COMPOSTING

Introduction

Composting accelerates the decomposition or natural breakdown of organic matter by microorganisms. Composting turns garden waste, kitchen vegetable and fruit scraps, and other organic material into a valuable soil amendment and plant fertilizer. Composting has been practiced for thousands of years and is still widely used throughout the world by gardeners and farmers who practice organic farming and sustainable agriculture.

Reasons to Compost

Home composting recycles urban green-waste and saves valuable space in landfills. Based on a 1992 study, 30 percent of what goes into landfills is organic, 60 percent if you add paper. Every year Americans dispose of 24 million tons of leaves and grass clippings. California Assembly Bill 939, passed in 1989, mandated a 50 percent reduction of material going to landfills by the year 2000. A statewide diversion rate of 42 percent was reached in 2000 and the amount of waste dumped in landfills decreased by only 13 percent.

Adding compost to soil increases the level of microbial activity. This helps plant-roots absorb nutrients. The organic matter helps improve soil structure, water retention, and aeration. Many micronutrients are chemically bound up in the soil which makes them unavailable to plants. Composting converts micronutrients in organic debris (iron, manganese, zinc, and copper) into a form plants can use. It also improves soil chemistry so that nutrients are more available to plants.

Compost provides food for earthworms, which live and multiply. Earthworms, in turn, help to aerate the soil and their castings contain nutrients which plants can absorb. It has been shown that plants grown in soils amended with compost tend to be healthier, have increased drought tolerance, and are more resistant to some pests and diseases. Composting decreases the amount one needs to spend on soil amendments and will lessen the need for chemical fertilizers. Overuse of chemical fertilizers (containing nitrogen and phosphorous) can cause serious water pollution problems. This results in an overgrowth of algae, fish deaths, and other adverse effects on natural ecological systems.

The Compost Process

The chemical process necessary to turn garden trimmings and kitchen scraps into good compost requires carbon, nitrogen, water, oxygen, and microorganisms such as bacteria and fungi.

Compost piles which are relatively cool, often harbor insects (such as spring tails and beetle larva), nematodes, fermentation mites, centipedes, millipedes, sow bugs, pill bugs, and earthworms, which assist in the decomposition process.

Some less desirable creatures, such as flies, ants, earwigs, snails, and slugs are also attracted to compost piles. To discourage these less welcome creatures try turning and moistening a pile more often.

Heat will build up in your pile if the material you use has the proper ratio of carbon and nitrogen. Frequent turning and watering will help maintain high temperatures, by supplying the oxygen and moisture necessary for complete and rapid breakdown.

The smaller the particle size, the faster the material can break down. There are mulching mowers which can help to shred plant materials and leaves; chipper/shredders can reduce the size of fairly large material, but they are expensive and need room for storage.

How to Make Compost

The optimum size for a compost pile to heat up properly and maintain temperature is a minimum of 3x3x3 feet. For the composting process to work most effectively, material to be composted should have a carbon to nitrogen ration of 30/1. This can not be measured easily, but experience has shown that mixing equal volumes of green plant material with equal volumes of natural dry plant material will give approximately a 30/1 carbon to nitrogen (C/N) ratio.

Materials high in carbon are referred to as browns and include such materials as autumn leaves, straw, woody stems, bark, mixed paper, newspaper and cardboard, wood chips or sawdust.

Green or nitrogen-rich materials are: vegetable scraps, coffee grounds, grass clippings, manure, leaves from green, newly pruned plant material, shredded corn stalks, and shredded natural fibers such as cotton, fleece, hemp, and burlap.

If a material is green when it is cut or harvested, it will lose some nitrogen if left to dry out before shredding, but it is still green. Leaves that have fallen from a tree, as in autumn leaves, are mainly carbon because the nitrogen has returned to the roots due to the shortening day length and cooling temperatures. Coffee beans, although brown in color from roasting, were harvested when green; therefore they are "green" even after roasting.

If you have too little nitrogen and your pile won't heat up, you can add a small amount of nitrogen fertilizer, such as ammonium sulfate, to your pile when turning it. If there is too much nitrogen there will be a strong odor of ammonia, but adding a little sawdust in the area of greatest odor can help.

Do not add the following to your compost pile:

- Animal feces from dogs, cats, and other carnivorous animals, (herbivorous animal manure such as chicken, goat, rabbit, cattle, elephant, is OK)
- Ashes (too alkaline)
- Weeds which have already formed seeds
- Diseased plants
- Dairy or meat products
- Bones, fish, lard, mayonnaise, peanut butter, oils, bakery goods (may draw critters to the pile, also take a long time to decompose)
- Palm fronds (too fibrous, difficult or impossible to shred, require too much time to decompose)
- Walnut husks and walnut leaves (require too long a compost time, inhibit the growth of some plants such as tomatoes)
- Rose clippings (avoid because of the thorns)

Methods of Composting

There are several methods of composting.

