Master Composter Brisbane

Course booklet

BRISBANE CITY

Dedicated to a better Brisbane

Contents

Chapter 1: Introduction

About the course

The Master Composters Course aims to provide a deeper understanding of composting and its applications in Brisbane. Composting is a practical skill but the many ways to do it, the science behind it and the potential for experimentation makes it a life-long learning endeavour.

During this course we aim to broaden your understanding of composting and develop your skills to the point whereby you feel confident and inspired to encourage others in the community to embrace composting. As a 'Master Composter' you will have the skills and resources to initiate, support, and encourage various composting initiatives so that the amount of organic waste going to landfill is reduced, Brisbane's soils are improved and strong connections are formed among people wishing to make a difference.

This course book is designed to be a reference which accompanies the course and is divided into five chapters. While the course itself will not follow this book exactly, the material will be presented in roughly the same order.

Additional class and home material will be provided throughout the course as well as practical activities which will give you the opportunity to learn about composting in a variety of ways.

The course content is designed to be delivered over the complete duration of the course and therefore it is crucial for you to participate in all sessions to get the full benefit. After the last session you will be given the opportunity to provide feedback so that we can continue to improve on the materials, delivery, facilities and other features of the course.

We hope you enjoy the Master Composters Brisbane course!

Organic waste

Organic waste refers to the part of the waste stream that is biodegradable and originates from a plant or animal source. Paper, cardboard, plant material, food scraps, meat and dairy are all considered as organic waste.

About half of the average household rubbish bin in Brisbane contains organic waste that could have been recycled through composting, or some other form of organic recycling. This organic material takes up a huge amount of landfill space and creates landfill gas as it starts to decompose. Landfill gas is largely comprised of methane which is approximately 21 times more potent than carbon dioxide as a greenhouse gas.

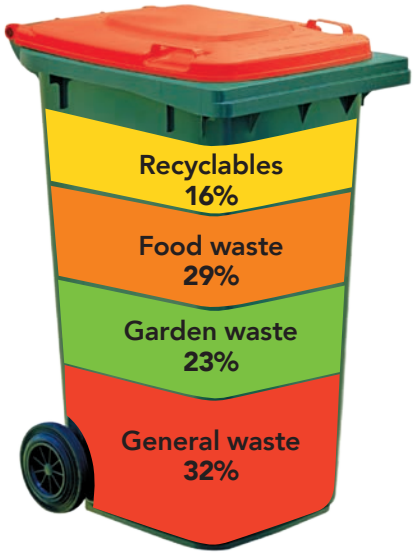


Figure: Breakdown of the average Brisbane household rubbish bin

Food waste

Food waste is the largest volume of avoidable material being sent to Brisbane landfill every year, representing about one quarter of the average rubbish bin. Research shows that about one in five shopping bags of food that we buy is being wasted, costing the average Australian household an extra $2200 to $3800 every year. In Australia, this represents about $10 billion per year!

For information about reducing food waste by improved storage, meal planning and shopping wisely see Council's Love Food Hate Waste.

> Unplanned takeaway meals, buying and cooking too much, and a lack of time are some of the most common things that lead to household food waste.
>
> Brisbane City Council

Picture: An example of organic food waste

The waste hierarchy

The waste hierarchy is a list of waste management strategies arranged in order of preference, from most preferred to least preferred. It is an internationally recognised approach to reducing waste in a meaningful way.

Although reducing food waste or reusing leftovers should always be the first choice, composting and other organic recycling methods play an important role in saving valuable resources from being lost to landfill.

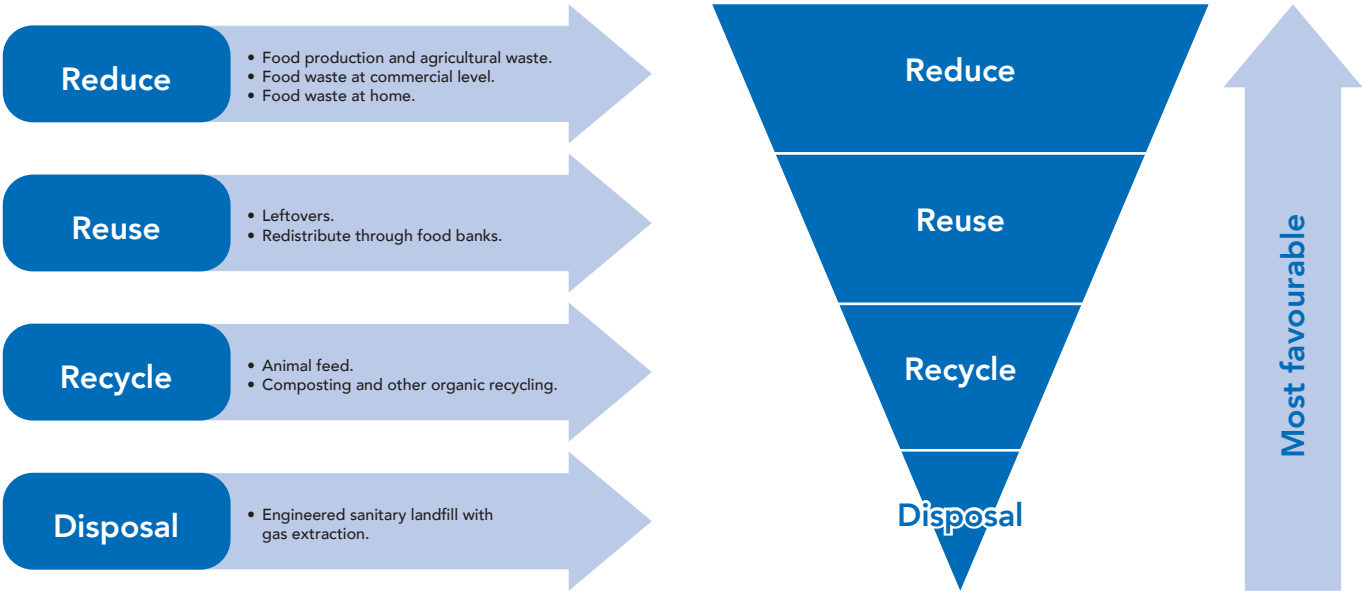


Figure: Waste hierarchy as applied to organic waste

Resource recovery and circular economy

Over the last few decades the waste management model has been a linear one. This usually involves taking a resource from the environment, processing, distributing, consuming this resource and then disposing of it in such a way that the original resource is lost (incinerated, buried in landfill or flushed out to sea). It is also known as the take-make-waste approach.

Figure: Linear model of waste management

Depleting resources and the energy heavy process of this model have meant that people are now looking for new ways to manage their waste. Recycling is one way to keep resources in the loop but there is a limit to how many times materials can be recycled. The circular economy however aims to keep resources in the loop indefinitely.

Figure: Linear economy compared to recycling and circular economies. Image provided by Circular Flanders.

In order to return organic waste to the soil for the next generation of food production, a circular economy model utilises composting to enrich the soil. In this model, valuable organic resources are kept in a loop of use and re-use.

