COMPOSTING YOUR ORGANIC HOUSEHOLD WASTE

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1. Introduction

One of the things that western society - and ours in particular, excels in is producing waste. We bury it in holes, burn it, dump it in oceans or build mountains out of it. The total waste production in Perth in 1991 will exceed one million tonnes. Over half a million tonnes is produced in the household. Approximately 70% or 350,000 tonnes of domestic waste is organic and can this be composted.

In a recent study commissioned by the State Government waste minimisation was identified as a priority and household composting is a very effective and appropriate method of reducing the waste stream.

Most of the environmental impact of landfills is caused by the decomposition of the organic waste fraction. The leaching of solubilised organic compounds is polluting and it also carries pollutants such as heavy metals into the groundwater table. During the decomposition of organic waste various polluting gases are released e.g. carbon dioxide (greenhouse), methane (ozone and greenhouse), ammonia (odour and acid rains) and hydrogen sulfide (odour), so more appropriate disposal of organic waste through composting is desirable. Landfill consumes land and approximately 500 hectares are currently restricted as a result of this.

On the opposing end of the environmental impact of landfill in Perth (Western Australia) there is the poor sandy soils of the Swan Coastal Plain. The sands are characterised by a low capacity to retain nutrients (fertilisers and moisture), have a very low organic matter and clay content and a low buffer capacity. To assist in improving the soils peat moss is imported from as far as Scandinavia, and is available on the market. There is a demand for soil organic matter in Perth such as a good compost.

Household composting results in a reduced (up to 50%) waste stream, reduced waste collection costs for the council and a good soil conditioner for gardens. A number of councils have already acknowledged these advantages and have made home composting bins available to ratepayers at subsidised rates.

2. Home Composting

2.1 What is composting?

Composting is the process whereby organic matter is rapidly decomposed by a range of microorganisms using oxygen. During the process heat is released which speeds up the process and this also sanitised the material from pathogens and weed seeds and plant disease.

The complete composting process consists of four different stages.

Stage 1.: *Incubation or mesophilic phase:*
This stage lasts for ± 24 hours during which the organic matter is invaded by mesophilic composting organisms. These are organisms that thrive between 25°-45°C. They cause the temperature to rise in the composting material.

Stage 2: *Thermophilic phase:*
This is the "hot" period, during which organic matter is decomposed rapidly. The temperature can go up to 70°C in the heat core. However 55° is the optimum temperature. The oxygen demand is very high bore and thus needs to be supplied by regular turning (every 2-3 days). This phase lasts for 2-3 weeks depending on aeration.

Stage 3 *Cooling Phase:*
This phase sets in when there is insufficient organic substrate left to maintain the high temperature. The temperature will drop due to water evaporation and heat convection. When the temperature drops below 45°C mesophilic bacteria and other organisms will re-invade the fresh compost. This phase lasts for a few days.

Stage 4. *Compost maturation phase.*
The fresh compost needs to stabilise (mature) further, since fresh compost can be toxic and "too sharp" for plants. This is done by other organisms such as fungi, protozoa and actinomycetes who give the compost the fresh earthy smell. For this phase counts "the longer the better", though 3-4 weeks would be a minimum. Worms and insects also play an important role during maturation.

2.2 Properties of compost.

Mature compost can improve the structure of sandy soils as well as heavy clay soils, by formation of soil aggregates. This will improve water retention capacity thus reducing irrigation requirements. Compost also improves the water absorption of sandy soils (wetting agent).

Compost contains a lot of nutrients (N,P,K) and trace elements (Ca, Mg etc) which are slowly released as the compost is broken down further. Compost can also absorb applied fertiliser and release it slowly. This reduces fertiliser leaching into the groundwater table.
During the composting process certain organic compounds and antibiotics are produced that prevent seed germination, giving compost the property to keep weeds down. If the composting process is done properly the compost will be free of pathogens, weed seeds and plant diseases.

