

Composting: Nature's Way To Recycle

What Is Compost?

Compost is a dark, crumbly, partially broken down form of organic matter that has not yet decomposed into humus. Compost, if it doesn't have unpleasant odors, is easy to handle and stores for long periods of time. It is an excellent soil conditioner.

When Is Compost Ready for Use?

Compost, when ready for use, is dark and crumbly. Finished compost has an "earthy" smell. Normally, it is ready for use in 4 to 8 months, depending on the types of organic materials composted, the climatic conditions during the composting period, and the care provided the compost pile. For many purposes, finished compost is easier to use if you first screen it through a 1-inch wire mesh screen to get rid of coarse or incompletely decomposed materials.

How Is Compost Used?

The main uses are as a soil amendment and a mulch. Compost improves the texture of clay and sandy soils and improves the water and nutrient holding ability of

Solid waste disposal is a critical issue. In the southern United States, more than 90 percent of our solid waste is land-filled. We must now dispose of nearly one ton of waste annually for each citizen. Many states in the South are feeling the crunch as landfill lifespans decrease.

Composting is nature's way to recycle. Common items from around the yard and house – grass clippings, leaves, pine needles, shrub and tree trimmings, and newspapers – can be composted for use in flower beds and gardens. Composting such items removes as much as 18 percent of solid waste usually generated by a household and sent to a landfill for disposal.

sandy soils. Adding compost to clay soils makes them easier to work and improves the internal drainage. Compost is also an ideal mulch material for flower beds, vegetable gardens, and around shrubs. In late fall, you can mix compost mulch into the garden soil as a soil amendment. Here are some more benefits of compost:

- Increases the soil earthworm population;
- Helps prevent soil crusting;
- Increases the soil microbial population;
- Makes it easier to pull weeds;
- Provides slow-release nutrients to plants;
- Reduces nutrient leaching and soil erosion; and
- Reduces soil compaction.

Compost used at the rate of 4 cubic yards per 1,000 square feet of surface area (equivalent to 100 tons per acre) provides a layer three-fourths of an inch deep. When planting trees and shrubs, you can amend the backfill soil added to the planting hole with one-third compost by volume. You can amend potting soils with up to 50 percent compost by volume.

Why Make Compost?

Disposing of leaves, pine needles, grass clippings, and other garden refuse is a problem for gardeners, particularly in urban areas. Many U.S. cities no longer pick up or accept yard trash for landfill disposal, and more cities join the list every year. These byproducts of the garden, lawn, and landscape can be turned into useful compost.

In many cases, compost does the same thing as peat moss, thus reducing gardening costs. Returning these organic materials to the land keeps natural biological cycles going and is an ecologically sensible and environmentally safe way to use organic wastes.

How Compost Forms

Composting speeds natural decomposition under controlled conditions. Fungi and bacteria change raw organic material into compost. During this process, microorganisms use organic matter and oxygen. The process puts a lot of heat, carbon dioxide, and water vapor into the atmosphere. The use of organic material and loss of carbon dioxide to the air accounts for the one-fourth to one-half reduction in size of the compost pile.

As microorganisms break down the organic materials, temperatures in a compost pile get near 140 °F to 160 °F at the center. The temperature of the compost pile is important for the biological activity taking place. The high temperature kills some of the weed seeds and disease organisms in these high-temperature areas. Thus it is important to have the compost pile large enough to make and keep heat but not so large that heat can't escape.

Turning the pile to place materials from the cooler outer areas into the center for decomposition is also important. In cooler sections of the pile, though, this kind of process does not occur. Low outside temperatures during late fall, winter, and early spring slow the decomposition.

Once the inner portion of the compost pile reaches the desired 140- to 160-degree temperature, it is necessary to turn the compost daily. This not only brings in outside layers of material to compost, it airs the pile. If it is turned too often, though, the compost pile will not have enough heat to continue the composting process.

