Compost

Compost Bins

Many compost bin designs were developed for areas having higher rainfall, moderate temperatures, and/or higher levels of humidity. Under these conditions, the compost must have a greater exposure to air to prevent it from becoming too wet and going anaerobic (stinky and nasty). These bins often have wire mesh or large air spaces in their sidewalls, which promote aerobic conditions necessary for healthy compost. While these compost bin designs will function in the arid southwest, they will also require greater inputs of water to maintain proper moisture for the compost-producing microorganisms.

While compost does require adequate aeration, we can conserve some water by using solid sidewalls on our compost bins. Larger diameter compost piles can also help conserve water by minimizing the surface area to volume ratio. Solid sidewalls of wood, concrete blocks, or sheet metal slow water loss, provide adequate aeration, and retain heat. If additional aeration is needed, then you can add more coarse materials or perforated drainage pipe.

There are several types of manufactured compost bins.

- The drum type composters are great for small amounts of kitchen and yard waste. These are rotated whenever new materials are added and are easy to manage.
- The upright bins, usually made of UV resistant plastic, are convenient for depositing compostable waste, but are not easy to inspect and make only small quantities of compost.
- Wooden slat or wire cage bins. are convenient and hold larger quantities of materials, but lose heat and moisture more readily.
- Multiple compost bins (there are several designs available on the Internet) provide flexibility to have compost at various stages of decomposition or segregation of materials and/or composting methods.

If you are unsure of which system you should use, try to envision the amount of waste your household generates over the course of a year. The average household with a small yard, low maintenance landscape, and kitchen waste can probably get by with a plastic bin or drum composter. If you have chickens, rabbits, and a large garden or landscape, at least two bins are recommended. With horses and acreage, you will definitely need large bins or possibly even free-standing piles you turn with a tractor. Regardless of methods/bin configuration, you will probably end up with about ¼ of the original volume. Remember: you can never have too much compost!

Making Compost - Carbon:Nitrogen Ratio

Twenty to forty percent of the solid wastes currently entering the landfill could theoretically be composted. In short, compost enhances soil fertility, increases water holding capacity, and adds humus. If you keep this material on-site (i.e. on your property), then it also reduces transportation costs and lengthens the usable life of sanitary landfills.

Compost need not smell bad, attract vermin, or take too much time. Composting is a microbial process that converts plant materials such as yard trimmings, grass clippings, leaves, safe animal manures, coffee grounds, vacuum cleaner and kitchen scraps into a beneficial organic soil amendment. Gardeners have used compost for centuries to increase soil organic matter, improve soil physical properties, and supply some of the essential nutrients for plant growth.

Composting is both art and science. The "science" is well documented and resources are available at Cooperative Extension offices, libraries, and on the Internet. The "art" is making it practical and easy given your individual household,

landscape/garden, and interests. If you only have a few annual flowerbeds and do not vegetable garden, you can compost kitchen scraps and yard wastes on a small scale. If you are vegetable gardener, you should make as much compost as possible - our summer temperatures and alkaline soils cause it to decompose more rapidly.

The critical factors in composting are maintaining: 1) a 20:1 carbon-nitrogen ratio by weight; 2) good aeration; and 3) adequate moisture. You should never add human/dog/cat waste, meat products, bones, dairy products, oil, or grease to your compost. The trickiest part is the carbon-nitrogen ratio. Green materials and manure contain relatively large amounts of nitrogen. Brown materials such as straw, pine needles, twigs, sawdust, wood shavings, and other non-green materials are almost entirely carbon.

When the carbon-nitrogen ratio is near 20:1, the compost will get warm and smell sweet like leaf mold. This ratio is ideal for decomposing bacteria and fungi. They utilize the carbon and nitrogen by incorporating it into their cell structure, increasing their populations and speeding the decomposition process. The bacteria and fungi die, leaving behind nutrient rich compost. When there is too much carbon, compost decomposes very slowly. When there is too much nitrogen, the compost will smell like ammonia. You are in control and can add appropriate materials at any time to adjust the ratio and shift the activity to create a proper balance.

Adequate aeration ensures that aerobic conditions predominate. A lack of aeration can create anaerobic conditions which lead to a stinky, unsavory compost pile. Straw, twigs, and pine needles can increase aeration or a few lengths of 4 inch perforated drainage pipe can be strategically buried in the pile to allow oxygen in the atmosphere to reach the inside of the pile.

Moisture is relatively easy to maintain once adequate aeration is achieved. Compost should be kept as moist as a wrung-out sponge. In humid areas, compost gets too wet and bins should be designed to allow some drying (woven fence wire). Conversely, in Arizona, compost tends to dry out too quickly.

During the fall season, we often have lots of leaves. Rather than burning or bagging them, compost them. Leaves are mostly carbon and will need an addition of nitrogen-containing materials to begin composting. Grass clipping are an ideal nitrogen containing material, but are not usually available in large enough quantities to compliment huge amounts of leaves. In these cases, you may also use a nitrogen containing fertilizer to make up the difference. Just make sure you layer the leaves and nitrogen fertilizer to ensure the nitrogen is available throughout the compost pile. Adding small amounts of soil to these layers will inoculate the compost with the local microbes.

