



# SMALL SCALE COMPOSTING IN THE LOW DESERT OF ARIZONA

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## What Is Compost?

Compost is decomposed organic matter, produced by the work of millions of bacteria, fungi, and other naturally occurring soil organisms. Good compost is very dark in color and smells sweet like forest soil. Compost can be incorporated into garden soil or spread on the soil surface as a mulch.

## Why Compost?

Composting yard and kitchen waste:

- reduces the amount of material sent to landfills;
- saves money spent on fertilizers and soil amendments;
- improves the water holding capacity of soil; and,
- loosens hard desert soil so that roots can penetrate more easily, once it is incorporated.

According to the U.S. Environmental Protection Agency, 26% of waste in landfills comes from kitchens and yards. Many Arizona cities have programs to encourage backyard composting. Visit your city's public works website for more information.

## What Is Needed For Successful Compost Production?

### 1. Native Soil Microorganisms

The compost pile should be inoculated with native soil. Just one or two shovels of soil, mixed into the compost will provide millions of fungi and bacteria that will turn kitchen and yard waste into compost. There is no need to purchase commercial products that contain these organisms.

### 2. Water

One of the biggest challenges to composting in the desert is keeping the pile moist. Remember, the work of composting is performed by millions of bacteria and fungi. Like all living things, these microorganisms require water to grow and reproduce. A healthy compost pile should be moist, but not wet (40%-60% of the weight of the pile should be water; it should feel like a well-wrung, damp sponge). Poorly drained piles will take on a foul odor and may harbor mosquito larvae. During the hot summer months, you may need to water the



Raked leaves and other yard waste make excellent compost.

compost pile weekly. Keep in mind that covering the compost will slow water evaporation, but will prevent rainfall from helping to keep the pile moist. A shaded location will also help reduce water loss.

### 3. Oxygen

Some bacteria and fungi require **oxygen** to survive (aerobic); others do not (anaerobic). Although both types will eventually convert waste to compost, we want to encourage the aerobic bacteria and fungi by keeping the pile loose and turning it often. Lifting and turning the compost periodically introduces oxygen into the system and kills anaerobic organisms. This will speed the decomposition process and prevent bad odors. Placing bulky materials, like small twigs in the pile will also improve aeration. These can be sifted out of the finished compost.

### 4. Organic Materials Like Kitchen and Yard Waste

Many organic materials from the kitchen and yard can be composted. Yard waste such as grass clippings, leaves, trimmings and spent flowers can be combined with kitchen scraps like vegetable peels, fruit rinds, cores, and coffee grounds (including filters) in the pile. Straw, sawdust, and shredded paper can also be added in appropriate quantities depending on types of other raw materials.

## A Note About Nitrogen

Just as plants need nitrogen to grow, decomposing bacteria and fungi require nitrogen to aid in their growth and metabolism. If there is not enough green material to provide adequate nitrogen, decomposition will be slow or may stop altogether. To jump start the decomposition, process or if there is not enough green material to achieve the 20:1 ratio, nitrogen-rich materials such as manure or synthetic nitrogen fertilizer, such as ammonium sulfate, can be added to the pile. Putting un-composted organic matter, particularly brown materials, directly into the garden can cause temporary nitrogen deficiency in plants, causing them to be small and yellow in color.

A 20:1 carbon-to-nitrogen ratio (C:N) will produce the best compost in the shortest amount of time. The carbon comes from "brown" or dry materials with a high carbon content like dry leaves, sawdust and shredded paper. Nitrogen comes from "green" materials such as kitchen scraps and manure. To achieve the ideal 20:1 ratio of carbon to nitrogen, a mixture of brown and green materials are mixed in the pile. The following table contrasts brown and green compostable materials.

Brown	Green
High in carbon	High in nitrogen
Not always brown in color	Not always green in color
Dry	Moist
Dry leaves, pine needles, sawdust, shredded newspaper	Kitchen scraps, grass clippings, chicken manure, coffee grounds

If the C:N is too high (above 35:1), decomposition will be very slow. If it is below 20:1, excess nitrogen may cause a foul odor.

