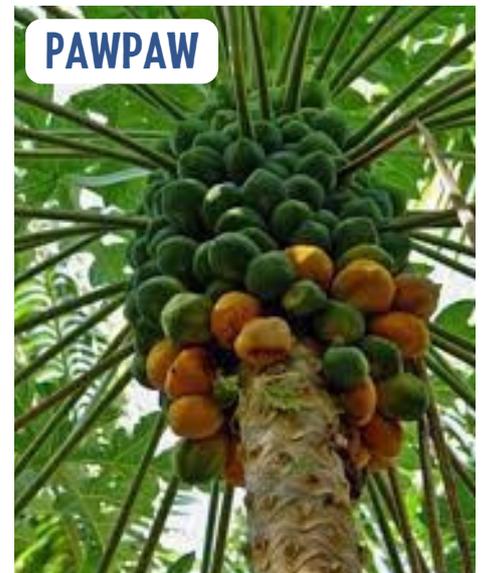
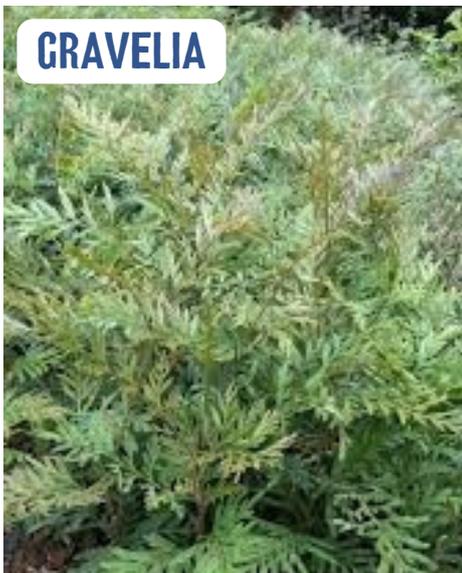
- Marketable; includes both the wood, nuts and fruits which would provide another source of income.
- Compatible with companion crops or forage; avoid trees that produce allelochemicals that inhibit growth of crops.
- High quality; should be nitrogenous trees that can be able to fix nitrogen in the soil.
- Deep rooted; to avoid competition for moisture and nutrients.
- Have rapidly decomposing foliage.



## ADVANTAGES OF AGROFORESTRY

- Improvement of soil fertility; leaves, fruits and branches of trees fall down and decompose, thereby increasing organic matter and recycling of nutrients.
- Effects on soil moisture and microclimate; shading and windbreak effects of trees influence microclimate and help to conserve soil moisture by reducing water that evaporates into the air.
- Soil conservation; trees cushion the impact of raindrops on the soil and reduce amount of rain-splash. Their roots bind / stabilise the soil.
- Improvement of biodiversity; agroforestry systems improve diversity and quantity of wildlife / animals by offering a greater variety of habitat.

Examples of common agroforestry trees are below.



# 5. KITCHEN GARDENING

## KITCHEN GARDEN

A kitchen garden is where herbs and vegetables are grown around the house for household use.

## BENEFITS OF KITCHEN GARDENING:

- To grow healthy, fresh vegetables yourself
- To save the cost of buying vegetables and herbs
- To make wasteland around the house more productive
- To recycle waste resources such as sweepings, kitchen scraps and dirt water into the garden

## EXAMPLES OF KITCHEN GARDENS

1. Multistorey garden (see instructions on next page)
2. Sack garden
3. Tyre garden



Figures 13 & 14 - Multistorey gardens prepared by pupils

## MATERIALS NEEDED FOR MULTISTOREY GARDEN

- Dam liners in multiple sizes
- Mixture of soil and manure
- Gravel/stone
- Water
- Perforated tins

## HOW TO MAKE A MULTISTOREY GARDEN:

1. Dig the soil using a jembe and use a fork jembe to dig the hard ground components.
2. Place the largest dam liner in the place you want the garden to be and use pegs to reinstate the circular shape.
3. Place the perforated tin at the center of the dam line and fill it with small to medium gravels.
4. Fill the dam liner with the mixture of clay soil and manure using a spade.
5. Place the second dam liner layer, place a perforated tin at the center and fill with gravel.
6. Fill the second layer with the mixture of clay soil and manure using a spade.
7. Repeat the procedure until the sixth layer or last layer.
8. Water the multistorey garden thoroughly.
9. Plant your seedlings in the different layers.

# 6. HOMEMADE PRODUCTS

## 1. LIQUID SOAP MAKING

**Ingredients:** Unga roll (Soap Jelly), sulphonic acid, industrial salt, caustic soda, simet, colour, foam booster, perfume and water

### PROCEDURE FOR MAKING LIQUID SOAP

1. Mix the sulphonic acid with industrial salt and stir until they mix well.
2. Place the soap jelly in the container and stir until it turns crystal white.
3. Mix the two mixtures (no 1 and 2) and stir as you add water little by little.
4. Add the caustic soda and simet to the mixture and continue to stir.
5. Continue adding water as you stir.
6. Add foam booster and colour and continue stirring until they dissolve.
7. Add perfume and allow the whole mixture to settle for 12 hours.

## 2. JIK MAKING

**Ingredients:** Instant jik and water

### PROCEDURE FOR MAKING JIK

1. Dilute an instant jik with water depending on the concentration needed.
2. Allow to settle for a few hours before using.

## 3. DETOL MAKING

**Ingredients:** Detol jelly, colour, perfume and water

### PROCEDURE FOR MAKING DETOL

1. Put the detol jelly in a container and stir thoroughly.
2. Add water and stir.
3. Add colour and perfume to the mixture and stir until they all dissolve.
4. Leave for few hours before using.

## 4. BIOPESTICIDES

**Materials needed:** Tithonia leaves, small drum, water. Use ratio of 1:2 (Tithonia to water)

### PROCEDURE FOR MAKING BIOPESTICIDES

1. Place tithonia leaves in the small drum
2. Add water to the small drum
3. Store it in the shade for 14-21 days to ferment
4. Sieve the fermented liquid and store in a jerry can
5. The biopesticide is now ready to use

### USAGE

Spray on the leaves of vegetables to prevent suspected aphids.



**Figures 15 & 16** - Making biopesticide and then applying it to plants

