

Composting for the Small Farmer - How to Make Fertilizer from Organic Waste (FSDA - UNEP, 1993)

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This booklet is the first in a series of practical, easy to use manuals on sustainable agriculture to be produced by FSDA.

About the Foundation for Sustainable Development in Africa (FSDA)

FSDA is a new development organization based in Nairobi. We operate on the philosophy that for development to be truly sustainable, it must be conducted as a profit/loss business. Therefore, FSDA receives no funding from donor agencies or countries. All of our projects and activities are funded with our own resources. It works; this booklet is just one small example.

Based on small, simple ideas, the Foundation offers communities a complete development package. Along with this booklet, we have produced a full colour, A2 size poster on recycling awareness and a number of high quality hand tools designed specifically for composting and urban waste management. Like all of our products, these tools are made with pride right here in Kenya.

We also offer comprehensive training courses in biointensive/sustainable agriculture, including trainings for composting on any scale in any part of the country.

FSDA welcomes collaboration. If you are interested in working with us or would like more information about our products, services and activities, please contact us at:

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Figure

What is Composting?

In a forest, where there are no man-made chemicals, the death of plants and animals helps to keep other living things healthy. Dead leaves and branches and the bones of animals are left on the forest floor. As they rot and break down, they slowly release nutrients into the soil. These nutrients, the nitrogen, phosphorus and potassium that are found in chemical fertilizers and even trace elements that are not, are used by the roots of growing plants. A forest is constantly recycling itself naturally. It does not need purchased fertilizers to survive.

Although we have come to believe differently, farmers do not necessarily need chemical fertilizers either. A farmer can use the natural process to make his or her own fertilizer by composting.

With the correct tools, a ready supply of organic waste and some basic knowledge, composting is very easy. Within three weeks to three months, a pile of kitchen scraps, weeds, crop residue and manure will become a rich, clean smelling fertilizer that will help grow crops as well and even better than chemicals, but with very little cost.



Figure

Why is Composting Important?

Composting will save you money, both in the short term and over a period of many years.

Fertilizer from the store is extremely expensive. Many farmers cannot afford to buy it. As a result, they plant without anything at all and their crops fail. Compost, however, is virtually free. With a little labour, any farmer can produce high quality fertilizer using garbage and waste from the farm.

When chemical fertilizers are used on a new plot of land, the first harvest usually does very well. As the years pass, however, the soil becomes less and less productive, even if a farmer uses more and more chemicals on the same area. The farmer is always spending more money, but the crops do worse every year. This happens because the chemicals leach quickly out of the soil when it rains, taking their nutrients with them. Purchased chemicals can also kill worms and microorganisms that improve soil quality and help crops grow. Long term fertilizer use 'burns' the soil, leaving it thin and susceptible to erosion.



Figure

Compost solves this problem by building healthy soil over a long period rather than from season to season. A farmer that plants with compost will find that yields increase overtime and that costs decrease. This happens in several ways.

Good compost holds up to 6 times its own weight in water. The water is held in reserve so that plant roots can use it during the dry season. This is especially important in arid areas.

Compost also has trace elements like iron, zinc and magnesium that are not found in ordinary chemical fertilizers. Although they occur in very small quantities, these trace elements are as important to plants as nitrogen, phosphorus and potassium.

The rich, light texture of compost loosens clay soils and makes sandy soils less porous. This allows air and microorganisms to pass more freely and lets roots grow easily into the soil.

Crops that are grown organically are much healthier than those grown with synthetic chemicals. In the long run, a family that eats organic foods will feel better and stronger and have lower health care costs. Organic produce can also be marketed at a higher price. Organic farmers in Europe and the U.S. sell their crops for more money than other farmers because consumers are willing to pay more for healthy food. Tourist hotels in Kenya could provide a good, stable market for organically grown food.

In cities, garbage poses a huge problem. Piles of waste in estates and markets smell bad and create dangerous health hazards. Anyone who reads this booklet-can take advantage of this situation by collecting clean organic waste and processing it into compost. The result helps everyone The garbage problem becomes less severe and farmers and gardeners are supplied with healthy, high quality fertilizer for almost no cost.

