South Carolina Gardening & Recycling Organics Wisely

GROW

Composting at Home

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A Guide to Managing Organic Yard Trimmings*

Garden and landscape refuse, such as leaves and grass clippings, account for up to 20 percent of the waste disposed in landfills. Obviously, it makes sense to divert these materials to mulch or compost. Through these processes organic trimmings can be recycled to improve and beautify the garden and landscape.

Composting is a biological process in which microorganisms convert organic materials such as leaves, grass, manure and food wastes, into an end product called compost — a dark, crumbly, earthy-smelling form of organic matter that reveals no hint of its origin. Composting is the same process that decays leaves and other organic remains in nature, except that composting controls the conditions so that the materials decompose faster.

Composting can occur under either aerobic (in the presence of oxygen) or anaerobic (without oxygen) conditions. Microorganisms involved in aerobic composting require oxygen (greater than 5 percent within the compost pile; fresh air is about 21 percent oxygen), while anaerobic microorganisms prefer an absence of oxygen. Aerobic decomposition is the preferred composting technique because it is the most rapid and efficient.

When mixed with soil, compost increases the organic matter content, improves the physical properties of the soil and supplies essential nutrients, enhancing the soil's ability to support plant growth. The practice of applying materials such as compost, leaves or grass clippings to the soil surface is called mulching. Mulching conserves moisture, controls weeds, reduces erosion, improves appearance and keeps the soil from gaining or losing heat too rapidly.

** From the SC Master Gardening Training Manual prepared by Robert Polomski, Extension Associate, Department of Horticulture, Clemson University*

Compost Process

Composting is the biological decomposition of organic matter. While decomposition occurs naturally, it can be accelerated and improved by human involvement. To produce a high quality end-product, it is important to understand the composting process. The microorganisms and invertebrates that decompose yard and food waste require oxygen and water.

The heat produced by bacterial activity increases the temperature in the compost pile to as high as 160˚F. As the process nears completion (after one month to one year), the pile temperature once again approaches the surrounding air temperature.

Nitrogen contained in yard trimmings and food waste are necessary for the microorganisms to carry out decomposition efficiently. The conversion of carbon in waste to carbon dioxide results in a reduction in both the weight and the volume of the pile.

Finished compost is composed of microorganisms and invertebrates, their skeletons and decomposition products and organic matter that is not broken down by these organisms.

Composting Organisms

Most composting organisms fall into two general groups: microorganisms and invertebrates. Among the microorganisms, aerobic bacteria are the most important in terms of beginning the decomposition process and generating heat.

The organisms present in a compost pile can be separated into three types. First-level consumers attract and become food for second-level consumers. Third-level consumers, such as centipedes, rove beetles, ground beetles and ants, prey on second-level consumers. *See diagram next page.*

Bacteria are one-celled colorless organisms that cannot make their own food through photosynthesis. They reproduce by splitting, producing billions of offspring over a relatively short time, although the life span of any particular generation may only be 20 to 30 minutes long. As a group, they can eat almost any type of organic matter, although specific bacterial populations will differ from pile to pile depending on the makeup of the pile and the decomposition stage.

Psychrophilic bacteria are active when a pile is first made, especially in the fall when the weather is cool. Optimum activity occurs at about 55˚F, but these bacteria are still active at 0˚F. The bacterial activity creates heat and sets the stage for the most efficient decomposers, the mesophilic bacteria, which are most active when the temperature of the pile is between 70˚F and 100˚F. As the temperature increases, thermophilic bacteria take over from 113˚F to 155˚F.

Actinomycetes and fungi, similar to bacteria, give the compost pile its faintly earthy odor. At the end of the composting process, they may appear as a blue-gray to a light green, powdery or cobweb-like layer in the outer four to six inches of compost. Fungi generally intermingle with the actinomycetes.

When the inner pile starts to heat up, most invertebrates are killed or migrate to cooler areas of the pile. In the cooler areas, nematodes prey upon bacteria, protozoa and fungal spores. Larger mites and springtails also feed on fungi. The life cycle within the pile continues to become more complex as predaceous mites and pseudoscorpions feed on other mites as well as nematodes. Complex invertebrates, like centipedes and ground beetles, feed on lower life forms, and decaying plant life in the pile attracts sowbugs, snails, slugs and earthworms.

