

NITROGEN-FIXING COVER CROPS, such as legumes (for example beans, peas, clover, and alfalfa), can help you grow your own soil fertility. If you rotate your garden beds and include legumes in your rotation, they will add nitrogen to your soil.

GREEN MANURES are plants that are grown specifically to re-incorporate into the soil. They are often slashed several times as they grow, and before they flower and seed, then chopped into the soil. They then need to be left to decompose before the area is planted, which will generally take two to three weeks.

Nitrogen-fixing crops are commonly used as green manure crops, as are borage, and buckwheat or rye. Other plants may also be used.

Another approach to green manure is to simply slash it and leave it on top of the soil as a mulch.

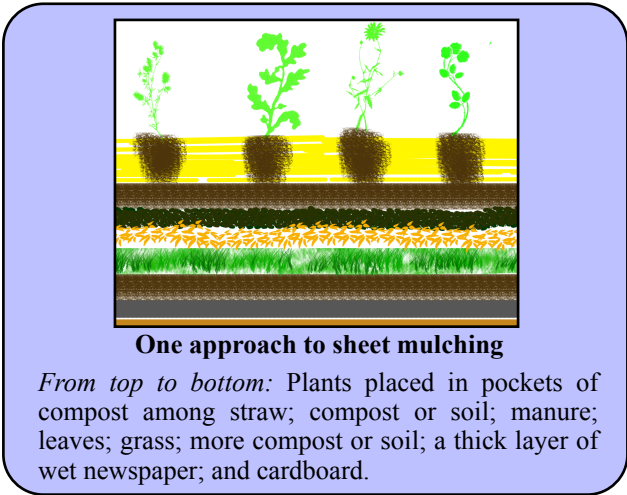
MULCH is any material that is placed over the top of soil as a protection. This can include inorganic materials like rocks, weed cloth, and plastic. Organic mulches will break down to feed the soil and develop its structure. Straw, because it is inexpensive and easy to spread, is the most common organic mulch. Straw from nitrogen-fixing plants such as alfalfa and peas is especially nourishing.

Compost can also be spread on garden beds as a “topdressing.” You can also put any of the materials you would put into a compost heap directly onto a bed. If wanted, you can hide mulches whose appearance you don’t like, such as food waste or newspaper, with others you prefer, such as grass clippings or wood chips.

Keep your mulch from touching woody plants to avoid creating an entry for pests and disease. Also, wait to integrate organic matter into the soil until it has reached a humus state. Otherwise, as it continues to decompose, it will rob plants of nitrogen.

SHEET MULCHING, also called **LASAGNE GARDENING**, is a no-dig approach to building a new garden bed on lawn or bare earth. A sheet of cardboard or many layers of newspaper is laid down as a weed barrier. Layers of other organic materials—for example, compost, manure, grass clippings, and/or straw—are also added. The type of layers and their order can vary. Seedlings are planted directly into the new bed.

It’s a good idea to add compost around the seedlings to give them a strong start before the other layers have broken down.



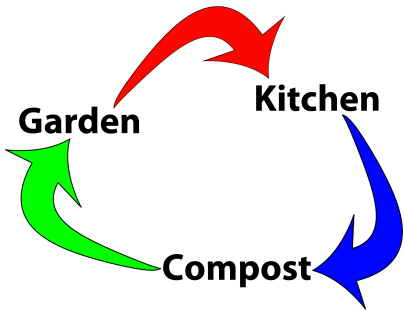
LIQUID FERTILISERS are produced as a by-product of both bokashi bin systems and worm farms. They can also be created by soaking organic materials in a bucket or a barrel of water for 2-3 weeks to make a tea. A lid will keep mosquitoes out. The odour can be quite strong.

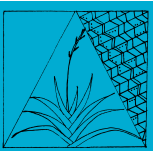
A tea made from seaweed is an excellent source of minerals. Manure teas provide nitrogen. Chicken and sheep manure and sheep dag teas are especially beneficial. Teas made from green manures or comfrey offer plants both macronutrients and trace minerals.

If you introduce viable seeds, for example by using weeds or horse or cow manure, you can destroy the seeds by soaking your materials for a couple of months.


