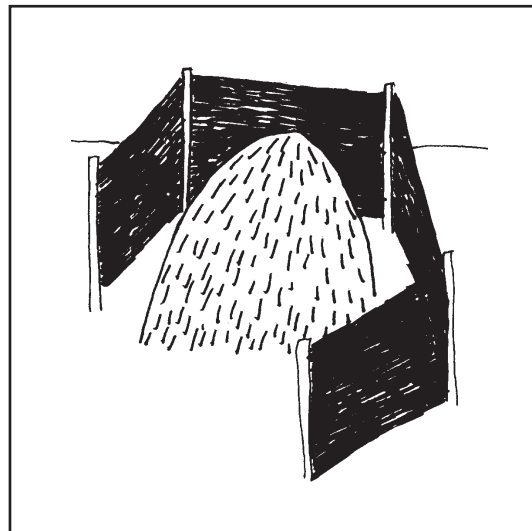
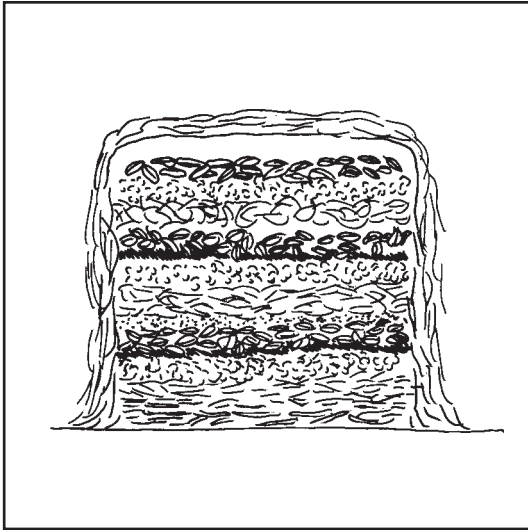


Composting in the Tropics



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What is compost and how is it useful?

Compost is organic matter (plant and animal residues) which has been rotted down by the action of bacteria and other organisms, over a period of time. Many types of organic matter, such as leaves, fruit and vegetable peelings and manures can be used to make compost. The end product is very different from the original materials. It is dark brown, crumbly and has a pleasant smell.

Compost is cheap, easy to make and is a very effective material that can be added to the soil, to improve soil and crop quality.

- Compost improves the structure of the soil. It allows more air into the soil, improves drainage and reduces erosion.
- Compost helps to stop the soil from drying out in times of drought by holding more water.
- By improving soil structure, compost makes it easier for plants to take up the nutrients already in the soil. Compost may also improve soil quality by adding nutrients. This can help to produce better yields.
- Compost can reduce pest and disease problems in the soil and on the crop. The crop will be stronger and healthier and therefore resist pest and disease attack.

Compost is a better way of feeding plants than using chemical fertilisers. These fertilisers provide nutrients for plants but do not improve soil structure or quality. They usually only improve yields in the season in which they are applied. Compost is not washed away through the soil like chemical fertilisers, so the beneficial effects are longer lasting.

Plants that are grown with chemical fertilisers are more attractive to pests because they have more green, sappy growth.

Making compost

Households and farms produce many materials which can be used to make compost. Making compost makes use of materials that may otherwise be wasted. Some of these wastes could also be used for other purposes. For example millet stalks may be needed for construction or kitchen wastes may be needed to feed livestock. A choice will need to be made as to whether to use such materials for the compost heap or not.

You may already be making compost. This booklet could help you to improve your methods. Organic matter is often piled up in the compound but left unmanaged. This will produce compost but the materials will take a long time to decompose and nutrients will be lost. If it is possible to invest some time and effort to manage the heap, the results will be very rewarding.

