



Backyard Composting Recycling a Natural Product

To protect the *āina*, many people practice the three Rs of conservation. They **recycle** aluminum cans, paper, and glass. They **reuse** paper as scratch pads and line garbage pails with plastic grocery bags. Some **reduce** their use of energy and materials through energy conservation and careful maintenance to make things last.

Apply the three Rs to yard trimmings and leftover food, and you have composting—an economical way to reduce solid waste, reuse organic materials, and recycle nutrients as a soil conditioner. Composting is about being good caretakers of our environment.

It's in the bag

In order to estimate how much you threw out last week, gather one day's garbage from your household. Weigh on a bathroom scale or estimate by comparing to a known weight, like a 20-pound sack of rice. Multiply by seven, and you have the amount of garbage produced by your household each week.

Look at what's in your garbage. Any recyclable plastic or aluminum containers or old newspapers? Take these to be recycled. See any food stuff – banana peels, fuzzy leftovers, coffee grounds – or yard trimmings? These materials are easy to compost. When you remove the recyclables, 20 pounds of garbage is often reduced to as little as 5 pounds.

Imitating nature

Composting is a process by which organic materials (such as branches, leaves, and fruits) biologically decompose under controlled conditions.

More simply, compost is the result of humans imitating nature's disposal system.

When vegetation dies or falls off trees in forests and fields, insects, worms, and bacteria eat it. They leave behind small loose particles called humus. Humus binds soil particles together into larger aggregates, or grains, that allow water and air to enter the soil more easily. Humus also contains important nutrients in forms plants can easily use for healthy growth and reproduction.

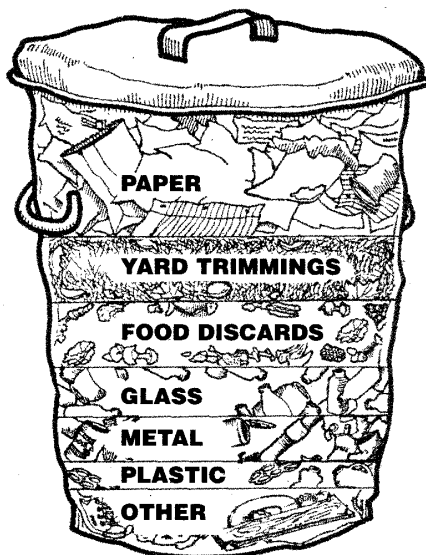
Mixed with soil, compost improves the soil's tilth. That is, it makes the soil looser, or lighter, which makes water, oxygen, carbon dioxide, and minerals more available to plants. Compost improves root penetration and makes the soil easier to work. Compost conserves water by helping the soil retain it better.

Because it is made from decomposed organic material from many sources, compost contains many of the nutrients plants require (although not always enough to sustain intense commercial production). Compost has

even been known to reduce the incidence of certain soil-borne diseases that have devastating effects on plant health and productivity, perhaps because the beneficial soil microbes added in compost outcompete the pathogenic organisms.

How it works

A balance of five essential ingredients is the key to rapid, trouble-free composting. If you maintain a pile with the correct balances of moisture, air, and carbon and nitrogen contents of the raw materials, then decomposing organisms—insects, worms, bacteria, and fungi—will do the rest.



Often, over half of home wastes are compostable.

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Water is required by all living things, including decomposers. The compost pile should be moist, but not too wet. A bad odor may indicate that excess moisture is inhibiting decomposition.

Oxygen is essential to most decomposers. Oxygen cannot circulate well if the pile is too tight, too big, or too wet. If the pile is soaked with water, most decomposers die and composting is taken over by a few “specialists” that can live without air. Anaerobic decomposition—detected by its swampy odor—is slow and inefficient.

Carbon is abundant in most organic materials and is broken down by decomposers to create food-energy. However, other nutrients are needed for carbon to be readily eaten. Wood and paper are examples of materials that are high in carbon but may be deficient in other nutrients and thus slow to decompose.

Nitrogen is required by decomposers in relatively large quantities. It is a major ingredient in protein, a basic building block of life. Without sufficient nitrogen in your compost pile to assist digestion of carbon-rich materials, decomposition goes very slowly. Green leaves and grass clippings are examples of nitrogen-rich materials.

Decomposing organisms produce heat by their activity. This heat in turn energizes them, and the whole process goes faster. Heat also helps kill disease organisms and weed seeds. The speed of composting varies, but at some point the center of the pile should feel hot or very warm to the touch. More mass (a bigger heap), more water, more air, or more nitrogen may be needed to get the process going.

A well managed pile can produce compost in about two or three months.

Getting started

A proper surface is important. Compost is easier to turn when piled on concrete or another hard surface, but worms and other beneficial organisms from the soil will have a harder time reaching the pile. Level ground is also a good surface.