The Composting Process



Figure

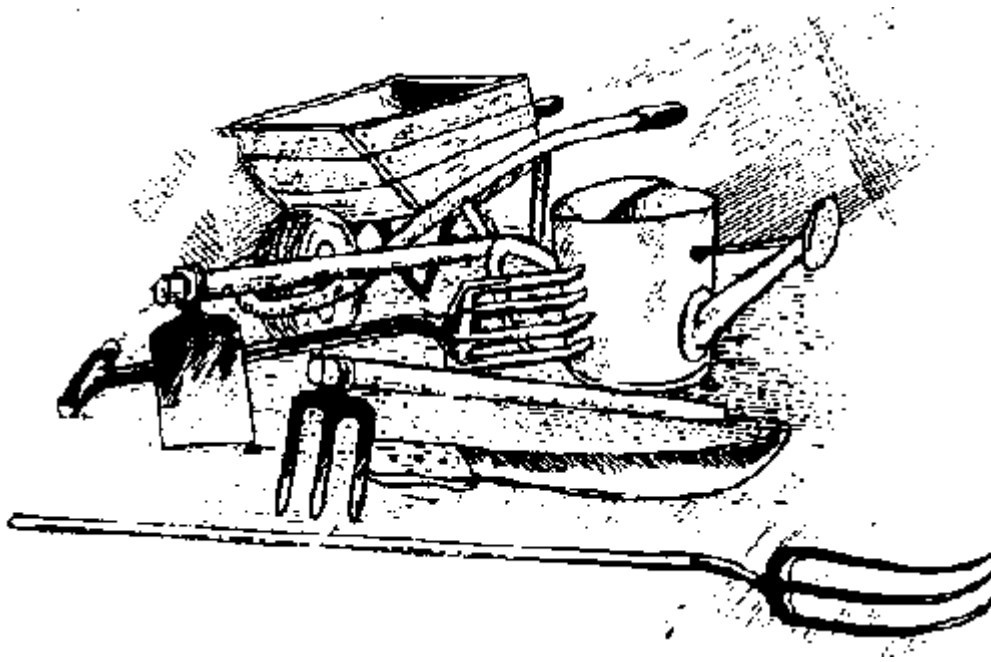
When organic matter is placed in a pile and watered, it attracts microorganisms like bacteria, fungi and algae that eat the material in the pile and each other. As these organisms increase in number and activity, the pile begins to heat up and break down. Different types of materials are placed in layers in the pile to help speed up the natural process of decomposition. With good air circulation and the right amount of water, the microorganisms will thrive and the pile will break down quickly. When the process is complete, within three weeks to three months depending on conditions, the pile of rough organic material has become a soil-like substance that is extremely rich in nutrients.

As we have said, composting is very easy, but it requires three basic things: the correct tools, a good supply of organic waste and enough water to keep the pile-moist. We will discuss four basic types of composting in this booklet: open pile composting, box composting, pit composting and trench composting.

The recommended tools

The correct tools will make your work much easier. These tools are an investment, but in the long run, they will save you time and money. We recommend the following list of tools, each one for a specific task in the composting process:

- Jembe (hoe)
- Fork spade (or regular spade)
- Panga (machete)
- Watering can or hose pipe
- Wheelbarrow
- Pitchfork