Earthworms

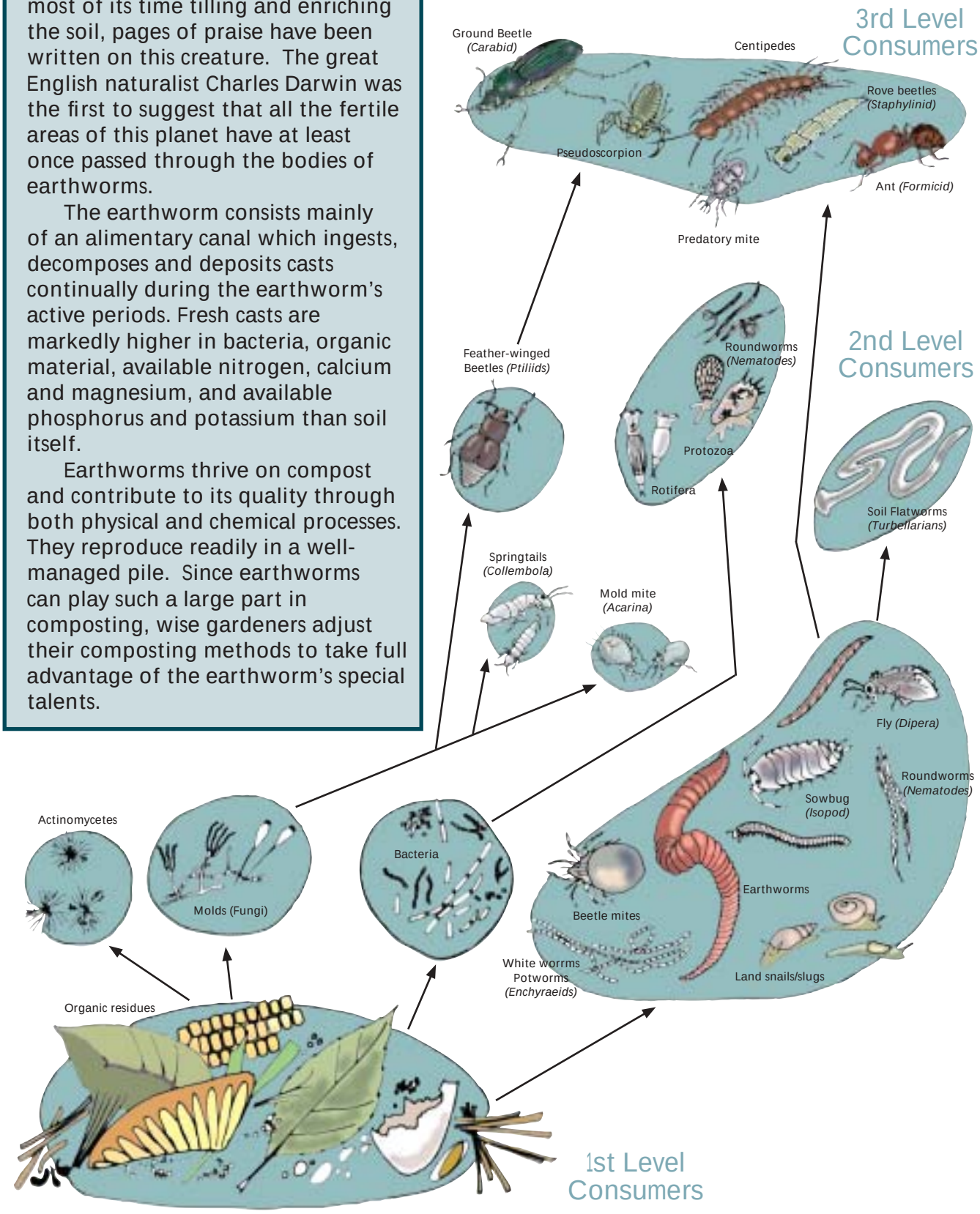
If bacteria are the champion microscopic decomposers, then the heavyweight champion is doubtlessly the earthworm. Ever since it became known that the earthworm spends most of its time tilling and enriching the soil, pages of praise have been written on this creature. The great English naturalist Charles Darwin was the first to suggest that all the fertile areas of this planet have at least once passed through the bodies of earthworms.

The earthworm consists mainly of an alimentary canal which ingests, decomposes and deposits casts continually during the earthworm's active periods. Fresh casts are markedly higher in bacteria, organic material, available nitrogen, calcium and magnesium, and available phosphorus and potassium than soil itself.

Earthworms thrive on compost and contribute to its quality through both physical and chemical processes. They reproduce readily in a well-managed pile. Since earthworms can play such a large part in composting, wise gardeners adjust their composting methods to take full advantage of the earthworm's special talents.

Food Web of the Compost Pile

Some of the visible creatures in the compost pile feed directly on organic wastes. Others wait until microorganisms have begun the process.



Factors Affecting the Composting Process

All natural organic material eventually decomposes. However, the length of the breakdown process can be accelerated through composting, or rather, the efficient "farming of microorganisms." Any factor that slows or halts the growth of these microbes also impedes the composting process. The following factors affect the length of the composting process:

- Organic materials (carbon and nitrogen contents of the food source);
- Volume;
- Aeration;
- Moisture;
- Surface area/particle size; and
- Temperatures reached during composting.