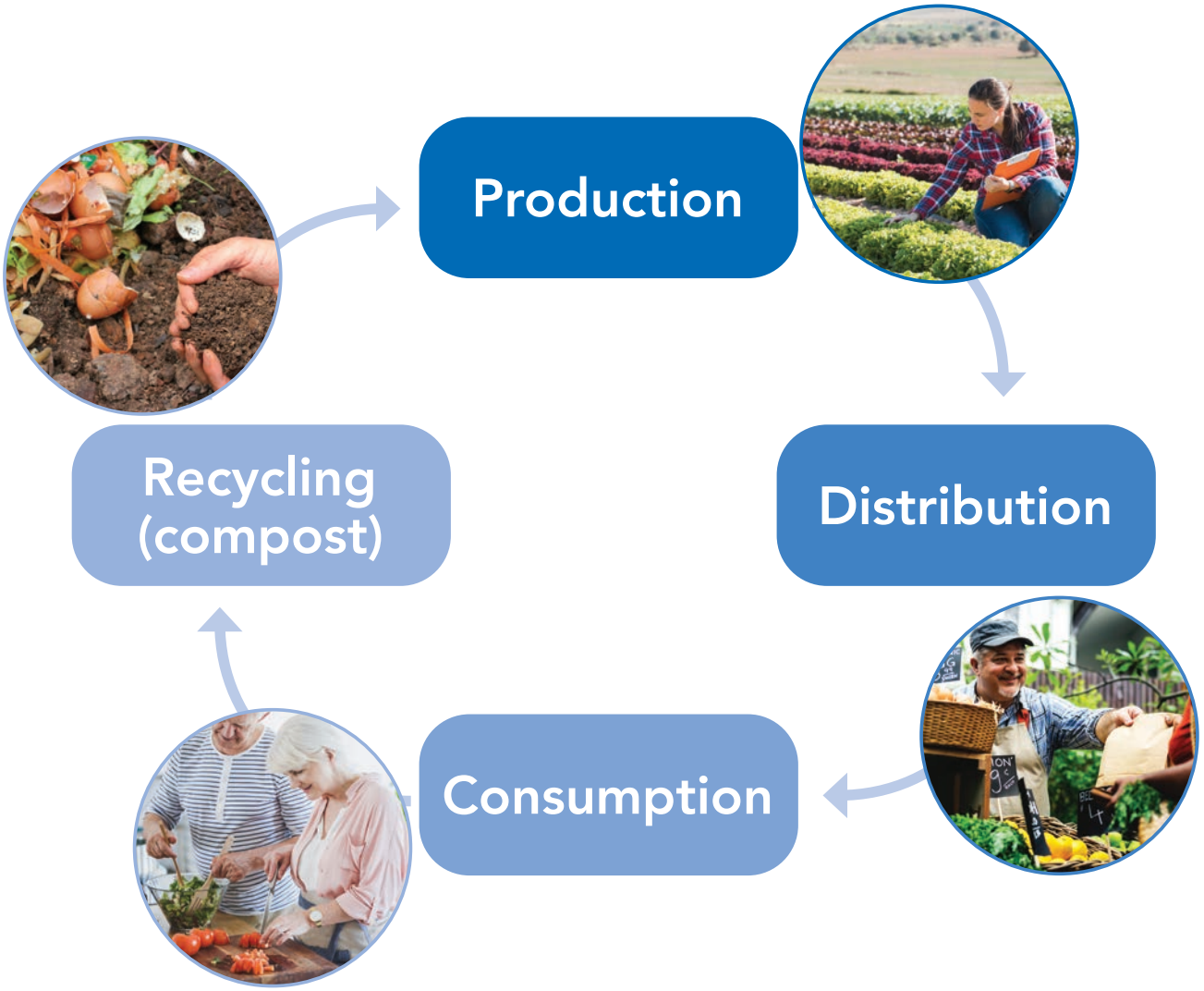


Figure: Food production in the circular economy

Organic recycling

Organic recycling is the process of converting any sort of biodegradable waste into compost. This can be done through various methods such as worm farming, fermentation systems, compost bins, no-dig gardening, trench composting and feeding organic waste to animals.

Chapter 2: Soil

What is soil?

Soil is a living ecosystem or 'soil food web' made up of a combination of inorganic and organic particles along with various living microorganisms such as fungi, bacteria, protozoa and nematodes as well as arthropods, worms and beetles. The inorganic part of soil makes up the majority and is composed of minerals from the parent rock it originally came from. There are many different types of soil which vary depending on their chemical and physical properties and how they were formed. The size of the inorganic particles determines the texture of the soil. For example, gravel has a very large particle size while clay has a very fine particle size.

The organic part of soil is made up of plant and animal material which gradually decomposes. The warmer and wetter the climate, the faster the organic matter breaks down. Organic matter in the soil provides nutrients, holds moisture, provides air space allowing drainage and oxygen to enter the soil, regulates acidity, provides food and offers protection for micro and larger organisms. Organic matter makes up about 5% of the soil volume (the remaining 50% is made up of equal parts air and water) but most Australian soils have less than 5% organic matter.

Soil pH

The degree of acidity or alkalinity affects the health of plants growing in soil. This can be measured by doing a pH test. Most plants prefer a neutral level which is around seven. The more acidic the soil, the lower the number and the more alkaline, the higher the number.

Types of soil

There are three main types of soil – clay, sandy and loam or a combination of these.

Clay soil – this is rich in nutrients and holds water well. However due to its very fine particles clay soil can be difficult to work with as it can be heavy and sticky and can frequently become water logged or compacted. The best way to improve clay soil is to add organic matter and gypsum. This will improve drainage and make the soil lighter and more friable. It is important also to avoid walking on clay soil when it is wet to prevent it from becoming compacted.

Sandy soil – does not hold water or nutrients well due to its large particle size. However, this also means that sandy soil drains well, is easy to turn and is well aerated. To improve sandy soil, add clay and organic matter. This will increase its water and nutrient holding capacity.

Loam soil – is the best for growing plants as it is made up of clay, sand and organic matter. As such it has a good capacity to hold water and nutrients while maintaining good drainage and aeration.

Soils in Brisbane

Brisbane has four main soil types. Different soil types influence where certain native plants grow in the Brisbane area:

- dark alluvial soils – alluvial soils are formed from very fine clay and silt particles which are deposited by rivers and flood water. They are usually sandy free draining soils located along the edges of free-flowing waterways. They are high in minerals and organic matter
- deep red loamy soils – these soils are well drained and are high in iron oxides
- gravelly red and yellow loamy top soils over clay – these soils are moderately well drained and are high in iron oxides
- shallow gravelly soils are generally quite low in nutrients and have low water and nutrient holding capacity.

Soil health

Soils become degraded due to land use or environmental reasons. One of the main causes of soil degradation is the loss of organic matter.

Organic matter provides food for the various living organisms within the soil that keep it alive and healthy. These microorganisms help to protect plants from diseases, provide food for the plants, help break down harmful pollutants and improve air flow throughout the soil. Regardless of soil type or the cause of the degradation, adding organic matter to the soil will improve it.

Refer to this table to see the various soil types in Brisbane's suburbs.

Complete the home soils activities at the back of this book to find out more about the soils at your home or community garden.

There are more organisms in one tablespoon of healthy soil than there are people on earth.

United Nations

Picture: Hands holding soil

Chapter 3: Composting

What is compost?

Compost is the crumbly soil-like material that is created when plant and vegetable matter breaks down. All biodegradable material naturally breaks down over time, but intentionally composting material provides a controlled ideal environment where specific bacteria, fungi and other organisms can flourish to provide the best possible finished product.

Composting is often likened to cooking as it requires the correct balances of different elements, moisture level and heat.

History of composting

Evidence of composting as part of agriculture has been recorded worldwide throughout history since the Stone Age. Mediterranean, Chinese, North American and African agricultural systems have all used various methods of composting. The earliest known written reference to compost was from around 2300 BCE in the Akkadian empire in Mesopotamia. References to compost are also found in the Bible,10th and 12th Century Arab writings and Renaissance writing. Even Shakespeare alluded to the power of compost when his character Hamlet told his mother "do not spread the compost on the weeds".

During the 20th Century a scientific approach to farming became popular and this saw a rise in the use of chemical fertilisers and pest control. Many farmers stopped composting all together in preference for using chemical fertilisers which delivered quicker results but have caused a myriad of environmental problems including the pollution of waterways, soil acidification, a significant decrease of organic matter in the soil and risks to human health.

Others looked at alternative ways of increasing crop production. Sir Albert Howard, a British botanist, spent 30 years in India studying traditional Indian practises of organic farming. Howard wrote about what he termed the "Indore" method of composting which encouraged the use of layering manure with three times the amount of plant matter and adding this to the soil to significantly increase the rate of plant production. Since then, organic materials have been further researched to assess their carbon/nitrogen ratio and the most effective balance of these materials to create the best compost.

Picture: Tractor spraying crops with pesticides

Small and medium-scale composting

There are several ways to compost depending on the amount and type of materials available, the physical characteristics of the site, economic constraints and the amount of time and energy available. For small to medium scale composting the most common methods are compost bins, compost tumblers or compost bays. On a larger scale the most common methods are aerated static pile composting, in-vessel composting and windrow composting.

Compost bin

This is basically a large bin with a lid and an open base. Some also have harvest hatches near the bottom.

Advantages

- Easy to assemble, simple design.
- Protects compost from sun, wind and rain and (to a degree) vermin.
- Inexpensive.
- Mostly made from recycled plastic.
- Available in a few sizes.

Disadvantages

- Slow compost process.
- Does not create adequate temperatures to kill. weed seeds or pathogens.
- Restricted access makes aeration difficult.
- Rats can burrow in underneath.

Picture: Compost bin

Compost tumbler

A compost tumbler is similar to a compost bin except that it is sealed and mounted on a frame so that it can be spun to allow aeration.

Advantages

- Whole bin turns on frame, digging not required for aeration.
- Protects compost from sun, wind, rain and vermin.
- Available in many different designs.

Disadvantages

- More expensive.
- Slow compost process.
- Does not create adequate temperatures to kill weed seeds or pathogens.
- Can get heavy making it difficult to turn.
- Does not have direct access to the soil for microbes and worms to enter.

Picture: Compost tumbler

Compost bays

A bay is a structure for holding larger amounts of organic waste for composting. Bays can be made from timber, steel mesh, bricks, bales of hay or woven sticks – just to name a few. For best results the internal measurements should be a minimum of $1m^3$ to allow adequate temperatures to be reached during the compost process.

Advantages

- Easy access for aeration.
- Cheap and easy to construct.
- High temperatures can be reached, kills pathogens and weed seeds.
- Faster composting process.

Disadvantages

- Requires more space.
- A large amount of material is required.
- Vermin may be able to able access the compost bin easily.

