



ACT

Government

Environment and
Sustainable Development

COMMERCIAL COMPOSTING GUIDE



This publication aims to provide existing or prospective operators of composting facilities with the background information when establishing a commercial composting operation. This guide is also a reference guide to the large volume of resources readily available and accessible.

WHAT IS COMPOSTING?

Composting is the natural, biological decomposition of organic matter by fungi, bacteria, insects, worms and other organisms. Successful composting entails the management of the decomposition process so that it is relatively quick, safe and clean. Poorly managed composting may produce offensive odours, encourage pests and vermin, spread plant and animal pathogens, cause environmental contamination and generate a product of inferior quality through extended processing times that will be inefficient and inappropriate in a commercial composting operation.

Organisms that decompose organic matter require the following basic inputs and conditions to maximise their processes and efficiency:

- A suitable 'food' source;
- A suitable temperature;
- Water; and
- Oxygen (if decomposing aerobically).

Aerobic and anaerobic composting

Biological decomposition of organic matter can take place in either an aerobic (oxygen rich) or anaerobic (oxygen poor) environment. While aerobic decomposition is the most common form of composting seen in commercial operations, properly managed methods of anaerobic decomposition may be beneficial at sites where pest and vermin are seen as a major issue, or where input materials are unbalanced.

Vermiculture

The process of composting whereby organic matter is broken down primarily by worm species is known as vermiculture. As opposed to composting processes that rely on organic matter breakdown by bacterial and fungal organisms, vermiculture is further benefitted by the role the



THE BENEFITS OF COMPOST

Soil conditioner and greenhouse gas abatement

Organic matter is not a homogenous material. Basically, it can be thought of as consisting of two components—a readily broken down fraction and material that will only degrade over a very long timeframe.

The nutrients that are embedded in the more readily degraded material are released during composting and become available once again for use by plants and other organisms. The resistant organic material that is left consists of very complex organic molecules, such as humic acid. Accordingly, this resistant material is often termed 'humus'.

Applying compost to the soil therefore not only provides a renewed source of soil nutrients, but the residual organic matter provides resistant soil organic carbon, which is an important sink for greenhouse gases. Furthermore, the increased levels of organic carbon will improve soil structure, increase its water holding capacity and enhance soil life (e.g. microbial activity, worms, beneficial insects, etc.). It also enhances the ability of the soil to retain nutrients and suppress some plant pathogens.





Compost is an essential component of many organic farming and permaculture systems. The application of compost to agricultural land provides not only increased soil fertility and water retention but can be an effective means of erosion and weed control.

GETTING STARTED

The right ingredients

At a very basic level, anything that was once a living thing can be suitable for composting. However, some organic materials (e.g. fish and meat industry products, as well as those found in hospitality and industrial waste) require special management, or may be considered unsuitable or best avoided in many circumstances.

All organic materials contain both carbon and nitrogen. For optimum biological activity, and thus efficient compost production, there needs to be a suitable balance of carbon and nitrogen in the material being composted. Generally, a carbon to nitrogen ratio (C:N) at the start of the process that is around 25:1 will be satisfactory.

At a somewhat basic level, potential composting materials can be categorised on the basis of colour coded groups—green, brown, yellow and red.

Green materials are rich in nitrogen (i.e. low C:N ratio) and are often, but not always, green in colour. These include grass clippings and general kitchen scraps.

Brown materials are rich in carbon (i.e. high C:N ratio) and are often brown. These include straw, sawdust and cardboard.

Where green materials are seen as the essential nitrogen components of compost, brown materials may be viewed as a bulk loading mechanism, making the parameters of the process easier to manage.

Yellow materials are generally able to be composted quite well, but typically require a greater attention to detail than green or brown materials. An example of this is human waste, which can be effectively composted but requires stringent controls and management to eliminate the risk of the spread of pathogens and diseases, as well as nitrogen overloading.

Red materials exhibit characteristics that mean they should either not be used at all, or that they will require very highly specialised treatment and management (e.g. petroleum products, fats and oils).

The optimum blend of the appropriate materials will accelerate the composting process.

While perhaps overly simplistic for a large commercial composting operation, such a classification system can provide a useful approach when initially sourcing materials and may be used by smaller operators without the capacity for accurate analytical testing.