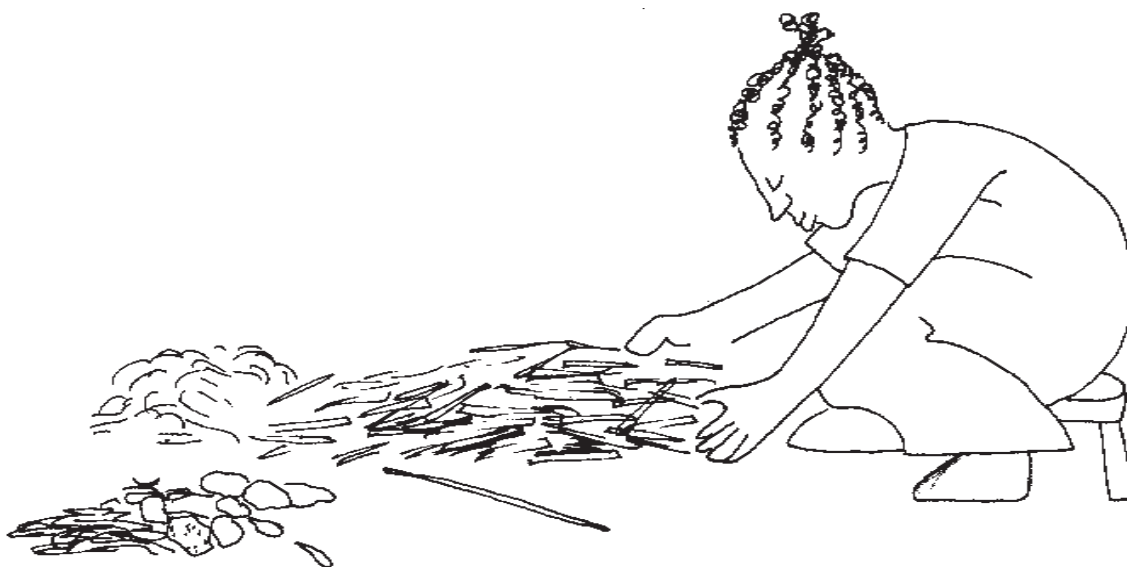
In a managed heap nutrient loss will be reduced, so more of the nutrients will be available to feed plants when the compost is used. This type of compost heap will often heat up enough to kill weed seeds and plant diseases.

What to put in a compost heap

Nearly all organic matter can be used to make compost but different items will take varying amounts of time to decompose and form different end products. For example, fruit on its own will go slimy and maize stalks will go dry and dusty.

It is essential to include a mixture of old and tough with young and sappy materials for a good result. This is because different types of organic matter contain different proportions of carbon and nitrogen. In general, young, living material that decomposes fast contains low levels of carbon but high levels of nitrogen. Tough, dead material, for example straw, decomposes slowly and contains large amounts of carbon but low amounts of nitrogen. Too little nitrogen-rich material and the decomposition will be slow; too much and the heap will become acid and smelly.

If different compost ingredients are not available, a local processing plant might have useful by-products such as coconut husks, groundnut shells or coffee berry residues. It may also be possible to obtain suitable material from the roadside. The table on the opposite page gives an indication of the type of items which can be put on a compost heap.



High nitrogen (fruit and vegetable wastes) and high carbon ingredients (straw and seed husks)

Examples of material that can be used to make compost:

Material	Preparation	Notes	Precautions
HOME			
Fruit and vegetable peelings		Decomposes quickly	
Wood fire ash		High in potassium and lime	Use in very small quantities
Paper and cardboard	Tear up or shred	Decomposes slowly. Mix with wet/moist ingredients.	
House and compound sweepings		Variable quantity and quality	

GARDEN			
Crop residues (the remainder of a crop after it has been harvested)	Chop up tough material. If dry moisten well before use.	If the material is tough, it will decompose slowly	Do not use if recently sprayed with herbicide
Dead leaves	If dry, use as above.		
Crops grown specifically for the compost heap	Chop up if large	Legumes commonly recommended	
Weeds	Chop up if large		Avoid roots of perennial weeds and mature seeds of annuals.

OTHER SOURCES			
Manure		Not essential but an excellent source of nutrients.	
Urine (animal and human)	Difficult to collect. May be collected in the bedding of animals.	Sprinkle on heap. Will greatly accelerate decomposition.	Use in small quantities
Soil	Use soil from the top 10cm of cropped land	Not essential but a sprinkling may reduce nitrogen loss from hot heaps. May be used to cover a heap.	
Seaweed	If used in large quantities should be wilted first. Always apply with dry material.	Has an abundance of trace elements.	