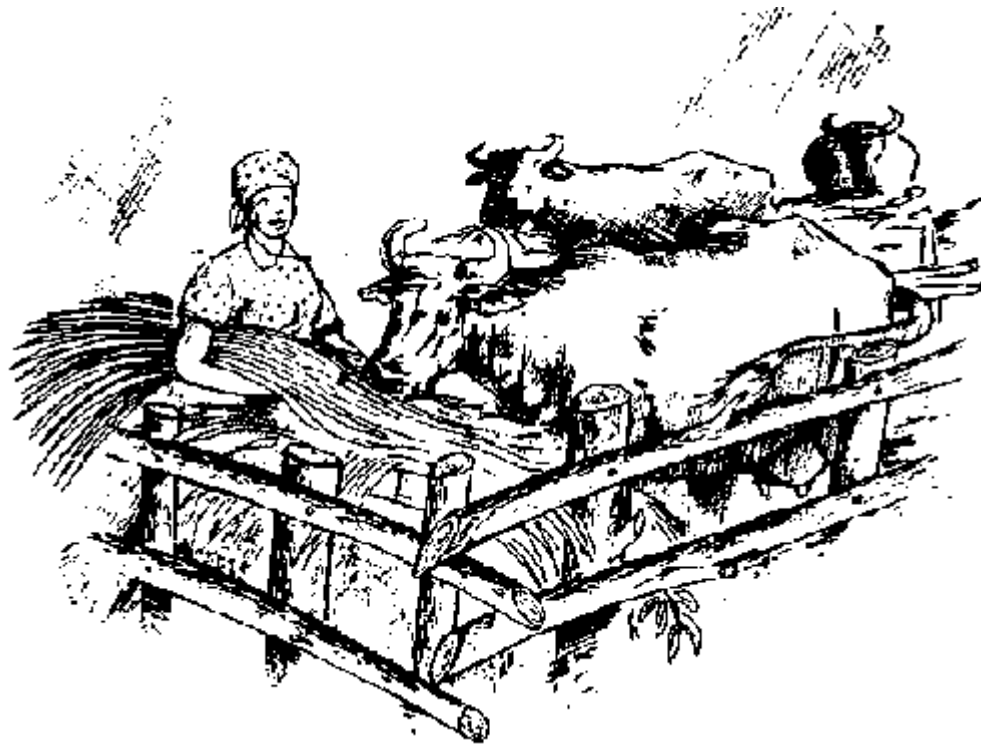
Figure

If any of these tools are not available, composting is still possible, but your work may be a little more difficult. There are many ways to compost - the result is the important thing. Once you have learned the basic steps, experiment with different methods to make your work easier and produce better quality fertilizer.

When to start

Composting can be done at any time of the year, but you should plan to begin at least three months before the rains so that the finished product will be ready for planting season. Collection of organic materials is the most important step. It is best to build the pile all at once, but if there are not enough materials available, the pile can be made gradually until it is the correct size. If materials are scarce, you can collect leafy waste from markets and blood, bone and manure from slaughterhouses. First, however, you must be sure that there are no plastics, metal or hazardous substances in the waste.

Manure can be more easily collected from a zero grazing unit. If there is space on the shamba for a plot of napier grass, you can keep your cow or cows in a small shelter and bring water and fodder to them where they are. This way the cows spend less energy in foraging. They will give you more milk, and manure can be collected every day without a lot of work.



Figure

The Ingredients

There are three major categories of organic material that must be collected for the composting process: dry vegetation, green material and soil.

Dry vegetation includes dried weeds, old crop residues, napier waste and maize and sunflower stalks. Dry vegetation will add carbon and improve the texture of the compost.

Green waste is a group that includes many type's of materials. Fresh weeds and leaves, bones (with no fat or meat), egg-shells, vegetable peelings, manure, coffee residues, tea leaves, banana peels and even ugali leftovers are all grouped in this category, and will be part of the same layer. Green materials contain water and nitrogen, which help to begin the composting process. Stinging nettle and comfrey are very rich in nitrogen and make excellent 'activators'. Wood ash, in small quantities, will add potassium and phosphorus to the compost. Other excellent materials are chicken manure, seaweed meal, dried blood, bone and fish meal. These ingredients will add nitrogen and trace elements, but they must always be balanced with dry, carbonous vegetation.

Soil makes up the last layer. The soil that you use should be of fairly good quality, not a clay or sandy soil, and if possible it should come from an area that has been under cultivation in recent years so you will know that it is fertile. Soil also helps to give the compost good texture. It will keep moisture and nitrogen from escaping, reduce the odour from the green materials and help to keep away flies.

Begin collecting all of these materials as early as possible and keep them separate from each other. The main problem in composting for gardeners and farmers with small plots is that they lack a sufficient amount of these materials. The earlier you begin to collect, the easier it will be to compost. Remember that almost anything that was once alive can be composted.

What cannot be composted

Charcoal ashes - Ash from a charcoal jiko is high in carbon dioxide, which will rob the pile of oxygen and slow down the composting process.

Dog and cat manure - Manure from these animals may contain pathogens which are harmful to infants and children.

Residue from crops that have been infested by pests or disease - Larvae from pests and bacterial diseases may not be killed by the heat of the composting process and can be transferred to new crops when you plant.

Eucalyptus, acacia leaves - Leaves from these trees are poisonous to some beneficial microbes that are important in composting. Do not build your pile under these trees.

Meat or animal fat - Meat and fat take a long time to break down and can attract flies and rodents.

