UofA UNIVERSITY OF ARKANSAS DIVISION OF AGRICULTURE
Cooperative Extension Service

Agriculture and Natural Resources

Composting

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Why Compost?

Waste management affects the life of each citizen. Yet many components of the issue are beyond the individual's capacity to show a personal contribution to positive solutions. Composting is an opportunity for individuals and families to have a direct effect on a much larger problem.

Landfill space, the normal disposal method for the great percentage of our waste, is becoming a premium commodity. New rules and regulations are increasing the cost of new landfill space and forcing us to maximize all existing space.

Arkansas legislation prohibits disposal of yard wastes (grass clippings, leaves and shrubbery trimmings) in landfills.
– Act 479 of 1993

Political and social concerns make new waste management strategies a tedious and costly process as we plan for the impending crisis. The NIMBY syndrome (Not In My Back Yard) continues to demand a broader public education and personal involvement in solutions.

Composting offers a YIMBY (Yes In My Back Yard) solution to at least one major component of this waste management dilemma. By all standards, yard wastes make up at least 13 percent of the municipal waste stream. Food wastes comprise another 10 percent of the total volume. That works out to about 200 pounds of yard waste and another 150 pounds of food waste per person per year. These segments alone can reduce our total waste volume by almost one-fourth. The result of a properly managed composting effort can be an economically sensible, environmentally sound, waste management strategy with a value added end product.

For centuries gardeners have been turning yard and food wastes into a valuable soil amendment called compost. Some may ask: Why not just incorporate the grass, leaves and food waste into the soils of your garden or flower and shrub beds? Given sufficient time and circumstances, any organic material will decompose, but adding the materials directly to the soil without first composting may cause problems. Plant materials incorporated directly into the soil compete with plant roots for soil nitrogen as they decompose. In sufficient quantities the addition of plant materials could tie up available moisture in the soil and induce a nitrogen deficiency in garden plants. Other considerations are the insects, diseases and weed seeds that may accompany the plant materials. The heat generated in a composting process helps to destroy weed seed, insects and disease pathogens.

Composting breaks down these organic materials into their basic end products. Instead of competing with plants, compost releases such essential minerals as calcium, potassium and phosphorous. Compost also improves

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Table 1. Materials to Compost, Carbon:Nitrogen Ratio and Limitations Associated with Each Material.

Material	C:N	OK?	Comments
Blood meal	4:1	Yes	
Cardboard (C)	170:1	Yes	Glue probably organic; less than 10% of weight of material in compost pile. Best if shredded.
Coal, barbecue ashes	No Nitrogen	No	Contains sulfur dioxide, may harm plants.
Coffee grounds (N,P)	20:1	Yes	Acidic
Cornstalks, Cobs (C,K)	60:1	Yes	Best if chopped up.
Cotton gin trash	30:1	Yes, but	Make sure that farmer did not use arsenicals on the cotton. Arsenic can carry over and cause vegetables to grow poorly.
Dishwashing, laundry water		No	Most dishwashing soaps contain perfumes, greases, sodium.
Diseased Plants		No	Pile may not get hot enough to kill disease organisms.
Eggshells	35:1	Yes	Crush; source of calcium.
Eggs (whole)		No	Attracts rodents.
Fish scraps (N,P)	5:1	No	Can attract animals or rodents.
Fruit wastes (N)	35:1	Yes, but	Can attract flies; bury scraps in pile.
Grass clippings (N,P,K)	20:1	Yes, but	If lawn treated with herbicide, leave on lawn to decompose. Good source of nitrogen when fresh.
Grease, cooking		No	Low in nutrients, attracts animals; may cause odors, slows decomposition.
Hair	3:1	Yes	
Leaves (C)	60:1	Yes	Oak leaves are more acidic.
Magazines (C)	No Nitrogen	No	Some questions about paper-coating; inks used.
Manures			
Horse, cow, chicken, pig, sheep, goat	10-20:1	Yes	Horse manure more likely to contain weed seeds. Compost thoroughly.
Dog, cat, human		No	May contain disease organisms.
Newspapers (C)	170:1	Yes, but	Shred for compost; use no more than 10% by weight in pile.
Peanut hulls (C,N,P)	50:1	Yes, but	Can carry Southern blight and nematodes. Many use successfully.
Pine cones (C)		Yes, but	Decomposes slowly, acidic. Must be shredded.
Pine needles (C)	90:1	Yes, but	Decomposes slowly, acidic.
Rice Hulls	100:1	Yes, but	Can have high levels of manganese.
Sawdust (C) all except:	500:1	Yes, but	Use in moderate amounts. Add additional nitrogen. Add 1 pound actual nitrogen (6 cups of ammonium nitrate) for each 100 pounds of sawdust.
Black walnut sawdust		No	Black walnut sawdust is toxic to the compost pile.
Pressure treated lumber sawdust		No	Contains arsenic.
Straw	80:1	Yes	
Vegetable peelings	10-12:1	Yes	Bury in pile.
Woodshavings (C)	700:1	Yes, but	Must add extra nitrogen (see amounts of extra nitrogen under sawdust).
Wood Ashes (P,K)	No Nitrogen	No (Yes, but)	Not recommended but could use very limited amount as a lime source; do not exceed 1 cup wood ashes for each bushel of compost pile. Highly alkaline, possibility of some heavy metal content.