Availability of materials

Some of the materials mentioned in the table, such as soil or crop residues, may be collected on the day of building the heap. Some ingredients, such as kitchen wastes, are collected on a regular basis. If the heap is to be built in one single process these materials should be gathered and stored. They should be kept dry and cool and covered so that too much air does not reach it. Banana leaves or grass thatch provide a good cover. This treatment should prevent water loss before the heap is constructed.

It is also possible to build the heap in stages and add the material as it becomes available. However, the process of decomposition will be slower and it will therefore take longer to make compost.

Materials that should not be put in the compost heap

- Material such as plants which have been recently sprayed with pesticides or herbicides
- Meat scraps, as these may attract rats and other pests
- Large amounts of material that is diseased
- Material with hard prickles or thorns
- Persistent perennial weeds. These should be killed by laying out in the sun to dry, or even burning, to avoid them spreading. The dried material or ashed could then be added to the heap.
- Non-organic materials such as metal or plastic

Where should a heap be placed?

There are three factors to consider when deciding where to put a compost heap:

Transport

A compost heap should be placed in an area to where it is easy to carry the materials collected. Distance and access to the fields or garden where the compost will be applied are also important considerations.

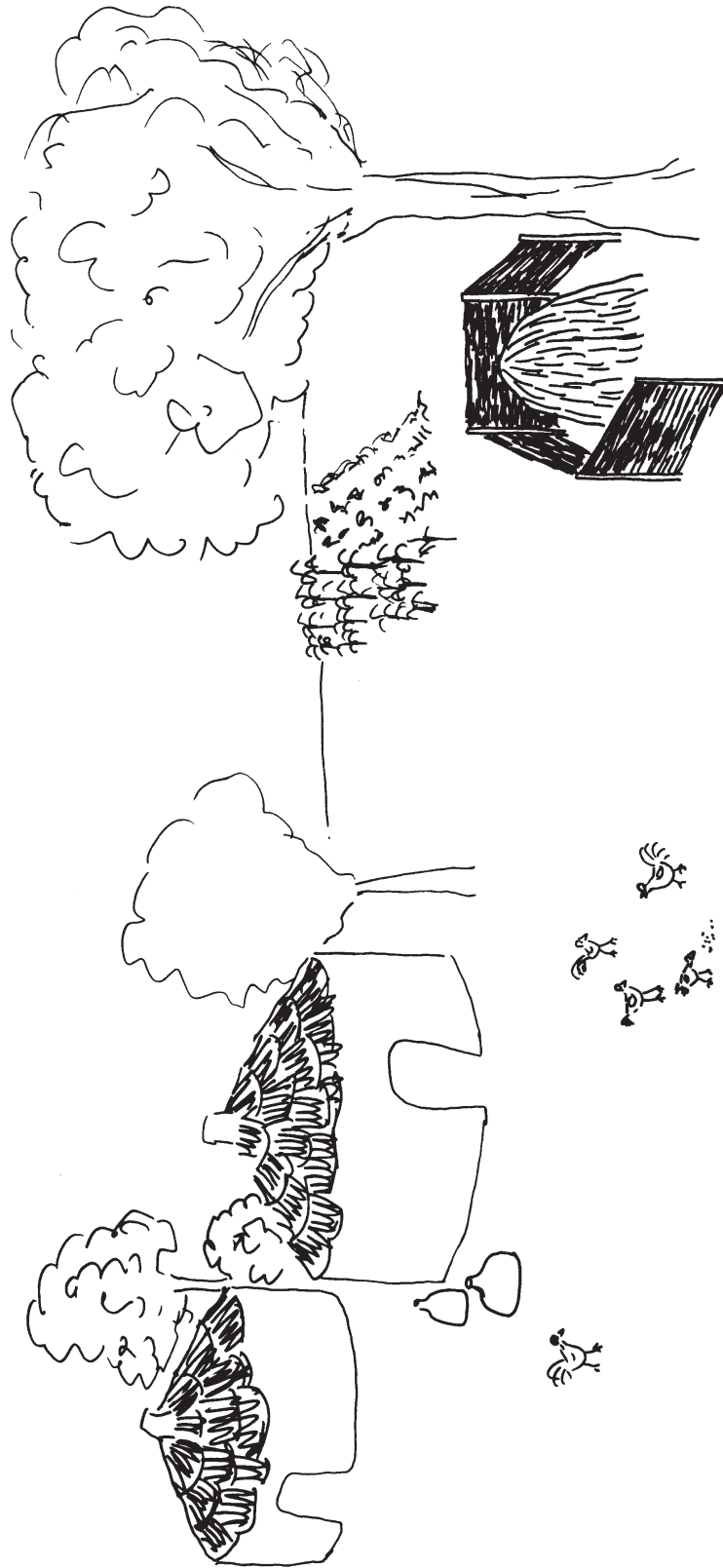
Water

A compost heap should be placed in a shady, sheltered area to avoid too much evaporation, for example under a tree. If you want to provide more shelter you could construct a fence around the heap, although this is not essential if labour is limited.