Open pile composting

This is the easiest and cheapest method of composting. It requires only water, organic waste and a little labour. The steps for building the pile are as follows:

- Choose a 5 ft. (1.5 m) x 5 ft. space near the shamba so that transport of the compost will not be difficult. If possible, build your pile under a shade tree. The tree will shelter the pile from too much sun, wind and rain and dead leaves will add nutrients to the pile.
- Clear this space of all weeds and grass and cultivate it to a depth of 6 inches (15 cm) to 1 foot (30 cm). Cultivating will allow water and heavy rains to drain. Water the cleared space lightly.
- On this clear space, put down a 3 inch (7.5 cm) layer of larger dry vegetation like maize stovers, banana stems and leaves, napier waste and small tree branches. This layer will allow air to pass more freely through the pile.
- Add a 4 inch (10 cm) layer of smaller dry vegetation. The smaller the individual pieces of material, the faster they will decompose. You can chop the dry material into finer pieces with a panga.
- Put down a 2 inch (5 cm) layer of green waste on top of the dry vegetation.
- Cover the green waste with 1 inch (2.5 cm) of soil.

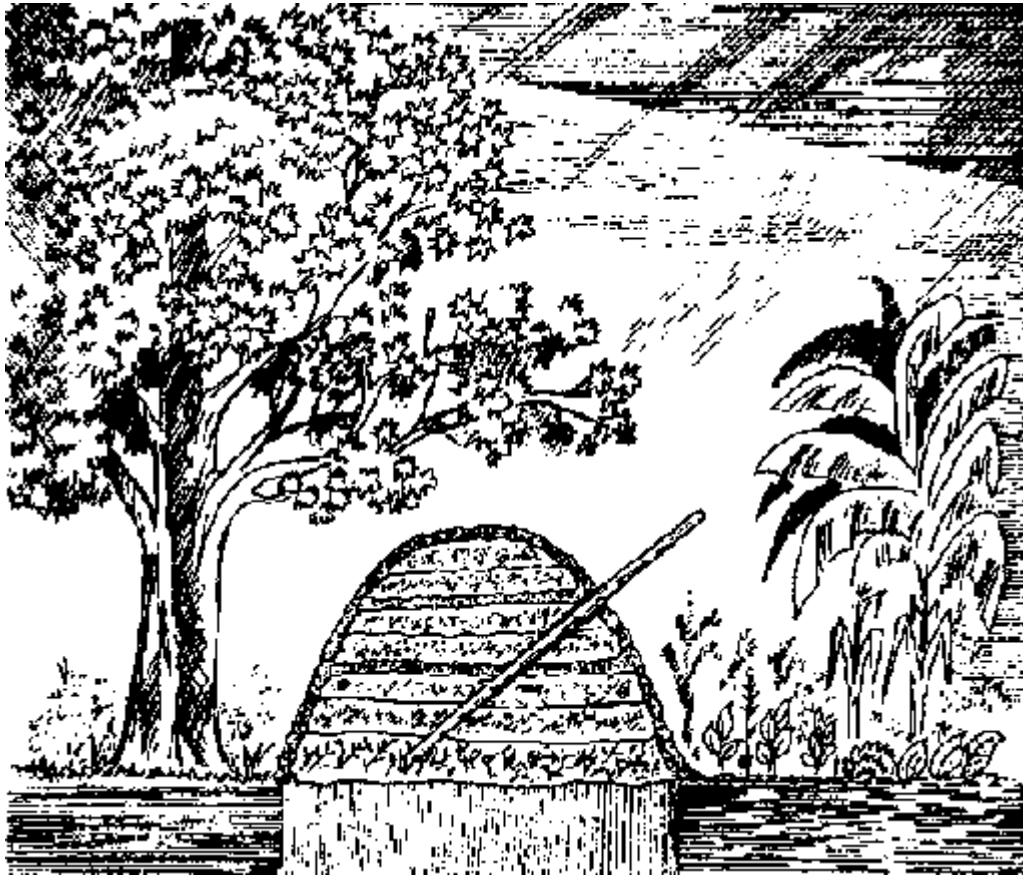
Keep adding layers of small dry vegetation, green waste and soil until the pile is 4 to 5 feet (1.2-1.5 m) high. Water each layer. In dry seasons, the top of the pile can be made flat, but during the rains, make the top rounded. This will allow excess water to drain off easily. If available, cover the top of the pile with a sheet of polythene paper. This will help protect the pile from wind and keep moisture levels even.