Organisms mainly bringing about the breakdown of the organic materials need lots of nitrogen. Adding materials that add large amounts of nitrogen (such as

fresh, green grass clippings or fresh farm animal manures) is necessary for rapid and thorough decomposition. You may add a nitrogen-containing fertilizer when a high-nitrogen organic source isn't available. Dry, brown materials, such as leaves and pine needles, typically contain a lot of carbon but little nitrogen. Green materials are typically high in nitrogen and water but low in carbon. The ratio of carbon to nitrogen (C:N ratio) in organic materials for composting is important in rapid and successful composting. The range of C:N ratios ideal for composting is 25:1 to 30:1. Ratios of 20:1 to 40:1 are acceptable. This does not mean a compost pile should have 25 to 30 times as much brown, high-carbon materials as green, high-nitrogen materials. The correct blend depends on the C:N ratios of the materials being composted.

The average or typical C:N ratios of several commonly composted organic materials demonstrate this clearly:

Material	C:N ratio
Grass clippings (fresh)	17:1
Shrub trimmings (fresh)	53:1
Leaves (fresh)	54:1
Hardwood bark	223:1
Softwood bark	496:1
Newsprint	398:1 to 852:1
Sawdust	442:1
Cardboard	563:1
Straw	80:1
Legume hay	16:1
Cattle manure (fresh)	19:1
Broiler litter (fresh)	14:1
Rice hulls	121:1
Corncobs	98:1

Microbes also need oxygen so they can decompose organic materials efficiently. Some decomposition occurs without oxygen (anaerobic conditions), but it is slow, and foul odors may develop. Mixing the pile two to four times a month helps provide the necessary oxygen and greatly hastens composting. A pile not mixed and aerated takes a lot longer to decompose.

Adequate moisture is also a must for microbial activity. The moisture content should be between 40 and 60 percent by weight. Dry materials will not decompose,

and composting stops completely at a moisture content below 15 percent. Proper moisture encourages the growth of microorganisms that break down the organic matter into compost. If rainfall is limited, water the pile now and then to keep decomposition steady. Lots of water is lost as water vapor (steam) from a hot compost pile. It may be necessary to add water when the pile is turned and mixed. Add enough water at the beginning so the pile is damp but not soggy. Avoid overwatering. Excess water can lead to conditions that slow down the degradation process and cause foul odors. It also leaches out nutrients. If the pile becomes too wet, turn it to dry it out.

The smaller an organic refuse particle is, the more quickly the microbes use it. Chipping or shredding the organic material before composting greatly cuts decomposition time. A chipper/shredder is useful for chipping or shredding most yard refuse, newspapers, and paper grocery sacks and is essential if brush, prunings, and/or small tree limbs are to be composted.

If you don't have a chipper/shredder, you can reduce the size of fallen tree leaves by mowing the lawn before raking. Windrowing the leaves into long, narrow piles makes shredding more efficient. If the mower has a bagging attachment, you can collect the shredded leaves with it. Vacuum shredders with collection bags are also available. Mulching mowers reduce the need for raking or bagging lawn clippings and leaf litter, but the material is not available for use in the compost pile, since it is blown down into the turf for on-site composting.

What Materials Can Be Composted?

Many types of organic materials can be used for composting: grass clippings, leaves, pine needles, hay, straw, weeds, farm animal manure, chopped corn cobs, corn stalks, sawdust, shredded newspaper, and many kinds of plant refuse from the garden. All woody materials should be run through a chipper/shredder to reduce particle size before composting.

Do not compost diseased plants from the flower or vegetable garden if the compost is to be returned to the garden later. Although heat during composting kills some diseases, some of the disease agents may be returned to the garden with the compost unless you turn the compost frequently and thoroughly and let it stay unused for several years. If diseases have not been a problem, this precaution is not necessary.

Avoid composting weeds heavily laden with seeds. Even though some seeds are killed during composting, if there are a lot of seeds, some may be returned to the garden when you use the compost. This would create a weed problem.

