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UNIVERSITY OF KENTUCKY — COLLEGE OF AGRICULTURE

Home Composting:
A Guide to Managing Yard Waste

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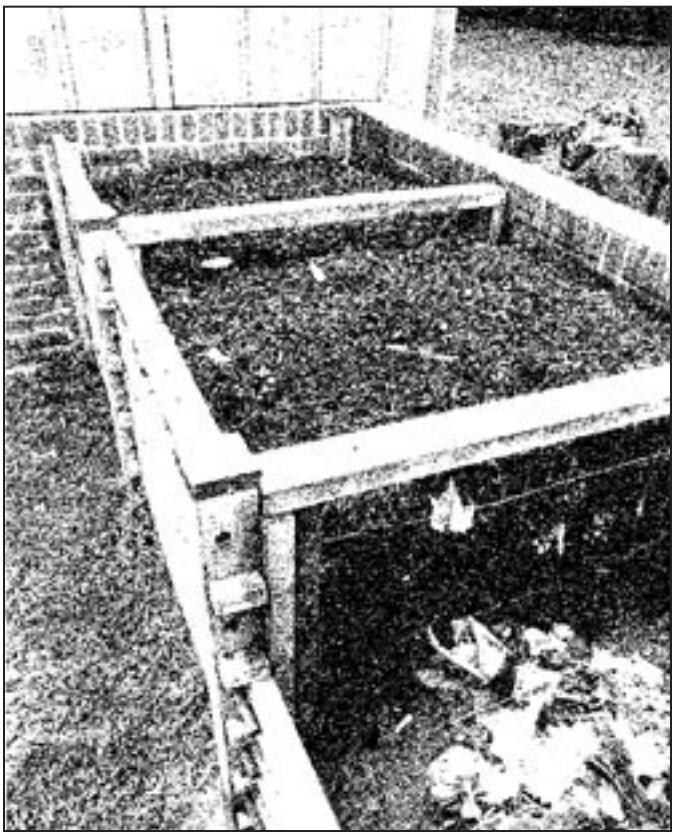

Backyard composting is an extension of processes that have gone on in nature since the origin of life. Without decomposition, the earth would soon be covered with dead animals and plants. With nothing going back into the soil, the soil soon would lack sufficient nutrients for the continuation of life. Natural recycling of these nutrients improves the soil in your yard and makes it more productive while reducing the rate at which landfills reach capacity.

Discarding yard wastes with other garbage creates an unnecessary expense for municipalities. Disposal costs for state-of-the-art landfills range from $30 to $60 per ton. Landscape refuse such as leaves, grass clippings, and trimmings account for up to 20 percent of the wastes being placed in landfills. Bans on outdoor burning and laws that limit dumping of landscape refuse in landfills make home composting an easy, economical, and environmentally attractive alternative for many homeowners. The home compost pile is one way that you can improve the environment by turning yard wastes into a usable product—humus—while extending the life of landfills. This in turn maximizes the value received for the tax dollar.

What Is Composting?

Composting is a controlled natural biological process where bacteria, fungi (microbes), and other organisms decompose organic materials like leaves, grass clippings, and food wastes. The end product is called compost, or humus. During composting, microbes utilize the decomposable matter both as an energy source and for making additional microbes. The word "controlled" distinguishes composting from other natural processes such as rotting or putrefaction, which are less desirable.

The practice of placing materials like compost on the surface of the soil to moderate temperature, conserve moisture, and control weeds and erosion is called mulching. Adding uncomposted materials directly to the soil may produce some undesirable effects. The microbes that break down the organic wastes will compete with the plant roots for nitrogen. This will result in nitrogen deficiency and poor plant growth. Composted materials are also easier to handle and incorporate into the soil.

How Decomposition Happens

Decomposition of organic material in the compost pile is dependent on maintained microbial activity. If any of the following four factors are not optimal, the process of decomposition will slow or stop (Table 1).

Table 1. Optimal composting conditions.

Oxygen	>5%
Moisture	40 - 60%
Carbon:Nitrogen	30:1
Temperature	90° - 140°F

Aeration

Composting can happen either aerobically (in the presence of oxygen) or anaerobically (without oxygen). Oxygen is essential for microbes to efficiently break down organic wastes. Decomposition will occur under anaerobic conditions, but the process is slow and produces foul odors. If the compost pile is too large or is turned infrequently, the interior of the compost pile can become anaerobic while the exterior is aerobic. Your goal should be 100 percent aerobic decomposition.