Apart from the C:N ratios, other factors will need to be considered when deciding what materials to source for a composting operation. Products that might chemically contaminate the compost (e.g. sump oil, pesticides or chemically treated timber) should not be added. Inclusion of materials that might contain plant or animal pathogens needs careful consideration and management if they are to be rendered harmless. The addition of plant species considered weeds also needs careful attention. Some organic materials can even contain or produce substances that are toxic to some composting organisms.

The right conditions and processes

Humans have improved upon the natural composting process very little in the last few thousand years, and as such decomposing organic matter will usually need little human interference to perform at its optimal capacity if provided with the right ingredients and conditions.

As such, if the right ingredients are used in the correct ratio, then the correct conditions for optimum compost rates will usually create themselves.

The composting process will be efficient and effective, with minimal generation of offensive odours and/or environmental problems if the following conditions are maintained:

- Moisture must be kept at a level between 35 and 60%. The compost should have the feel of a squeezed out sponge. Moisture levels can be estimated by attempting to make a ball with a handful of composting material. Generally, a weak ball may be formed that will break apart when bounced in the hand. If the material is unable to hold any shape at all, the compost is likely to be too dry. If water is able to be squeezed from the ball, the material is likely to be too moist;



- The acidity of the material needs to be kept at a pH level less than 7.5. This is best controlled by ensuring that a balanced input of materials is maintained (e.g. the addition of too much lime will increase the alkalinity of the compost); and
- Temperatures within the compost are required to be around 55°C. Digging into the heap should give off heat that warms the hand without discomfort. This rule, however, differs for vermiculture systems where the ideal temperature for optimal worm activity is around 20°C. Too high a temperature may result in worm migration out of the active feedstock layer and lead to a breakdown of the system.

Optimum temperatures, moisture levels, aeration and mixtures of materials will generally provide good incidental control of flies and other insect pests. Rodents, birds and feral animals may be a little harder to control. However, good site hygiene and management will lessen the requirement for specific control measures.

Pre-processing, to physically break larger-sized material down into smaller, more readily degraded fragments, can often improve the efficiency of the process by reducing the time taken to produce a suitable product. An example of this is through the preferential addition of sawdust as opposed to woodchips.

The right site and system

The space needed for a composting operation will depend upon the intended scale and the specific system design to be used. Processing and storage of compost may entail the presence of large amounts of material onsite for several months.

Large commercial composting operations commonly use a 'windrow' system where compost heaps are often hundreds of metres long and are aerated using heavy machinery. Smaller operations may use any number of methods, potentially utilising boxes, barrels or containers to house their processing compost.

Potential offsite impacts (namely visual, odour, dust, noise and runoff) are critical considerations. Selecting a site separated from neighbours and sensitive land uses by appropriate distances and physical boundaries, combined with good process management, are the most effective ways of dealing with offsite impacts.

When selecting a site for a composting operation, consider:

- The estimated processing and storage times with regard to the amount of material being composted, the desired end product, the system in place and the associated space requirements;
- Separation distances and physical barriers to sensitive environments and neighbours. Residences, hospitals, schools, other businesses and public areas (e.g. parks, churches, halls, sporting grounds, etc) will require special consideration;
- Local climatic conditions, particularly rainfall, temperature, and wind speed/direction;
- Distances to surface and ground water resources, as well as the likelihood of flooding;
- Availability of water;
- A suitable slope for drainage (i.e. too flat a slope may cause ponding, odour and other problems, while too steep a slope can result in scouring and erosion of material from compost piles);



- Access to sufficient supplies of the appropriate materials, as well as a market for the final product; and
- Local and State regulations that may impose restrictions on the transport and treatment of certain wastes.

Targeting a market

It is important for the operator to consider who the targeted market for their product is. This could be local residential and/or nursery markets, or large agricultural and forestry markets, or even both.

Producing a marketable compost of high quality requires due care during processing. Certain markets may demand a consistent product, with special requirements for pH and nutrient content. Some may even require an auditable quality control system be implemented.

The target market may influence the ingredients that are sourced and hence the location of their sources. Targeting certain packaged compost or potting mix markets may require the use of a sterilisation process to meet quality standards.

