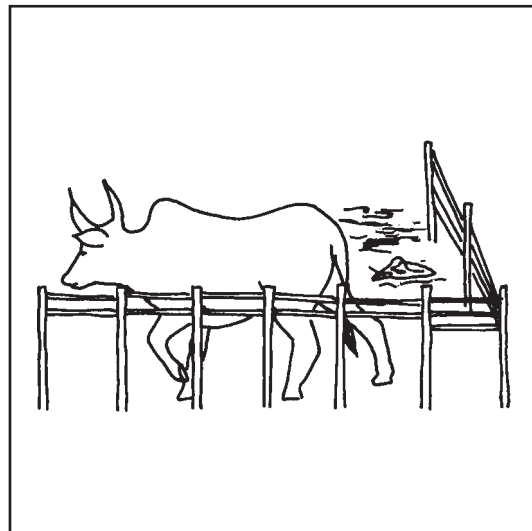
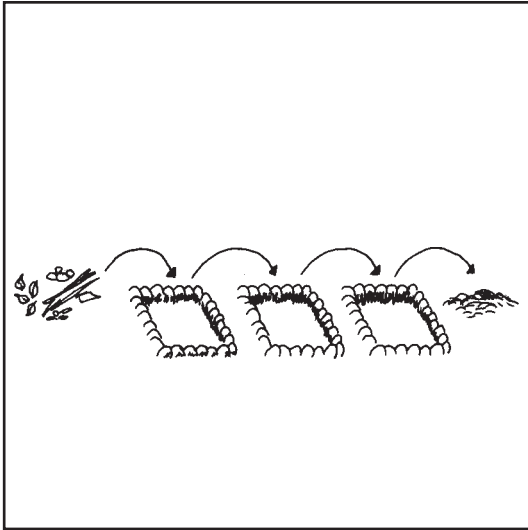


Composting in the Tropics II



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What is compost and how is it useful?

Compost is a cheap, effective and long-term way of improving the soil to grow better crops. Various materials such as leaves, fruit and vegetable scraps and animal manures are excellent for compost making, but many other waste materials can also be used.

This booklet follows on from 'Composting in the Tropics' which concentrated on the principles of composting and especially the heap method. The heap method of composting is popular and widely practised. This second booklet looks at other methods of producing compost, including variations on the heap method and also describes practices suitable for different climates in the tropics, for example arid areas.

Here are some general reminders of the principles of composting which are applicable to most methods. For those who are unfamiliar with the practice of composting, we recommend that you read 'Composting in the Tropics' together with this booklet.

- Compost making requires a balance between easily decomposable materials (fruit and vegetable skins and young leaves) and material which is difficult to decompose (crop residues and small twigs). This is to make sure that the structure of the compost is suitable and that it has a good balance of nutrients.
- Decomposition happens due to the activity of micro-organisms and other insects. These need certain conditions to live. This includes moisture and air. In most cases the compost heap will need to be watered if it becomes too dry. In some cases aeration is not needed and if not then this will be stated in the method.
- All compost heaps warm up. Temperature and evaporation (water loss) need to be assessed and to do this a stick can be used. It should be pushed deep into the compost heap, left there for a few minutes and then taken out and felt with the hand. It should feel warm and damp. If it is cold and dry then the heap is not functioning as it should and will need watering or aerating.

Unmanaged heaps

Often, materials which could be used to make compost are not used as well as they could be. Kitchen scraps and sweepings are often piled in a corner and left unmanaged. The activity of the organisms in the heap is very slow and so heat is not created in the heap. In this method the material does eventually break down into compost but this will take a long time and much of the goodness of the compost is lost.

Managed heaps

The methods provided in this booklet describe ways to accelerate the breakdown process. The activity of the organisms increases because the heap is managed properly. This means that the heap heats up to higher temperatures and produces useful and fertile compost more quickly. The following methods are described:

- The Indore method
- The Bangalore method
- The Heating process/Block method
- The Chinese high temperature stack
- Pit composting
- Trench composting
- Basket composting
- Boma composting
- Composting specific materials: domestic waste, seaweed, coffee pulp, water plants and human waste

The Indore method

The Indore method involves putting layers of different materials on top of each other to form a heap. First, make a base 1 metre (m) wide and 3m long, with twigs and cane shoots that are difficult to decompose. This allows ventilation which is important for the survival of micro-organisms. Then the layering is as follows:

1. 10 centimetres (cm) of material which is difficult to decompose, for example maize stalks. Then sprinkle with water.
2. 10cm of material which is easy to decompose, such as fruit and vegetable scraps.
3. 2cm of animal manure (if available).
4. A thin layer of soil from the surface of cropped land to obtain the micro-organisms needed for the composting process.
5. Repeat these layers until the heap reaches 1m to 1.5 m high.
6. Cover with grass or leaves (such as banana leaves) to prevent water loss.