Manure, a “green” material, is readily available to us. Horse, alpaca, llama, sheep, goat, rabbit, and cattle manures are available to us through both formal and informal channels. Horse manure is the most plentiful in our area and is often free for the taking. The main caution is to beware of bermudagrass (and other weed) seeds – horse manure can contain viable seed. Other types of manure are less likely to contain weed seeds, but you can ask the owner what the animals feed and/or graze upon.

Shredded paper, a “brown” material, can include newspaper, office paper, phonebooks, and other sources. Over the years, there have been concerns about toxicity from heavy metals coming from colored inks. Evidence shows such low concentration of heavy metals - if any at all - that colored paper may be used without significant risk. Many inks currently used are soy-based. According to one science-based source, shredded computer or other office paper and glossy magazine-style paper decomposes slowly and may contain dioxins. There are enough concerns about the dioxin in bleached and glossy paper that it would be wise not to use them in the garden.

Coffee grounds from espresso bars and restaurants are collected and composted by many gardeners. Coffee grounds are in between “brown” and “green”, having some nitrogen but other properties and compounds that may inhibit decomposition. Contrary to popular opinion, coffee grounds do not appreciably acidify the soil. However, having greater than 20% coffee ground content in a compost pile is not recommended. All things in moderation…

Brewing and wine making waste products can be composted. Wine making waste is called “pomace” and contains seeds, stems, skins, and pulp. Brewing waste contains crushed grain and hulls. These materials are still relatively high in nitrogen and should be added to brown materials prior to composting. The idea is to prevent aerobic conditions from developing. If it does, you will smell ammonia or other foul odors.

Green weeds, another “green” material, can be composted as long as the flowers have not matured and produced viable seed. Grass clippings are very difficult to compost because they tend to create mucky layers that prevent aeration of the compost pile. A better solution is to mow using a composting mower that spreads the clippings evenly on the soil surface where microbes can recycle their nutrient – this also reduces fertilizer demand.

Some gardeners use commercially available compost "starters" or accelerators. These are supposed to help the decomposition process by adding nitrogen, enzymes, and bacteria to a pile. These products are largely unnecessary as these compounds and organisms are already present. Tests conducted at universities and private research stations have showed that the best compost additives are either your own, unpasteurized but finished compost or native topsoil from your garden.

Compost Temperature

In theory, compost can be finished in as short as two weeks (this is the claim with compost tumblers/rotating drums). This all depends on the proper mix of air, water, and raw materials. A C:N ratio between 25:1 and 30:1 is the optimal range for fast composting. As the amount of carbon increases, the composting organisms still work, just more slowly. The more slowly it composts, the cooler the temperature within the pile.

There are two schools of thought on compost temperatures: hot vs. cool, each with advantages and disadvantages. A realistic time frame for hot compost is eight weeks. Hot composting can be likened to combustion: more air (oxygen) results in hotter compost and faster decomposition. Hot compost piles require a minimum size: at least four to five feet square and four feet high. Piles smaller than this lose heat too quickly. Hot compost reaches temperatures between 113 and 158 degrees F and must be turned often to maintain the necessary level of aeration. The hot method utilizes thermophilic microorganisms that thrive at these high temperatures.

Advantages of hot composting:

- speed of decomposition
- efficient use of space
- kills most weed seeds and pathogens present in the raw materials

Disadvantages of hot composting:

- amounts of labor needed
- a solid knowledge of C:N ratios in materials, some nitrogen is volatilized (turned into a gas and lost) to the atmosphere
- beneficial soil microbes can be killed by high temperatures

Cool compost is more forgiving with respect to C:N ratios. If nitrogen is in shorter supply (i.e. a high C:N ratio), the microbial populations do not reproduce as fast. Cool compost still heats up, but only to a maximum of about 120 degrees F. This is a "laid back" method of composting. It can take between six months and two years to finish composting.

Advantages of cool compost:

- less work
- preserves beneficial soil microbes
- conserves nitrogen (no volatilization)
- new materials can be added any time

Disadvantages of cool composting:

- potential for nutrient losses from exposure and weathering
- it takes more time to finish
- does not heat kill as many weed seeds and pathogens
- requires some attention to C:N ratio and moisture as materials are added
- it can have some material that is not composted mixed in with the finished compost

Choose a method that fits your needs and personality. Having multiple bins allows you to have the best of both worlds: a batch of hot, a pile of recent raw materials awaiting their turn to be added to the next hot pile, and a bin full of ready to use finished product.

Remember that composting is an art and science. It is very forgiving – when things are out of balance you can readjust your compost by adding materials or increasing aeration.

January 28, 2024

Adapted from original Backyard Gardener publications by Jeff Schalau, Agent, Agriculture & Natural Resources, University of Arizona Cooperative Extension, Yavapai County