Figure

During the dry season, the pile should be watered every morning and evening. This will encourage the microorganisms to begin their activity, but be careful - too much water will drown them and too little water will discourage them from feeding. The pile should be moist, like a cloth that has been soaked and then squeezed of excess water.

When you have finished building the pile, drive a long sharpened stick diagonally into the middle of the pile. The stick acts like a thermometer. Every week, take the stick out of the pile and feel of it. If it is hot, the process is going well. If it is not hot, the pile may need more or less water, or application of an 'activator' like a tea made from comfrey leaves.



Figure

Another reason the pile may not be hot is a lack of air. To increase the amount of air, you can turn the pile as often as once every 1 to 3 weeks. The pile should be turned from the inside out so that the outer layer of the old pile becomes the middle of the new pile. Depending on the weather and how often the pile is turned, the compost will be ready for application in three weeks to three months.



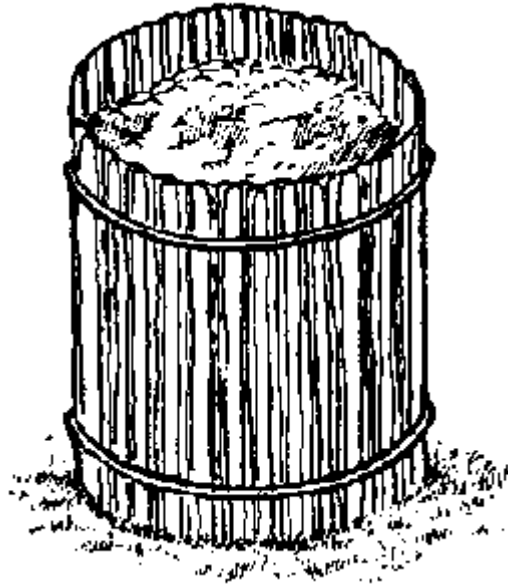
Figure

Some organic farmers recommend that if you have enough time, it is best to leave the pile to decompose as naturally as possible. The less the pile is disturbed, the better the quality of the compost will be.

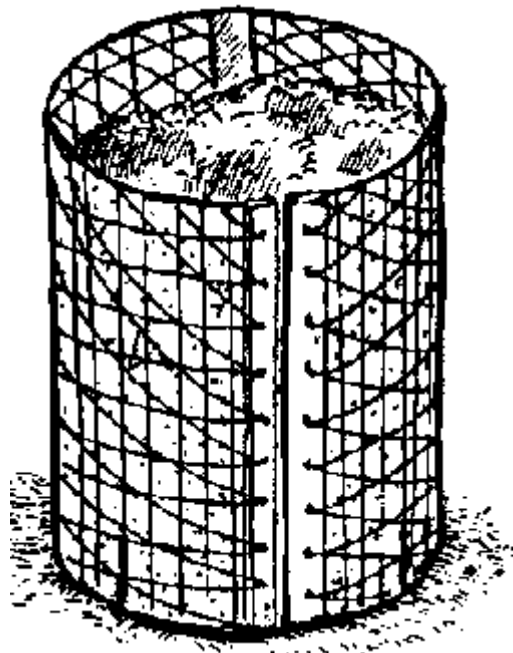
Box Composting

Box composting is basically the same as open pile composting, only it is done within a container. The ingredients, site, pile size, turning and layers will all be the same. The container is used for several reasons:

- The box keeps excess water out of the compost during the rains.
- It prevents the material from drying out, especially at the edges.
- It insulates the pile, keeping even the edges hot so that the compost will decompose more evenly and quickly.
- It makes the heap look tidy. This is better for urban gardeners living in more crowded neighborhood estates.



Wooden cylinder container



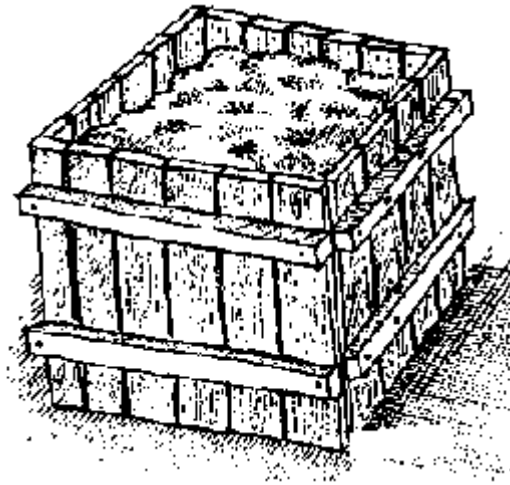
Wire cylinder container

The disadvantage of box composting is that it requires extra; money and materials. If this is not a problem, there are several ways to build the container.

