FOUNDATIONS FOR FARMING

Composting for Small Scale Farmers and Gardeners.

What is compost?

It is the **Aerobic** decomposition by BACTERIA and FUNGI of a mix of organic material.

Composting Methods.

- Thermal compost
- Worm or Vermi-compost (cold composting)
- Static compost

All three of these methods are suitable for the small-scale farmer/gardener. There are pros and cons for all:

Thermal composting is the most reliable to guarantee a product that is weed and pathogen free, it also is very fast (7 to 8 weeks). This method does however involve a fair amount of manual labour.

Worm composting provides an excellent product (worm casts, which are higher in plant available nutrients), but requires large numbers of worms and does not eliminate weed seeds.

Static compost is the easiest but most unreliable due to the uncontrolled environment leaving risk of pathogens, seed. It is also very slow (Can take up to a year).

Thus thermal compost is the most suitable method, but it requires diligence and training to achieve the required results.

The minimum size of a thermal compost heap is about 1.5 m cubed. This size is ideal for a home garden or small scale vegetable garden situation. A 2x2x2m pile is preferable for field crops such as maize, this size pile will produce enough compost to fertilize ½Ha if FfF principles are used. These piles are also small enough for a single person to work in a few hours. In a small-scale or garden situation it is also not too difficult to accumulate or gather enough raw material to build a heap of this size.

Ingredients Required.

1. Plant material.

Plant material is divided into 2 categories, green and brown.

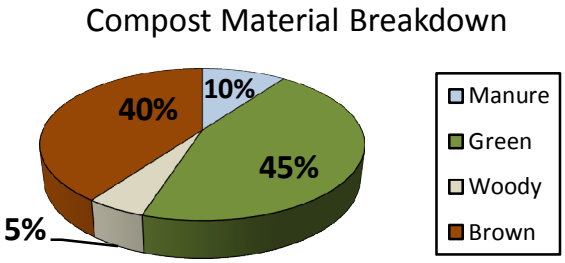
- The green is anything that was cut while still green (even if it has now dried). Examples are grass, weeds and leaves.
- The brown material is anything that has dried, but was not cut green. Examples are maize stalks, thatching grass and fall leaves.
- Within this brown material it is also good to include woody material such as small sticks, seed pods or wood chips. These larger pieces assist in aeration of the compost.

The ratios of the materials should be equal, green to brown.

2. Nitrogen Source.

A Nitrogen source is a material which has a high nitrogen content. Examples are manure, legumes and fertilizers (Urea or Ammonium Nitrate).

- **Manure**: The smaller the animal, the stronger the manure. For cattle use 16 wheelbarrows for a 2x2x2 or 6 wheelbarrows for a 1.5x1.5x1.5 (10%).
- **Legumes**: Examples are soya waste, peas, beans, groundnut tops or Lucerne (20% of pile).
- **Fertilizers**: Mix about 16kg with the water for a 2x2x2.



3. Water.

This is the most limiting resource in communal areas, thus it is important to place your compost close to a water source. Through the 8 week process we will require at least 800L of water. To conserve water and achieve maximum saturation of the plant material we should dunk the materials into a water filled container, such as a drum.

Each time we turn our compost we must ensure that we have adequate moisture in the heap. Use the squeeze test for this.

Squeeze Test
Take a handful of compost material, squeeze hard.

- If moisture comes through your fingers, itôs too moist.
- If when you open your hand the material stays in one piece, and no water came through your fingers, the moisture is perfect (±50%).
- If when you open your hand the material breaks apart, there is not enough moisture.

4. Oxygen.

Oxygen is freely available in the air, thus all we need to do is manage the environment in our compost to ensure maximum oxygen penetration. This is done by:

- Including chunky woody material in our ingredients
- Do not compact the compost
- Never cover compost with plastic
- Turn the pile at the correct time.

5. Micro-organisms

No magic additives are required to make good compost, all the naturally occurring organisms will already be present on your plant material.

Method.

a. Building the pile.

It may take an extended period for enough material to be gathered to build a pile of the desired size. This is not a problem. The materials should be piled separately until such time as enough of each material (green, brown, woody, nitrogen) has been accumulated.