Water usually needs to be added to the heap so ideally, a source of water should be nearby. If you do not have a borehole close by you should keep a container, such as a jerrycan filled with water, near to the heap.

Vermin

It is important to consider pests and vermin such as rats, snakes, termites, flies and mosquitoes. It is possible that they may be attracted to the compost heap so it should not be placed too close to the home.



A compost heap should be placed away from the home, in a shaded position, with water available nearby

Other considerations before building a compost heap

Size

A good size for a heap is about 2 metres wide by 1.5 metres high. If it is much larger air circulation will be poor. The heap should not be smaller than 1 metre by 1 metre. The length can vary, as required. If there is not enough material available to make a compost heap of this size, a number of people could collect ingredients together to make a common one.

Water

If water is scarce, it may seem preferable to use available water directly for irrigation rather than for producing compost. However compost added to the soil can improve its water holding capacity and, in the long term, will reduce the amount of the water required to irrigate the crops.

If water is scarce, you may want to consider building the heap in a pit. This method is preferred in dry areas because the heap needs less water. Trenches are dug and are filled in the same way as a compost heap. However, heavy rainfall or a high water table could make the pit too wet.

Labour

Building a heap should be timed to fit in with the slack periods of labour. Some composting procedures, such as regular turning, are more labour intensive than others.