Complete this process within one week. After 2 to 3 weeks the heap should be taken apart and rebuilt. This is because the materials do not all decompose evenly. Again, a layer of coarse material should be laid down first. **The material which was on the outside of the heap and has not decomposed, should be placed into the middle of the new heap and watered.** This should then be covered with the remaining material. The original layered structure is lost. After another three weeks this process may have to be repeated depending on how much the heap has decomposed. Full decomposition should take 3 months.

Urine (diluted with 4 parts water) sprinkled over the layers of soil can accelerate the process of decomposition. Urine also adds valuable nutrients to the compost. Ash in small quantities also acts as an accelerator and can be sprinkled over each layer of soil.

However, too much urine or ash can be destructive to the micro-organisms in the heap.



The Indore method: Sprinkling diluted urine before covering the heap

Advantages: The Indore method produces compost in a short space of time and the process can be controlled. Weed seeds and diseases are killed.

Disadvantages: The Indore method requires a lot of water and is very labour intensive. It works best when you have a lot of material to use all at once.

Variations on the Indore method

The Indore method can be varied depending on availability of materials. If you have lots of one particular material then the Indore principles can be applied as described below.

Low rainfall areas

In dry areas with limited water, many livestock and/or green leafy plants, heaps can be made in the following way:

1. 15cm layer of coarse plant material
2. 30cm of loosely spread, shredded, green leafy plant material (high water content)
3. 10cm of livestock manure
4. 2cm of soil from the surface of cropped land to obtain the micro-organisms needed for the composting process

Repeat these layers until the heap is 1.5m high. Cover with clay, dung or banana leaves to prevent water loss.

Areas with high livestock numbers

Where there are plenty of livestock, the following method can make use of large quantities of livestock waste. This heap should be constructed near the livestock enclosure. It should be made as follows:

1. 15cm of dry straw-like material
2. Add an 80cm layer of animal manure or add thinner layers over several days as it becomes available
3. 2cm of soil from the top 10cm of cropped land
4. Cover with mud, clay or dung

The Bangalore method

The Bangalore method is a popular method of composting. A few days after completing a heap, it is covered with mud or damp grass so that it is closed off from the outside air. This allows 'anaerobic' micro-organisms (that do not need air) to decompose the heap. The heap should be 1m to 1.5m high, 1m wide and 3m long. The method for building the heap is as follows:

1. 10cm layer of material that is difficult to decompose (stalks and crop residues). Then sprinkle with water.
2. 10cm of material that is easy to decompose (fruit and vegetable wastes)
3. 2cm of animal manure (if available)
4. A thin layer of soil from the surface of cropped land to obtain the micro-organisms needed for the composting process
5. Repeat these layers until the heap reaches 1 to 1.5m high
6. Cover with wet clay, mud or damp grass



Making the heap airtight with clay/mud cover

Advantages: The Bangalore method uses less water and labour than other methods as turning is not required.

Disadvantages: Weed seeds and diseases can survive due to the low temperature. The process of decomposition cannot be controlled. Experience of composting is needed as the process is more complex than other heap methods.

The Heating process / Block method

This resembles other methods of composting in that a heap is built in a layered structure. However the treatment is different, and it can be used to compost large quantities of organic matter.

The Heating process is based on a continuous block system. That is, new blocks are being made all the time and piled up.

Each block should be built with a ground surface of about 1m to 1.5m by 1m (no larger than 3m by 3m) and a maximum height of 1m.

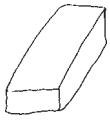
On the first day, a block is made by building up layers of materials collected for composting. After two days, when the block has started to decompose, the air is forced out of the block by trampling over it. This is similar to the Bangalore method of composting, as the heap is deprived of air and anaerobic micro-organisms (those that do not need air) cause decomposition.

On days two and three, new blocks are built next to the first block. On day four, a new block should be built on top of the original block, cutting it off from the outside air totally.