Organic Materials

All organic materials contain carbon and nitrogen. One of the most critical factors in composting is the balance of carbon and nitrogen within the plant waste added to the pile. The carbon to nitrogen ratio is commonly expressed as "C:N" or "C/N." Microorganisms require carbon for energy and nitrogen to make protein. Leaves, straw and sawdust are high in carbon, while grass clippings, manures and vegetable scraps are higher in nitrogen. It helps to think of these materials as "browns" and "greens." These C:N ratios are significant because microbial activity is greatest when the C:N ratio is 30:1. The tiny composters need about one part of nitrogen for every 30 parts of carbon in the organic material. When the decomposing organisms do not have the proper diet of carbon, the organisms may lose nitrogen to the atmosphere as ammonia. If the initial carbon portion is too high in the compost heap, the process will be considerably slower and very inefficient. Materials can be blended and mixed to achieve a suitable C:N ratio.

The dominant organic waste in most backyard compost piles is leaves. Grass clippings may compact and restrict air flow. Branches and twigs greater than 1/4 inch in diameter should be put through a shredder/chipper first. Spent plants and trimmings from vegetable gardens and flower beds are excellent sources of nitrogen for the compost pile and may be added with small amounts of soil. Kitchen wastes, such as vegetable peelings, coffee grounds and eggshells are appropriate additions to the compost pile. Other organic materials used to add nutrients to the pile are blood meal, bone meal and livestock manure.

Volume

A pile should be large enough to hold heat and small enough to admit air to its center. As a rule of thumb, the minimum dimensions of a pile should be 3' x 3' x 3' (one cubic yard) to hold heat.

Aeration

Oxygen is required for microbes to decompose organic waste efficiently. Some decomposition can occur in the absence of oxygen (anaerobic conditions); however, the process is slow, and foul odors may develop. Also, anaerobic decomposition leads to the production of chemical compounds that are toxic to plants. Organic matter allowed to decompose anaerobically should be exposed to air for several days or sometimes months to complete the composting process and to destroy any plant-toxic compounds. Because of the odor problem, composting without oxygen is not usually recommended in a residential setting. Mixing or turning the pile once or twice a month provides the necessary oxygen and significantly hastens the composting process.
A pile that is not mixed or turned may take three to four times longer to decompose. Raising the pile off the ground allows air to be drawn through the pile as the material decomposes. Coarse materials should be placed on the bottom as the pile is built. Another way to introduce air is to place perforated PVC pipes within the pile.

Moisture

Adequate moisture is essential for microbial activity. Materials in a dry compost pile will not decompose efficiently. If rainfall is limited, the pile must be watered periodically to maintain a steady decomposition rate. Enough water should be added to completely moisten the pile, but overwatering should be avoided. Too much moisture will force out the air and suffocate the microorganisms, resulting in anaerobic conditions, slowing down the decomposition process, and causing foul odors. Water the pile so it is damp but does not remain soggy. Squeeze compost in your hand to judge moisture content. If the material feels like a damp sponge and yields only a few drops when squeezed tightly, its moisture content is sufficient. Piles that are too wet should be turned to increase air content; piles that are too dry should be turned and sprinkled with a hose.

Surface Area/Particle Size

The more surface area the microorganisms have to work on, the faster the materials will decompose. Grinding the organic material before composting greatly reduces decomposition time. A shredder is useful for chipping or shredding most yard refuse and is essential if brush or sticks are to be composted. A low-cost method of reducing the size of fallen tree leaves is to mow the lawn before raking. Windrowing the leaves into long narrow piles 1 foot high will make the shredding process more efficient. If the mower has an appropriate bag attachment, the shredded leaves can be collected directly. A few twigs and sticks can be left in the pile for aeration.

Temperature

The temperature of the compost pile is very important to the biological activity taking place. Heat generated by microorganisms as they break down organic materials increases compost pile temperatures. The microbes that are so essential to the decomposition process fall into two categories: mesophilic, those that live and function in temperatures of 70˚F to 100˚F, and thermophilic, those that thrive at temperatures from 113˚F to 155˚F. While high temperatures have the advantage of killing disease organisms and weed seeds, moderate temperatures encourage the growth of mesophilic bacteria, the most effective decomposers. Pile temperatures

between 90˚F and 140˚F indicate rapid composting. Temperatures greater than 140˚F kill or reduce the activity of many of the most active, beneficial organisms. If temperatures exceed 140˚F, the pile should be turned to cool it. If the pile does not reach at least 120˚F, more nitrogen or water may be needed. Cold weather can also prevent the pile from heating.

Building a Compost Pile

The compost pile should be located near the place where the compost will be used. Composting is best done in a location screened from your view and that of neighbors. Good locations for the pile are near the garden or between the garage and house. Do not locate the compost pile near a well or on a slope that drains to surface water, such as a stream or a pond. Locating the pile too close to trees may also create problems, as roots may grow into the bottom of the pile, making turning and handling the compost difficult. The pile will do best where it is protected from drying winds and is in partial sunlight to help provide heat. The more wind and sun the pile is exposed to, the more water it will need.