When using any liquid fertiliser, avoid burning your plants by diluting your liquid to the colour of weak tea before adding it to the soil. If you are using the fertiliser as a foliage spray, you need to dilute it even further.

Zero Waste for healthier food, healthier soils, and a healthier planet





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Feed Your Soil with Recycled Organic Waste!
A RECAP tip sheet on composting, bokashi, worm farming, crop rotation, growing green manure, mulching and sheet mulching, and liquid fertiliser.

Love your soil and your soil will love you! Soil is the foundation of your garden. If you take care of your soil, you’ll find that your plants are more resilient, and that your food crops are tastier and more nutritious.

- Keep plants or mulch covering your soil at all times.** A mulch over any plant-free areas will insulate and create more consistent soil temperatures and moisture levels to help plants thrive. Mulches also suppress weeds and reduce soil compaction from hard rains. If you use an organic mulch, it will eventually break down into a soil-enriching compost.
- Develop and preserve your soil’s structure.** Your soil requires channels to exchange gasses, to absorb moisture from the air, and to drain excess moisture. Different soil types require different types of care. Once you have a good soil for gardening, don’t compact it by stepping on it, and minimise turning and digging (especially deep digging and plowing).
- Return at least as much organic matter to your soil as you take out.** Organic matter is anything derived from plants. Each time you harvest food or other plants from your garden beds, you are removing nutrients. Add these back into your beds with compost, green manures, mulches, bokashi, worm castings, or similar. Whenever you do this, you are not only taking care of your garden beds, you are reducing the amount of waste going to landfill.

Weeds can be your soil’s best friend!

They can help keep soil covered, and they can bring up trace minerals from deep in the soil to improve soil fertility, especially if they have deep tap roots. Just keep your weeds from going to seed and from choking your chosen seedlings. When you do pull your weeds, leave them to feed the soil.

How else might you increase your soil’s fertility?

You may want to look online to consider whether your soil life and and soil nutrient quality could benefit from adding effective micro-organisms (EM) or biodynamic preparations.

Recycling your organic materials: Which method is for you?

When choosing which combination of approaches to take to composting, you may want to consider:

- What types and how much food waste and other organic materials you can create or acquire easily;
- Which composting methods are best at processing which types of materials (see table); and
- Which methods will fit into your yard and household.

Advice varies on how to compost. The table below is a good starting point. It is worthwhile to read more and experiment.

Which Type of Organic Material Goes Where				
Organic Material	Bokashi Bin★	Worm Farm★	Compost Pile	Mulch & Sheet Mulch
Meat, fish, oil, and dairy	✓	✗	✗	✗
Coffee grounds and tea bags	✓	✓	✓	✓
Food scraps	✓	✓	✓	✓
Cardboard, newsprint, paper, untreated sawdust, wood ash, vacuum cleaner dust, pet hair, undyed human hair	✗	✓	✓	✓
Grass clippings, sticks, leaves, weeds, and other bulk yard waste ♦	✗	✗	✓	✓
Manures ♦ ■ (e.g. sheep, goat, rabbit, poultry, llama, alpaca, horse, cow)	✗	✗	✓	✓
★	See detailed exclusions for bokashi bins and worm farms on page 3.			
♦	To avoid introducing new weeds to your gardens, weeds with viable seeds and manures containing weeds with viable seeds (e.g. horse and cow manure) should be composted at the centre of a hot compost pile, only, or soaked in water for a month or more. Similar care should be taken with easily rooting vegetation such as convolvulus and oxalis.			
■	Avoid composting dog, cat, and pig manure as these increase risk of disease. All manures may contain pathogens, so treat with care through a truly hot compost, or aging manure for at least a year, or waiting at least four months after application to harvest high-risk crops like root crops, greens, and strawberries--crops that are easily contaminated by soil.			

COMPOSTING

In nature, organic materials such as leaves, dead grass, old trees, and dead animals and insects are recycled by decomposing to make humus. Humus is a stable, earthy-smelling, and spongy black/brown material that improves soil quality.