Picture: Compost bays

Carbon and nitrogen ratio in composting

To create successful compost, it is important to create the ideal balance between carbon and nitrogen materials. These are sometimes referred to as the 'browns' (carbon-rich) and 'greens' (nitrogen-rich) materials. This is to provide food for the various microbes and creatures that play a crucial role in the composting process. The ideal carbon to nitrogen ratio is approximately 30 parts carbon to one-part nitrogen. Some materials are particularly high in their carbon or nitrogen content and this ratio should be adjusted accordingly to keep the balance. As a rule of thumb, add twice the amount of carbon rich material to nitrogen rich material to roughly get the required balance. If there is too much nitrogen in the mix the compost pile will smell.
This is because the microbes will not be able to consume all the material and it will start to produce ammonia and other gases. If there is not enough nitrogen the compost process will slow down as the microbes will not be able to consume the carbon.

Nitrogen-rich products (greens)

- ✓ Fruit and vegetable scraps
- ✓ Fresh lawn clippings
- ✓ Tea leaves and coffee grounds
- ✓ Manure from cows, sheep, alpacas and chickens
- ✓ Egg shells

Carbon-rich products (browns)

- ✓ Dried leaves and dry grass clippings
- ✓ End-of-season vegetable plants
- ✓ Small twigs and sticks (no thicker than your thumb)
- ✓ Paper towel and cardboard
- ✓ Shredded paper
- ✓ Contents of your vacuum cleaner bags

AVOID these ingredients

- ✗ Manure from carnivores (e.g. cats and dogs)
- ✗ Meat scraps
- ✗ Vegetable fats and oils
- ✗ Weeds that you don't want to sprout again in your garden
- ✗ Dead plants, or weeds and plants that have been sprayed with pesticides
- ✗ Dairy products
- ✗ Treated timber
- ✗ Plastic

Figure: Table shows list of nitrogen and carbon materials and what to avoid

Rates of nitrogen and carbon in composting materials are detailed in the tables below.

Nitrogen rich products ('greens')	High	Medium
Fruit and vegetable scraps	✓	
Manures (cow, sheep, guinea pig)		✓
Manures (chicken, duck)	✓	
Coffee grounds		✓
Grass clippings	✓	
Garden waste	✓	
Hay		✓

Carbon rich products ('browns')	High	Medium
Dry leaves		✓
Dried grass clippings		✓
Wood chips	✓	
Cardboard	✓	
Shredded paper	✓	
Straw		✓
Sawdust	✓	

Figure: Chart showing rates of nitrogen and carbon in composting materials

Microbes and creatures

Picture: Worms are an important part of the composting process

Microorganisms are important in the decomposition process. Each organism plays a different role depending on the type of material and stages of the compost process.

Most of these microorganisms are difficult to see with the naked eye.

Actinomycetes

A fungi-like bacteria that form long cob-web like threads throughout the soil. They keep the various other bacteria in the soil in balance and break down the tough, woody materials in the compost. They are responsible for the 'earthy' pleasant smell of finished compost.

Bacteria

Different types of bacteria dominate at different stages of the composting cycle as conditions change. The ideal type of bacteria for successful composting are aerobic bacteria as they hasten the process and excrete plant nutrients such as nitrogen, phosphorous and magnesium. Bacteria consume carbon for energy and nitrogen to build protein. They oxidise the material which causes the compost to heat up. This type of aerobic bacteria starts to die if the oxygen levels drop below 5%. If this happens anaerobic bacteria take over and produce low quality nutrients and ammonia-like substances, hydrogen sulphide (gas that smells like rotten egg), cadaverine and putrescine which all create bad odours.

At the beginning of the compost process mesophilic bacteria predominate, producing acids, carbon dioxide and heat, and are then overtaken by thermophilic bacteria once the temperatures get over 40^{0}C. Their populations start to decrease after it reaches 60^{0}C. Mesophilic bacteria take over once again during the compost maturing or curing process.

Fungi

These include moulds and yeasts which provide the initial break down of the tough components. They remain active during both the mesophilic and thermophilic phases.

Macro-organisms

These larger decomposers include various insects such as ants, mites, millipedes, centipedes, springtails, slaters, flies, beetles, snails, slugs and spiders as well as earthworms, nematodes, and various types of larvae. They consume parts of the compost material, as well as the bacteria and fungi present and aid in aerating and mixing the material.

Activators

Compost can be accelerated by adding an activator or inoculator. Activators are usually materials which are high in nitrogen. However, they also contain components which stimulate the bacteria in the mix. Common activators include manures, coffee grounds, comfrey leaves, yarrow, spent flowers, soil, finished compost, blood and bone and urine.

Moisture and aeration

Moisture

Adequate moisture content in the compost is vital to feed the microbes. Dry patches in the mix will slow the decomposing process down. Ideally it is better to dampen all the ingredients before adding them to the compost as it is harder to dampen them afterwards. Protect the compost from the sun and rain to prevent it from becoming too dry or too wet.

If the compost is too wet, it may become anaerobic and start to smell. In this case bulking materials such as wood chips or screwed up paper may help.

Leachate is the term used to describe the liquid that seeps out of the bottom of the compost. This is rich in microbes and nutrients and can be added back into the compost to help speed the process along.

Tap water in Brisbane contains chemicals which may kill some of the microbes in the compost. If the compost is too dry, consider adding liquids such as:

- stale beer, juice or other drinks
- sour milk
- cooking water
- grey water
- water from a vase.

In addition to reducing waste, the liquids will contain added nutrients and microbes.

Aeration

Along with adequate moisture, carbon and nitrogen materials, the decomposers in compost need adequate oxygen.

To aerate your compost:

- Place a layer of sticks at the bottom of the compost pile to create air pockets.
- Dampen materials before adding them as water poured on top can squeeze out air.
- Insert a pipe with holes drilled in it into the compost to allow air to passively enter the compost pile.
- Turn the compost with a pitch fork or screw-type aerator.
- Physically agitate the compost (tumbler or machine).

Larger or 'hot' compost systems require turning more often as the microbes use up the oxygen faster than 'cold' systems. Most small backyard type compost systems only need to be turned about every two weeks. For hot composting systems it should be turned every three days until it has finished heating up and then only turned once or twice after that until it is cured. This allows the microbes to get established.

Picture: Aerating compost

Hot composting vs cold composting

Most backyard composting is generally considered to be cold composting. This is due to the fact that the temperatures reached in the compost do not get very high. The material is added gradually and breaks down slowly. This method is suitable for most backyard composting situations as it is easy to maintain, is a continual feed system and does not take up much space.

Hot composting has the advantage of producing finished compost far more rapidly than cold composting and also kills most weed seeds and pathogens in the process due to the high temperatures. In order to create a hot compost, the receptacle (usually a compost bay) must be a minimum of $1m^3$ and all the material must be added at once. This means that enough nitrogen and carbon material must be stockpiled prior to setting up the bay and therefore it is not a continuous feed system. Once the pile has been constructed no further material can be added. For this reason, many people have a 3-bay system so that while one bay of material is composting, a new one can be started and a continuous supply of compost is ensured.

Picture: Large compost bays allow for temperatures to build up

How to build hot compost

1. Build a bay from pallets, old gates, straw bales or other materials, which allow air to flow through. Allow a minimum space for the compost of 1m^2 .
2. Dig drainage to direct the leachate away from waterways, vegetable patch or pathways.
3. Collect carbon and nitrogen rich materials to completely fill the bay. You may need to ask your neighbours for grass clippings, collect coffee grounds from the local café or scraps from the local fruit shop to make up the volume.
4. Place a layer of sticks in the bottom and then add alternating layers of carbon and nitrogen materials. The carbon layers should be thicker than the nitrogen layers. Ensure the materials are already damp.
5. Between every few layers add an activator to add microbes into the mix.
6. If you are using a pipe with holes in it to add air to your compost put this in at an early stage and build the compost around it.
7. Once the pile is a minimum of 1m^3 place a protective cover over it such as a lid or piece of sacking or plastic and leave for three days.
8. If material has started heating up after three days turn it thoroughly ensuring that the outer parts of the compost move to the middle of the pile. Check the moisture level at this stage too. Material should be slightly damp, but not soaking wet.
9. Continue to turn the compost every three days until it starts to cool down then leave it for a few weeks. Turn it again and check its progress.

Solving composting problems

Problem	Cause	Solution
Smelly compost	Compaction causing anaerobic bacteria to take over	Turn the compost to add oxygen.
	Compost too wet causing compaction	Turn the compost and add material such as balled newspaper to soak up some of the moisture. Check that the compost is sheltered from rain.
	Too much nitrogen (smell of ammonia)	Add carbon materials to correct the balance.
	Rotting meat, oils or fats	Remove them from the compost.
Slow to break down	Not enough nitrogen material	Add material with high nitrogen content such as comfrey, fresh grass clippings or manure.
	Not enough active ingredients	Add material with high nitrogen and microbial content such as comfrey, manure, fresh grass clippings, soil or compost.
	Not enough air	Turn more regularly.
	Compost too dry	Wet materials before adding to compost or add more liquids to compost. Ensure there are no dry patches and there is enough protection from the sun.
Finished compost too coarse	Particle size too large	Chop material up before composting or sieve it after completing.
Pests – maggots/ cockroaches* etc **See more info below**	Ingredients such as meats or fats in compost	Avoid meats or fats in compost. Cover maggots with garden lime. Cover each layer of food scraps with carbon material. Turn more regularly to prevent food waste rotting before it breaks down.
Pests – mice or rats	Rodents can access compost	Put fine wire mesh under the bin.
	Rodents nest in compost	Turn compost more regularly. Create a hot compost. If rodents are present spray them with a hose to make them leave.
	Excess grains and bread in compost	Avoid adding grains and bread.
	Compost too dry	Add more water until compost is damp throughout.