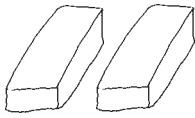
This process continues until each of the three blocks has a second built on top. On day seven, a new block is built next to the first and the cycle is repeated. The illustration given clarifies the steps to be taken.

Advantages: The Block method is a good method for large quantities. It also enables continuous compost making.

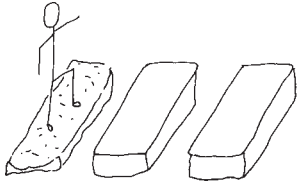
Disadvantages: The Block method is only suitable for large quantities. It requires a lot of labour and material. Weed seeds and diseases can survive due to the low temperature so such material should not be included. It is difficult to control and check the process. The process is complex and requires some knowledge and experience of compost making.



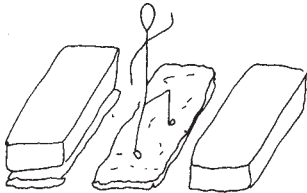
day 1: make block 1



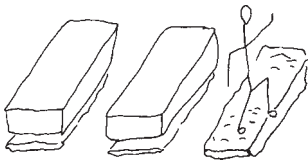
day 2: make block 2



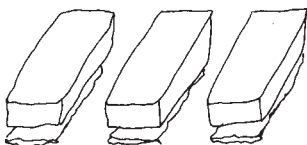
day 3: make block 3, trample over block 1



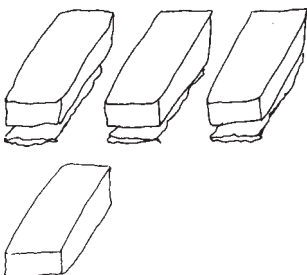
day 4: make block 4 on top of block 1,
trample over block 2



day 5: make block 5 on top of block 2,
trample over block 3



day 6: make block 6 on top of block 3



day 7: make block 7 next to block 1,
and the cycle starts again

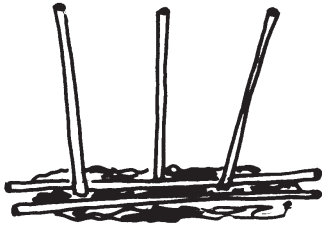
The Heating process /Block method

The Chinese high temperature stack

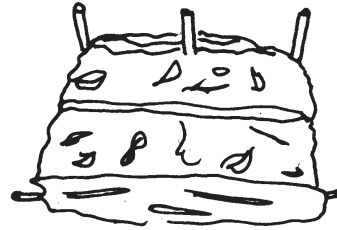
The Chinese high temperature stack has been used successfully for a very long time in China. It can compost most wastes and is especially good for the hygienic disposal of human excrement, because the temperature can rise up to 70°C and kill all diseases. **Previous experience in compost making is essential as there are health risks if the process is not managed properly.**

The pile is usually 2 to 3m wide, 6 to 7m long and 1 to 1.5m high. The layering is as follows:

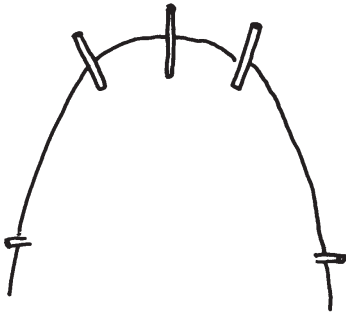
1. Make a layer 15 to 30cm thick with crop wastes such as straw or stalks
2. Lay bamboo poles (8 to 10cm diameter) 2m apart across this first layer. Further bamboo poles are then arranged vertically to act as air vents.
3. Add other wastes in layers, for example green material, straws, animal manures and human waste, until a height of 1.5m is reached.
4. Cover with a layer of mud mixed with a binder such as horse manure, wood ash, wheat bran or chopped rice straw. The sides need to be sloped so that the mud stays in place.
5. After 24 hours the heap starts to warm up and settle. The bamboo poles should be carefully removed leaving air passages
6. Once the heap has reached 60 to 70°C (after 4 to 5 days) the holes are blocked. This is to reduce cooling in the winter and evaporation in the summer.
7. After 14 days, turn the heap to ensure good mixing and an even breakdown of the material. Restack and add water if the material looks dry. Replaster with another coat of mud. The compost should be ready within 8 weeks.



1. Start the heap and put the bamboo poles in place



2. Build the heap around the poles



3. Cover the heap with a mud mixture



4. Take the bamboo poles out

Chinese high temperature stack

Advantages: This method disposes hygienically of human waste.

