Part Two:

Composting at Home

A Guide to Managing Organic Yard Trimmings*

Garden and yard trimmings (e.g, leaves, grass clippings) account for up to 20 percent of the waste disposed of 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 scraps) 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. The amount of oxygen needed in the compost pile must be greater than 5 percent. (By comparison, fresh air is about 21 percent oxygen.) 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 "S.C. Master Gardening Training Manual" prepared by Robert Polomski, Extension Associate, Consumer Horticulture Coordinator, Department of Horticulture, Clemson University

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 (e.g., centipedes, rove beetles, ground beetles, ants) prey on second-level consumers. *See the "Compost Food Web" on the front inside cover.*

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 4 to 6 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.

The 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 trimmings and food scraps 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 scraps 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.

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, smart 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. *See the "Compost Food Web" on the front inside cover.*

Factors Affecting the Composting Process

All natural organic material eventually decomposes. The length of the breakdown process, however, 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;
- 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, manure, coffee grounds and vegetable scraps are higher in nitrogen. It helps to think of these materials as "browns" and "greens," or better yet, as "dry" or "fresh" to remember which is which. 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 nitrogen for every 30 parts carbon.

Average Carbon-to-Nitrogen (C:N) Ratios for Organic Materials

GREENS/ NITROGEN	C:N RATIO	BROWNS/ CARBON	C:N RATIO
Pig manure	5-7:1	Leaves	30-80:1
Poultry manure (fresh)	10:1	Cornstalks	60:1
Alfalfa or sweet clover hay	12:1	Straw	40-100:1
Vegetable scraps	12-20:1	Bark	100-130:1
Poultry manure with litter	13-18:1	Paper	150-200:1
Coffee grounds	20:1	Sawdust	400:1
Grass clippings	12-25:1	Wood chips	800:1
Cow manure	20:1		
Horse manure	25:1		
Horse manure with litter	30-60:1		

SOURCE: Clemson Extension Master Gardener Program

Remember, this ratio describes the chemical composition of a material and does not mean you need 30 times the volume of brown to green.

Pretend you are filling your compost bin. You have leaves (60:1), food scraps (15:1) and grass clippings (17:1). Add the three numbers on the carbon side of the ratio (60, 15, 17) and divide by the number of materials (i.e., three) 92 ÷ 3 = about 31:1. Some people think of it as two parts green to one part brown. Many people have success with equal parts green and brown.

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. Food scraps (e.g., vegetable peelings, coffee grounds, 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.

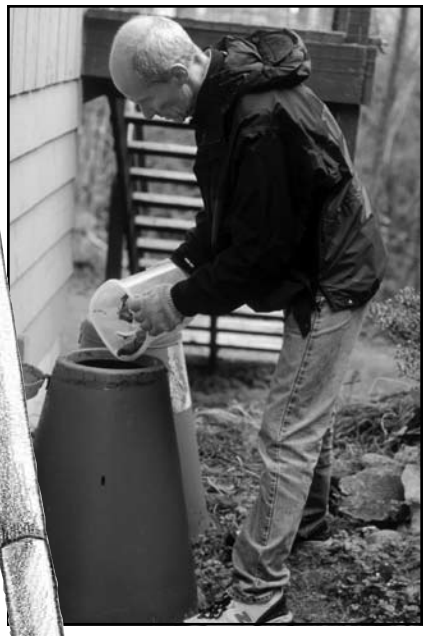
Volume

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 feet (1 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.

Particle Size

The more surface area the microorganisms have to work, 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 trimmings 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.

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 also may 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 the pile is exposed to wind and sun, 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" on page 11 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.

The ingredients and tools needed include:

- greens, fresh material (nitrogen);
- browns, dry material (carbon);
- water;
- garden soil (optional);
- a pitchfork;
- a tarp or cover (optional); and
- a hotbed thermometer (optional).

'Fast' Compost Recipe: Step-by-Step

1. **COLLECT MATERIAL** to create a 1-cubic-yard pile (3 X 3 X 3 feet). Chop or shred any coarse materials to increase their surface area. Start the pile with a 4 to 6 inch layer of "browns" (dry), high-carbon materials (high C:N ratio). Next, add a 4- to 6-inch layer of "greens" (fresh), high-nitrogen materials (low C:N ratio). Add additional nitrogen if necessary. Vegetative food scraps should be added in this layer. If food scraps are included, an additional thin layer of soil, sawdust, leaves, straw or compost should be added to absorb odors.

2. **LAYER MATERIAL** until the pile is about 3 to 4 feet high. Remember to water each layer as you construct the pile. Apply about a quarter-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. In most cases, organic yard trimmings 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. 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.