Cockroaches

In Australia there are more than 450 different species of cockroaches and most of them are native. Almost all cockroaches found outside the home are native and are helpful in the composting process. They aerate, break the pieces up into smaller particles and provide manure. If they are getting out of hand, turn the compost more frequently to disrupt their nests and add moisture to the mixture. If you have chickens even butcher birds or magpies nearby, leave the lid off the compost bin for a couple of hours and allow them to pick through the compost for a feed

You can also try adding some garden lime, dolomite or wood ash or a little diatomaceous earth. Diatomaceous earth is a naturally occurring soft siliceous sedimentary rock that is sold as a fine white powder and acts as a repellant for hard-bodied insects.

Picture: Native cockroach

Other factors that may contribute to the success of your composting

- **Particle size** – large (especially woody) chunks will take a long time to break down. By adding smaller materials to your compost, you will achieve a more consistent texture overall. Use a shredder, machete, or lawn mower to reduce the feedstock particle size. For industrial scale compost systems use large shredders and grinders.
- **Quality of the materials** – a wide variety of materials with high nutrient content will produce a good quality product.
- **Types of carbon materials** – oily leaves such as eucalyptus and pine can slow the composting process down so try to minimise their use or age them first.
- **Leachate** – this is the liquid that seeps out of the compost and can attract flies or cause odours if it leaks out of the compost area. Most importantly, it should not get into drains or waterways. Most leachate will be absorbed into the ground but if it does leak, dig channels to redirect it back in to the compost and cover the surrounding soil with mulch to absorb the leachate. Cover it with mulch or dried grass clippings to reduce odors.

Maturing the compost

It is important to completely cure or mature your compost before using it. Immature compost can damage plants because it uses too much oxygen and nitrogen from the soil. The compost is considered mature when most of the original materials have completely broken down and it has a rich earthy smell with a crumbly texture. It should no longer be able to heat up even after stirring it. You may still be able to see large or woody items such as avocado seeds as these will take years to break down. Remove any large pieces from the finished compost and keep it protected from sun and rain. Allow a minimum of four weeks and up to four months to fully mature the compost after you have stopped adding materials.

Once the compost has finished maturing it can either be used straight away or sieved using a sieve or trommel, depending on its intended use.

Picture: Finished compost

Using compost in the garden

Finished compost can be applied directly to the soil by spreading around plants and trees up to 40mm deep. It can also be used as a potting mix or mixed with commercial potting mix to improve it. To prevent your potting mix from drying, cover it with mulch.

Picture: Compost being used as potting mix

Fresh compost also makes a good seed-raising medium but needs to be sieved to a fine consistency. Placing pockets of compost around the garden for planting seedlings is an effective way to make the compost go further.

Picture: Sieving finished compost

Erosion control

Compost can help prevent erosion by:

- increasing the amount of water entering the soil
- increasing soil water-holding capacity
- providing ideal growing environments for seedlings to become quickly established
- binding particles together
- filtering sediment.

For sites requiring greater remediation like construction sites, using compost for rehabilitation has been found to be much more effective than using silt fences. There are two ways to use compost for erosion control: compost blankets or mats and compost filter berms or swales.

Compost blankets—are thick applications of compost directly onto disturbed soil. The compost is a mix of fine and coarse materials to provide protection for the soil underneath and a place for new seedlings to be able to sprout.

Compost 'swales' or 'berms'—are dikes of compost, either self-supporting or contained with permeable socks and are used for steeper slopes.

Health and safety

As the process of composting involves decomposing matter it is important to ensure your safety at all times. By following these health and safety precautions you should have no adverse reaction from composting:

- Identify all potential hazards on your site and develop an operating procedure to manage them. Provide a safety induction for any people working on site.
- Always wear gloves, especially if you have cuts or abrasions on your hands.
- Wash hands after handling compost even if you have been wearing gloves.
- Be mindful of sharp objects in the compost - report any sharps to the relevant people if you are working at a public site.
- If you injure yourself while working with compost, ensure you wash the area thoroughly, apply antiseptic cream and cover. If symptoms such as itchiness or redness persist, seek medical advice.
- Do not add pet faeces, meat or plate scrapings from sick people to your compost as these may carry human disease-causing organisms unless you are confident you are able to maintain temperatures higher than 55 degrees for 4 or 5 days.
- If you see signs of rodent infestation, act to remove them and prevent them from returning so that they do not bring in disease.
- Dampen compost before turning it or using it in the garden to reduce compost particles becoming airborne.
- People with weakened immune systems, allergies or respiratory conditions should use caution when handling compost by wearing a mask and gloves.
- Wear enclosed shoes when handling tools to protect your feet from injury.
- Rinse tools after working with compost so that potential pathogens from immature compost is not spread to mature compost or your garden.
- Use separate tools for composting and gardening to prevent pathogens being spread between the two.
- Ensure finished compost is left to sit for as long as possible before using to ensure any potential harmful microbes are neutralised.
- Wear sunscreen and a hat when working outdoors to protect yourself from the sun.
- Ensure you consume plenty of fluids when working in the garden to prevent dehydration.

Picture: Always use appropriate equipment

Chapter 4: Animals in the compost system

Earthworms

It is estimated that there are about 80 foreign species of worms in Australia. These arrived in the pot plants of settlers over the last 200 years. In addition, there are approximately 1000 species of native worms in Australia but they are rarely seen and little is known about them. The native species that is most often seen in South East Queensland is Digaster longmani, which can grow to two metres. However, the Giant Gippsland Earthworm, Megascolides australis, recorded from Gippsland, Victoria can grow to four metres.

Earthworms are extremely beneficial to soils and plants. Their gut is full of beneficial bacteria and enzymes that they transfer via their manure. These bacteria convert minerals into a soluble form and break down cellulose into humus. In addition, their burrowing action brings oxygen into the soil and provides holes for rainwater to enter. The burrows also become lined with a mucus the worms exude, containing nitrogen-rich nutrients. The soil takes on a honeycomb-like quality making it ideal for plant roots to grow. As rainwater flows through the burrows, the mucus is dissolved and taken up by the plants.

You can increase the number of worms in the soil by creating conditions that attract them to your compost or garden. Follow these tips to maintain ideal conditions:

- the soil should not dry out. Consider using grey water in your garden.
- the soil should be covered with mulch at all times
- do not use chemical pesticides or fertilisers
- avoid tilling the soil
- keep adding organic matter to the soil.

For more gardening tips for Brisbane, download the Green Gardening Guide.

Composting worms

Composting worms are a group of worm species chosen for worm farming because of their ability to rapidly consume large amounts of food waste and breed quickly. The most common species of compost worms are:

- Tigers (*Eisenia Fetida*)
- Reds (*Eisenia Andrei*)
- Blues (*Perionyx Excavatus/Spenceralia sp.*)
- European Night Crawlers (*Eisenia Hortensis*).

Picture: Worms can get through large amounts of food

Name	Description	Size	Photo
Tigers (Eisenia Fetida)	Brown with yellow stripes	Up to 130 mm	
Reds (Eisenia Andrei)	Similar to Tigers but darker in colour and the stripes are less obvious	Up to 130 mm	
Indian Blues (Perionyx Excavatus/Spenceralia)	Have a blue sheen in the light	Up to 75 mm	
European Night Crawlers (Eisenia Hortensis)	Dark pink or red in colour	Up to 260 mm (about 2x size of reds)	

About worms

Worms have segmented bodies with sensitive hairs to help them move through the soil. Worms do not have eyes but are quite sensitive to light, chemical changes and touch. They breathe through their skin as they do not have lungs and constantly secrete mucus to remain damp to prevent drying out and suffocating.

As the worm moves through the soil it ingests organic matter and this is pushed through the worm's digestive tract with its strong muscles. Worms do not have teeth and instead keep a few grains of sand in a gizzard where the material can be ground up into smaller pieces. As the food passes through the worm's body it is lubricated and then mixed with calcium carbonate to neutralise the acids found in the rotting vegetation. Enzymes help to break down the food before it goes into the worm's intestine where beneficial bacteria consume the food and in doing so convert it into a form the worm can absorb as nutrients. The waste that leaves the worms body is called castings and are basically the soil particles which the worm did not absorb. These castings are enriched with nutrients, beneficial bacteria and neutralised acid.