the soils physical properties. Soils mixed with compost have improved tilth, infiltration, drainage and water holding capacities.

What Is Composting?

Composting is the biological decomposition of organic matter. Decomposition occurs naturally, but it can be accelerated. Microorganisms, worms and insects break organic materials into compost. Compost contains nutrients that, when returned to the soil, are used by plants. This is nature's way of recycling.

Benefits of Compost

Compost improves the structure of the soil by adding organic matter. In sandy soil, compost holds moisture and helps to hold soil together. In heavy clay soil, compost particles bind with clay particles to form larger particles. Surface water can drain between the larger particles. Surface layers of soil conditioned with compost retain water better and resist surface crusting and erosion.

Compost attracts earthworms. Their tunnels aerate the soil and improve drainage and bring up minerals from the subsoil. Earthworm activity contributes to good soil structure. Although compost is considered a soil conditioner rather than a fertilizer, it contains both plant nutrients and essential trace elements. Some chemical fertilizers release elements so quickly that rain can leach them away before plants derive much benefit. In compost, most of the nitrogen and phosphorus are held in organic form and slowly released, making them available throughout the growing season.

Materials to Compost

Many organic materials are suitable for composting. Table 1 lists a range of potential wastes. Each entry is ranked according to acceptability for composting. Some materials listed are unsuitable because they may pose a health hazard or create a nuisance. Yard trimmings, such as leaves, grass clippings, straw and non-woody plant materials, can decompose easily.

The C:N ratio listed in Table 1 is helpful in choosing the amount of various materials for composting.

What is the C:N ratio and why is it important? The carbon to nitrogen ratio (C:N ratio) is the relative percentage of carbon to that of nitrogen in various organic materials. Decomposing microbes are the most active and efficient when the C:N ratio is 30:1. The more carbon in the pile relative to nitrogen, the longer the decomposition process. Excess nitrogen causes the pile to lose nitrogen to the atmosphere as ammonia gas.

Leaves with a C:N ratio of 60:1 are high in carbon and take longer to decompose. If a nitrogen source such as grass clippings or manure is added, the composting process accelerates. Fertilizer can be used to provide the nitrogen if desired. Apply 1 cup of fertilizer, such as 13-13-13, for every 10 square feet of pile surface area. This could be applied again each time you add another 6 inches of high carbon material.

Methods of Composting

The approach depends on the time that finished compost is desired, materials and space available. Turning units require regular (weekly or biweekly) maintenance. If kitchen wastes are to be composted without other materials, worm composting or soil incorporation (burying) should be used. If kitchen wastes will be mixed with yard wastes, the turning method is recommended. However, holding units or heaps may work when precautions are taken to minimize pest problems. Turning the pile frequently helps avoid pest problems. Yard wastes are generally not susceptible to pest problems – so slower, low-maintenance units are suitable.

Composting With Holding Units

Holding units (Figure 1) are used to hold yard and garden wastes until composting is complete. This is the easiest, but slowest, way to compost. Material should be added as it is generated; no turning is required.

Holding units can include circles of wire fencing or hardware cloth, old wooden pallets wired together or wire framed in wood. Landscape timbers, concrete blocks or rocks provide more permanent holding units. Holding units should be at least 3' x 3' x 3'. In any case, units should allow for air circulation through sides and back. Two or three units – one for fresh, one for maturing compost and a third for finished compost – may be helpful.

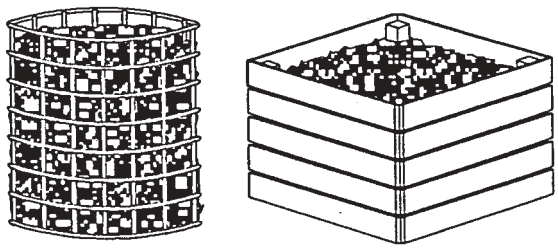

Figure 1. Examples of units to hold yard and garden wastes until composting is complete.

