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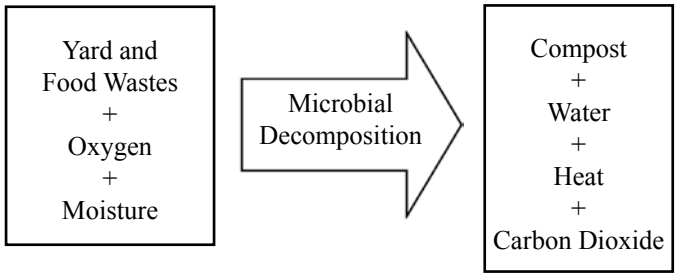
Backyard Composting

What is compost?

Compost is a dark, crumbly, earthy-smelling material that results from the decomposition of organic materials. Compost does double duty when added to soil. It supplies nutrients to plants and improves the structure of any type of soil by holding soil particles together in larger aggregates. Compost also improves water retention because it will hold almost twice its own weight of water.

Compost is relatively stable but continues to change when mixed with soil. Humus is the stable, end result of organic matter decomposition that provides an environment for a complex nutrient transfer system within the soil. Like air, it is essential to life on earth. By incorporating compost into our soil, we are helping to replenish the humus we have lost through farming and other human activities.



Three good reasons to compost:

1. Improve the health and appearance of the garden and landscape plants.
2. Save money on fertilizers and expensive soil conditioners and learn about some of nature's fascinating processes.
3. Up to 75% of materials in typical landfills could be composted. Composting as much as possible could significantly reduce the waste stream, which would extend the life of the landfill and save tax dollars.

Composting: Accelerating a natural process

Most of us have walked in the forest and felt the soft layer of rich, dark decaying leaves and smelled the sweet, earthy aroma of compost. As autumn leaves fall, hundreds of different tiny creatures such as springtails, millipedes, sowbugs, worms, mites, etc. are waiting to chew, shred, grind and otherwise digest the fallen debris. They excrete organic matter which becomes food for microorganisms such as bacteria, fungi, and other decomposers.

To duplicate this natural process in your backyard in a speedier fashion, you must provide the decomposers with plenty of carbon and nitrogen (from organic materials), water, and air.

There are many sources of carbon and nitrogen available during the year. (See the chart below.) Autumn leaves present Marylanders with an abundant carbon source. Dry leaves and most other carbon sources can be stored until materials high in nitrogen are available. Nitrogen is plentiful during summer months in the form of grass clippings, weeds, and spent plants. Nitrogen sources do not store easily.

Carbon Sources (Browns)	Nitrogen sources (Greens)
Cornstalks & corncobs	Alfalfa
Dry leaves	Coffee grounds
Newsprint	Crab/fish waste*
Straw & hay	Fruit & vegetable wastes
Sawdust & wood chips	Grass clippings
Shrub trimmings	Fresh hay
Shredded telephone books	Manure: cow, horse, poultry, sheep, rabbit
Wood chips	Seaweed
Shredded copier paper (Uncoated)	**Trench method only*

Water is added to the compost pile when needed to maintain a 60% moisture content, i.e., the consistency of a 'wrung-out sponge'.

Carbon-to-nitrogen ratio (C:N)
The ideal carbon to nitrogen ratio for a beginning compost pile is 30:1. It is helpful to know the relative carbon/nitrogen mix of the materials you have in your landscape. For example, the carbon to nitrogen ratio (C:N) for oak leaves is approximately 80:1; grass clippings are approximately 17:1, but when mixed together (start with equal amounts **by weight**), the resulting ratio is almost a perfect 30:1! Of course, other materials have different ratios and should be added with some care. Newsprint and sawdust, for example, have a C:N of approximately 700:1, so these materials should be used sparingly in order to maintain a more effective compost pile.

You don't have to be a math whiz to have a working compost pile, just know that you need a combination of "greens" (high in nitrogen) and "browns" (high in carbon).