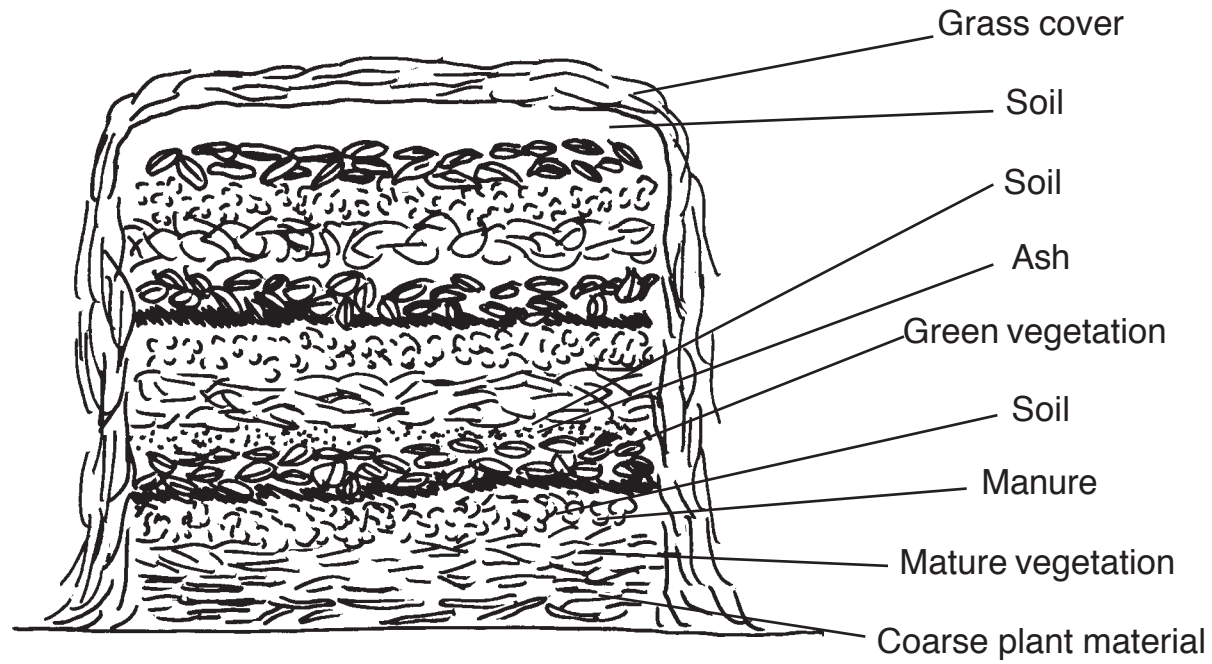
How to build the compost heap

A compost heap should be built on bare soil and not on a hard surface such as concrete. This is the recommended way to build a compost heap:

1. Firstly make a base 30 centimetres (cm) high and 2 metres (m) wide with coarse plant material such as twigs. This will ensure good air circulation and drainage.
2. Add a 10cm layer of material that is difficult to decompose such as maize stalks.
3. Add a 10cm layer of material that is easily decomposed such as fruit and vegetable scraps.
4. Add 2cm of animal manure, old compost or slurry, if available.
5. Add a sprinkling of earth from the top 10cm of cropped land.
6. Ash and urine can then be lightly sprinkled onto these layers, to accelerate the process of decomposition.
7. Then water the whole pile well.
8. Repeat all these layers except the first layer of coarse material, until the heap reaches 1 to 1.5m high.

The heap should be covered to protect it against evaporation and heavy rain as this will wash away all the nutrients. Sacking, grass thatch or banana leaves are suitable for this.

Each layer should be laid down by starting at the edge of the pile so that the heap does not collapse. Another way to ensure this is to use a wire mesh (not useful in dry areas because it will allow drying out) or wooden planks around the heap. Air vents, made out of bamboo canes with holes cut in them and placed both vertically and horizontally throughout the heap, will improve the air circulation.



The layers of a compost heap

Organisms involved in the composting process

Most of the organisms involved in the composting process are so small that you cannot see them. In order to survive they need water, air and organic material which is their food. The organisms feed on the organic matter and produce carbon dioxide, water and heat.

There are three important phases during the decomposition of a compost heap; the hot phase, the cooling down phase and the maturation phase.

During the 'hot phase' the highest temperatures are reached at the centre of the heap. This has a hygienic effect, killing diseases, if present, in the organic materials and sometimes weed seeds also.

Next, the heap goes through a 'cooling down phase' and the fungi become important. They break down the tough fibrous material such as crop stems.

During the final, 'maturation phase' larger organisms such as termites and worms also have an important role in breaking down and mixing material.

In a hot climate the organisms are more active and the organic materials are broken down more quickly than in a cold climate. The types of organic matter used and the acidity of the soil will also affect the rate of decomposition.

Conditions required in the heap

The compost heap requires three conditions: air, water and heat.

Air

The micro-organisms in the heap require oxygen to survive. The carbon dioxide produced by the activity of the organisms also needs to be blown out by a flow of air. If there is not enough air, other unwanted organisms will thrive which produce a bad smell and slow the decomposition of the heap.

Water

The activity of the organisms in the compost heap will slow down if the heap is too dry. But if the heap becomes too wet then there will not be enough air and the composting organisms will die. This will cause the heap to ferment rather than compost. Judging the right amount of water requires a little experience.

Heat

The heap will create its own heat as the decomposition process occurs. If the heap becomes too hot the micro-organisms may leave the heap, causing decomposition to slow down. When the heap cools down the organisms will return.

Managing a compost heap

To ensure successful compost production it is important that the heap is well managed after it is built. It requires water, turning, heat and a maturation phase.

Water

In dry conditions the heap will need to be watered twice a week. A way of testing the moisture is by placing a small bundle of hay in the middle of the compost heap. When removed, after five minutes, it should feel damp. If it does not, water needs to be added to the heap.

There are a number of ways to reduce evaporation from the heap and therefore the amount of water that needs to be added to it:

- Cover the heap with banana leaves or grass cuttings
- Cover the heap with a layer of mud
- Do not turn the heap (see page 14 for 'turning')

If the heap becomes too wet it should be opened up and mixed with dry organic matter or allowed to dry in the sun before rebuilding.