There are no set rules when building a compost pile. Pay attention to the items covered in the "Factors Affecting the Composting Process" section and use good judgement and common sense. The following two recipes should help you create a "fast" or "slow" compost pile.

"Fast" Compost Recipe

Fast compost is labor intensive and requires a lot of turning. Maintaining a 30:1 carbon to nitrogen ratio is very important in fast composting. This method can produce compost in a couple of months or less.

Ingredients and tools needed

- Greens and browns (shredded)
- Water
- Garden soil (optional)
- Pitchfork
- Tarp or cover (optional)
- Hotbed thermometer

Collect material to create a one cubic yard pile. Chop or shred any coarse materials to increase their surface area. Start the pile with a four- to six-inch layer of "browns," high carbon materials (high C:N ratio). Next, add a four- to six-inch layer of "greens," high nitrogen materials (low C:N ratio). Add additional nitrogen if necessary. Vegetative kitchen waste should be added in this layer. If food waste is added, an additional thin layer of soil, sawdust, leaves, straw or compost should be added to absorb odors.

Layer material until the pile is about three or four feet high. Remember to water each layer as you construct the pile. Apply about a 1/4 inch layer of soil or finished compost between layers. One reason for adding soil is to ensure that the pile is inoculated with decomposing microbes. The use of soil in a compost pile is optional, however. In most cases, organic yard wastes such as grass clippings or leaves contain enough microorganisms on the surface to cause decomposition. Studies have shown that there is no advantage in purchasing a compost starter or inoculum. The microbes already in the soil and on organic materials are just as efficient in decomposing the waste as those provided by the commercial inoculum. However, one way to ensure that activator microbes are present in the new compost is to mix in some old compost as the pile is prepared. When you're done, make the top of the pile slant to the center to catch rainfall. At times, you may want to cover the pile with a plastic covering or tarp to regulate the amount of moisture entering the pile. The cover should not rest on the pile because it may cut off oxygen.

Consider the porosity of the mixture. If dense materials, such as manure or wet leaves are used, wood chips, straw or dry bulky material should be added to improve porosity. The thickness of the layers will depend on the C:N ratio of the materials being used. Mix the layers.

Conduct a squeeze test to evaluate the moisture content of the compost. Add water until squeezing a handful will yield one or two drops of water. Adding too much water may leach out nutrients.

Yard Waste Compost Troubleshooting

Symptoms	Cause	Solutions
Smells like rotten eggs or garbage	Pile is too wet	Turn pile and add dry stalks, leaves or straw.
Pile is dry inside	Not enough water	Turn and moisten materials, cover pile.
	Too much woody material	Mix in fresh greens or nitrogen fertilizer such as urea, blood meal or chicken manure. Chop or remove coarse woody materials.
	Pile is too small	Add material to fill bin or make 3' x 3' x 3' pile.
Pile is damp inside, but not composting	Lack of greens	Mix in fresh greens or nitrogen fertilizer. Chop or remove excess woody material.
Pile has shrunken, but looks undecomposed	Outside of pile is dry, inside probably composted	Use material that has not decomposed in a new batch.
Clumps of slimy grass, ammonia smell	Too much fresh grass	Leave clippings on lawn, or mix in brown leaves or straw.

“Slow” compost recipe

Slow composting is the least labor- and time-consuming way to compost; it’s ideal for people who don’t have a large amount of yard waste to compost all at once. This method can take from six months to two years or longer to produce compost, so be patient. The bins or containers can be made of old wooden pallets stood on the ends in a square and nailed or tied together. A chicken-wire cage supported by three or four wooden stakes will also work well. A standard-sized garbage can with eight or more slots in the sides of the can for ventilation and five in the bottom for drainage can also be used. In all cases, elevate the bin one foot off the ground or start the pile with a three to six inch layer of small twigs or chopped corn stalks to improve air movement and drainage. If you choose not to use a container, cover the heap with a layer of yard waste or soil to prevent moisture loss.

The ingredients and tools needed are the same as those for “fast” compost. Add greens and browns to the pile whenever they become available. Turn the pile occasionally to mix the materials together to prevent them from clumping together and to avoid anaerobic decomposition. You will know that materials are decaying without oxygen by the foul odor: a telltale sign that it is time to turn the pile. Look for ready-to-use compost near the bottom of the pile.

Curing

Curing is an important and often neglected stage of composting during which the compost matures at low, mesophilic temperatures. Curing finishes the decomposition of resistant compounds, organic acids, large particles and clumps of material that remain after active composting. As a result, the pH shifts toward neutral, the C:N ratio decreases, and the concentration of humus increases. When the compost pile’s temperature no longer reheats after turning, the curing stage begins. Curing may be considered complete when the pile temperature falls close to air temperature (without the pile being anaerobic or overly dry).