Worms are hermaphrodites, which means that they have both male and female parts in their bodies and are capable of self-fertilisation. Despite this, worms usually mate and mutually exchange sperm to fertilise their own eggs. The eggs are then matured inside the clitellum or 'saddle' which is a swelling around the worm's body. Fertilised eggs are encased in a capsule which is then deposited into the soil where they then start hatching after a few weeks, depending on conditions. There are generally about four worms in each capsule.

Picture: worm and worm capsules

Picture: Close-up of a worm capsule containing developing baby worms

Worm farming

Worm farming can be done on a small, medium or industrial scale and has the potential to process some problematic components of the waste stream due to the worms' ability to neutralise and break down chemical bonds.

Small-scale worm farms can be bought or home-made. Larger scale worm farms are also available for sale but containers such as baths also make excellent worm farms. On an industrial scale, worm farms can fill whole warehouses and are useful in settings such as abattoirs or food processing factories.

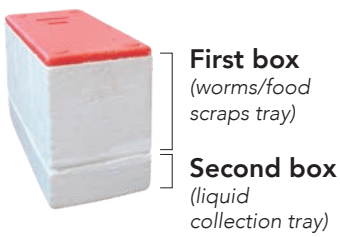
Worm farms need to be protected from heat and should not be kept in the sun. The worm bedding should be moist but not flooded to allow the worms to breathe.

How to make a home worm farm

You will need:

- two polystyrene boxes, such as broccoli boxes (one should have a lid)
- a piece of fly screen to fit in the bottom of the box
- a piece of hose or tubing about 5 cm long.

Materials needed



Guide to box setup

Method:

1. Take your first box and use a screwdriver or pen to make airholes in the lid for airflow, and holes in the bottom for drainage. Make sure the holes are evenly spaced.
2. Take the second box and use a sharp knife to cut it in half horizontally. Remove the top half of the cut box as it is not needed for your worm farm.
3. Place the remaining bottom half of the box so it fits neatly under your first box. This smaller lower box will act as the liquid collection tray for the worm leachate generated by your worm farm, while the larger upper box will be the tray for your worms and food scraps.
4. Tape your upper and lower box sections together so they don't topple over easily.
5. Spread the insect screen in the bottom of the upper tray over the holes that you made in step one. This will stop the worms from falling through into the liquid collection tray below.
6. Make a hole at one end of the lower tray to insert the hose or tube for drainage. Place a container under the hose outlet to collect the liquid. Congratulations, you've just built a worm farm!

Picture: Example of home made worm farm

Setting up a worm farm

1. For purchased worm farms, begin by lining the upper tray with a few sheets of damp newspaper or cardboard. This step is not necessary for homemade worm farms as the fly screen prevents worms falling through the holes.
2. Add a 5 cm layer of bedding material to your upper tray such as coir peat (coconut fibre), shredded paper, rotted manure, compost, or mulch. Soak this material before you add it to your worm farm.
3. In the upper tray of your worm farm, add a minimum of 1000 worms (at least three to four decent sized handfuls if getting them from a friend). Worms breed very quickly and double their population every three months, so don't be afraid to give worms away to other new worm farmers. Compost worms can also be bought online.
4. Place your worm farm in a cool, shaded area as worms don't like heat. Even a little sun can cook them! Worms enjoy a dark and moist environment, so keep a thick layer of damp newspaper, hessian or carpet on top of the food waste to encourage the worms to come to the surface to feed. If using newspaper, your worms will eventually eat it so replace it as necessary.

Picture: Worm farm

Feeding your worms

Feed your worms in the upper tray, underneath the layer of newspaper. You can feed your worms every day or less frequently if feeding larger quantities. Worms will eat approximately half their body weight in food per day. A standard-sized worm farm will cater for food scraps from about two to three people. If you produce a lot of food waste, you may need to use a compost bin to take care of the rest.

Compost worms eat almost all of the materials you would add to a compost heap. However, there are a few items that worms don't like to eat including:

- fresh citrus products such as orange and mandarin peel
- fresh onions and garlic
- chilli
- meat
- bread and dairy products – these are OK in small amounts but otherwise may attract cockroaches. Dairy products may also cause your worm farm to become smelly.

The smaller the food scraps are when you add them, the faster the worms will get through them. If you are going away on holidays, fill an entire separate tray with harder vegetables, such as celery, pumpkin, carrot and broccoli stems, and the worm farm will be fine to leave for up to two months. Place the food in a different part of the worm farm each time to encourage the worms to move throughout the whole area. You can also cover the food with a small amount of the bedding material each time or wrap the food in a piece of newspaper or paper bag and add the whole thing to the farm to prevent smells and vinegar flies.

Harvesting the castings

As the worms consume the food in the upper tray, they produce castings that resemble dark soil. If you have a homemade worm farm, exposing the castings to the sun will cause the worms to burrow away from the sunlight. You can then scrape off the top layer of castings for use. For purchased worm farms, you can add another feed tray to your worm farm. Simply add some food to the new tray and cover with a new thick layer of damp newspaper, cardboard or hessian. The worms will move up to the new tray when there is no food left in the first tray. This may take several months. Once the worms have migrated to the new tray, you will be able to harvest your castings, which will be full of rich nutrients for your garden.

Using worm castings

Compost or castings can be used in a variety of ways, including:

- mixing an equal amount with garden soil to make potting mix
- digging it into the top four to six inches of soil in your garden beds before planting
- digging it into your established garden beds, taking care to keep it away from plant stems
- using it as a top dressing for your lawn.

Worm leachate

The liquid that accumulates in the bottom tray, sometimes called 'worm tea,' is actually leachate or seepage from the worm farm. This can be diluted until it is the colour of weak tea (approximately 1:10 ratio) and used as a fertiliser. Real 'worm tea' however, is made using actual worm castings soaked in a bucket of water and molasses, aerated using a fish tank bubbler or similar for at least 24 hours. The aeration prevents the mixture from becoming anaerobic and the molasses feeds the microbes in the castings, creating a rich and potent addition to the garden.

Solving worm farm problems

Problem	Cause	Solution
Smelly	Too much food	Reduce food
		Add more carbon material such as shredded paper or cardboard
	Not enough worms	Add worms
	Not enough oxygen	Aerate by stirring
	Too acidic	Add dolomite or garden lime
	Wrong food materials added	
Slow to break down	Food pieces too big	Cut food into smaller pieces
	Too much food	Reduce food
	Cold weather	Feed less during cold weather
	Not enough worms	
Other creatures in worm farm (Worm farms are ecosystems and it is normal for small insects to appear. They will help with the decomposition.)	Other creatures attracted by food	Place feet of worm farm in bowls of water or wipe Vaseline on the legs to deter ants
		Stir food in or 'pocket feed' - covering food over with carbon-rich material
		Add extra water if dry
Vinegar flies around worm farm	Too much food	Reduce food
	Exposed food	Stir food through
Worms are dying	Too wet	Add shredded paper
	Too dry	Add water, place in shade
	Not enough food	Feed more often

Composting with black soldier fly larvae

Picture: Adult Black Soldier Fly (hermetia illucens)

Picture: Black Soldier Fly larvae

The Black Soldier Fly (BSF) often lays its eggs in backyard compost bins and when they hatch into squirming larvae, many people think something has gone wrong with their composting system. This is not the case. BSF larvae, unlike maggots from house flies, do a great job of consuming organic waste and should be welcomed into a compost bin. The adult black soldier fly is not harmful to humans – it does not bite or spread diseases inside the house.

Its adult stage is about five to nine days long and in that time the female lays 600-800 eggs near rotting material. When the larvae emerge, they fall into the material and consume it (up to twice their body weight in one day) until they are mature. This stage is about two weeks long.

Black soldier flies thrive in Brisbane's hot and humid environment. There is no need to purchase them as they tend to just appear in backyard compost systems. They don't breed through the cooler months.

There are many designs for specific BSF larvae farms but in general the farm should include:

- working area for the larvae to live and eat
- entrance for the adult BSF to get in and lay her eggs
- lid to protect the larvae from sun and rain
- opening to provide food
- drainage
- exit for mature larvae to get out
- access to the farm to occasionally empty the compost if it becomes too deep and threatens to suffocate the larvae.

Many people use BSF larvae in combination with other animals such as poultry, reptiles or fish. Larvae can be fed straight to the animals as they are very high in protein (about 42%), fat (about 30%) and essential vitamins and minerals, especially calcium which is vital for producing strong egg shells.

100 FLY FARMS SET TO TACKLE WASTE CRISIS AND HELP SAVE THE SEAS

Partnership heralds first serious challenge to use of fishmeal in animal feeds.

WASTE-to-nutrient pioneer AgriProtein has partnered with international engineering group Christof Industries to build up to 25 fly farms a year up-cycling organic waste into insect protein for animal feeds.

Using a high-tech blueprint developed with Christof Industries, AgriProtein plans to roll out 100 factories by 2024 and a further 100 by 2027 (200 in total). The USD 10 million partnership will help bring insect protein into the mainstream of feeds used in aquaculture, poultry farming and pet food.