Oxygen is added to a compost pile by turning with a garden fork. Compost may be turned by transferring it from one bin into the next or by turning it from one side to another. A well-mixed compost pile can reach temperatures in excess of 150°F, but the ideal range is between 90° and 140°F. This heat will help destroy undesirable weed seeds and diseases. Even so, avoid composting weeds heavily laden with seeds. The interior temperature can be checked with a thermometer or by feeling it with your hand. Compost at 90°F will feel comfortably warm; at 140°F, it will be too hot to touch for longer than 10 seconds.

Anaerobic decomposition involves different microbes from aerobic decomposition. Both processes use carbon, water, and nitrogen, but aerobic microbes do not require free oxygen to break down the organic matter. Anaerobic decomposition releases methane, carbon dioxide, water, hydrogen sulfide (rotten egg smell), mercaptans (skunk smell), formaldehyde, acetic acid (vinegar), and ammonia. Some of these chemicals are also toxic to living plants, and the odors are offensive. Anaerobic decomposition is a slow process that can take months to years and may leave live weed seeds and diseases in the compost.

Turning a compost pile at fairly frequent intervals during the first 10 to 15 days will achieve approximately the same degree of biodegradation as making the same number of turns over a longer period. Greater aeration during the initial stages of decomposition intensifies the activity of the microbes and subsequently reduces the time and space required for composting.

Compost that has become anaerobic can be salvaged by turning it on a daily basis until the foul odors have been replaced by a pleasant earthy smell. The compost is then safe to use around tender plants in the landscape.

Moisture

Most organic matter added to a compost pile will contain some moisture. However, more water is generally needed in the beginning and during dry periods if the microbial activity is to remain high. This may come from rainfall or irrigation.

Water the layers as you add them, and cover the pile with plastic during very wet or dry periods. If you are in doubt of the moisture content, squeeze a handful of the material being composted. About two drops of moisture will form if the organic material is adequately moist.

Excessive moisture displaces air from the compost pile, allowing the pile to become anaerobic. Avoid poorly drained locations and the addition of large volumes of soil to ensure that problems do not develop as a result of excessive moisture.

Particle Size

The smaller the particle size, the faster it will be turned into compost. Smaller particles have a larger surface area that can be attacked by microbes. Nothing added to the compost pile should be over 2 inches in size. A shredder is essential for reducing the size of woody material added to the compost pile. Tree leaves should also be shredded to prevent them from forming layers. This task can be handled easily and efficiently by picking up fallen leaves with a mower equipped with a bagger. Shredding will not only speed up the process of decomposition, but it will also reduce the initial volume of the compost pile.

Fertilizer

Carbon serves as both a cell building block and an energy source for microbes. Nitrogen is also required for the growth and metabolism of the microbes. The ideal carbon-to-nitrogen ratio (C:N) in a compost pile is 30 parts carbon to 1 part nitrogen (30:1).

Materials like sawdust and straw are high in carbon and decompose very slowly. Conversely, materials like manure are very high in nitrogen. An ideal C:N ratio is achieved by mixing high nitrogen material with high carbon material (Table 2). Manure or blood meal can be used as organic sources of nitrogen. Otherwise, use a commercial fertilizer with a high nitrogen content. Other nutrients such as phosphorus and potash are usually present in adequate amounts for decomposition.

Table 2. C:N ratios of organic matter usable in composting.

Food scraps	15:1
Grass clippings	19:1
Rotted manure	20:1
Oak leaves	26:1
Leaves in general	35:1 to 85:1
Straw	80:1
Pine needles	60:1 to 110:1
Newspaper	170:1
Sawdust	625:1

During the initial stages of decomposition, organic acids are produced and the pH drops.* However, microorganisms will generally break down these organic acids to other materials fairly rapidly so that the drop in pH is not significant. However, if the compost pile is anaerobic, the pH will initially drop much lower.

The addition of lime to the compost pile will convert ammonium nitrogen to ammonia gas, which leads to the loss of nitrogen. Finished compost is usually slightly alkaline without the addition of lime.