Unfinished compost can be toxic, especially to seedlings and newly established plants. Therefore, compost must be allowed to decompose thoroughly before use.

Composting Alternatives

Sheet composting in the garden involves applying raw composting materials directly on top of the soil in layers. Shredded organic matter can be applied between plants as a type of mulch and allowed to decompose slowly. Material can then be incorporated directly into the soil after frost in the fall.

Trench composting involves digging a trench about eight to 12 inches deep and filling it up with shredded organic materials. Vegetable scraps, kitchen scraps (excluding meat, bones, and fatty foods) and other yard trimmings (especially diseased or insect-infested plants) can be used. Microorganisms and earthworms will slowly convert these materials to usable organic matter. Covered trenches are often used as paths between rows of vegetables while the organic matter is decomposing.

Compost-hole-digging is similar to trench composting, except that it involves smaller areas. A post-hole digger can be used to make holes between vegetables or ornamental shrubs and trees, and filling the holes with kitchen scraps and covering them with soil. By the following spring, the organic matter should be well-decomposed.

Using Compost

Soil amendment

Compost is used as an organic amendment to improve physical, chemical and biological properties of soil. Adding compost will increase the moisture-holding capacity of sandy soils, thereby reducing drought damage to plants. When added to heavy clay soils, compost improves drainage and aeration and reduces waterlogging damage to plants. Compost increases the ability of the soil to hold and release essential nutrients. The activity of earthworms and soil microorganisms beneficial to plant growth is promoted with compost. Other benefits of adding compost include improved seedling emergence and water infiltration because of a reduction in soil crusting.

Over time, yearly additions of compost create a desirable soil structure, making the soil much easier to work. For improving a soil's physical properties, incorporate one to two inches of well-decomposed compost into the top six to eight inches of soil. Use less for sandy soils and more for clay soils.

To a limited extent, compost is a source of nutrients. However, nutrient-release from compost is slow, and the nutrient content is too low to supply all the nutrients necessary for plant growth. It is usually necessary to supplement compost with some fertilizer, particularly nitrogen. If the C:N ratio of the compost is less than 20 to one, nitrogen tends to be released rather than tied up. For the majority of yard trimmings composts, the C:N ratio is less than 20 to one. Thus, while compost may not supply significant amounts of nitrogen, especially in the short run, nitrogen tie-up should not be a major concern with most yard trimmings. About one cup of ammonium nitrate (0.15 pound actual nitrogen) per three bushels (100 pounds) compost is required to provide the additional nitrogen needed by most garden plants.

Have your soil tested every few years to determine whether supplemental phosphorus and potassium are required. The pH of most composts made from yard trimmings is usually 7.0. The neutral pH of compost should not pose any problems when mixed into the soil and, in fact, is beneficial to plants growing on acid soils.

Potting soils

Compost can be used as a component of potting mixes. Generally, no more than one quarter to one third by volume of the potting mix should be compost. Too much compost may result in waterlogging and poor aeration for roots.

Although proper composting destroys most weed seeds and disease-causing organisms, some may still survive because of incomplete mixing. To obtain a completely pasteurized compost for use in the potting mixture, heat the material in an oven at 160°F for 30 minutes.

Mulch

A two- to three-inch layer of compost can be used as a mulch around vegetables and ornamental plants. Extend the mulch layer up to or beyond the dripline of shrubs and trees. The dripline is defined by the outer edge of the plant's branches. Applying compost will help conserve moisture and keep the soil cool in the summer and warm in the winter.

Compost Questions and Answers

What is compost?

Compost is the partially decomposed remains of plants. In its final state of decomposition, it is referred to as humus.

Does compost have any value as a fertilizer?

Yes, decomposed materials have some nitrogen, phosphorous, and potassium content, though in small amounts. The addition of garden fertilizers to speed up decomposition supplies some of the nutrients, as well.

Can compost be used as a substitute for fertilizer in the garden?

It can be used as a source of nutrients; however, there are not enough nutrients present in compost to supply the needs of vegetable crops. The lack of large amounts of nutrients in compost is far outweighed by the other advantages of the organic material.

Is it necessary to add lime (calcium) to the compost pile?

No. Too much lime may cause a loss of nitrogen from the pile. Most finished compost will have a nearly neutral pH.

Is it necessary to add inoculum to the compost pile to activate the composting process?

Inoculation with prepared microbes may hasten the process. However, there are enough microbes present on the material being composted to initiate the process.

Should compost piles be covered?

A compost pile that has a good moisture content (like a damp, wrung out sponge) will benefit from being covered with plastic or carpet scraps. Covering helps to keep piles moist in summer and prevents them from getting too soggy in winter. However, if a pile is too dry or soggy to start with, covering may make the problem worse.

What are the best materials for composting?