The Australian Standard AS4454-2003 prescribes a number of measures to be referred to when creating a compost product that is safe for commercial use. The measures aim to give assurance that a product is of a consistent quality, is uncontaminated by heavy metal concentrations, and is free from plant and animal pathogens and plant propagules. A number of tests, with varying degrees of complexity, are included in the Appendices of the Standard to provide a means of determining the quality of the product.



Gaining the right approvals

Under Schedule 1 of the Environment Protection Act 1997 an 'environmental authorisation' is required for a facility that composts, or is intending to compost, more than 200 tonne of animal waste or 5000 tonne of plant waste per annum. Furthermore, the Environment Protection Authority (EPA) may request that individual composting operations gain environmental authorisation or enter into an environmental protection agreement.

All composting operations are encouraged to develop and implement an environmental management plan (EMP). Development of an EMP promotes effective business management, through the planning and documentation of intentions and outcomes, and aims to provide the EPA and site operators with a useful tool for the protection of the environment.

For further information please, contact the Environment Protection Authority by calling Canberra Connect on 13 22 81.

SPECIAL CONSIDERATIONS

Although the concepts inherent to basic composting are relatively simple, a commercial operator must take into account a number of important considerations:

- Specialist advice should be sought before incorporating significant quantities of meat and fish products into a composting operation;
- Care needs to be taken when sourcing ingredients that may have been affected by certain physical, chemical and biological contaminants;
- Under certain conditions, compost has the potential to spontaneously combust. To minimise the risk of fires, temperatures should be monitored and attention paid to moisture levels and the aeration of the compost pile. A fire management plan may need to be developed and incorporated into the site's EMP;
- Composting green waste has the potential to unintentionally introduce weed species into the finished product. The survival of weed species' seed banks can be limited by the maintenance of ideal composting conditions where heaps are kept moist, maintain a stable temperature and are provided with adequate aeration; and
- Pasteurisation of product created in vermiculture systems may be necessary to eliminate the risk of animal pathogens, plant pathogens and plant propagules surviving the process. This can be achieved by composting the material at temperatures exceeding 55°C either before or after its breakdown in the vermiculture system.

FINDING FURTHER HELP

This brochure aims to provide a compost operator with some basic starting information. There are many valuable resources available for gaining further advice, including:

- The internet, which contains literally thousands of relevant materials, though it is advised to ensure that material comes from a reliable source;
- Your local library or bookshop, which will likely hold a number of useful books and magazines;
- Advice from local gardening or permaculture clubs; or
- The contracted services of a professional consultant.

WEBSITES TO GET YOU STARTED

- The Recycled Organics Unit (ROU) based at the University of NSW has a large amount of useful resources and publications.
www.recycledorganics.com
- The Waste Management Association of Australia (WMAA) provides quality background information to get started.
www.compostaustralia.com
- The Bokashi method of anaerobic composting allows wastes, including meat and fish products, to be fermented quickly, without producing offensive odours. Bokashi Composting Australia is a privately owned company but their website provides useful information on the method.
www.bokashi.com.au/
- The Australian Worm Growers Association Vermiculture Inc is a network of worm farmers that promotes the farming of worms for the recycling of organic waste.
www.ausworm.com

RELEVANT LEGISLATION AND USEFUL GUIDELINES

- *AS4454 Composts, soil conditioners and mulches* (Australian Standard 2003—currently under review);
- *Environment Protection Act* (ACT Parliamentary Council 1997);
- *Environmental Guidelines for the Preparation of an Environment Management Plan* (ACT EPA 2009);
- *National Environment Protection (Movement of Controlled Waste Between States and Territories) Measure* (National Environment Protection Council—as varied November 2010);
- *Guidelines for Using Compost in Land Rehabilitation and Catchment Management* (NSW Department of Primary Industries and Department of Environment and Climate Change 2007);
- *Composting and Related Facilities EIS Guideline* (NSW Department of Urban Affairs and Planning 1996);
- *Composting and Related Organics Processing Facilities* (NSW Department of Environment and Conservation 2004);
- *Best Practice Guideline to Composting* (WMAA 2004); and
- *Environmental Assessment Guides for Planners: Composting* (SA Environment Protection Authority 2007).