Disadvantages: This method requires a lot of material. It is important to have knowledge of the principles of composting before attempting this method.

Pit composting

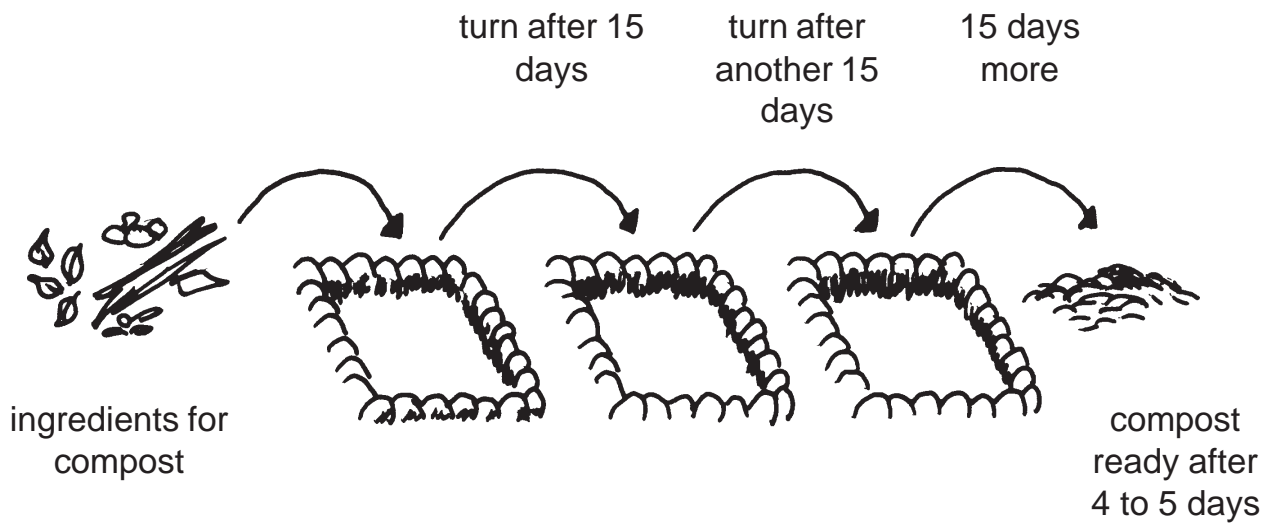
This method involves making compost in pits which have been dug in the ground. The best depth for a pit varies according to local soil conditions and the depth of the water table. A typical pit would measure 1.5 to 2m wide, 50cm deep and any length. The pit can be lined with a thin layer of clay to reduce water loss. Often, several trenches are dug next to each other, to allow turning from one pit into the next. Take care not to dig the pits too close to each other as the walls between them will be too thin and may collapse.

Material should be placed in the pit in layers as described below. For a larger pit measuring 2m wide, 2m long and 1m high, 1 to 1.5 litres of water should be poured on before applying the layer of soil which seals the pit.

The layering is as follows:

1. 10cm of material which is difficult to decompose (stalks or crop residues)
2. 10cm of material which is easy to decompose (fruit and vegetable scraps)
3. 2cm of animal manure (if available)
4. A thin layer of soil from the surface of cropped land to obtain the micro-organisms needed for the composting process
5. Repeat these layers until the heap reaches 1 to 1.5m high
6. Cover with grass or leaves (such as banana leaves) to prevent water loss

After 2 to 3 weeks, all the contents of the pit should be turned over into the second pit and 2 to 3 weeks later this should be turned into the third pit. As the decomposing material from pit 1 is turned into pit 2, new material which is ready for composting can be put into pit 1, thus creating a process of continual compost making.



Pit composting

Advantages: Pit composting is quick, easy and cheap as it does not require investment in materials. It needs less water so it is useful for dry areas.

Disadvantages: It is more difficult to follow the decomposition process than with an above ground heap. It is hard work to dig the pits especially if labour is limited.