Fishmeal production is considered destructive to the environment and insect protein a more sustainable alternative. AgriProtein rears fly larvae at an industrial scale on organic waste and harvests the larvae to make natural, high-protein feed products. The process diverts huge volumes of organic waste from landfill, helping tackle local waste management issues.

CEO Jason Drew said: "Organic waste accounts for nearly half of all solid municipal waste. Disposing of it to landfill is a costly environmental hazard, which is why countries are setting reduction targets or banning it altogether. A fly farm located close to a city absorbs the weight of a typical cruise ship in organic waste per year to rear fly larvae, reducing the volume, pollution and cost of landfill."

Other animals that contribute to composting

Pets

The manure and bedding from chickens, ducks and guinea pigs can be regularly added to compost piles as an activator and source of carbon and nitrogen. Replace with fresh carbon material for their bedding such as straw, grass, leaves and shredded paper. This will absorb any urine or liquid from the manure and also provide a carbon content to the mix.

Chickens are great organic recyclers and in return provide manure, eggs, feathers and possibly meat. They can be given leftover fruit and vegetable scraps (especially leafy greens), meat scraps and grains. To prevent attracting rodents, it's important to clean up any uneaten food daily. Like humans, chickens don't like everything they are given to eat. Carefully observe what they do not eat and do not offer it again. Click here for more information about keeping livestock in Brisbane.

Some items are harmful to chickens and should never be given to them. These include:

- rhubarb
- avocado
- onions and garlic
- citrus
- mouldy food
- poisonous weeds from the garden
- sugary food.

Picture: Chickens are great organic recyclers

Ducks are another type of poultry suitable for backyards and help to recycle organic waste into manure and eggs.

Some items are harmful to ducks and should never be given to them. These include:

- citrus
- spinach
- iceberg lettuce
- potatoes, tomatoes, eggplant, chili and capsicum
- uncooked dried beans
- corn
- onions and garlic
- avocado.

Guinea pigs will happily eat fruit and vegetable scraps and are a great source of fun for their owners.

Some items are harmful to guinea pigs and should never be given to them. These include:

- cereals and grains
- nuts and seeds
- corn
- beans and peas
- potatoes, tomatoes, eggplant, chili and capsicum
- avocado
- onions and garlic
- beetroot
- mushrooms
- sugary food.

Dogs will happily eat many kitchen scraps and help reduce the amount of household food waste disposed of in landfill.

Some items are harmful to dogs and should never be given to them. These include:

- cooked bones
- onions, chives and garlic
- chocolate
- caffeine products
- mouldy or spoiled food
- avocado
- bread dough
- grapes, raisins or sultanas
- nuts, especially macadamia nuts
- mushrooms
- fruit seeds
- corn cobs
- unripe tomatoes.

Using manures

- Animal manures are good sources of nitrogen, phosphorous, potassium and other nutrients that plants need to thrive, although these are highly variable depending on the animal's diet and other factors. Different manures are often referred to as either 'hot' or 'cold' which is based on the level of nitrogen in the manure. Hot manure should not be used directly on gardens as it can burn plants from the high amount of ammonia it produces. With all manure, however, it is highly recommended that it is composted before putting it on your garden in order to kill parasites, pathogens and weed seeds.
- Fresh manure has a very strong smell that is reduced or eliminated after it has been composted.
- Composted manure has a crumbly consistency making it easier to shovel and spread.
- Composting the manure converts its nitrogen into a form that makes it available to plants.
- Without composting the manure, much of the nitrogen it contains is lost to the atmosphere.

Chicken manure

Chicken manure has a very high nitrogen content and is therefore very hot. Once it has been composted it will no longer burn plants.

Duck manure

Duck manure is not as hot as chicken manure but is also a useful addition to the compost. Compared to chickens, the quantity of manure from ducks is much greater and it also contains more liquid which means it breaks down quicker.

Cow manure

Cow manure is considered cold manure, which means it contains less nitrogen than most other manures, but it is still useful to add to compost for structure and to add microbes.

Picture: Herd of cattle

Guinea pig manure

Due to their small size, guinea pig droppings break down quite quickly in compost. This manure is high in nitrogen and considered a 'hot' manure. The bedding is a good source of carbon and can also be composted.

Picture: Guinea pig

Dog and cat manure

Avoid these in your general compost as they can contain parasites and pathogens that are dangerous for humans. A separate compost must be created for managing pet waste and the finished compost should not be used on food gardens. An easy way to manage dog and cat manure is to half bury a bucket with a tight-fitting lid and the base removed into the soil. Each time you add the faeces, cover it with a carbon-rich material such as dry leaves. Eventually it will break down and disappear into the soil.

Chapter 5: Other organic recycling methods

Fermentation systems (Bokashi)

This is an anaerobic method for recycling organic waste and is well suited to people in apartments but is also useful for households in general to manage their meat and dairy waste.

A special mixture of Effective Microorganisms (EM) is spread over the waste to initiate the fermenting process. It is important to limit exposure to air because preferred bacteria require an anaerobic environment. Each time waste is added, it needs to be pressed down, covered with EM and then covered with a piece of cardboard or a heavy plate.

All food scraps including meat, dairy, bread and fruit and vegetable scraps can be added. The fermentation system and EM create an acidic environment inside the bucket. The material is prevented from rotting and therefore does not produce odours. The liquid produced can be heavily diluted and used as a plant fertiliser or undiluted it can be poured down the sink as a natural drain cleaner.

Once the bucket is full, it needs to be left for a further two weeks before emptying. The process inside the bokashi bucket is only the first stage and it then needs to either be buried in the soil or composted for the next part of the process.

Trench composting

Many people in sub-tropical and tropical countries simply bury their organic waste directly in the soil. The material is quickly consumed by worms and other lifeforms in the soil and converted into a rich humus. This method is particularly good for compacted areas such as an old lawn or pathway.

Dig a trench or hole at least 45 cm deep and alternate layers of food scraps and carbon-rich material. Cover with soil and finish with mulch. Do not plant in that area for a few months.

Advantages

- Simple and easy to set up composting system that requires little in the way of infrastructure.
- Helps to improve and break up damaged and compacted soil.

Disadvantages

- If the waste is not buried deep enough it can attract rats and possums.
- The waste breaks down anaerobically – producing methane (a potent greenhouse gas).
- Decomposition is fairly slow.
- There is a risk that you may be introducing plant disease into your soil.

Worm tubes

Worm tubes are a great way to add nutrients to raised garden beds or plant pots. They consist of a piece of PVC pipe or bucket without a base and a tight-fitting lid. Tubes are buried in the garden and fruit and vegetable scraps are placed inside the tube.

You can either add worms to the tube or wait for earthworms in the garden to find the nutrients.

Picture: Worm tubes

Mulch

Picture: Mulch is used to cover soil

Mulch is any sort of organic material that is used to cover the soil. Many different materials can be used including compost, dry leaves, wood chips, straw, hay, grass clippings or even rocks. Place a 10cm layer of mulch around the base of your plants away from the stems to avoid fungus and rot damaging the plant. Fresh grass clippings should not be used as a mulch around trees as they can burn surface roots when they heat up. Mulching has many benefits for soil including:

- prevents soil drying out
- prevents weed germination
- keeps soil temperature constant
- adds organic matter.

No-dig gardening

Sometimes called 'lasagna gardening', no dig gardening is a way to utilise the composting process to create a new garden without having to dig into the soil. Carbon and nitrogen material is layered directly onto the soil to create a raised garden for planting. To avoid vermin, minimise how much food material is used as your nitrogen component.

Grasscycling

Grasscycling simply means allowing mown grass to fall back to the ground instead of catching it and taking it elsewhere. This should only be done if the grass is not long as the long grass will smother the growing grass. During the season of fast growth, it should be mown twice a week and only when dry. Always ensure the blades are sharp. Grasscycling cuts down on the amount of water needed by the lawn as the small pieces of grass limits moisture evaporation from the soil and provides fertiliser as the nutrients from the cut grass are returned to the soil.

Picture: Grasscycling

Leaf mould

Leaves with pungent oils such as eucalyptus, pine or camphor should only be used in small amounts in compost because they break down very slowly. Instead, consider making a leaf mould to use as a rich soil conditioner.

If possible, mow the leaves first to reduce their size and pile them up in the corner of the garden or a specific compost bay. You can add some blood and bone or seaweed emulsion and wet through thoroughly. Turn a few times until the leaf mould stops heating up and then leave it for a few months until it forms a rich dark crumbly humus.

Chapter 6: Industrial-scale composting

Windrow composting

Material is placed in low rows called windrows which are regularly turned for aeration – moving the material from the bottom to the top of the pile. Windrows can be either indoors or outdoors. Some operators use specially designed machines to turn the compost while others use front-end loaders or bucket loaders on a tractor.

Advantages

- Large amounts of compost can be produced relatively quickly (up to about 16 weeks).
- All parts of the pile compost evenly as the material is regularly turned.
- Relatively low cost to set up.
- Simple to operate.