Composting mimics this process of organic recycling. In compost piles, we see macroscopic decomposers like earthworms, centipedes, and beetles. The main decomposers, however, are microscopic organisms such as bacteria and fungi. These often prefer specialised materials and certain temperatures. These microorganisms use **carbon** for energy and **nitrogen** for cell growth and reproduction. Since they are living, they also need **air** and **water**.

There are many ways to make compost because, whenever all these components are present together, **composting starts to happen**. Eventually, humus is the result.

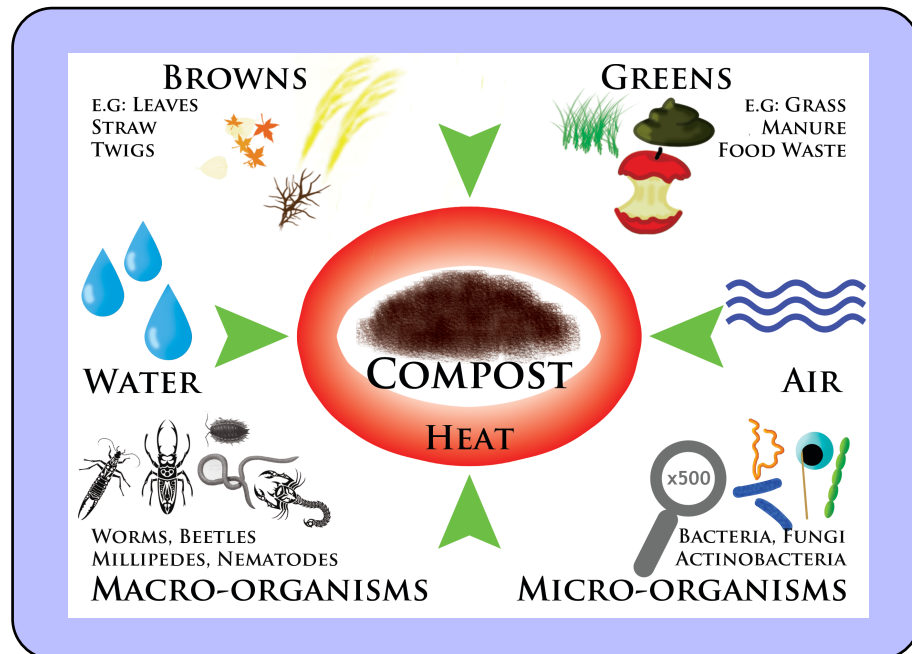
The most efficient decomposers are bacteria that prefer the pile to be 57-71°C. If temperatures are above 65°C then most seeds, eggs, and parasites are killed, making it safe to compost weeds and weedy manures. This is called an **active system** or a **hot compost pile**. A **passive** or **cold compost** will still decompose, just at a slower rate.

How can you speed up the process?

Many gardeners prefer cold composting as it is less labour-intensive and does the job just fine over time. But if you do want to speed up the process, you could try any combination of the following techniques.

- A bigger size pile or container results in a hotter pile and faster decomposition. Hot temperatures are best achieved with a minimum of a cubic metre of material to start.
- A well-aerated pile will decompose faster. Turning your compost regularly, especially when it starts to cool, can help keep it aerobic.
- The ideal moisture content for a hot and steamy compost is 40-60%, or about like a damp sponge.
- A covered bin, or a pile covered with carpet or similar, will maintain heat and moisture for faster decomposition.
- Smaller material pieces provide more surface area for bacteria, resulting in hotter and faster decomposition.
- The ideal ratio of carbon to nitrogen is around 30:1 by weight, but anywhere in the 20:1 to 40:1 range is effective. To increase the amount of carbon (“**brown**” material), add leaves, straw, twigs/sticks, newspaper, cardboard, brown grass, prunings, wood ashes, and similar. To increase the amount of nitrogen (“**green**” material), add food scraps, green grass, manures, seaweed, weeds, human urine, and similar. As most of these green nitrogenous materials also contain carbon, a good rule of thumb is to add a **2:1** to **1:1** ratio by volume of “brown” carbon-rich material and “green” nitrogen-rich material in alternating layers.

WARNING: With a hot compost, you need to watch out for over-heating and the possibility of starting a fire.