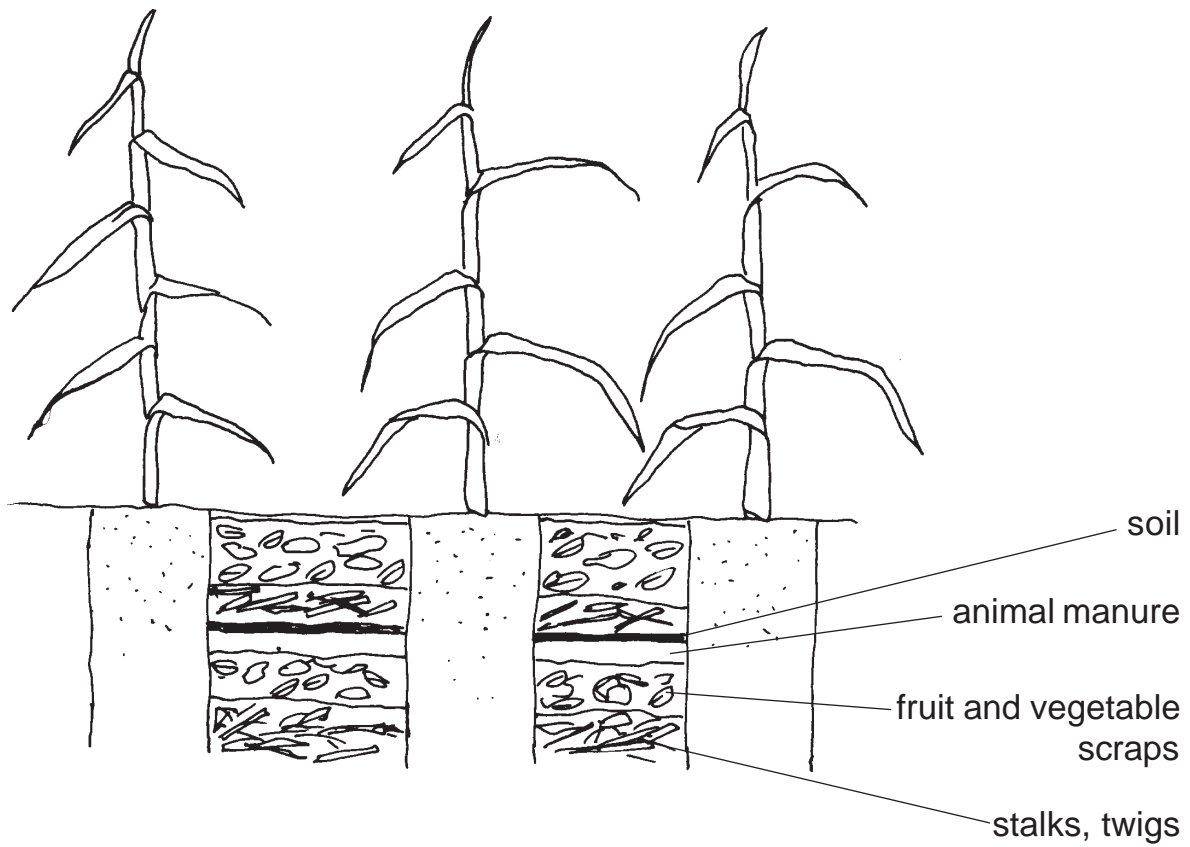
Trench composting

Trench composting is similar to pit composting except that plants are grown directly onto the pit as opposed to taking the compost out of the pit and spreading it on land. A trench should first be dug. The size depends on how much material you have available and how many plants you are planting in the trench. The width can range from 50cm to several metres, the depth 1m or less and it can be any length. It should then be filled as follows:

1. 10cm of material which is difficult to decompose (stalks or crop residues)
2. 10cm of material which is easy to decompose (fruit and vegetable scraps)
3. Add 2cm of animal manure (if available)
4. A thin layer of soil from the surface of cropped land to obtain the micro-organisms needed for the composting process
5. Repeat these layers until the pile is about 50cm above the ground
6. Cover with soil, grass or leaves (such as banana leaves) to prevent water and nutrient loss and leave to settle for about one month before planting

Less digging is required if the trenches are dug as shown in the picture. In these smaller, individual trenches layers of soil should be added in between the compostable material. It should be left to settle for about a month before planting. These trenches make more efficient use of compostable material because more crops can be grown in the same area as a wider trench.

Advantages: Trench composting is especially useful against termite attack as most species live above ground level.