Disadvantages

- Requires specific machinery for turning.
- Requires fairly large areas of land.
- Leachate needs to be managed to prevent contamination to waterways.
- Odours need to be managed.
- Generates dust.

Picture: Crawler style compost turner

Aerated static pile composting

Most often aerated static piles are large industrial scale compost systems but the principle can also be applied to small-scale systems. Air is forced into a series of pipes which run through the compost mixture. Turning the pile is therefore not required as this provides oxygen (positive pressure aeration). Some operators use a passive or negative pressure aeration – the air is drawn through the pile due to the chimney effect as the hot gases rise. The most successful systems utilise both positive and negative pressure.

Advantages

- Large amounts of compost can be produced relatively quickly (but slower than turned windrows).
- Does not require turning.
- Temperatures can be controlled.

Disadvantages

- The outer layer of the compost can easily dry out so moisture content needs to be continually monitored.
- Requires electricity or other source of energy to power air blowers.
- Pipes can become clogged during the process.
- Leachate and odour management.

Picture: Active aerated static pile

Picture: Passive aerated static pile

In-vessel

Picture: In-vessel composting

The composting process occurs inside a vessel of some kind and with accurate temperature control and monitoring. The material is processed within a few weeks inside the vessel but still requires a maturation period of weeks or months outside. In-vessel composters vary from small systems suitable for restaurants to large industrial size. Some of the different types of in-vessel composting systems include:

- containers
- silos
- agitated bays
- tunnels
- rotating drums
- enclosed halls.

Advantages

- Does not take up as much space as windrows.
- Requires much less physical management.
- Particularly suitable for composting food waste.
- Odours and leachate are easy to manage.

Disadvantages

- More expensive.
- Requires technical expertise.

Anaerobic digestion

On an industrial scale, anaerobic composting or digestion is used to generate electricity. Biodegradable waste and sewage sludge are composted without oxygen to produce biogas (composed mostly of methane and carbon dioxide), which can be used as fuel. Anaerobic digestion is widely used in Europe but is relatively new in Australia.

An extremely acidic environment is created during anaerobic digestion with 30–60 of the solids converted into biogas. The leftover solids, or digestate, are used as fertiliser.

Picture: Biogas plant in action

Advantages

- Reliable source of renewable energy.
- Byproducts provide further income.
- Can take a wide variety of feedstock.
- Suitable for medium to large scale situations.

Disadvantages

- Expensive to establish.
- Requires a lot of maintenance and operational involvement.
- Requires a constant source of feedstock.

Chapter 7: Public education and behaviour change

Composting is a relatively easy activity which gives people the opportunity to make a real difference to our environment. As a Master Composter you will be actively championing and promoting composting in the community and working to increase the amount of composting in Brisbane.

Successful community-based public education and behaviour change initiatives are based on a few simple strategies:

- building on what people already know
- providing the necessary skills
- addressing the cause of an issue
- working collaboratively to find solutions to problems
- identifying what motivates people and supporting them
- identifying the barriers and working to break them down
- interactive community-based engagement with the topic
- hands on activities
- accepting failures and challenges as useful learning tools
- Helping participants to visualise a positive future celebrating and building upon successes.

Designing workshops, displays, events and ongoing programs with these features in mind will help achieve deep, meaningful and long-lasting behaviour change.

Volunteering opportunities

There are many ways to volunteer in the community to promote composting awareness and education.

Consider these possibilities:

- managing or volunteering at a community composting hub
- providing a compost trouble-shooting phone, email or online service
- running compost workshops at schools, aged care facilities or other community locations
- assisting with setting up and maintaining a compost system in an apartment block, school or workplace
- setting up a compost demonstration site with examples of different composting systems such as compost bins, tumblers, bays or other systems such as worm farms or worm towers.
- developing portable display materials or exhibit for use at fetes or other events
- running neighbourhood compost working bees at community gardens.

Workshops

Workshops on gardening related topics are very popular and can be held in a variety of locations:

- gardening clubs
- libraries
- community gardens
- schools, early learning centres, vacation care
- aged care facilities
- groups such as Scouts, Guides and other clubs
- prisons, hospitals or other institutions
- garden centres
- cultural centres
- parks
- shows and events.

Picture: Encourage people to get involved in compost workshops

Apart from the standard compost and worm farm workshops consider running short workshops targeting specific seasons or niche areas.

Here are some ideas to get you started:

- grasscycling (summer)
- making leaf mould (autumn)
- hot composting (winter)
- composting for flower gardens (spring)
- bokashi and/or worm farming for small spaces
- worm farming for kids (or adults)
- compost mini-beasts for kids (or adults)
- making compost teas
- composting pet waste.

It is important to remember when running workshops that people need to physically participate in the activities to learn new skills rather than passively listen to the information.

Displays and exhibits

Picture: Displays are a great way for participants to interact

Setting up displays and exhibits at events, including school fetes, country fairs and cultural festivals, can be a particularly effective way to interact with large amounts of people without having to spend anything on advertising. A display can be combined with a workshop or practical activity. Competitions, giveaways and interactive activities will help attract people to find out more. Some suggestions include inviting people to hold a worm, encouraging them to smell sweet matured compost or the chance to win 500 worms, a bag of compost or a worm tower.

Picture: Kids love holding worms

Special dates and events

Relevant special dates can provide focus points for displays and information stands. Yearly special dates include:

- Earth Day – 22 April
- International Compost Awareness Week – first full week in May
- World Environment Day – 5 June
- World Food Day – 16 October
- World Soil Day – 5 December.

Some events in and around Brisbane that may provide a suitable platform include:

- LEAF (Logan Eco Action Festival) – Late May
- Northey St City Farm Winter Solstice Festival – June
- Green Heart Fair – Chermside – June
- Peaks to Points Festival – every second year in July
- Green Heart Fair – Carindale – September
- Griffith University Sustainability Week – September.

There are also many local suburban festivals, school fetes and open days which are great opportunities to engage with people about composting.

Picture: Green Heart Fair

Compost demonstration sites

Picture: Compost demonstration sites provide working examples of different compost systems

Compost demonstration sites are permanently erected displays and examples of various types of organic recycling. They are usually located in community gardens and provide opportunities for people to see and physically touch real and operating compost bins, tumblers, bays and worm farms. Good quality signage is useful to complement the display to enhance the visitor experience and understanding.

Compost demonstration sites can be an effective way to get the composting message across because they are a permanent fixture that people can refer to at any time regardless of workshop times and also serve as ideal settings for workshops and other events.

Promotion

There are a number of ways to promote your message about composting initiatives, workshops or displays.

- **Word of mouth** – this is the most effective way to engage the local community and to form networks where people feel willing to participate.
- **Letter box drop** – while this may be a way to easily reach many people it works better if targeted to a specific audience e.g. people living in a particular street or apartment building or as part of a broader marketing plan as it can be expensive to design, print and distribute material.
- **Social media** – leveraging your personal network plus tapping into the power of paid promotion to extend reach beyond your network to environmentally conscious people interested in composting, gardening or similar topics.
- **Local media** – if you can get local newspapers or radio to put together an article about your project this is a very effective way to reach people within your community.

Community Composting Hubs

Community composting provides the opportunity for people to value their organic waste and use it to improve the soils in their own neighbourhoods. Residents are encouraged to take responsibility for their waste and work together to keep this valuable part of the waste stream continually cycling within the local community. The community composting hub itself becomes a public display of the commitment local people have made to improving their environment and connects members of the community who are not necessarily gardeners with composting. In this way they serve as an introduction into composting and an educational display of how it works.

Home, community and centralised composting are all part of an integrated approach to organic waste management and serve different but complementary functions in the city. Home composting keeps resources at the most local level, community composting is a medium-scale system which can be scaled up or down depending on the community's need and resources, and centralised composting is able to manage larger sources of waste such as waste generated by the hospitality industry.

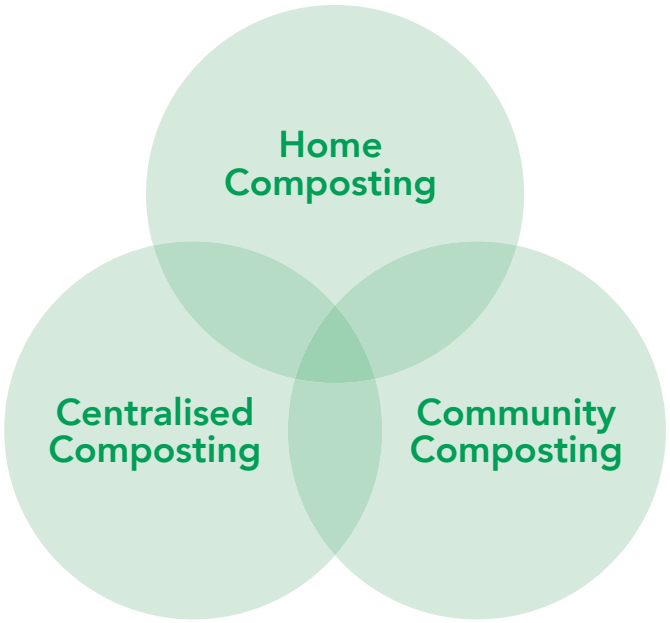


Figure: Integrated organic waste management

Community composting hubs can be set up in areas for the public to use but also lend themselves to apartment blocks, schools and retirement homes. There needs to be an end use for the compost. Hubs work best if located at a community garden.