Materials for Composting

Any organic material can be composted. However, many are more desirable and easier to work with than others. Yard wastes such as leaves, grass clippings, straw, and nonwoody plant clippings produce high-quality compost with relative ease (Table 3).

Table 3. Suggested mixes (by weight):

3 parts tree leaves to 1 part grass clippings
2 parts farm manure to 1 part straw
5 parts farm manure to 1 part newspaper

Grass Clippings and Woody Materials

Grass clippings need not be removed from the lawn. However, if they are collected, they should be mixed in with other materials such as leaves. This will prevent them from becoming matted down and anaerobic. Clippings treated with herbicides are allowable if added in small quantities and allowed to thoroughly decompose.

Woody materials such as branches, logs, and twigs may be used if they are chipped to ¼ inch or less.

Other Acceptable Materials

Kitchen wastes: Kitchen wastes such as coffee grounds, egg shells, and vegetable scraps may be added.

Sawdust: Sawdust may be added if nitrogen is supplied at the rate of one pound of actual nitrogen (6 cups of ammonium nitrate) per 100 pounds of dry sawdust.

Wood ash: Wood ash acts like lime and should not be added at more than one cup per bushel of organic matter.

Newspaper: Newspaper may be added to compost piles, although paper is very high in carbon and will slow down the rate of decomposition. Slick paper with colored inks should not be used. It is recommended that newspaper be recycled through appropriate community paper recycling centers rather than backyard composting.

** pH is the measure of how acidic (sour) or alkaline (sweet) something is. The scale ranges from 1 to 14 with neutral being 7. The lower the number, the more acidic. The higher the number, the more alkaline. Sulphur is often used to make soil more acidic, while lime is used to make it more alkaline.*

Unacceptable Materials

Materials that should NOT be added to compost piles include human and pet feces, which can transmit diseases. Meat, bones, whole eggs, or dairy products should not be added as they may attract rodents.

Commercial microbial preparations (compost starters) that claim to enhance composting are unnecessary. Microbes necessary for the decomposition of organic matter are everywhere. You can get a faster startup of microbes by mixing a small amount of soil or finished compost in with the material to be composted.

Composting Structures

Composting can be done in a pile, a bin, or a pit, depending on what is convenient. To save space, hasten decomposition, and keep the yard looking neat, contain the compost pile in some type of structure.

Ideally, the smallest size for a compost pile is 3 feet by 3 feet by 3 feet (1 cubic yard). This allows for moisture retention and insulation of the pile against changes in the external environment. Very large piles become anaerobic if not turned frequently.

Large plastic garbage bags may be used to form compost anaerobically. Fill a 30- to 40-gallon bag with organic wastes. Add one tablespoon of high nitrogen fertilizer and one cup of lime. Mix. Add one quart of water. Seal the bag. You will have compost in six months to a year.

A barrel or drum composter (Figure 1) will generate compost in a shorter period of time. You need a 55-gallon plastic or metal barrel with lid. Make sure the drum has not been used for toxic chemicals. Drill six to nine rows of ½-inch holes around the barrel. Fill the barrel two-thirds full with organic matter. Add ¼ cup of high nitrogen fertilizer. Add water if necessary. Every few days, secure the lid, turn the barrel on its side, and roll around the yard to mix and aerate the compost. Compost should be ready in two to four months.

Bin-type structures handle larger volumes and can be made from

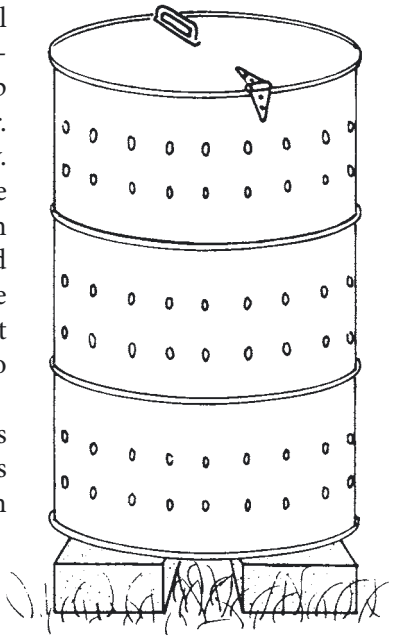

Figure 1. Barrel or drum composter.