The dimensions of the pile, as a rule of thumb, should be at least 3 feet high by 3 ft wide by 3 ft long to maintain sufficient heat in its interior. If the pile is too large, air has trouble getting to the center. Maximum recommended size is 5 ft high by 5 ft wide, with no limit to the length.

The appropriate location for a compost pile is a shady area protected from wind (to prevent it from drying out). Protect the pile from heavy rain by covering it with a

plastic sheet, or make it under a roof. Build it where it can't be flooded.

Have a protected area to store finished compost if it isn't going to be used immediately. Avoid mixing undecomposed materials with finished compost.

Choose a composting method

Set-ups for a compost pile range from simple to elaborate.

Basic compost heap—Simply pile and mix the compost materials on the ground. Cover the pile when it rains to prevent it from getting too wet or losing nutrients to leaching. Turn the heap regularly (every week or two). Building the pile over a layer of scrap plastic pipes drilled with holes allows for air penetration from below and reduces the need for turning.

Compost pit—Pits are ideal for composting materials consisting mostly of food scraps. Dig a hole in the ground, add the materials, mix with soil in the hole, and refill the hole with at least 8 inches of soil. Fallow areas of your garden are good places for compost pits.

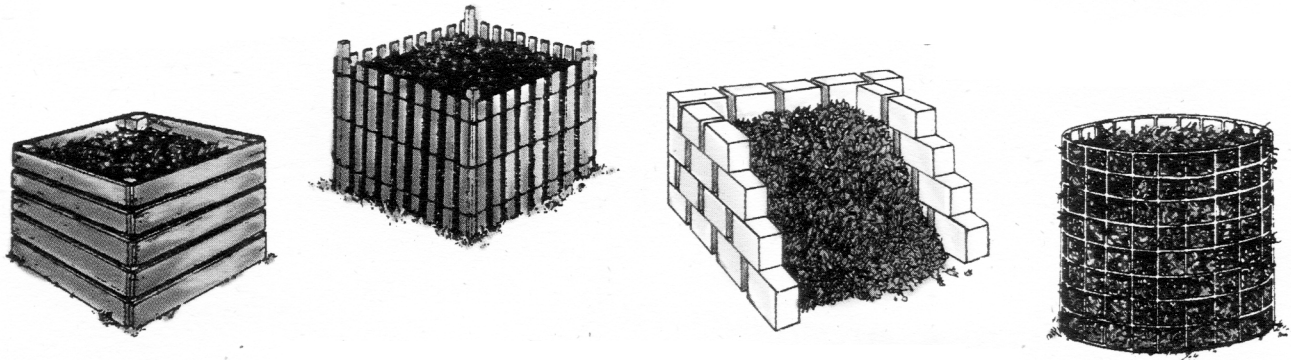
Holding units—Bins help to contain the compost heap, keep it out of sight, and can make it easier to turn. They can be made of concrete blocks, wire mesh, or wood (although wood may lead to termite problems). If the bin is a movable type, it can be lifted from the pile and placed next to it when it is time for turning; just shovel the heap back into the empty bin. Old garbage cans can be used as holding units if they have enough large holes to allow air to circulate and holes in the bottom to allow water to drain.

Turning units—Some commercial composting units feature rotating barrels that make mixing the pile easier and reduce the use of shovels or forks for turning. Another way to make turning easier is to build two or three adjacent holding units. The first is filled with the new pile. When the pile is turned, it is shifted into the next bin. By the third turning, the pile is usually on its last month of decomposition.

What to compost

Organisms that decompose organic materials to form compost depend on a “diet” of carbon and nitrogen. Fresh, green materials are rich in nitrogen, and so are animal manures. Just as plants need nitrogen to grow, decomposers need nitrogen to fuel the decomposition process. Grass clippings are rich in nitrogen, and wood chips are a carbon source. The key to making a compost

Some examples of compost enclosures



pile is to combine nitrogen-rich materials with carbon sources in the right proportions, with the right amount of moisture, and adequate aeration.

Building a compost pile

This simple recipe for making a compost pile should produce ready-to-use compost in a few months.

1. Accumulate enough materials for a pile at least 2 x 2 x 2 ft; or even better, to make a 3-ft cube.
2. Shred or chop the materials to 1–2 inches in size to expose more surface area for faster decomposition.
3. Start the pile with a 4–6 inch thick base of carbon-source materials (dead leaves, wood chips, shredded paper, etc.). Moisten. Add a 2–3 inch layer of nitrogen-rich materials. Food scraps may make up part of this layer. Continue to alternate and mix layers of nitrogen-rich materials with carbon sources, adding water as needed. The pile should be about 3–4 ft high or, if in a bin, not more than 4–5 ft high. Close the bin or cover

the pile with a plastic sheet.