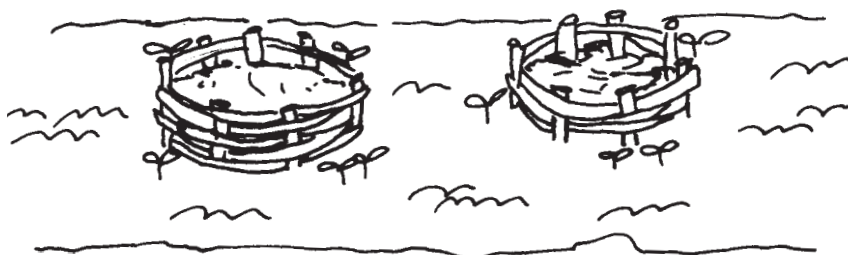
Narrow trenches filled with compostable material

Basket composting

If materials for composting are in short supply, you can still make good use of them by using the basket method of composting. It is especially useful for food production in home gardens. The method is as follows:

1. Dig circular holes 60cm in diameter and 60cm deep
2. Line the bottom with material which is difficult to decompose (twigs, stalks)
3. Add 8cm of animal manure
4. Add 15cm of green vegetation (young leaves that have a high water content)
5. Add 0.5cm of ash
6. Repeat steps 3 to 5 until the hole is full
7. Cover with grass or leaves to prevent water and nutrient loss
8. Using thin sticks, and weaving them together, mark the circular outline of the pit with a round 'basket', 10cm in height.

Seeds or seedlings can then be planted around the basket structure. The plants will make use of the nutrients in the compost.



Seedlings growing around a 'basket'

If you build more compost baskets in your garden, place them in different areas every time so that the whole garden becomes more fertile.

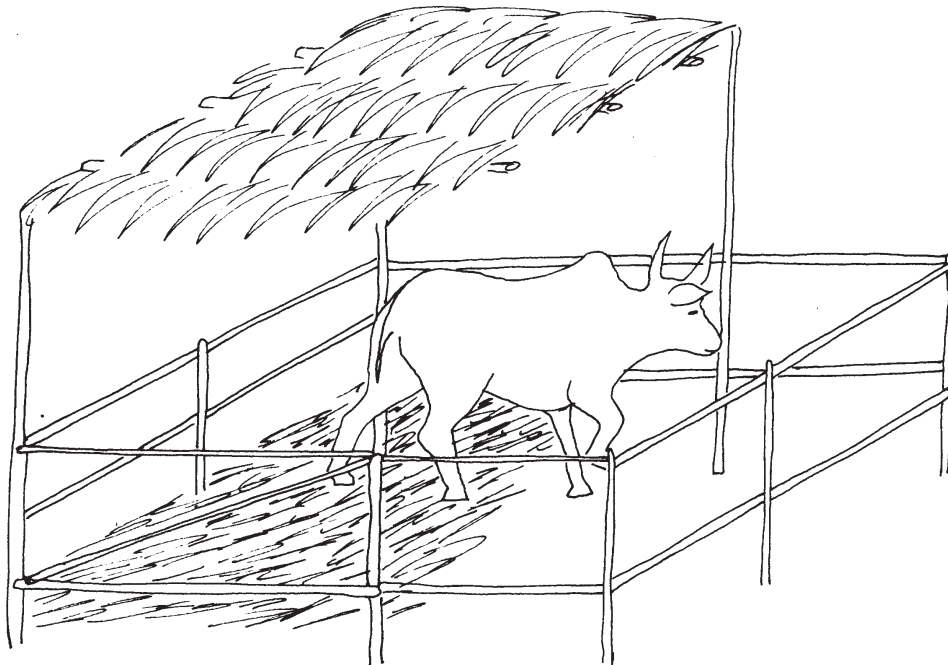
Advantages: Basket composting is a good way of composting domestic waste. It makes good use of nutrients in a small kitchen garden.

Boma composting

The Boma method is used on farms where there are animals (cows, sheep, goats, rabbits, chickens), which are kept in enclosures where droppings are concentrated.

Droppings and urine have a high content of plant nutrients. It is advisable to add new bedding (maize stalks, weeds, leaves, sawdust) for the animals once a week and enough to soak up all the urine. The bedding prevents nutrient loss, through the leaching of urine, or drying out of manure. Animals will trample on the waste and accelerate the breakdown of the bedding. This will ensure that plenty of compost can be made on a weekly basis.

To increase the quantities of urine collected, add plenty of bedding to soak up all the manure and urine. The animal stall should preferably be covered so that the nutrients in the urine and manure do not get washed away by rain.