Examples of different compost heaps - three bin method (timber and wire), plain compost heap, birds nest compost heap.

WORM FARMS

Building your worm farm

Layered worms bins can be made from old tyres or plastic trays. Another approach is to line a bathtub with drainage pipes. Instructions can be found readily online, and a variety of worm bins can be bought commercially. Most have multiple layers. Layers can be quite heavy when full, so consider size and design carefully.

The worms in your farm need to be happy living in a shallow bin. Tiger worms (*Eisenia fetida*) are best and can be bought readily online. Of the earthworms found commonly in New Zealand soil, red worms (*Lumbricus rubellus*) are most acceptable.

Worm feeding and care

Worms require a temperature of 10-30°C, so give them shade and shelter, and avoid large amounts of fresh grass clippings or leaves, as these will cause overheating.

For food, worms require a diet of about 70% fruit and vegetable scraps and 30% carbon (for example, shredded paper, cut-up cardboard, untreated sawdust, or **dry** leaves). Give your worms food scraps regularly, but if your worm bin starts to smell of rotting food, you are overfeeding.

It's essential that you keep your worms moist, but if your worms try to climb out, your bin is too wet.

Avoid the following as they disrupt digestion and/or respiration:

- shiny, highly-coloured, or plastic-coated paper;
- spicy food and chillies;
- highly acidic food (for example onion, garlic, citrus, or large amounts of kiwifruit);
- meat, dairy, fats, and oils (no salad dressing!);
- processed wheat (bread, pasta);
- manures;
- twiggy garden waste;
- plastics, pesticides, and insecticides.

Also avoid highly acidic foods because an acidic bin attracts pests such as fruit and vinegar flies and ants. You can reduce acidity by adding more dry carbon materials and a good sprinkle of lime.

Feeding tip: Keep a scrap bin in your kitchen, such as an ice cream container, and line it with newspaper. Collect your food scraps in this, then feed both the scraps and the newspaper to the worms when the container is full. This keeps you from needing to use your fingers to scrape food scraps into the bin.

Using worm juice and worm castings

Worm tea and castings have high levels of nitrogen, phosphorous, and potassium (**NPK**), serving as excellent fertiliser. They are found at the bottom of the bin. As the bin fills, your worms will move upwards. Methods of harvest vary by bin.

Drain off the liquid and dilute (approx. 1:10) before putting it on your garden. Worm castings can be mixed directly with soil.



Going on a holiday?

Feed your worms in advance and cover them to keep them moist. For holidays longer than a couple weeks, you can find someone to feed your worms or purchase a coconut fibre block from a garden centre or worm grower.

BOKASHI: ORGANIC FERMENTS

Building your bokashi bin system

Bokashi is an indoor, two-bucket system designed to ferment food waste. It can easily be kept on a kitchen counter or under a sink. A top bucket sits inside a bottom bucket. Holes in the bottom of the top bucket allow liquid to drain into the bottom. An **air-tight** lid keeps the system oxygen-free so that food scraps will ferment.

You can make your own bokashi bins with paint buckets or something similar, or you can buy your bins online or at a garden store.

Feeding bokashi

The fermentation process requires micro-organisms, which can be bought commercially as “Compost-Zing.” A handful of Zing is added to the bottom of the top bokashi bin, and again after every 3cm of food waste. Any type of **well-drained** food waste can be included. Fermentation is an anaerobic process, so compact each layer to remove any air.

Avoid adding the following to your Bokashi bin:

- Liquids, as these create a sour smell;
- Paper, meat bones, and sea shells, as these will not break down.

Using the ferment

Every 2-3 days empty any liquid from the bottom bucket, diluting it 1:100 and adding directly to your soil, or diluting 1:500 or more for a foliage spray.

Keep your bokashi bins out of direct sunlight. Once they are full, put them somewhere warm (for example, in a water closet or laundry) and keep them there for 10-14 days, until the material smells pickled. The ferment can then be mixed with a bit of soil, buried directly in a shallow (30 cm) garden trench or a planting box, and covered with a bit of soil. You can plant on top of it 10 days later.