### C:N Ratios of Commonly Compostable Materials (From the US Environmental Protection Agency)

Chicken manure	6-14:1
Cow manure	10-30:1
Coffee grounds	20:1
Grass clippings	17:1
Alfalfa hay	15-19:1
Dry leaves	40-80:1
Newspaper	400-850:1
Sawdust	442:1
Vegetable waste	11-19:1
Fruit waste	40:1
Pine needles	60-110:1

## What Materials Should Not Go Into A Compost Pile?

- **Animal products** such as meat, bones, fat, and pet feces do not belong in the compost pile. They take a long time to decompose, smell bad, attract flies and other vermin and harbor bacteria that can be harmful to human health. It is okay to compost eggshells and poultry, horse, sheep, cattle, lama, alpaca, and rabbit manures.
- **Oily products**, like margarine and cooking oil are slow to decompose and should not be composted.
- Although thorough composting should kill **plant diseases** and **weed seeds**, it's probably best not to take any chances. Avoid using weeds that have gone to seed or plants that are diseased. Weeds that are still green and moist can be pre-treated to kill seed during the hot summer months by placing them in closed, clear, plastic trash bags which are left out in the sun for several weeks.
- Never add **fireplace ash** to the compost pile, as it increases the pH. Most Arizona soils are alkaline; increasing the pH would be detrimental to plant growth and nutrient availability.

## How Do I Build And Maintain My Compost Pile?

1. **For best results: grind materials into small pieces.** Smaller pieces provide more surface area where decomposing organisms can work, and the compost will finish faster. **Mix the green and brown materials together, rather than layering.**
2. Remember to keep compost moist. In dry climates the leading cause of slow decomposition is lack of water. Decomposing microorganisms live in the film of water surrounding the material in the compost heap. It should have the consistency of a wet sponge that has been squeezed of excess water.
3. Turn the pile regularly to increase the amount of oxygen available to the decomposing organisms. Add water as you turn the pile to ensure even moisture. Microbial activity will cause the compost to heat up. Ideally, the internal temperature of the pile will reach 130o F for seven consecutive days. Compost thermometers can be purchased from several sources for \$20-\$25.

### What type of container should I use?

It is not necessary to purchase an expensive or complicated bin for making compost. The structure should keep birds, dogs, cats and other animals out, while allowing easy access for adding more material and turning. A good bin allows for gas exchange and drainage. In Arizona, a number of municipalities offer recycled trash containers as compost bins for free or at a minimal cost (see image below). Recycled wooden pallets can be attached with hinges to create an effective and low cost compost container. Bottomless baskets made of hardware mesh or chicken wire can also be used as inexpensive or free compost containers. The optimal size of a

backyard compost bin or pile is 3'x3'x3' to 4'x4'x4'. If the pile is too small, ambient air temperatures and moisture loss may interfere with microbial activity and heating. If the pile is too large, it may get too hot, anaerobic, and/or become difficult to turn, and/or not allow enough oxygen to the center of the pile.

### What is the best location for my compost bin or pile?

Keep the bin close enough to the kitchen so that it is convenient to visit. Be sure it is near a hose bib or other water source so that it can be watered frequently. Consider placing the bin in the shade, to reduce water evaporation. Since nutrients will move into the soil from the compost, place it in a location where you would like to eventually plant.

### How do I know when the compost is finished?

Finished compost no longer resembles the original materials in appearance or odor. It should be dark brown or black in color and have a sweet smell. Most disease-causing organisms or weed seeds that may have been in the raw starting materials will be killed if the pile has reached an internal temperature of 130oF for seven consecutive days. When raw materials are continually added to the pile, the process slows. Once the pile cools, age the compost for three to six months to allow other organisms to finish the process and stabilize the product.

## Troubleshooting Your Compost

If your pile is...	Then
Attracting flies, vermin or other animals	Remove and avoid adding further meat, meat products, dairy, fat, or animal carcasses.
Slow to decompose or not heating up	Lower C:N by adding more green materials to increase nitrogen. Check moisture content and add water if necessary. Turn the pile. If the pile is smaller than 3'x3'x3', increase the size.
Smells rotten or like ammonia	Increase C:N by adding more carbon-rich brown materials. Check for poor drainage and remedy as necessary. Turn the pile to improve aeration.



Recycled trash container modified into a compost bin.

## For Further Reading

The Arizona Department of Health Services has published a document on safe composting for school gardens:

<http://www.azdhs.gov/phs/oeh/fses/school-garden/documents/plant-derived-composting-attestation.pdf>

The U.S. Environmental Protection Agency maintains a composting website: <http://www.epa.gov/compost/>

Cornell Waste Management Institute's site has a series of free fact sheets on composting: <http://cwmi.css.cornell.edu/factsheets.htm>



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