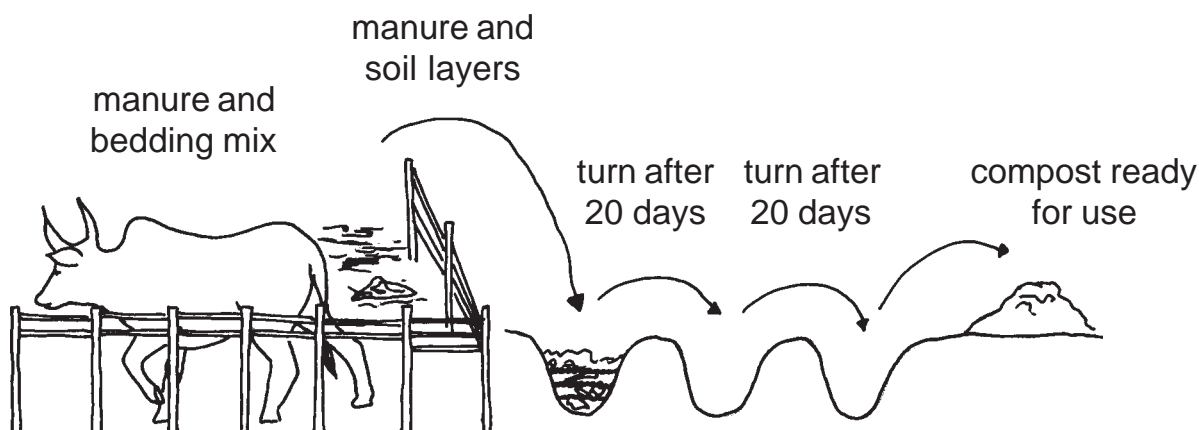
A covered animal stall with plenty of bedding

Well mixed manure can be taken out either daily or weekly. If daily, the manure should be piled up and covered with a layer of soil to protect it from drying and losing nutrients.

Then proceed as follows:

1. Dig 3 trenches, each 30cm deep, preferably near the animal enclosure for ease of transport.
2. Place dry vegetation in the bottom of the pit.
3. Add 10cm of animal manure/bedding mix.
4. Add 5cm of soil from the surface of cropped land to obtain the micro-organisms needed for the composting process.
5. Add 10cm of manure/bedding mix.
6. Continue with these layers until the heap is 1 to 1.5m high. In the dry season the pile can be made up to 1.5m high but in the wet season, to avoid it getting waterlogged, keep the pile smaller (up to 1m).
7. Cover with grass, maize stalks or banana leaves to prevent water loss or waterlogging.

Transfer the contents of the first trench into the second trench after 2 to 3 weeks and from the second trench into the third trench after another 2 to 3 weeks. If you are not going to use the compost straight away it should be covered with soil, banana leaves or cut grass to prevent it from losing water and nutrients.



The manure/bedding mixture is turned into several trenches to produce compost

Composting specific materials

Composting a mixture of organic wastes makes decomposition easier and produces a more balanced end product. Sometimes there are situations where there is a large quantity of one type of material and there is little chance of this being mixed with large amounts of other materials. However if dealt with properly these materials can make good compost.

Composting domestic waste

Domestic waste includes any kind of decomposable household waste such as kitchen scraps, paper, sweepings or wood ash. It should not include any plastic or tins. It should not include meat or slaughter wastes which attract vermin and insects and give an unpleasant smell. Neither should it include excreta from man, cats or dogs as these contain toxins which can be harmful unless composted properly (see section on human waste composting). It is also better not to use too much of the same type of material.

Most domestic waste is produced in small quantities at regular intervals. Instead of adding small amounts to the heap every day, it is better to wait until enough material has been collected to create a 30cm layer and then add it to your heap. Domestic waste has little structure, giving poor aeration. So ventilation of the heap needs to be carefully managed.

Composting seaweed

Seaweed contains many trace elements and growth regulating substances which are highly beneficial to crops. For those farmers who are close to the sea, it can be very useful. The main requirement when composting seaweed is to remove most of the salt. If the seaweed is wet then it should be mixed with a large amount of dry material such as straw. Dried seaweed (laid out in the rain to leach the salt away or washed in fresh water and dried in the sun or in an oven) can be used in a normal compost heap. Generally the decomposition of seaweed is very quick. Another way to use dried seaweed is to grind it and use the powder as a fertiliser.