Most fruit and vegetable food wastes, coffee grounds, eggshells, vacuum cleaner bag contents, and kitchen scraps (such as vegetable peelings) may be added to the compost pile. Do not put grease, fat, meat scraps, or bones in the compost pile. They may attract dogs or other animals as well as flies and may develop an odor during decomposition.

Dry materials, such as leaves and pine needles, may be collected in fall and stacked and stored until late spring and summer when fresh lawn clippings from warm-season grasses are available for mixing and composting. Ryegrass clippings from overseeded lawns and fescue clippings provide nitrogen-rich compostable materials in early and midspring. Do not compost sawdust or wood shavings from wood treated with preservatives.

Where To Make a Compost Pile

Put the compost pile somewhere that is convenient but not quickly noticeable. If you plan to use the compost mainly in the garden, choose a location near the garden. Since the compost pile needs to stay moist, a convenient source of water is helpful. Don't locate a compost pile where drainage is poor and water may stand, even for short periods.

A shaded area is best for composting. Don't locate a compost pile close to trees, though. Tree roots may spread rapidly through the lower areas of the pile and make the compost difficult to dig.

Size of a Compost Pile

The size of a compost pile varies with how much material is available, but a minimum size is required to maintain heat and moisture. A pile should not be less than 3 feet wide and 3 feet high. Anything smaller is too small to keep heat and moisture and to decompose properly. Where more organic materials are available, the pile should be about 5 feet wide (for easy working) and any convenient length.

You may find that if there is enough organic material, two or three small piles provide greater flexibility than a single, large one. In this way, you can

build a pile and let it compost while a second pile serves as a place to collect materials. Three piles are even more ideal – one finishing, one in the process of decomposition, and one to which you can add fresh materials. In this way there is almost a continuous supply of compost.

You may not have enough materials to build several piles or may not have room for them. If so, a single, tall pile may work. Although not ideal, you can add fresh materials to the top of the pile (rot pile) and dig out decomposed material from the bottom (passive composting). This does not allow for turning, which aids heating and complete and speedy decomposition and is a slow process. Nevertheless, with limited space and materials, such a pile serves a definite and useful purpose.

Containing the Pile

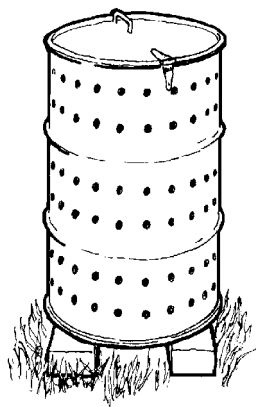
It is possible to stack the materials for composting in a loose pile, and the process will take place. If you want some type of bin or enclosure, you have many materials available to build it.

The sides should be loose enough to let some air move through them. One side should open for easy turning and removal of the compost. The enclosure may be round, square, rectangular, or any other convenient shape. An enclosure of some type will prevent pet dogs from feeding on materials in the compost pile.

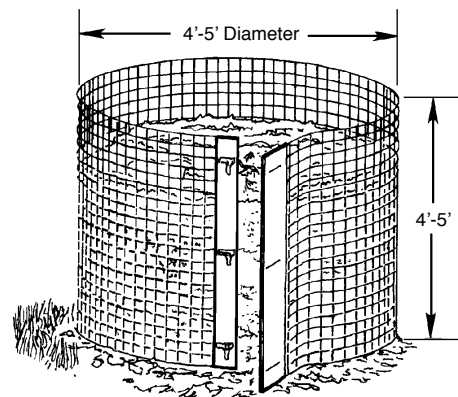
Composting Structures

You can use woven-wire fencing (hog wire, chicken wire, chain link), wood slat fencing (snow fence), cement blocks, bricks, wood pallets, or scrap lumber to enclose a compost pile. If woven-wire fencing is too loose to keep in fine materials, line the enclosure with plastic (having some air holes) to keep the pile neat and to speed decomposition.

You may pile bricks or concrete blocks without mortar, but leave space between some of them to let air move through the sides. Scrap boards are suitable for sides, since there is normally enough space between them for air movement. Lumber is gradually ruined by



Barrel or drum



Circular bin

exposure to damp compost, and boards occasionally have to be replaced as they decay.