Compost is found to benefit plants growth and produce healthy vegetables, with more flavour than vegetables grown with solely synthetic fertilisers

2.3 Requirements for composting to take place.

There are five requirements for composting to take place.

1. Organic matter
2. Moisture (40-60%)
3. Nutrients (C:N:P = 250:10:14)
4. Air (oxygen)
5. Microorganisms

It is important to mix the ingredients in the correct ratios, in order to produce a complete diet for the microorganisms. Too much carbon (paper, sawdust) will result in incomplete composting and the compost will exercise a demand on the nitrogen in the receiving soil. Too much nitrogen will result in loss through ammonia, causing odour and attraction of flies.

A correct combination of waste can be calculated from Table 2. A carbon to nitrogen ratio of between 20 or 30 to 1 is essential.

Table 2 Approximate composition of some organic waste materials

Material	C/N ratio	% Moisture in material	g C/100 g moist material	g N/100 g moist material
Lawn clippings	20	85	6	0.3
Weeds	19	85	6	0.3
Leaves	60	40	24	0.4
Paper	170	10	36	0.2
Fruit waste	35	80	8	0.2
Food waste	15	80	8	0.5
Sawdust	450	15	34	0.08
Chicken manure	7	20	30	4.3
Chicken litter	10	30	25	2.5
Straw	100	10	36	0.4
Cattle droppings	12	50	20	1.7
Human urine	-	-	-	0.9 g/100 ml

Calculation example : Lawn clippings : food waste : paper = 4 : 2 : 1

Carbon/Nitrogen ratio : $$\frac{C}{N} = \frac{(4 \times 6) + (2 \times 8) + (1 \times 36)}{(4 \times 0.3) + (2 \times 0.5) + (1 \times 0.2)} = 27.5$$

The smaller the particles, the quicker the composting will proceed. Garden prunings and branches may have to be shredded. A small shredder may be a useful investment depending on the compost requirement.
When the combination is correct the microorganisms will come by themselves. The moisture content is also important to keep an eye on, as too much moisture

prevents air from entering resulting in a stinking mass and too dry will reduce the activity of the micro organisms.

2.5 Trouble Shooting

There are four main causes for a failing compost heap.

Cause	Remedy
1. **Too dry** Insufficient rise in temperature	Add water, or moist organic matter (grass, food)
2. **Too wet** low temperature, bad odour (rotting)	Add dry organic matter such as sawdust or paper
3. **Carbon:Nitrogen too high.** Indicated by short time composting before stopping, with correct moisture content and no foul odour.	Add high nitrogen waste, eg grass clippings, manure
4. **Lack of other nutrients** (phophorus !) Low temperature	Add bone meal or rock phosphate.

2.4 Methods

Of all the available techniques available, the compost heap seems to work best if sufficient waste is available to produce a minimum size heap of 1 to 2 cubic meter. This size is required to insulate the inner heat core, so that sufficiently high temperatures cen be achieved.
Compost bins and the various other constructions are more suitable for small households. Examples of different methods are the Indore, Berseley and New Zealand systems. Construction designs of these and a number of others are described and evaluated in the referred literature list at the end, particularly useful is the 'Rodale Guide to Composting'. They require some investment of money and generally don't function better than a heap, but work with less organic matter input. In enclosed bins the compost has a tendency to become too moist due to a lack of water evaporation.
A few tools for composting are gypsum, as it contains much calcium, which makes compost firmer and reduces ammonia emission and thus flies. Seaweed is good for the supply of nitrogen and trace elements. Fly problems can also be reduced by planting fly repelling plants such as citronella and marigolds and calendula. Composting of various wastes is very much open to experimentation by the individual and as long as the basic rules are respected, success should follow.

Useful literature

Handreck K. A., Composting, making soil improver from rubbish, Discovering soils no 3, CSIRO, 1978.
Minnery J., The Rodale guide to composting, Rodale Press. (Alexander library)
Conacher Jeanette, Composting and organic growing, Organic Growers Association, Wembley. ($2 + 80 c postage)