3. **MIX IT UP.** Use your pitchfork to turn the materials added to the pile. 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.

4. **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.

5. **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.

'Slow' Compost Recipe

Slow composting takes the least labor and time of the many ways to compost. It's ideal for people who don't have a large amount of yard trimmings to compost all at once. This method can take from six months to two years or longer to produce compost, so be patient.

Stacking cinder blocks on three sides (as pictured on page 13) makes an inexpensive bin. A standard-sized garbage can with eight or more slots in the sides

Troubleshooting Tips for Composting Yard Trimmings

SYMPTOMS	CAUSE	SOLUTIONS
The pile smells like rotten eggs or garbage.	The pile is too wet. There is not enough air.	Turn pile and add dry stalks, leaves or straw.
The pile is dry inside.	There is not enough water in the pile.	Turn and moisten materials, then cover pile.
	There is too much woody material in the pile.	Mix in fresh greens or nitrogen fertilizer such as urea, blood meal or chicken manure. Chop or remove coarse woody materials.
	The pile is too small.	Add material to fill bin or make 3 X 3 X 3 feet pile.
The pile is damp inside, but not composting.	The pile lacks "greens."	Mix in fresh greens or nitrogen fertilizer. Chop or remove excess woody material.
The pile has shrunken, but materials are not decomposing.	The outside of pile is dry, but inside has probably composted.	Use material that has not decomposed in a new batch.
The pile has clumps of slimy grass and an ammonia smell.	The pile has too much fresh grass.	Leave grass clippings on lawn or mix in brown leaves or straw.

of the can for ventilation and five in the bottom for drainage also can be used. In all cases, elevate the bin 1 foot off the ground or start the pile with a 3- to 6-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 trimmings 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 tell-tale 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 8 to 12 inches deep and filling it up with shredded organic materials. Vegetable and other food scraps (excluding meat, bones and fatty foods) and 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. Fill the holes with food scraps and cover them with soil. By the following spring, the organic matter should be decomposed.
- **VERMICOMPOSTING** is the production of compost using worms to digest organic waste.

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 1 to 2 inches of well-decomposed compost into the top 6 to 8 inches of soil. Use less for sandy soils and more for clay soils.

  To a limited extent, compost is a source of nutrients. Nutrients are slowly released from compost and, often, 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 1, 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 1. 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 1 cup of ammonium nitrate (0.15 pound actual nitrogen) per 3 bushels (100 pounds) compost is required to provide the additional nitrogen needed by most garden plants.

  Have your soil tested annually 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 in acidic soils.

- **POTTING SOIL:** 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 2- to 3-inch layer of compost can be used as a mulch around vegetables and ornamental plants. Extend the mulch layer up to or beyond the drip line of shrubs and trees. The drip line 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

Q. What is compost?

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

Q. Does compost have any value as a fertilizer?

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

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

A. 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.

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

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

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

A. No. Inoculation with prepared microbes may hasten the process, but there are enough microbes present in the material being composted to initiate the process.

Q. Should compost piles be covered?

A. 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. If a pile is too dry or soggy to start, covering may make the problem worse.

Q. What are the best materials for composting?

A. 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 (no dog or cat feces), grass clippings, vegetable scraps, small tree limbs and shrubbery trimmings, coffee grounds and rotted sawdust are considered good composting materials. Invasive weeds (e.g., Florida betony, nutsedge) should be left on pavement to thoroughly dry out before composting. Avoid composting feces, meat and dairy products or materials contaminated with chemicals.

Q. How do you know when you have the best carbon to nitrogen ratio (C:N) for fast composting?

A. Experimentation is the best way to get a good sense of carbon and nitrogen ratios in different materials. Composting books often have tables giving some rough figures. See the chart on page 11 for carbon-to-nitrogen ratios for organic materials.

Q. Is it necessary to shred materials for the compost pile?

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

Q. Do compost piles need turning?

A. 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.

Q. How do you gauge the proper moisture content for composting?

A. 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.

Q. Do compost piles have offensive odors?

A. In general, 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.

Q. What can be done about a smelly pile?

A. 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.

Q. When is compost ready to use?

A. 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 6 to 8 months, though an ideally mixed and tended pile may take less than 8 weeks to become compost.

Q. How can I use compost?

A. 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.

Q. What is the difference between compost and mulch?

A. 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.

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

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

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

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

Q. Do compost "tumblers" work?

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

Composting Food Scraps

- Burying food scraps 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 composted at home?

- **GREENS (FRESH MATERIAL):** Fruit and vegetable scraps, bread and grains, coffee grounds and filters, tea bags and trimmings from yard
- **BROWNS (DRY MATERIAL):** Non-recyclable paper, paperboard, fall leaves, clean sawdust and wood shavings

What CANNOT be composted at home?