Composting coffee pulp

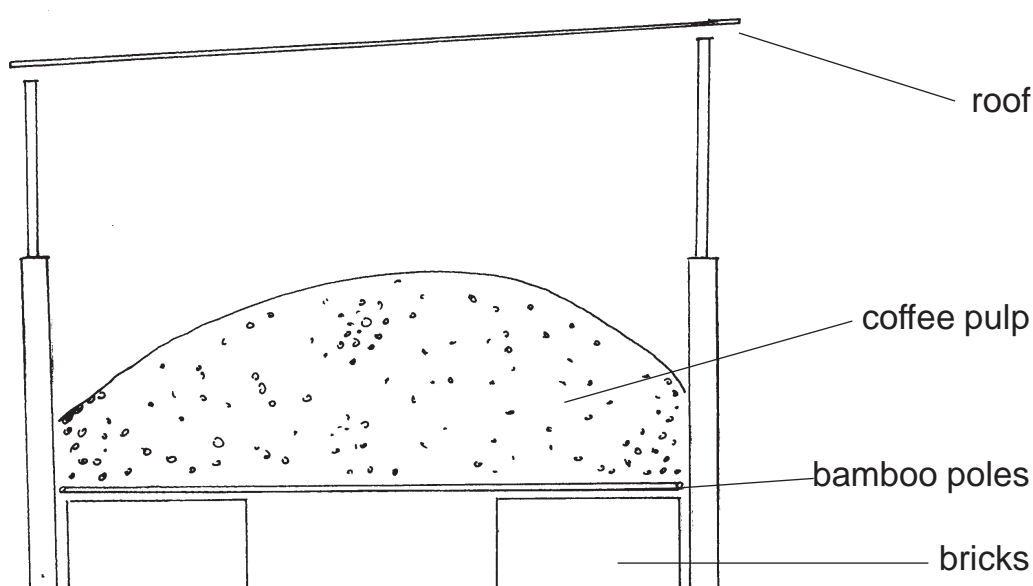
In coffee producing areas, large quantities of coffee pulp are a problem. The fermenting piles give off unpleasant smells, breed flies and pollute waterways.

Coffee pulp is a good fertiliser as it is rich in organic matter, nitrogen and potassium. Some growers spread the heavy wet pulp on their coffee plantations but there can be problems with transport and spreading and this can lead to smells and plant growth problems. It is much better to compost the material first so that it can be used more effectively.

This dense material needs good aeration so a number of above ground, elevated boxes should be constructed. These need to be roofed or covered to stop too much water from entering the compost heap. The elevated floor can be made of bamboo poles mounted on bricks or stones.

Before composting, the pulp needs to be drained and loaded into the boxes to a height of about one metre. Vegetable waste can be mixed in if available as well as some soil or compost. This is to obtain the right micro-organisms that decompose the waste.

The heap should be turned every 4 to 6 weeks and the compost should be ready in 4 to 6 months.



An elevated box for composting coffee pulp

Composting water plants

Water weeds (for example the water hyacinth) are a considerable problem in areas where lakes and waterways are becoming more and more disturbed. Controlling them with herbicides is harmful to the environment, expensive, and a waste! Indeed, they can become a valuable soil improver if composted as follows:

1. Harvest water weeds and spread out for a few days along the water's edge to dry.
2. A compost heap can be made, using the wilted plants, soil, ash, animal manure and household waste (kitchen scraps). Use the Indore method of composting by placing twigs at the bottom and building up the different layers to form a heap. This will help prevent the heap from being too wet.

Compost made with water hyacinth only, may in some cases reduce yields, so it is advisable to test the compost in small amounts before applying to a crop.

Composting human waste or sewage

There are a number of problems in dealing with human waste or sewage as diseases can spread through handling the waste and through the consumption of the crops grown using the waste. **It is very important to use appropriate methods when dealing with it and to have previous experience of the composting process.** The best way of composting human waste/sewage is by using the Chinese high temperature stack. This method ensures that diseases and pathogens are killed in the heating process. It is important that the temperature of the heap is tested to make sure that the high temperatures needed are being reached. These problems should not prevent the use of human waste or sewage in a compost heap, as it is a useful way to dispose of it and it is a good source of nutrients for plants.

Reference list

Other useful information about composting methods can be found in the following:

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

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

Notes

Notes

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

HDRA - the organic organisation

Ryton Organic Gardens

COVENTRY CV8 3LG

United Kingdom

Tel: +44 (0) 24 7630 3517 Fax: +44 (0) 24 7663 9229

Email: ove-enquiry@hdra.org.uk

Website: www.hdra.org.uk

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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