4. Inoculate a new pile, if desired, by sprinkling a small amount of topsoil or compost between layers. Some composters believe this speeds the process by “seeding” the new pile with decomposing organisms.
5. Monitor moisture content; test by feeling a handful of compost and squeezing it as you would a sponge. It should feel moist without yielding more than a few drops of liquid. If the pile is too wet, turn it to allow air in and improve drainage. If the pile is too dry, water it and turn it.
6. Periodically check the temperature in the pile’s interior. A compost thermometer is helpful, but you can estimate the temperature by touch. It should peak between 120° and 160°F (hot to the touch). When the temperature begins to drop, turn the pile and rotate materials from the outer and top parts of the pile toward the base and middle; move the more composted middle part to the outer part of the pile. For easy turning, use a garden fork to shift the compost to a second bin; the mate-

Materials OK to use

Nitrogen-rich materials

Grass clippings
 Seaweed and aquatic plants (washed to remove salt)
 Fruit and vegetable trimmings
 Kitchen scraps like coffee grounds, egg shells, leftover bread, rice, etc.
 Fresh, leafy garden trimmings

Carbon sources

Chipped trees
 Twigs, small branches from trees and shrubs (chopped)
 Sawdust (from untreated wood)
 Stems of fibrous grasses
 Palm fronds (chopped or shredded)
 Newspaper or white paper (shredded)

Undesireable materials

May contribute pests (weeds, plant diseases) when inadequately composted

Weedy, persistent plants
 Diseased plants

Human health hazard

Dog or cat feces, used kitty litter

May attract flies, rats, animals

Oils
 Dairy products
 Meat or bones of animals, poultry, fish

Are not biodegradable

Metals, glass
 Rubber, plastics

rial at the top will now be at the bottom. In the process, you are aerating the pile, and you can add water if the pile seems to be dry.

7. Continue to monitor the temperature in the pile. It should heat up again. After the temperature peaks, turn the pile once more. You may note that white molds decrease over time, insect populations will change, and beneficial worms become abundant as the compost matures.

8. The process is completed when the pile does not generate any more heat. When the pile is cool and the compost has aged for another four weeks, it should be finished. The pile should be much smaller than its original size, and the original materials should no longer be recognizable. The compost should be dark, loose (crumbly), and without any strong or unpleasant odor.

9. Use the compost to mix into the soil or to make compost tea to use for watering crops, seedlings, and starts. Spread compost on your lawn and under shrubs, flowering plants, vegetables, and trees.

Helpful hints

- Chop or shred leaves, twigs, and other materials to speed composting. Smaller pieces of organic material “cook” faster than larger pieces because more of the material surface is exposed.
- A compost pile needs the right mix of materials to decompose quickly. When building the pile, try to have at least one part nitrogen-rich materials for every two to three parts carbon sources. You may need to experiment with different materials and proportions to develop enough heat for rapid decomposition.
- If there is not enough nitrogen-rich material, sprinkle

small amounts of commercial nitrogen fertilizer between layers. (Note: these fertilizers are concentrated; use sparingly.)

- Balance moisture and aeration to develop heat; too much of either results in a “cold,” inactive pile. The hotter the pile, the faster the composting process. Temperature of an actively composting pile normally range from 120 to 150°F. Higher temperatures (140–160°F) kill harmful pathogens, insects, and weed seeds. Avoid turning the pile too often, because the heat is lost whenever the pile is turned. Turn it immediately, however, if an odor develops; the smell should fade away.

Alternatives to composting

You can reuse organic materials in your yard in other ways. People practice “passive” composting when they pile up organic materials but don’t turn the pile. Without turning, the pile will be “cooler” and much slower to decompose. The materials break down eventually, and compost can be removed from the bottom of the pile. This method may not kill weed seeds and plant pathogens, and the pile may attract insect and animal pests.

To fertilize your lawn, leave nitrogen-rich grass clippings in place after mowing. Mow “high”—clippings should be less than one-third of the grass blade—and mow so as to spread the clippings evenly across the lawn.

Mulching is similar to composting but requires less effort. Chipped or shredded organic materials such as lawn clippings, leaves, pine needles, shrubs, and trees can be spread on the soil surface around your plants. Mulch controls weeds, keeps moisture in the soil, and reduces soil erosion.

Compost Pile Troubleshooting

<i>Symptoms</i>	<i>Likely problems</i>	<i>Solutions</i>
Offensive odor	Insufficient aeration	Turn and “loosen” pile
Ammonia odor	Too much nitrogen	Add carbon-source materials
Pile doesn’t heat up	Insufficient nitrogen	Add nitrogen-rich materials
	Pile too wet	Turn, add dry carbon sources, protect from rain
	Pile too dry	Turn, sprinkle with water
	Pile too small	Add more materials
Pile attracts flies, animals	Inappropriate materials	Don’t use meats, oils; remove attracting materials or rotate them to center of pile and cover pile with carbon-source materials.