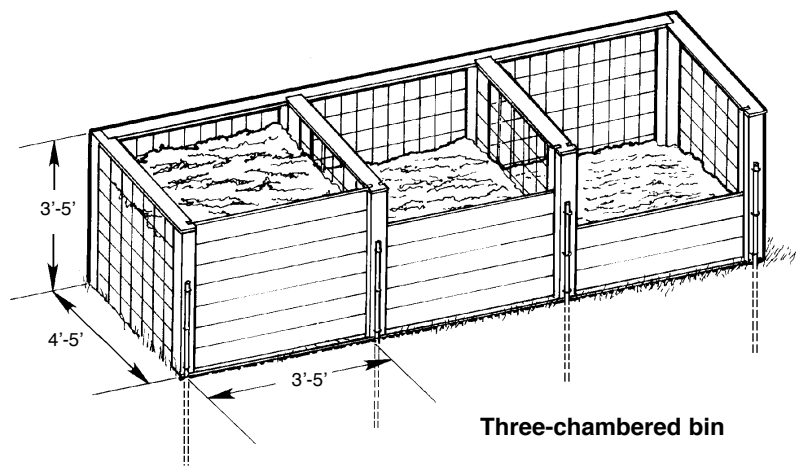
A barrel or drum composter generates compost in a relatively short time and provides easy turning. It requires at least a 55-gallon barrel with a secure lid. Be sure the barrel did not contain toxic chemicals. Drill six to nine rows of 1/2-inch holes over the length of the barrel, and place the barrel upright on blocks to let bottom air circulate and excess moisture drain off. Fill it two-thirds full with moist organic waste materials or add water until the material is moist. Add about 1/4 cup of a high-nitrogen fertilizer to speed composting.

Every few days, turn the drum on its side and roll it around the yard to mix and air the compost. Take off the lid after turning the pile to let air in. Ideally, the compost will be ready in 2 to 4 months.

The barrel composter is an excellent choice for people with relatively small yards. For more organic waste, bin-type structures are the most practical. You can make a circular bin by using a length of small-spaced, woven-wire fencing held together with chain snaps. The bin should be about 3 to 5 feet in diameter and at least 4 feet high. With this design, it is easy to turn the composting materials by unsnapping the wire, moving the wire cylinder a few feet, and turning the compost back into it.

You can easily make a square bin from four discarded wood pallets by wiring them together at the corners. You can use a fifth pallet as a base.

An efficient and durable structure for fast composting is a three-chambered bin. It holds a lot of compost and allows good air circulation. The three-chambered bin works on an assembly line idea, having batches of compost in varying stages of decomposition.



Three-chambered bin

A balanced mixture of compost materials (see Constructing the Compost Pile section) is started in the first bin and allowed to heat up. Next, it is turned into the middle bin, while a new batch of material is started in the first bin. Finally, the material in the middle bin is turned into the last bin to cure as finished or nearly finished compost.

To make this structure, it is best to use rot-resistant wood, wood treated with a preservative, or a combination of wood and metal posts. Unless the wood is treated or is rot resistant, it decomposes within a few years. Each bin should be about 5 feet by 3 feet and about 3 to 4 feet high (1.6 to 2.2 cubic yards capacity). Removable slats in the front offer easy access for turning and removing the compost.

There are many other structures for composting, and no one structure is best. If you don't want to build a structure but still want a bin of some type, several commercial composting units are available through garden stores or mail-order catalogs. Most of these are similar to the barrel composter described earlier and provide an easy way to make small amounts of compost quickly.

Building the Compost Pile

Building a compost pile is usually described in terms of layers, but the layers in the pile may not be well-defined. Layering is not really necessary, but it does give the quickest and most complete decomposition.