Recruiting volunteers

The day-to-day operations of community composting hubs relies on a quorum of well trained and dedicated volunteers. Attracting and keeping volunteers is crucial for the long-term sustainability of the project. By connecting the composting work with growing food, you are more likely to attract and keep volunteers than if it is composting only. Stable long-term volunteers will most likely be residents and responsible for the bulk of the daily management. By developing a volunteer management plan, short-term volunteers can be brought in throughout the year to assist. Possible short-term volunteers may come in for working bees or excursions from a variety of organisations including:

- Volunteering QLD
- Conservation Volunteers Australia
- universities, TAFEs and other RTOs offering relevant courses
- Work for the Dole
- community engagement days for local businesses
- men's Sheds
- local schools, childcare services and kindergartens
- other local residents.

To attract outside volunteers, they will most likely be looking for something in return. This could include:

- training
- certificate of participation or appreciation
- fresh produce from the community garden
- meeting new people and creating connections
- taking home finished compost – advertising a free giveaway event should attract a crowd.

Picture: Volunteers are an important part of community compost initiatives

Volunteer management planning

Short-term volunteers can assist with larger jobs such as:

- turning or sieving the compost
- building new infrastructure
- painting signs
- collecting materials for composting.

To make the best use of volunteers' time it is important to be ready with a plan, clear instructions, tools and enough jobs so that everyone can be involved and feel useful. Also allow for differing degrees of difficulty, bearing in mind some may find the work more challenging than others. Do not assume people will already know how to do certain tasks and be prepared to explain things in plain English as well as have a list of tasks for people to refer to. Provide a safety induction to any new volunteers on the site and offer them gloves and masks to wear.

Allow time at the end of the session to sit and relax together over a cup of tea and a snack and see the results of the day's work. Making social connections will more likely to result in volunteers coming back again.

Income and entrepreneurial opportunities

There are a number of potential income earning opportunities in composting that a keen composter can explore.

Here are a few ideas to get your started:

- running workshops through libraries, parks and private businesses can often attract a fee. Experience is required in workshop delivery, but volunteering is one way to develop this
- providing an organics collection service to local cafes, fruit shops and other businesses for composting can also provide an income. This can be collected on bicycles – promoting a more sustainable and visible community service
- in-home compost assistance often connected with a lawn mowing or garden maintenance service, people are provided with assistance starting and maintaining their home composting system for a fee
- starting a compost YouTube channel or a blog providing information, how to guides and other information. This could also be a platform to review and/or sell products related to composting.

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Glossary

Aerobic – relating to, or involving oxygen

Anaerobic – relating to or requiring an absence of oxygen

Beneficial bacteria – the type of bacteria which aerobic composting encourages in order to overcome pathogens and produce good quality compost.

Biodegradable – a material capable of being decomposed by bacteria or other living things without causing harm to the environment

Bokashi – an anaerobic compost method which uses microbes to ferment the products until they are composted or buried

'Browns' – a term used in composting to refer to carbon –rich materials such as dry leaves, straw, shredded paper and dry grass clippings

Calcium carbonate – the active ingredient in dolomite and garden lime used to reduce acidity and also the material secreted by worms to regulate soil acidity

Carbon – a chemical element which provides a source of energy for the microbes involved in composting

Castings/casts/vermicast – worm manure which contain enzymes, beneficial bacteria and nutrients and act as a valuable plant growth stimulant

Compost – the dark, crumbly sweet smelling humus-like material which is produced at the end of a controlled composting system

Compostable – a material capable of being decomposed in a compost environment without leaving harmful products behind

Degradable – the ability to break down into smaller or simpler components.

Digestate – the nutrient-rich remaining material left over after anerobic digestion and can be used as a fertiliser

Enzymes – the substance produced by a living thing which causes chemical changes

Feedstock – the material that is used in the composting process

Frass – the manure from insect larvae

Gizzard – the muscular part of an animal's stomach used for grinding food

Grasscycling – the process of leaving grass clippings in place when mowing instead of removing them

'Greens' – a term used in composting to refer to the nitrogen-rich materials such as food scraps

Hermaphrodite – an animal with both male and female reproductive organs

Leachate – the liquid that seeps out from compost or other material and leaches some of its components

Lignin – the cells in plants which make them woody and rigid

Macro organisms – larger organisms involved in the composting process such as worms and insects

Microorganisms – the bacteria and fungi which cannot be seen with the naked eye and consume the material in the composting process

Nitrogen – a chemical element which provides protein for the microbes involved in composting

Organic matter – any material which was once living – such as leaves, plant matter, food scraps etc

Permaculture – a whole systems design approach to living based on patterns observed in the natural world

pH – a measurement to describe how alkaline or acidic something is

Pathogens – a disease causing bacteria, virus or other microorganism such as E.coli or salmonella

Vermiculture – the cultivation of worms to convert organic waste into a useful soil amendment

Home soil activities

Learning outcome

It is useful to get to know the soil you are working with by discovering its characteristics. In this activity, you will learn to identify different types of soil, the pH level and water-holding capacity of various soils.

Inswons

Collect soil samples from three different sites. Using each of the three soil samples, identify the soil texture, pH level and water-holding capacity with and without the addition of organic matter. Repeat each test for each soil sample and record your results in the table over the page.

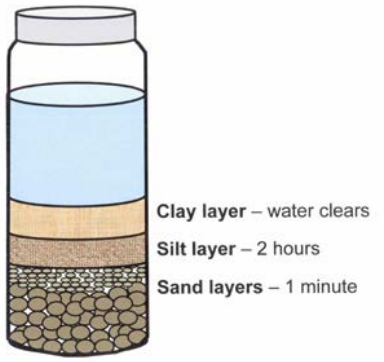
Activity 1a – Identify soil texture

Take a handful of soil, moisten it and form it into a ball in your hand. Roll it into a flat sausage between your fingers and decide which category it falls into based on the following criteria:

Clay soil – keeps a firm shape and bends like plasticine. Is also smooth to touch.

Sandy soil – sand particles can be seen and/or felt. Cannot be moulded into a particular shape as it tends to crumble.

Loam – holds together but is still a little crumbly. Smooth and spongy to touch.



Activity 1b – Identify soil texture

Take a handful of soil and place it in a jar of water, removing large sticks and stones. Fill the jar with water and a drop of dishwashing liquid. Shake it up and let it settle for at least 24 hours. into distinct layers. Sand will form the bottom layer, silt will sit on top of that, followed by clay. Mark these different layers to determine the proportions of each in your soil.

Activity 2 – Determine soil pH level

For this test you will need to purchase or borrow a pH testing kit. Take another sample of the soil (about a tablespoon) and place it on a clean surface. Pour a few drops of the pH testing liquid onto the soil and mix it in to form a thick paste. Sprinkle some of the powder from the pH testing kit onto the soil, mix through and leave it to sit for a few minutes. Compare the colour the soil has now changed to with the pH indicator card to determine the pH level.

Activity 3 – Test water-holding capacity

Use a funnel over a jar (or adapted drink bottle as in picture) and paper towel for a filter for this test. Place a filter in the funnel then add 1/3 cup of soil. Cover the soil with a second filter and slowly pour 1 cup of water on it. Time how long it takes from when you start pouring until when it has finished passing through the soil into the jar. This could take 30 minutes or more. Measure how much water has passed through into the jar.

Activity 4 – Test water-holding capacity with the addition of organic matter (OM)

Take a new funnel and filter and the same amount of soil from the same sample type as in the previous activity. Add some compost to the soil, gently mix it through and cover with another filter. Pour in one cup of water and, again, time how long it takes to percolate through. Record the percolation time and measure the final water level in the table below with the added OM (compost).

Record your findings here

	Sample obtained from where?	Activity 1a & b: Texture (clay, sandy, loam)	Activity 2: pH level	Activity 3a: Percolation time	Activity 3b: Water level	Activity 4a: Percolation time *(with OM added)*	Activity 4b: Water level *(with OM added)*
Sample #1							
Sample #2							
Sample #3							

What conclusions can you make about the soil in the samples you took?

Listing feedstock

Home activity

Learning outcome

In this activity, you will identify the different organic waste materials available to you at home and in your local area and determine which of these waste materials are considered 'browns' and 'greens'.

Instructions

Identify the organic waste materials available to you in your local area (including on your property, your neighbours, streets, local businesses etc). List the waste materials in the table below and identify whether the material is carbon-rich ('browns') or nitrogen-rich ('greens'). Also identify if those materials are an activator.

Carbon-rich materials 'browns'	Nitrogen-rich materials 'greens'	Activator? (Y/N)

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