Most plant material can be used for composting. Leaves are perhaps the best material because of their availability and organic content; however, other types of organic materials, such as animal manure, grass clippings, vegetable refuse, small tree limbs and shrubbery trimmings, coffee grounds, and rotted sawdust are considered good composting materials. Invasive weeds, such as Florida betony and nutsedge, should be left on pavement to thoroughly dry out before composting. Avoid composting feces, meat and dairy products, or materials contaminated with chemicals.

How do you know when you have the proper 30:1 carbon to nitrogen ratio (C:N) for fast composting?

Experimentation is the best way to get a good sense of carbon and nitrogen ratios in different materials. Books on composting often have tables giving some rough figures. Remember, the 30:1 ratio is an ideal ratio which produces a quick, hot compost. Wide variations from the ideal will yield fine compost in a longer period of time.

Is it necessary to shred materials for the compost pile?

The finer the material that goes into the compost pile, the quicker and more thorough the decomposition.

Do compost piles need turning?

Yes and no. Turning the pile will supply more oxygen for the microbe population and will shift undecomposed material on the edge of the pile to the center where it too will be decomposed. Compost can be created without turning, though it will take longer.

How do you gauge the proper moisture content for composting?

Materials should feel like a wrung-out sponge, moist but when squeezed in your hand no more than a drop or two of water should come out. Some very dry materials (straw, cardboard and others) may need prolonged soaking to reach adequate moisture levels.

Do compost piles have offensive odors?

As a general rule, compost does not produce offensive odors if composted in a bin with adequate ventilation. If animal manure is used, some odor may be detected in the first or second day, but will dissipate as the process accelerates.

What can be done about a smelly pile?

Smelly piles are most often caused by poor aeration. The bacteria which live in such "anaerobic" piles produce a rotten egg smell. Smelly piles should be turned to introduce air and encourage "aerobic" bacteria. Wet compacted areas should be broken up with a pitch fork, and coarse dry materials such as straw or corn stalks may be mixed in to aid drainage, absorb moisture and create air spaces.

When is compost ready to use?

When the pile returns to normal temperature and the organic material crumbles easily, compost is ready to use. At this point you should not be able to recognize the material that you put in the original pile. The composting process in the average pile takes about six to eight months, though an ideally mixed and tended pile may take less than eight weeks to become compost.

How can I use compost?

Compost can be used to enrich the garden, to improve the soil around trees and shrubs, to amend the soil for house plants and seed-starting mixes (when screened) or to top-dress lawns.

What is the difference between compost and mulch?

Compost is decomposed organic material. Mulches are materials—organic or inorganic—used as a surface treatment on soil to suppress weeds, hold moisture, and prevent erosion. Compost is just one of many mulch materials. Other mulches include gravel, wood chips, plastic, fabrics and sawdust.

How can wood/bark chips be made to compost faster?

Rechipping to open more surface area and adding nitrogen will both speed up decomposition of wood chips to some extent.

Why can't dairy products, meat, and fish scraps be composted?

Animal products attract flies, rodents and other pests which carry diseases.

Do compost "tumblers" work?

Compost tumblers work very efficiently if wastes are chopped, moistened and contain adequate nitrogen. Tumblers with flat sides or internal bafflers are recommended, as they mix and aerate materials more thoroughly than those with smooth sides.

Including Food Scraps

- Burying food scaps in the garden is a simple method requiring no special tools.
- Food "digesters" provide a convenient and pest resistant way to compost food scraps.
- Worm bins are a fun and interesting method for composting food scraps to produce rich compost and worms for fishing.

Materials to Avoid in a Compost Pile

Some materials may pose a health hazard or create a nuisance and, therefore, should not be used to make compost. Human or pet feces should not be used because they can transmit diseases. Although animal remains can be safely decomposed in commercial composters, wastes such as meat, bones, grease, peanut butter, whole eggs, and dairy products should be avoided in home compost piles because they may attract rodents.

What Can Be Put In Home Compost Systems?

Greens: fruit and vegetable trimmings, bread and grains, coffee grounds and filters, tea bags and trimmings from yard.
Browns: non-recyclable paper, paperboard, fall leaves, clean sawdust or wood shavings.

Do not compost or bury

Meat, fish, poultry or dairy products—put in disposal or trash.

Evergreen leaves, sawdust or shavings from painted or treated wood and coated paper.

How do I store food scraps in the kitchen?

A plastic container with a lid is great for storing scraps in the kitchen until you are ready to take them outside. Empty the container into your worm bin, a hole in the garden or compost bin every two days so food scraps don't start to smell. A five-gallon bucket with tight lid can be used outside to store food scraps for longer periods if it is inconvenient to add them to the compost, but odors and flies may become a problem—especially in summer. Sprinkling an inch or two of sawdust, peat or coconut coir on top of layers helps prevent flies and odors. Food scraps can also be stored in a plastic container in the freezer to control these problems. Do what works best for you.