You can alternate layers of brown material high in carbon with layers of green material high in nitrogen and water. Common dry, brown materials are yard and home

refuse such as shredded leaves, pine needles, shredded newspaper and paper bags, wood chips, and dead garden plants. Common green, moist materials are kitchen vegetable scraps and peelings, grass clippings, and green weeds and plants. In order to have enough of the right organic materials, you may have to stockpile dry, brown materials in fall, winter, and early spring to have them on hand when grass clippings become available.

Rapid composting depends on the proper ratio of brown and green materials as well as on small particle sizes and enough oxygen and water. A compost pile with too much brown material (high C:N ratio) and too little green material (low C:N ratio) will not heat, and decomposition is slow. A compost pile with too much green materials will sour, smell, and lose nitrogen to the air as ammonia.

When you compost materials with high C:N ratio values, you should layer them with materials with low C:N ratios or add a nitrogen fertilizer to bring the C:N ratio down and closer to a good level for rapid composting.

Materials with a high moisture content (fresh animal manures, fresh grass clippings) should be mixed with dry materials (leaves, hay, paper) to prevent souring and anaerobic decomposition.

Shredded or chopped materials decompose fast; so if a shredder is available, run coarse organic matter through it. Place materials that tend to mat (fresh grass clippings) in layers only 2 to 3 inches thick. Moisten, but do not soak, the layers of organic materials as you add them.

It is difficult to moisten the center of a compost pile after you form the pile. Lots of water as steam. If enough moisture is not available, composting will be very slow. If soil is available, you can layer it with the organic materials, but soil is not necessary for composting process or to make compost successfully. You can mix soil with finished compost to make a potting soil. Keep alternating layers of materials until the pile is at least 5 feet high.

Care of the Pile

Keep the compost pile moist but not soggy and well aired for good microbial growth, proper heating, and decomposition. Lack of moisture and air reduce microbial activity. Too much moisture may cause undesirable decomposition and odors. During dry weather, you may have to add water weekly. You can also add water when you turn the compost pile and mix the layered materials. Covering the pile with plastic can reduce moisture loss and aid decomposition during dry periods. A plastic covering also protects the pile from becoming too wet during periods of heavy rainfall.

To speed decomposition, turn and mix the pile ingredients periodically. "Active composting" is hard work – make no mistake about that. Turning helps aeration of the pile and reverses any undesirable reactions. Turning and mixing also let you place the cooler and slower composting materials from the surface of the pile in the pile center. In warm weather, turn the pile at least once every 2 weeks. When you turn, you can layer more organic matter into the pile. Turn the pile

immediately if at any time you detect a strong ammonia or other offensive odor.

Turn by slicing through the pile and mixing each slice. Where space is available, you may shift the entire pile to an adjacent place or into another bin. The main reasons for turning are to shift materials from outer parts of the pile closer to the center where they can heat and decompose easier, to mix the layered materials, and to add water, materials, and air to compost.

The compost pile should be hot within a couple of days after you form it. This means the pile is decomposing properly. Failure to heat might be caused by too much water, not enough oxygen, a C:N ratio that is too high, or too small a pile. Composting slows in winter because of the cold weather.

As materials decompose, the pile shrinks to about half its original size. The length of time required for composting to be completed varies with the nature of the ingredients, the frequency of turning, the size of the pile, whether or not you add materials during the process, and the time of year.

Guide to composting problems

Symptom	Problem	Solution
Bad odor	Not enough air	Turn it; add dry material if the pile is too wet
Center of pile dry	Not enough water	Moisten and turn the pile
Compost damp and warm only in the middle	Too small; cold weather	Collect more material and mix old ingredients into a new pile
Pile is damp and sweet smelling but still will not heat up	Lack of nitrogen	Mix in a nitrogen source, such as fresh grass clippings, fresh manure, blood meal, or nitrogen fertilizer
Interior looks or smells charred	Extremely high temperature	Pile too large; reduce size, add water

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Publication 1782

Extension Service of Mississippi State University, cooperating with U.S. Department of Agriculture. Published in furtherance of Acts of Congress, May 8 and June 30, 1914. JOE H. MCGILBERRY, Director (rev 1M-1-04)