Three possible designs are shown on these two pages. The main considerations for these designs is the cost of the materials. The wooden cylinder container is the least expensive of the three designs. You can use thin, straight tree branches bound into a cylinder by wire or sisal rope. The wire cylinder type and the wooden box will require some investment, but these containers will last longer.

You can build your container without a bottom, so that you can lift it clear of the pile. This will make turning the pile easier. When the container is lifted, the pile should retain its shape.

Remember that any box design should include openings to allow air to pass in and out of the container. If air cannot reach the compost, the pile will begin to smell.



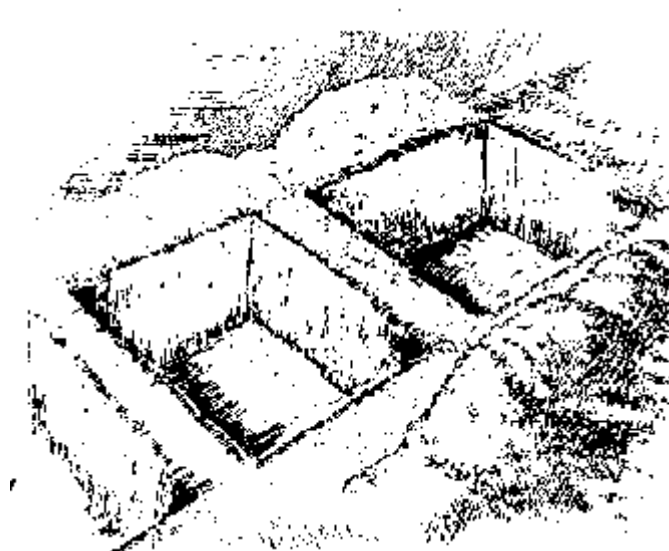
Wooden box container

Pit composting

Pit composting is similar to box composting but requires no extra materials. The sides of the pit act in the same way as the sides of the box. To begin, collect your materials and chop them into small pieces. The lack of air in the pit will slow down the decomposition of the materials. The smaller they are to begin with, the faster they will decompose.

While you are collecting the materials, dig three pits close to or inside the shamba. The pits should be next to each other in a line. Dig each pit 3 cubic feet (1 cubic metre), 3 ft. (1 m) deep, 3 ft. wide and 3 ft long.

When you have dug the pits, make layers of organic material in the first pit until it is filled to ground level or slightly higher. Water each layer. In the meantime, continue to collect waste. After one month, turn the compost from the first pit into the second pit and refill the first pit with new layers. After another month, turn the compost from the second pit into the third. Turn the material in the first pit into the second and fill the first pit with more layers. Now all three pits will be filled. After the third month, the third pit will be full of finished compost, ready for the shamba. Keep rotating the compost from pit to pit. Every month you will have a fresh supply of fertilizer.