Worm Bin Composting

Worm bins are a fascinating way to turn food scraps into high-quality compost. Follow these easy steps to start your own worm bin. Check out Mary Appelhof's book, "Worms Eat My Garbage" for more detailed information on composting with worms.

Step 1. Get a bin.

Use a sturdy wood or plastic box with a tight-fitting lid to keep pests out and moisture in. Holes drilled in the bottom are essential for drainage. A box about one foot deep is best, since worms must live near the surface to breathe. Worm bins can be made from old cupboards or crates, or built with plywood. Bins made from recycled plastic are available through mail-order catalogs.

Worm bins should have one square foot of surface for each pound of food added per week. A two foot by four foot by one foot deep worm box can process about eight pounds of food scraps a week—usually enough for two people. Weigh your food scraps for a few weeks before buying or building a bin. Keep worm bins in a basement or enclosed garage if possible. Cold winter weather and hot summer temperatures can dramatically slow worm composting. If the bin is kept outside, find a spot that is shady in summer but gets some winter sun. Outdoor bins can be insulated with rigid foam insulation tacked to the lid and sides.

Step 2. Fill the bin with bedding.

Carbon-rich bedding supplies worms with a balanced diet, and helps prevent flies and odors. Good beddings include moist autumn leaves, shredded cardboard or newspaper, straw, or untreated coarse sawdust and wood shavings — a mix of these works best. Immerse dry bedding in a garbage can full of water for several minutes before adding to worm bin, or mix and spray with hose until everything is moist like a wrung-out sponge. Fill the bin to the top with loose bedding to keep the worms from freezing in winter or getting too hot in summer. (Tip: save a few bags of leaves each fall to rebed your bin later.)

Step 3. Add worms.

Red worms, also known as "red wrigglers" or "manure worms," are best for composting. "Earthworms" or "night crawlers" are not suitable for composting. Start with about a pound of worms (about one pint of pure worms) to keep up with food scraps. Get worms from a friend's bin, or call the Recycling hot line at 1-800-768-7348 for sources.

Step 4. Bury food scraps.

Pull aside bedding to make holes or trenches large enough to lay food scraps one to two inches thick, and deep enough to cover scraps with a few inches of bedding. Bury in a different spot each week to give the worms a balanced diet of food scraps and bedding. Place a sheet of plastic or moist newspaper on top of the bedding to keep moisture in and flies out.

Step 5. Harvest compost and worms.

After six to 12 months, most of the bedding should look like dark, rich soil. To harvest compost and rebed the bin, push the compost to one side of the bin (it shrinks as it composts) and fill the empty side with fresh bedding. Then bury food scraps only in the new bedding until any food scraps in the old bedding finish decomposing, and most worms have migrated to the fresh food. Harvest finished compost and replace with fresh bedding.

It is simple to pick out a few worms for fishing. To harvest more worms to start new bins, shovel a few gallons of compost into a pile in bright daylight. After 15 minutes, scrape away the outer layer of compost until many worms are visible. Repeat until worms are concentrated at the bottom of the pile.

Stackable Worm Bins
A number of worm bins are for sale that use stacking trays to take advantage of the worms' tendency to feed on the surface and migrate out of finished compost. The top tray is fed fresh food scraps. When material in the bottom level is decomposed and worms move up into fresh materials, the tray is removed, harvested and then rebedded and replaced on top.

Worm Bin Troubleshooting

Symptoms	Cause	Solution
Smells like rotten eggs or garbage	Too wet Meat, fish, dairy or pet waste in bin Food scraps not covered	Mix in dry leaves, peat moss or sawdust. Keep food scraps and pet waste out. Cover food with bedding when added.
Bedding is dry, few worms	Not enough water	Mix and moisten bedding, cover with plastic or moistened cardboard. Move bin out of sun.
Food scraps building up	Too much food Bin too cold or too hot	Limit food scraps. Add more worms. Build another bin. Move bin to cool basement or garage. Keep bin filled with bedding.
Maggots in bin	Meat, dairy or other animal products	Keep animal products out of the bin. Cover bedding with cardboard or plastic.
Fruit flies swarm out when bin opened	Exposed food scraps	Always cover food scraps with bedding. If you still have fruit flies, add an inch of sawdust or peat moss to top of the bedding, or cover bedding with cardboard or plastic
Worms crawling up sides of bin	Too much food, bedding too wet or fully decomposed	Limit food scraps or build another bin. Add dry bedding.

Summary: Successful Yard Waste Composting

It's not a secret — simply place garden waste in a pile and bacteria, bugs and fungi will turn it into compost — but it may take a year or longer. For quicker composting, provide the decomposer organisms with proper food and conditions:

1. A balanced diet.
Composting bacteria thrive on a mix of succulent "greens," like fruit and vegetable trimmings, annual weeds and flowers, and on woodier "browns," such as autumn leaves and corn stalks. An equal mix of greens and browns works well. Too many greens can produce a smelly, soggy mess. A pile that is mostly browns takes a long time to decompose. The chart below lists common greens and browns.