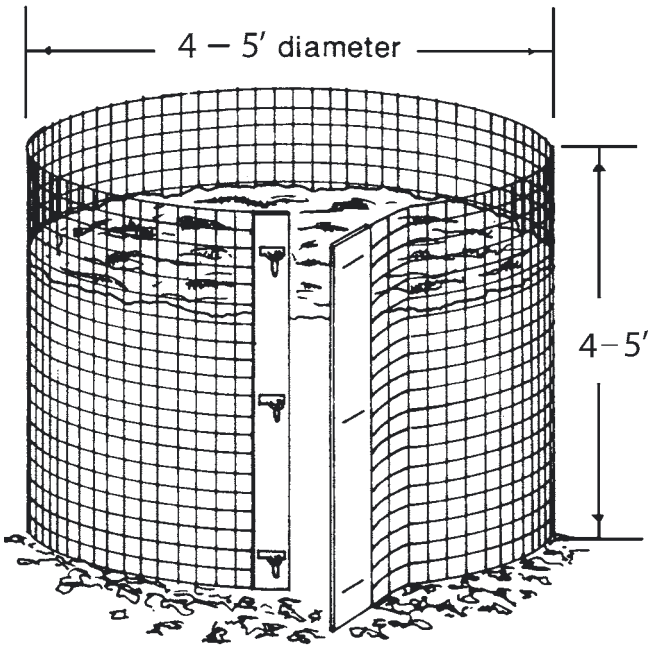

Figure 2. Bin composter.

woven wire without much expense (Figure 2). Woven wire should be 4 to 5 feet wide and 18 to 20 feet long. Bind the two ends together, and fill with compost. When it is time to turn the compost, lift the wire frame, move over a few feet, and turn the compost back into it.

A three-chambered bin will be efficient and durable (Figure 3). It works like an assembly line with compost turned back and forth in the first two bins and stored for future use in the third bin. Wire, wood, masonry material, or a combination may be used. All wood should be pressure treated to ensure that it will last for more than a year or two.

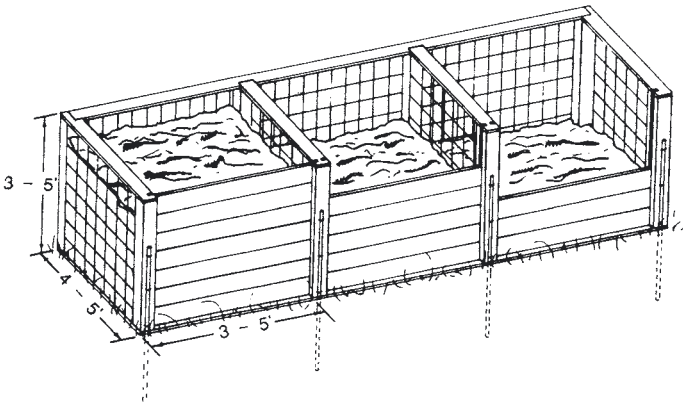

Figure 3. Bin composter with three chambers.

Uses for Compost

Finished compost will have about half its original volume. It should be dark brown or black and crumbly and have an earthy smell. The pH will be neutral to slightly alkaline.

Compost may be used as a soil conditioner. As a soil amendment, it improves the soil's physical condition and fertility. Compost makes heavy clay soils easier to work and, as a result, improves aeration, root penetration, and water infiltration. Addition of compost to sandy soils helps retain water and nutrients.

Although compost contains some nutrients, it should not be considered a fertilizer. In most cases, additional fertilization will be necessary to achieve maximum plant growth and production. Nevertheless, the humus in compost will increase the efficiency of fertilizer used.

Compost makes a good mulching material. It can be used around both garden and landscape plants. It can also be used as a growing medium for house plants or, once pasteurized, for starting seeds.

Compost Troubleshooting

Symptoms	Problem	Solution
Has bad odor	Not enough air	Turn the pile daily until the odor is gone
Center of pile is dry	Not enough water	Moisten materials while turning the pile
Compost is damp and warm	Pile too small	Collect more material and mix the pile in the middle but nowhere else
The pile will not heat up	Lack of nitrogen	Mix in a nitrogen source such as grass clippings, fresh manure, or fertilizer

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