CARBON: NITROGEN FOR SELECTED MATERIALS

Less than 40:1 = Nitrogen source
More than 40:1 = Carbon source

Organic material	**C:N****
Alfalfa	12:1
Corn cobs	98:1
Cornstalks	60:1
Coffee grounds	20:1
Crab wastes*	5:1
Grass clippings	17:1
Fresh hay	32:1
Leaves (avg.)	55:1
Manure, cattle	20:1
horse	30:1
poultry	10:1
sheep	16:1
swine	19:1
Newsprint	400-800:1
Sawdust	450:1
Seaweed	17:1
Shrub trimmings (green)	50:1
Straw	80:1
Telephone books	770:1
Vegetable wastes	13:1
Water hyacinths, fresh	93:1
Wood chips (hardwood)	560:1
Wood chips (softwood)	640:1

*best used in trench composting
**all numbers approx.

MATERIALS TO AVOID WHEN COMPOSTING

Bones	Milk
Cat manure	Peanut butter
Cleaning solvents	Petroleum products
Cheese	Plastic
Cooking oil	Salad dressing
Dairy products	Soil
Dog manure	Sour cream
Lard	Synthetic fabrics
Mayonnaise	Wood ashes
Meat products	

Cool / Passive composting

This method is not labor intensive, but requires patience. This process is carried out by a narrow range of microorganisms (mesophiles) that reproduce in the ambient (outdoor) temperature range, i.e., 40° F. to about 110° F. These microbes are thorough and produce excellent compost, but they need about a year to complete the process.

If you constantly add fresh materials to your pile, the materials on top of the pile will be in the early stages of decomposition when the material at the bottom is ready to use. Remove the top of the pile and harvest the compost at the bottom annually, or start a new pile when the first pile is 3'x3'x3'. Don't build a pile over 5' high because the weight and volume will compact the organic wastes and limit air movement. This can cause smelly, anaerobic decomposition. Turn the pile once or twice a year, to hasten the process and create a more uniform product.

Hot / Active composting

This method produces a compost harvest in the shortest period of time but requires more careful attention and periodic labor.

Hot composting usually involves a bin, or perhaps a pile, which is filled all at one time with the necessary ingredients without the addition of more raw materials later. The ideal bin size is a minimum of 3'x3'x3' or 27 cubic feet. A heap this size involves a broad range of microorganisms and generates significant heat. Once triggered into action and provided with the appropriate mixture of carbon (browns), nitrogen (greens), water, and air, the 'thermophiles' (heat- loving bacteria) will generate temperatures of 130-170° F., and will produce a compost harvest in six to eight weeks.

Mesophiles: Microbes/decomposers that live and reproduce between 40° F. and 110° F.

Thermophiles: Microbes/decomposers that live and reproduce between 110° F and 170° F.

The temperature will typically rise within 24 hours after the bin is filled. As the thermophiles consume nutrients and oxygen, they produce enough heat to evaporate some of the moisture. The temperature will decrease as they begin to die. This occurs when all of the easily digested sugars and starches are broken down and the tougher compounds like hemicellulose and cellulose remain. Before the temperature drops below 100° F., turn the materials so that fresh materials, air and, if necessary, water are available at the core of the bin.

In time, the volume of the original material will decrease. DO NOT add more raw materials unless the process is not working properly. (See *Trouble-shooting.)* Continue checking the temperature, turning, adding moisture, etc., until the volume of the material is about 50% of the original. The temperature will not rise again. The compost should be dark brown and should not resemble the original materials. Let the pile sit for two weeks, allowing the mesophiles to finish it off. This is known as *curing* and will help stabilize the nutrients.

Sheet Composting

This is an excellent method for creating a new bed in late summer for planting the following spring.

- Mow the area to be amended as low as possible, then sprinkle a nitrogen-rich fertilizer (blood meal, cotton seed meal, or urea) or grass clippings liberally over the area.
- Place a thick layer of newsprint or corrugated cardboard over the entire area. Use at least eight layers of newsprint.
- Spread a three-inch layer of well-rotted manure, compost, or shredded leaves over the paper.
- Spread a six-inch layer of soft garden trimmings (no twigs or branches), kitchen scraps, chopped leaves, straw, any mixture of these or like materials. Water well.
- The bed of organic materials will settle to about six inches high when ready to use.
- This method uses up large amounts of organic material, requires initial labor, does not require turning and boosts earthworm population.
- Under ideal conditions this process could be complete in six months, but chances are it will take nine to twelve months.