Passive

Passive composting requires little effort. Brown and green raw materials are placed in a pile in proper proportions, and occasionally watered to keep it moist until it is completely composted (material is no longer recognizable as leaves, grass, vegetables.) Such a pile is usually built gradually, adding material a little at a time.

Another option is to place the composting material in a commercial compost bin, and then adding water and stirring occasionally. Finished compost is removed through the bottom door as it appears ready for harvesting.

Both of these passive methods are relatively slow. Since the pile does not heat up to the extent that an active pile does, seeds which could sprout in your garden, or diseased plants which could infect other plants should not be included in the pile. This method requires very little work, but it will take much longer to get finished compost (5-12 months vs. 1-3 months for the active method).

Active

The active or hot composting method is the most labor intensive, but it is also much faster than the passive method. Under optimum conditions it is possible to have beautiful brown compost in just a few weeks with the active method.

Begin by building a compost pile all at once, watering as you add the material. Every few days, or weekly, the whole pile should be turned by forking it from one place to another (or from one bin to another), watering it as it is turned. While turning the pile place material from the outside of the old pile into the center of the new pile.

If using a compost thermometer, the pile should be turned if it reaches 150 degrees or if it begins to cool down to 100 degrees or below. The aeration and moistening should cause the pile to heat up again.

A temperature of 140 degrees for a 21-day period is required to kill most seed (except for tomato seeds) and diseases. A small home compost pile is often not large enough to maintain this high a temperature for a sustained period of time. Therefore, it is usually best to exclude weed seeds and diseased plants.

Worm Composting

Worm composting is generally done in manufactured worm bins, but can be done in wooden boxes or plastic storage boxes as well. Newspaper torn into narrow strips and moistened, can be used as bedding material and then worms are added along with a small amount of composted material. When making a worm bin from a plastic storage box, choose one that is opaque, if possible. Using a drill, make about twelve 1/4 inch holes in the bottom of the box to allow the worm "tea" to drain. Otherwise the box will get too wet and the worms will try to leave or may drown. Purchased worm bins usually come with bedding material. With a three-box system, the bottom section will catch and hold the worm "tea".

Kitchen green waste is added every few days. To add new "green" material, put on plastic gloves and pull the worm castings to one side of the box; add the green materials; then push the castings back over the new material. The next time, pull the material from the opposite side of the box, add the material and cover it over, as before.

Worm bins should be kept in a shady location. Direct sun on the worm bin can "cook" the worms. New material should only be added after the previous material has been fairly well digested. If too much material is added at one time, or so frequently that it is not digested, the box may become anaerobic (smelly). Should this happen, do not add more material for a week; or add some finely shredded paper (carbon) and gently mix it into the castings, then wait a while before adding more green material.

At some schools the cafeteria saves the green scraps from preparing lunches for use in the worm bins. Not all school districts will allow this, so check to see if this is possible at your school. Meat products, cheeses, fried foods, oils and fats, should not be put into the worm bins. These materials take a long time to decompose and tend to draw unwelcome critters (raccoons, dogs, and cats). The worms do not "eat" the waste products; rather, they digest decomposing materials.

Note that only certain species of worms (red wigglers or manure worms) can be used to digest decomposing material. They are not the usual earthworms. The earthworms usually found in garden soil are long lived, but do not multiply fast enough to use in a worm bin.

Purchased Worm Bin

Kitchen Green Waste for the Bins

Composting Worms

The worms will multiply in the bins and over time the castings can be harvested and used in the garden as a soil additive and plant food.

Worm castings should be mixed with soil at a ratio of 10 parts soil to one part worm castings because of its high nitrogen content.

Worm tea should be diluted 6:1 as it can have up to 21% nitrogen.

Trenching

To use this method, dig a trench about one foot deep. Pile the soil alongside the trench. Kitchen scraps may be placed in the trench as they become available. Cover each batch as it is put into the trench and continue to the end of the trench. Plant your crop about 12 inches away from the trench. You can also bury kitchen scraps in a small hole about one foot deep near existing plants in a garden.

Soil Incorporation

Chop or shred the yard trimmings as finely as possible and spread them over the soil and around plants as mulch allowing it to decompose on the surface. It is a good idea not to work this material into the soil until it has decomposed because nitrogen will be drawn from the soil by the process of breaking down the mulch. If raw mulch that has a high carbon content and little nitrogen is worked into the soil, it is necessary to add nitrogen at the same time.

Compost Resources

There are a number of books and websites that provide more information on composting. Click here to link to School Garden Reference for books specific to composting.

Click here to link to School Garden References for information on compost programs and earthworm sources in the San Diego area.

Click here to go to http://ucanr.org/pubs.shtml the website for the University of California, Division of Agriculture and Natural Resources to purchase *Compost Production and Utilization: A Growers' Guide,* Publication 21514. From this website you may also download at no charge, *Compost in a Hurry,* Publication 8037.