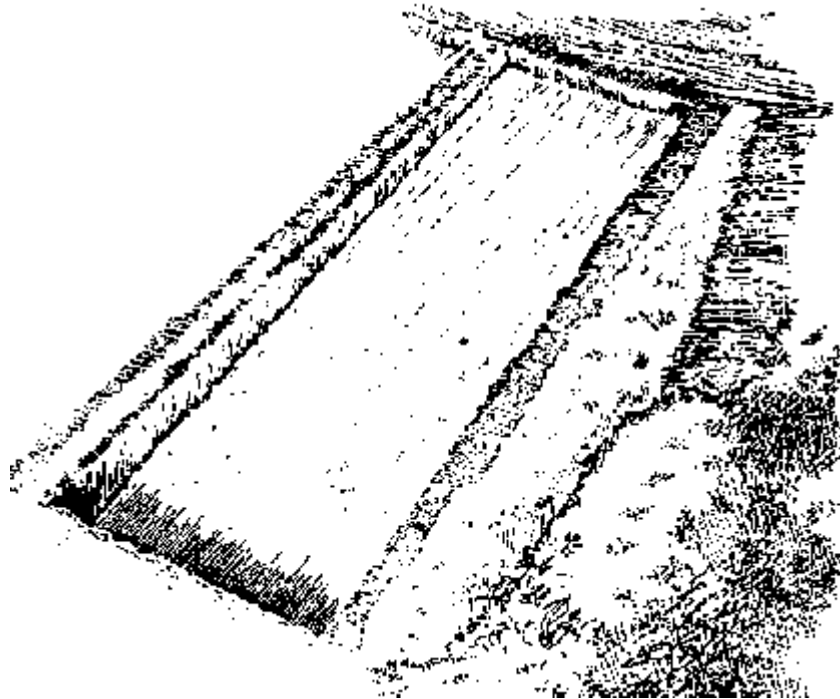
Figure

Trench composting

Trench composting is slightly different from the first three methods. It is the best method for areas where there is a lack of water and organic materials. Trench composting should be started at least two or three months before the rains to allow time for the materials to decompose.

To begin, dig a trench 3 feet (1 m) wide and 1 foot (30 cm) deep. The length will vary depending on the availability of material. Take out the soil and leave it to the side of the trench.

As you collect materials, mix them with soil and put them in the trench. If you have enough material at one time, arrange it in layers. Water the materials as they go in the trench. When the trench is full and the soil has been replaced, you will have a 'raised bed'. Do not step on the bed so the soil will stay loose. Seeds or seedlings can be planted right on the bed, but wait for the materials to decompose or they will compete with growing plants for nitrogen and other nutrients.



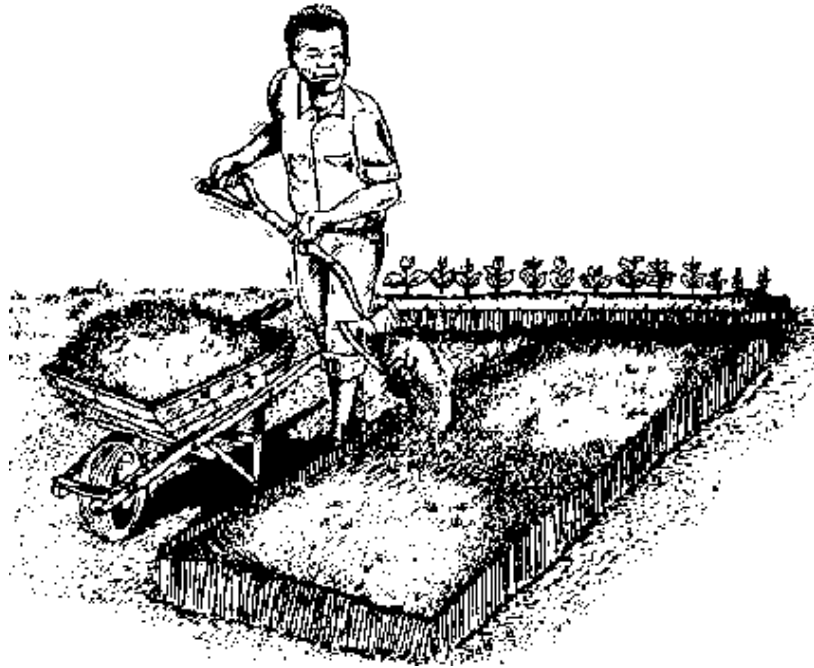
Figure

Application

There should be no large, recognizable materials in your finished compost. Maize cobs and other large materials may take longer than three months to compost. When most of the compost is ready, take the larger objects out of the pile and put them into a new pile that is in earlier stages. You will be left with a light textured, soil-like material.

Rates of application will vary depending on the quality of your soil, the size of your shamba and the amount of compost you have made. Farmers with large plots of land may want to set aside a smaller area for organic production, such as a kitchen garden for family use. Compost is excellent for growing quickly maturing crops like vegetables and flowers, and when combined with double digging (cultivating to a depth of 2 feet (.7 m) and making raised beds) can increase production by as much as 3 to 5 times.