Another form of sheet composting involves spreading an eight- to ten-inch layer of shredded leaves over an existing bed. Cover with one- to two-inches of well-rotted manure or compost or simply sprinkle one pound of nitrogen-rich fertilizer over each 100 square feet of shredded leaves. Water well to get it started.

Trench Composting

This method offers the small-plot vegetable gardener an opportunity to improve the soil on a continuous basis. After fall harvest, dig a trench in the walking or gardening space, about eight to twelve inches deep. Begin burying your kitchen waste and other raw organic materials in the trench, covering the material as you go with chopped leaves, grass clippings, straw or soil. Each year or season, you can alternate the location of trenches. You can bury a broad range of organic materials without the fear of attracting animals or creating anaerobic odors. Plus, you can continue to compost all winter!

Temperature Control

Temperature can be monitored in several ways. Compost thermometers are available for purchase. Or use your hand to monitor the temperature. If the pile feels cool when you thrust your hand into it, it probably needs to be turned. (The target temperature is 100º and body temperature is about 98.6°). If the pile/bin feels at least as hot as the hot water from your faucet, it is doing fine. If it feels really hot and has the aroma of ammonia, it may need a little more carbon, because excess nitrogen may cause anaerobic decomposition that results in bad odor and more heat.

Anaerobic = no oxygen.
Aerobic = in presence of oxygen.

pH

Avoid adding lime to your compost pile/bin as it can cause a chemical reaction that releases nitrogen gas in the form of ammonia, thus denying nitrogen to the microorganisms that do the work for you.

Even though many organic materials are initially acidic (low pH), the compost process tends to neutralize the pH of the finished product resulting in a pH of around 7.0, or neutral pH.

Help! There are bugs in my compost!

An array of soil invertebrates such as earthworms, flatworms, springtails, grubs, maggots, millipedes, ants, sowbugs, etc. performs the initial breakdown of coarse materials - biting, chewing, decreasing the size of the materials and thus increasing the surface area so that the microorganisms can do their work.

Two other major contributors to the process are *protozoa* and *actinomycetes*. Protozoa are microscopic animals that eat bacteria. Fortunately, the bacteria are able to reproduce more rapidly than protozoa can eat them. As protozoa metabolize and reproduce, they generate heat, which in turn encourages the reproduction of more bacteria.

Actinomycetes are filamentous bacteria that are responsible for the sweet, earthy aroma of forest leaf mold, newly plowed farmland, or finished compost.

When is Compost Done?

- When the material is even in color and texture and has an earthy smell with no "off" odors.
- When the temperature of the pile is at the outdoor temperature.
- When a small amount placed in a plastic bag and sealed causes no condensation of moisture inside the bag.

Summary of Composting Methods

Type	Advantages	Disadvantages
Hot	Quicker harvest. Kills many weed seeds and diseases. Less likely to attract unwanted animals.	Requires careful attention and frequent labor. Requires storage of some materials prior to use. (Most carbon sources can easily be stored for many months.)
Cool	Materials added as generated. Less labor. Compost rich in beneficial organisms.	Takes a year or more. Some nutrients lost to leaching. Can attract animals and flies.
Bin	Neat and tidy appearance. Can be used for either hot or cool method.	Must purchase or fabricate. May be difficult to turn materials. Generally requires more labor than other methods.
Tumbler	Neat and tidy. Good for maintaining aeration. Works well for cool composting. Good for small space.	Costly. Volume is usually inadequate for hot composting. Filling and/or harvesting may be awkward. Requires close attention.
Worm composting	Easy. Little or no odor. Can be done indoors or outdoors. Rich product. Excellent way to compost food waste.	Requires careful attention to food materials added. Must provide suitable location and temperature for worms; may attract fruit flies. (See fact sheet HG-40, Indoor Redworm Composting.)
Sheet composting	Accommodates large volume of material. No turning required. Boosts earthworm population.	Requires timing and patience. Requires some initial labor. May not be ready for planting when anticipated.
Trench composting	Easy. Boosts number of earthworms. Doesn't attract flies or animals.	Requires planning, persistence, and regular trips to the garden.