2. Bite-sized pieces.
Decomposers can break down small pieces more quickly than large ones. For rapid composting, chop woody stalks with a shovel or machete, run over them with a lawn mower, or put them through a shredder.

3. Moisture.
Materials should be moist but not dripping wet—like a wrung-out sponge. Spray and mix dry trimmings as they are added to the pile. Keep compost piles in the shade, and cover open piles with plastic.

4. Fresh air.
If materials are too wet or compacted, composting will slow down and may create bad odors. Start with a good mix of materials, including some coarse stalks or sticks so air can flow through. Let air into soggy piles by turning them and mixing in coarse stalks or dry straw.

5. Pile size.
A pile that is one cubic yard (3' x 3' x 3') is ideal. Smaller piles dry out quickly, though bins with solid sides and a lid help keep small piles moist. Larger piles may need to be turned to let air into the middle.

6. Preventing pests and other problems.
Use the chart below to avoid materials that may attract pests, create odors or cause other problems.

What can be put in home yard waste compost systems?

DO compost in piles or bins	DO NOT compost at home
Greens	
Fruit and vegetable trimmings, coffee grounds, eggshells, etc.	Clippings recently treated with "Weed & Feed" or other herbicide — put in curbside yard waste collection.
Fresh garden trimmings, flowers and plant leaves	Insect-infested or diseased plants - put in curbside yard waste collection.
Barnyard manure (horse, cow, chicken)	Pet feces (dog, cat, rodent, exotic bird)
Garden vegetable leaves and stalks, fallen fruit	Meat, fish, poultry, dairy products. Put in disposal or household garbage.
Weed leaves, stems and flowers	Weed seed heads and roots of spreading weeds like ivy, buttercup, morning glory and quackgrass - put in curbside yard waste collection.
House plants and potting mix	No meat, bones or fat
Browns	
Autumn leaves	Large amounts of evergreen leaves, needles or cones
Twigs and stalks	Branches over 1/2 inch diameter; berry brambles, rose stems, holly
Coarse sawdust or shavings	Sawdust from plywood, treated or painted wood
Shredded paper, cardboard, paper towels	Coated photo or copy paper, colored paper, waxed cardboard

Books & Resources

Most garden books these days have a section on composting, and there is a small library of books devoted to composting. Here is a selected list of books you might find helpful. Check your public library for availability.

Backyard Composting: Your Complete Guide to Recycling Yard Clippings, published by Harmonious Technologies. Even more condensed than *Let It Rot*, it covers the basics in sound bites. Includes brief discussion of permaculture and other interesting agricultural ideas.

Compost Critters, by Bianca Lavies. A wonderful children's book built around the author's spectacular photos, that provides a fascinating look at the critters who live in your compost heap. Also shows Lavies' real working pile (she uses a type of bin) at various stages. Recommended (especially if you have children, and for teachers).

"Consumer Reports Magazine" has reviewed low-pesticide gardening, shredders and mulching mowers, and other topics related to composting. It also is a useful source of information.

Home Composting Made Easy, by C. Forrest McDowell and Tricia Clark-McDowell. Eugene, OR: Cortesia Press. E-mail: cortesia@cortesia.org. In South Carolina, call 1-800-768-7348 for a FREE copy. This booklet covers the basics for starting and maintaining a backyard composting bin. It includes helpful tips, plus the do's and don't for proper bin maintenance.

Let It Rot! The Gardener's Guide to Composting, by Stu Campbell. A classic covering all the basics in a short time, written in a highly readable, down-to-earth style. Good discussion of how to not be obsessed with high temperatures (>140˚F) in the home pile, and the uses of compost.

"Organic Gardening Magazine," published by Rodale Press. The Rodale family defined the American notion of "organic" gardening close to a half century ago, and one of the pillars of their method is composting. The magazine runs a special page on composting every month and will send you a pen and run your picture if you send them a photo of you with your compost heap. Articles on composting abound. Try Jeff Cox's "And I piled it my way!" in the April 1995 issue (Vol. 42, No. 4).

The Rodale Guide to Composting, by Jerry Minnich and Marjorie Hunt. A "Composter's Bible" of over 380 pages, this book looks at various aspects of composting. The chapter on methods gives the pros and cons of several different ways to make compost.

The Urban/Suburban Composter: The Complete Guide to Backyard, Balcony and Apartment Composting, by Mark Cullen and Lorraine Johnson. A pleasant book that, in spite of its title, covers the basics much like the other books. It contains a helpful chart comparing different systems for people in different living situations, a few ideas for very small-scale composting and a section on vermiculture.

Worms Eat My Garbage, by Mary Appelhof. A delightful book with illustrations, which will set you up for vermiculturing and vermicomposting. A classic. Recommended.