- **MEAT, FISH, POULTRY OR DAIRY PRODUCTS:** Put them in your household garbage.
- **EVERGREEN LEAVES, SAWDUST OR SHAVINGS FROM PAINTED OR TREATED WOOD AND COATED PAPER**

How to Store Food Scraps in the Kitchen ...

A plastic container with a lid is great for storing food 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 5-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 also can be stored in a plastic container in the freezer to control these problems. Do what works best for you.

Worm Bin Composting (or Vermicomposting)

Worm bins are a fascinating way to turn food scraps into high-quality compost. Follow these easy steps to start your own worm bin. Read 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 out pests and retain moisture. Holes drilled in the bottom are essential for drainage. A box about 1 foot deep is best, since worms must live near the surface to breathe. Worm bins can be made from old cupboards, crates or plywood. Bins made from recycled plastic are available through mail-order catalogs or your local discount store. Worm bins should have 1 square foot of surface for each pound of food scraps added per week. A 2 X 4 X 1 feet deep worm box can process about 8 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

Worm Bin Troubleshooting

SYMPTOMS	CAUSE	SOLUTIONS
The bin smells like rotten eggs or garbage.	The pile is too wet.	Mix in dry leaves, peat moss or sawdust.
	Meat, fish, dairy products or pet waste has been added to the bin.	Keep these items out of the bin.
	Food scraps have not been covered.	Cover food with bedding when added.
The bedding is dry and has few worms.	There is not enough water in the pile.	Mix and moisten the bedding. Cover with plastic or cardboard. Move the bin out of sunlight.
Food scraps are accumulating.	There is too much food in the bin.	Limit the amount of food scraps added. Add more worms. Build another bin.
	The bin is too hot or too cold.	Move the bin to a cool basement or garage. Keep the bin filled with bedding.
Maggots are in the bin.	Meat, fish, dairy products or pet waste has been added to the bin.	Keep these items out of the bin. Cover bedding with cardboard or plastic.
Fruit flies swarm out when the bin is opened.	Food scraps are exposed.	Always cover food scraps with bedding. If you still have fruit flies, add an inch of sawdust or peat moss to the top of the bedding or cover it with cardboard.
Worms are crawling up the sides of the bin.	There is too much food in the bin, the bedding is too wet or the contents are fully decomposed.	Limit the amount of food scraps added. Build another bin or add dry bedding.

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 1 pound of worms (about 1 pint of pure worms) to keep up with food scraps. Get worms from a friend's bin or visit www.wormfarmingsecrets.com for sources.
- **STEP 4: BURY FOOD SCRAPS.** Pull aside bedding to make holes or trenches large enough to lay food scraps 1 to 2 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 6 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 (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 bins, shovel a few gallons of compost into a pile in bright sunlight. After 15 minutes, scrape away the outer layer of compost until the worms are visible. Repeat until the 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.

Summary: Successful Composting

It's not a secret. Simply place garden scraps 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 scraps, 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

To Compost or Not to Compost?

DO COMPOST IN PILES OR BINS	DO NOT COMPOST AT HOME
GREENS (FRESH MATERIAL)	
Fruit and vegetable scraps, 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 (DRY MATERIAL)	
Autumn leaves	Large amounts of evergreen leaves, needles or cones
Twigs and stalks	Branches over 1/2 inch in 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

takes a long time to decompose. The chart on the previous page 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 1 cubic yard (3 X 3 X 3 feet) 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:** Avoid materials that may attract pests, create odors or cause other problems. See the chart on page 20.

Books and Resources

There is a small library of books devoted to composting. In addition, most garden books have a section on composting. Here is a selected list of books you may find helpful. Check with your public library.

- **"Backyard Composting: Your Complete Guide to Recycling Yard Clippings"** (no author listed) – It covers the basics and includes a 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 provide a fascinating look at the critters who live in your compost heap. Also shows the author's working compost pile at various stages. It is recommended, especially for children and teachers.

- **"Consumer Reports Magazine"** reviews low-pesticide gardening, shredders and mulching mowers as well as other topics related to composting.

- **"Home Composting Made Easy"** by C. Forrest McDowell and Tricia Clark-McDowell – 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 DOs and DON'Ts for proper bin maintenance.

- **"Let It Rot! The Gardener's Guide to Composting"** by Stu Campbell – A classic covering all the basics and written in a highly readable style. It includes 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"** is an extremely valuable and respected resource offering extensive information of landscaping, composting and organic living. For more information, visit **www.organicgardening.com**.

- **"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 help you with vermiculturing and vermicomposting. Many experts consider this a classic.