Troubleshooting and Often Asked Questions

Should I cover the pile or bin?
Covering is not necessary, but it may help control evaporation and conserve nutrients. Rainfall can be a real benefit during dry periods.

Should I add soil? Bioactivators?
Soil is not necessary and could compact the pile and displace oxygen. Bioactivators are not necessary. To kick-start a newly charged bin, simply add a few shovels full of compost.

Should I attempt to compost pine needles? Oak leaves? Holly leaves? Walnut leaves?
Certainly. Tough pine needles and holly leaves will take longer. Newly shed oak leaves are acidic but will be pH neutral when composted. Walnut leaves contain little, if any, of the toxin *juglone*. (Most of that chemical is produced by walnut roots and remains in the soil.) The composting process breaks down *juglone*.

What happens to weed seeds? Diseased plants?
Even though hot composting will usually kill most weed seeds, one should avoid adding weeds that are in flower or have seed heads. Many disease pathogens are killed by hot composting, but...when in doubt, leave it out.

Should I compost kitchen scraps?
Many kitchen scraps are welcome additions to your compost pile/bin. Save vegetable and fruit parings, rinsed egg shells, coffee grounds and filters, tea bags, stale bread, etc. Be advised, however, some municipalities may have restrictions on the backyard composting of kitchen scraps. Indoor redworm composting and trench composting are good alternatives for kitchen scraps.

Should I use treated lumber to construct my compost bin?
It is best to avoid using treated lumber (ACQ or copper azoles) in the fabrication of a compost bin. Also avoid adding sawdust from treated lumber to the compost bin/pile.

Should I use grass clippings that have been treated with herbicides (weed killers)?
Although many herbicides break down within a few weeks or months, some others can survive the compost process and have an adverse effect on plant material. Leave out any treated grass clippings.

Why is the pile/bin not heating up?
This could be the result of insufficient nitrogen. Or, the pile/bin could be too wet (inadequate oxygen), or too dry (insufficient moisture). If too wet, turn the heap to dry it out. If too dry, add water. If the moisture is ok, add a nitrogen source.

Why does my compost smell bad?
This is the result of anaerobic digestion and could be caused by too many nitrogen-rich materials (lots of matted grass clippings) or too much water. Turn the pile and add some shredded newspaper, straw, or sawdust to dry it out.

Where should I place my pile/bin?
The microbes don't really care. Make yourself comfortable. In full sun, you may have to add water more frequently. In shade, you may have to share the nutrients with the nearby plants as their roots invade the pile. Avoid placing bins next to wooden structures - moisture can attract termites.

Do I have to add materials in layers?
No. It works, but it is better to mix the ingredients thoroughly. Layering is often suggested since it requires less labor.

Can I add fertilizer to my compost pile/bin?
Yes, but don't rely on inorganic fertilizer as your sole source of nitrogen. Organic sources include blood meal or dried blood, cottonseed meal, alfalfa meal, even nitrate of soda.

Will fabrics compost?
Yes, but avoid wool. Animal products tend to break down anaerobically. Cotton is an excellent source of carbon, so don't hesitate to add old tee shirts, or other discarded 100% cotton fabrics to the compost pile. Also, don't forget to add the lint from your clothes dryer.

Now that I've got it, what do I do with it?

- Incorporate it into the soil as a **soil amendment.** Add to established beds or when creating beds.
- Use two inches of compost as mulch around landscape plants to keep the soil cooler, retain moisture, and add nutrients to the plants over the course of the growing season.
- Grow vegetable and flower transplants and container plants in screened compost. Try a mixture of 50% compost and 50% commercial soil less growing media.
- Use it to make compost tea, which has multiple benefits to plants and soil. Applying it to the soil around plants or spraying it on foliage applies beneficial microbes that could suppress the colonization of disease-causing fungi. Compost tea also contains small amounts of organic nutrients necessary to the health of plants. It encourages earthworm activity and will enhance the population of soil microbes.

To make compost tea, simply combine one gallon of compost and four gallons of water in a five gallon plastic bucket. The compost can be contained in an old pillow case or wrapped with vinyl window screen. Stir the compost around, remove the compost the next day and use the tea.

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