Non-woody materials, such as grass clippings, crop wastes, weeds and leaves, will compost in holding units but can take six months to two years. The process can be hastened by chopping or shredding wastes, mixing high nitrogen and high carbon materials, maintaining proper moisture and turning. Kitchen waste should be buried in the pile as it is added. Pest proof sides and covers may be needed to keep rodents and other animals from disturbing the compost.

Since yard and garden wastes can be added continuously, the stage of decomposition varies from the top to the bottom of the compost pile. Generally the more finished compost will be found near the bottom of the pile and partially decomposed materials near the top. Removing the compost and then forking it back into the holding unit after three or four months will speed the rate of composting.

Once the compost at the bottom is finished, it can be removed and used. The less-decomposed material can be moved back into the unit until the finished compost is uncovered.

Speed Composting With Turning Units

Turning units can compost non-woody yard and kitchen wastes in two months or less. By frequently turning the compost, more oxygen is provided to the microbes decomposing the wastes.

Turning units (Figure 2) usually take two forms: either a series of bins or a horizontally mounted rotating barrel. The high temperatures (110° to 140°F) produced when piles are turned every 5 to 10 days offer important advantages:

- Kill major disease organisms and fly larvae.
- Help kill weed seeds.
- Provide the environment necessary for the most efficient decomposer organisms.

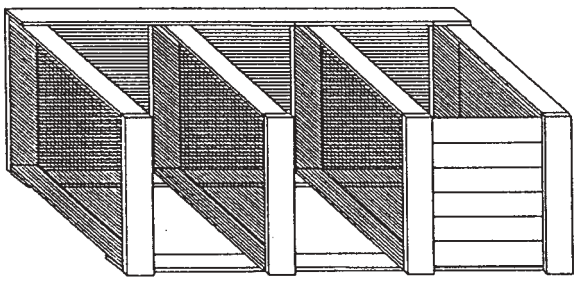

Figure 2. A series of bins used to speed composting.

Materials to be composted should be stockpiled until enough accumulate to fill one bin (3' x 3' x 3') of the turning bin or to fill a barrel composter to the prescribed level. Prior to composting, food wastes should be stockpiled in a pest-proof container, such as a plastic 5-gallon bucket. After a day's accumulation of food waste is added, a layer of sawdust can be added to reduce odor. When it's full, top off with a layer of sawdust. These units require frequent maintenance and are more expensive to buy or make. However, the expense and effort will yield finished compost in a fairly short time.

Hot and Fast Compost

1. Locate compost bins on bare soil that has been loosened.
2. Build bin no smaller than 3' x 3' x 3'.
3. Drive some hollow poles or pipes into the ground within bin (to provide air). Drill holes in the poles or pipes prior to driving.
4. Chop all materials into small particles.
5. Layer compost ingredients:
   - Bottom layer – approximately 6" of straw or chopped carbon material.
   - 4" of green garden and kitchen wastes.
   - 2" of manure, or old compost and soil.
   - 3" to 6" dry roughage (dry grass, chopped leaves, or straw).
   - Add water as you go.
6. Repeat layering until bin is full.
7. Turn pile every two to five days to mix outer edges inward and mix top to bottom. Or monitor heat in piles using a compost thermometer (optional). When the pile has heated and starts to cool (about one week), turn it. Move dry materials from edges to middle.
8. Keep pile moist, but not water logged. Add water as needed.
9. Repeat step 7 until pile does not reheat after turning. Let cure two weeks before using.
10. Compost should be ready in two to four months.

This method requires attention to materials preparation, moisture and turning.

Composting With Heaps

Heap composting is similar to the previous units except that it does not require a structure. A heap should measure about 5 feet wide and 3 feet high; length can vary depending on amount of materials used.

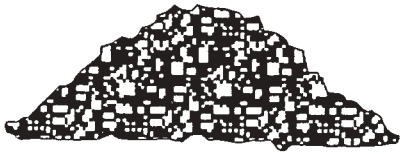

Figure 3.

Materials can be added as they become available or stockpiled until enough is available to make a good sized heap. It is best to have two heaps. When one is large enough, it should be allowed to decompose undisturbed. Additional waste can then be added to the second heap.

The pile may be turned regularly or not at all. If the heap will be turned, kitchen waste can be composted with yard waste. If the pile will not be turned, adding kitchen waste may attract pests.

Covering the heap with a layer of yard waste, mulch, sod or soil helps prevent moisture loss and may reduce pest problems.

Preparing the Compost Pile

Prepare the compost pile in layers to facilitate proper mixing. Figure 4 illustrates the layer process. Each pile ideally should be about 4 feet high. Moisten all layers as they are put in the pile.