When the pile is to be constructed it is important that the right ratios are attained. The most simple way to achieve this is collect equal quantities of green and brown materials. Donôt forget the chunky woody material (at least 5% of total).

Begin by placing pegs in the ground to the desired size. Then saturate the materials and begin building. Spread the manure throughout the pile. Ensure that you keep the pile neat in a cubed shape, as this is the most efficient shape for minimal heat and moisture loss.

b. Temperatures and turning.

The compost will begin to get hot very quickly. Under ideal conditions the temperature can reach 60°C within 48 hours. This heat is created by the reproduction of thermophilic bacteria and will only occur if there is adequate water and oxygen.

Heat is essential to kill all seeds in the compost and all undesirable pathogens or pests. This is achieved in the temperature range from 55°C to 68°C. The temperature needs to be maintained in this range for at least 3 days. All parts of the pile need to be exposed to this heat. This heat however only exists on the inside of the pile (the outer 40cm is much cooler). This is one of the reasons why turning is important. Each time you turn the pile you should attempt to move material from the outside to the inside, and visa verse.

When turning the pile gauge whether the moisture content is still adequate. A lot of moisture is lost as steam and this needs to be replaced. The adding of water can also cause cooling.

The simplest way to determine what the temperature within the pile is, is by using a temperature probe. This can be made out of a thick metal rod or wire, it should be at least 1.2m long. Once the pile has been constructed, the end of this probe should be plunged into the heart of the pile. Each day this probe must be extracted and held to the skin of the forearm. When the temperature exceeds 55ºC this probe will be too hot to keep on the skin. From the first day that this temperature is achieved we must begin counting the days. After three consecutive days of this high temperature it is time to turn the pile.

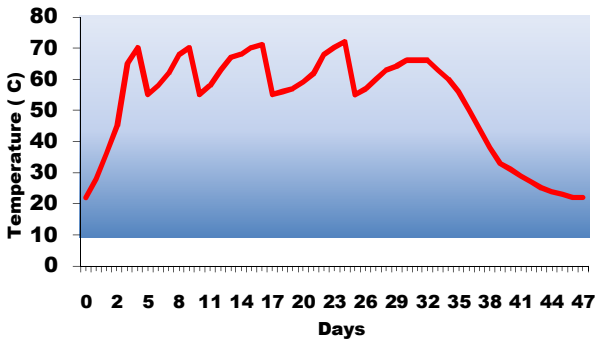
The turning process must achieve three things:

1. Exposed new material to the required heat,
2. Aerated the pile with oxygen, essential for the heat process and
3. Allowed for the lost moisture to be replaced.

At this point it is important to note that if the pile is not turned it will become anaerobic. This means that it will run out of oxygen. If this happens the desirable bacteria will die off or go dormant and undesirable anaerobic bacteria will become dominant. If this happens the temperature will drop and often a bad smell will be noticed.

Compost Temperature Cycle.

The temperature cycle of the compost heap will follow a similar trend to that displayed in the graph below. The



temperature will continue to rise until the pile is turned, then it temporarily drops. It then slowly begins to rise again. This will continue until all the nitrogen in the pile has been utilized. If your compost does not get hot it generally indicates that there is not enough nitrogen present, but could also be due to too much or too little water. Be careful not to add too much Nitrogen, this will prevent the compost from maturing within the 7 to 8 week period as desired. The temperature can continue rising for many more weeks depending on how much nitrogen there is. If the correct ratios are achieved at the start of the process, the compost begins to cool after 5-6 weeks. After the compost has matured it can then be stored in situ for long periods without further turning. The mature compost will also not degrade nor will nutrients leach out of it. It will be in the form of a stable organic fertilizer and inoculum.

Indicators of good compost.

Smell	If it smells bad, it is bad! This is due to the presence of alcohols, Acetic acid, butyric acid, valeric acid and putrescine. All of which are produced in anaerobic conditions.
Color	NOT BLACK. Deep, rich brown indicates humics. Tan, honey color means fulvics.
Texture	Crumbs, air passages, aggregates visible.
Fungal Strands	Visible thick threads, in compost, not aerial, not fuzz.