Water should be sprinkled onto the heap if it is too dry

Turning

Within three weeks of building the heap, its size will have decreased considerably. Turning the heap will replace the oxygen supply and will ensure that the material on the outside decomposes as well. To turn a heap take it apart, mix the ingredients and rebuild it. The material on the outside of the heap is put in the middle of the heap. If the heap is dry, add water, and if it is wet, add dry matter. The first turning should be done after 2 or 3 weeks and the next after another 3 weeks.

The temperature and moisture of the heap should be tested a few days after each turning. A third turning may be necessary before all the material, other than twigs and thick stems, has decomposed.

Compost can be made without turning, but material left at the edge of the heap may not compost properly. Weed seeds and any diseased plant material present in this may not be killed. These materials should be separated from the finished compost and used in the next compost heap. Although turning is not essential it is recommended to produce better compost.



Taking the thatch off the outside of the heap before turning the heap

Heat

To test the heat of the heap put a large pointed stick into the heap, as shown, about 10 days after it has been built. The stick should feel slightly too hot to touch when removed after a few days. If it does not this may be because decomposition has not started. In this case, more air or water may be needed, or the heap may just need to be left for a while longer. If the heap is very hot, decomposition is happening but the excessive heat may kill the micro-organisms. In this case, the supply of air will need to be reduced and more water added to cool it down. You should test the temperature of the heap from time to time using the stick method.



Placing a stick in the heap to test the temperature

Maturation

Once the compost heap has cooled down it should be left to mature. The compost can be used as soon as most of the original material is no longer recognisable and has turned into a blackish brown colour, with a pleasant smell.

Even at this stage the heap should be kept covered to protect it from the rain and sun. The compost needs to remain moist, but not wet, while it is waiting to be used. If the compost is stored for too long before use it will lose some nutrients and may also become a breeding place for unwanted insects.

Using compost

The main use of compost is to increase and maintain crop yields by improving the ability of the soil to hold water and nutrients and keeping the soil healthy. It can also be used to prevent soil erosion by incorporating it into the soil.

Compost is commonly used close to home in the kitchen garden. When preparing a soil bed for sowing seed, compost can be mixed with the top 10cm of soil. It should not be dug in any deeper as crop roots will not be able to take up the nutrients released by the compost. An effective way of using limited supplies of compost is to place small amounts of compost directly into the planting holes. In dry areas these holes can be extended into pits or furrows which can be used for trapping water.

Compost can be used for mulching between crops or around trees. Compost that has not fully decomposed can be used for this; it will continue to mature on the ground and animals in the soil will draw it into the soil where it will decompose further.

When using compost as a mulch it should be covered with a thin layer of straw. This will avoid loss of nutrients due to direct exposure to sunlight and heat.

Compost can also be mixed with soil and used for raising tree seedlings and can be used as fish feed.



Spreading compost around the base of plants to suppress weed growth and improve soil structure

Reference list

Other useful booklets about composting include the following:

'The Preparation and Use of Compost; Agrodok 8' (1990) by Inckel, M. *et al* AGROMISA, PMB 41, 6700 AA, Wageningen, The Netherlands

'Soil Management: Compost Production and Use in Tropical and Subtropical Environments' (1987) Food and Agriculture Organization of the United Nations (FAO) Soils bulletin 56. FAO, Via delle Terme di Caracalla, 00100 Rome, Italy

'Field Notes on Organic Farming' (1992) Njoroge, J. Kenya Institute of Organic Farming, PO Box 34972 Nairobi, Kenya

Notes

Notes

Further information on composting, and organic farming generally can be obtained from HDRA. Other publications include booklets covering green manures, weed control and the neem tree, as well as single information sheets about crop pests and diseases and their control, natural pesticides and green manures. Please write to:

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The aims of HDRA - the organic organisation are to carry out scientific research into, collate and disseminate information about, and promote interest in organic gardening, farming and food in the UK and overseas. For more than a decade, HDRA's international programme has been involved in the support and extension of sustainable farming practices; supporting research on aspects of tropical organic agriculture, providing advice and literature on appropriate organic techniques and providing tree seeds and technical information to organisations involved in tree planting and research.

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