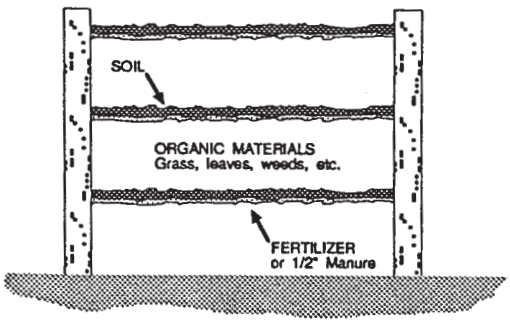

Figure 4.

Steps to follow include:

1. Place coarser materials (such as shredded branches, brush, pinecones, etc.) at the bottom of the heap. Note: The coarse material also allows air circulation around the base of the pile creating a chimney effect that takes air up through the pile and heats it up.

2. Layer organic wastes (such as leaves, grass and plant trimmings) 8 to 10 inches deep. Water this layer until moist, but not soggy.

3. Apply about a 1-inch layer of soil or old completed compost on top of the fertilizer layer. Adding soil and/or compost ensures that the pile is inoculated with decomposing microbes. Note: In most cases, organic yard wastes, such as grass clippings or leaves, contain enough microorganisms on the surface to bring about decomposition. Studies show that there is no advantage to purchasing a compost starter or inoculum. Microbes multiply as rapidly from the soil and/or added organic wastes as from the inoculum. Those microbes already in the soil and on organic materials are just as efficient in decomposing the waste as those provided by the commercial inoculum. Adding soil, however, helps reduce leaching of mineral nutrients, such as potassium, released during decomposition.

4. Place the nitrogen source on top of this layer. Use 2 to 3 inches of livestock manure or a nitrogen fertilizer, such as urea, ammonium nitrate or ammonium sulfate, at a rate of 1/3 cup for every 10 square feet of surface area. Note: If these nitrogen sources are not available, 1 cup of 13-13-13 fertilizer per 10 square feet of surface area will also suffice. Do not use fertilizer that contains a herbicide or pesticide. Other organic sources of nitrogen are green grass clippings or blood meal.

Repeat the sequence of adding coarse material, organic waste, soil and fertilizer until the pile is completed. Remember to water each section as you make the pile. The pile should be about 5 feet high with a scooped-out basin on top to catch rain water.

Composting With Worms

During worm composting, worms digest food waste, leaving behind high quality castings called “vermicompost.” Worms work most efficiently between 60° and 80°F, which makes worm composting an option for a basement or other semiheated indoor space. In a properly managed worm composting bin, odors and flies should not be a problem. Some people even keep their worm bins in their kitchens.

In this system, redworms (*Eisenia fetida)* are placed in a bin with bedding and food wastes. Redworms are efficient processors of food wastes and organic materials.

A shallow wooden box or plastic tub (at least 2' x 1' x 1') with holes drilled for air and with a lid will serve as a bin. Bins should provide a dark, moist environment. Shredded newspaper or cardboard makes good bedding. The bedding should be moistened so that it is 50 to 70 percent water, by weight, or about as wet as a wrung out sponge. Add a layer of moistened bedding about 8 inches deep to the bin before you add the worms. Leave uncovered until the worms work down into the bedding away from the light. They should move into the bedding within an hour. Add 1/2 cup of soil to provide grit and microorganisms.

Kitchen scraps can be incorporated by digging a small hole in the bedding, placing the wastes into the hole and then covering the hole with bedding. Burial spots should be rotated. Keep moist but not wet.

Compost can be harvested when the bin contents have become fairly uniform, dark, "worm castings." This usually takes three to six months. Finished compost can be harvested by moving it to one side of the bin, adding fresh bedding to the empty side, and resuming feeding on the side with the fresh bedding. Worms will migrate to the fresh bedding within one month. Remove finished compost and place additional bedding in its place.

Worm bins work best if sized and stocked according to the amount of waste to be handled. Surface area is more important than depth. Every pound of food waste to be composted per week requires 1 square foot of surface area. Two pounds of worms are needed for every pound of garbage produced per day.

Uses of Compost

Compost is a valuable amendment to your soil. Adding compost increases the ability of sandy soils to hold water. In heavy clay soil, the addition of compost improves the texture which reduces water logging during rainy seasons. Compost increases the soil's ability to hold and release nutrients as the plants need them. Over time, compost causes the soil to change until it becomes easy to work.

Recommendation: Apply 1 to 2 inches of finished compost evenly over garden per year.

1 inch compost spread on a 20' x 10' garden requires: 16 cubic feet of compost or a pile 2' x 4' x 2'.

Remember:
A 30 gallon garbage can = 4 cubic feet compost
4 garbage cans of material = 16 cubic feet compost

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