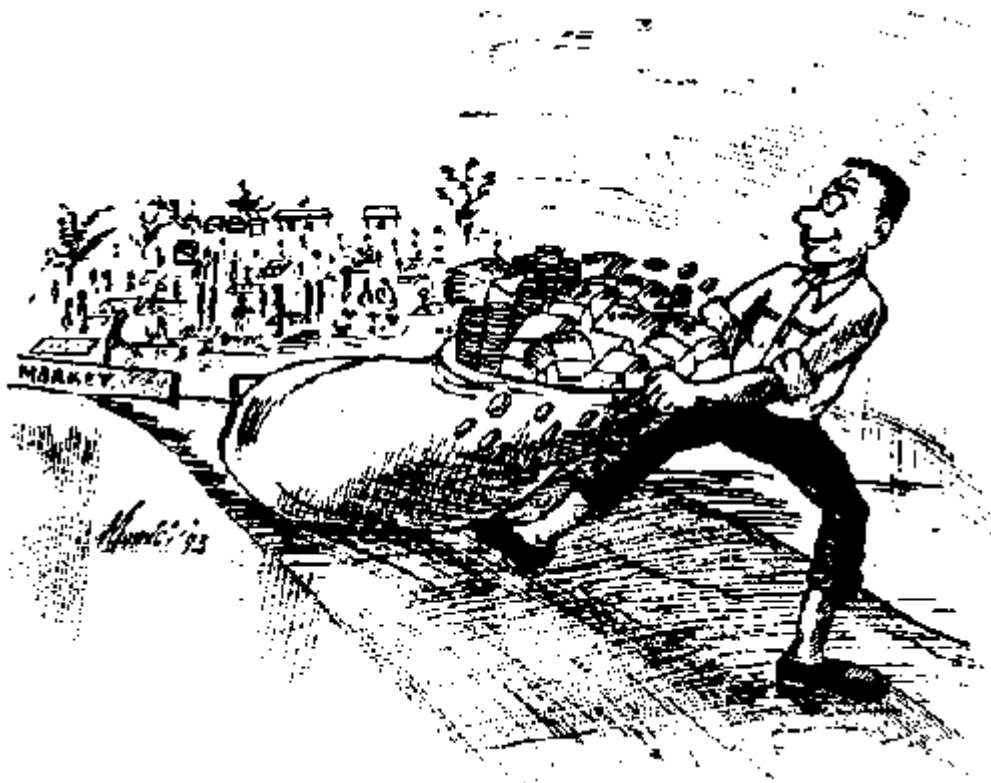
It is best to start small and intensively. This way you will see the direct benefits of your labour. Use the compost you have made on a seed bed or a small area that you plan to farm intensively. Top dress the area with an inch or two of compost and cultivate it into the upper layers of the soil. Do this every time you plant. The results will be evident within a few seasons.



Figure

Compost is also excellent for planting trees, and should be mixed generously in and around the seedling hole. The trees will need much less water and will be more resistant to attack from pests and disease.

For planting crops like maize on larger areas, a mixture of compost and soil can be placed in drills or holes directly with the seeds. Experiment with different amounts and notice the results.

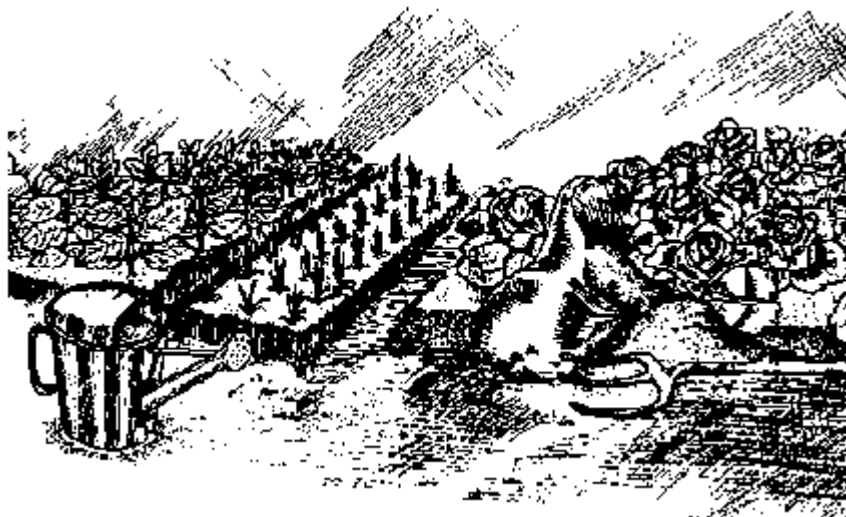


Figure

The information in this booklet serves only as a basic guide to composting. Every farmer is also a scientist. We should all be constantly experimenting with new ideas to grow more and different varieties of food for less money to build a stronger and better Kenya.

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Figure

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