

Contents

Composting

What is Compost?	1-2
Why We Compost	3-4
Methods and Tools	5
Compost Contents	6-8
Using Your Compost	9
Involving Children	10
How to Compost Infographic	11
Additional:	
<u>Lesson Plan - Soil Texture and Composition</u>	
<u>Lesson Plan - Decomposition Observation Bags</u>	
<u>Stop the Smell - Five Reasons Your Compost Smells</u>	
<u>Six Compost Problems and How to Fix Them</u>	
<u>What to do With Your Compost in the Winter</u>	



Special thanks to:

Michael Klug, Carolyn Hoagland, Erin Lee and Barbara Roberts for organizing, leading, and providing written materials for the workshop.

The University of the South, University Farm, South Cumberland Community Fund, and AmeriCorps VISTA for sponsoring the Cumberland Teaching Gardens.

What is Compost?

Each year, plants grow, die, and fall to the ground to be consumed by earthworms, insects, and soil microorganisms. Next year's plants grow by using the remains of previous plant molecules to build new stems, roots and leaves for themselves. Plants can get nutrients from mineral soil, but it is much easier to absorb nutrients from dead plant material as it continues to break down slowly in the soil. In natural ecosystems this nutrient cycling builds soil fertility over long time scales.

Composting is the means by which humans collect excess plant material from gardens, yards, and kitchens, and then aid in the process of its decomposition. In your compost pile, decomposition happens as hungry microorganisms break down organic matter. Well-decomposed plant material contains just about all the nutrients needed to grow healthy plants, so it's in our best interest to utilize and enrich this process by creating favorable conditions.

The Hidden Process

Most soil microorganisms build their bodies

using about eight carbon atoms for every one nitrogen atom. We say they have a carbon to nitrogen ratio of 8:1. It takes a lot of energy to break apart plant material and to maintain their own cells. It is not unusual for microorganisms to burn up about 20-30 carbon atoms for every one nitrogen atom they incorporate into their bodies.

In order for microorganisms to live and grow, they need access to food that has a carbon:nitrogen ratio between 25:1 and

40:1. Fresh green leaves, coffee grounds, and fresh food waste have a C:N ratio that is too rich in nitrogen and lacking in carbon. Dead plant material, such as dead brown leaves collected in fall or leftover straw from wheat harvests have a C:N ratio that has too much carbon, and not enough nitrogen. By combining these fresh "green" materials with long dead "brown" materials, we can provide a C:N ratio that will make for happy microorganisms and quality compost.

Some Dirty History

Prior to the development of synthetic fertilizers and tractors in the early 1900's, all farms were powered by draft animals that contributed pulling power and plenty of manure. When farmers switched to tractors, their draft animals were sold off and the soil no longer received compost or layers of manure. Synthetic fertilizer typically replaces the Nitrogen (N), Phosphorus (P) and Potassium (K) needs of plants, but it does so in a way that is very disruptive to the soil. In order to *maintain soil health*, the microbes that live in soil need dead plant matter and manure to eat.

We also need to add some soil to the compost pile. This provides an inedible clay mineral substance that microorganisms can use as an anchor. Microorganisms favor a process that glues decomposed plant molecules to tiny particles of clay. These clumps, referred to as, "aggregates" make the compost stable and it releases its nutrients slowly.



Myths and misconceptions

It stinks!



Not if you mix in an the right amount amount of browns with your greens and turn weekly. Too much fresh material allows the compost pile to collapse on itself and causes part of the pile to be without oxygen - which will lead to stinkiness. Be sure to add enough bulky leaves or straw to the pile.



It's a lot of work!



Compost can happen in a slow and easy way. Just spread a 3-4" layer of food waste on top of a 3-4" layer of brown material and repeat as needed. If you are using a compost tumbler, you don't even need to layer - just throw it all in. When four months have passed, start a new pile. An additional four months later, start a new pile and also begin using the original pile.



Why We Compost

Composting truly turns **trash to treasure**. Compost is made from discards, but it results in free, high-value soil amendment that is often called “black gold.” It makes your garden happy by:

- ☞ **Naturally fighting disease and harmful insects** that might otherwise destroy the crops you’ve worked hard to grow.
- ☞ Promoting growth of **beneficial bacteria and fungi that breaks down dead plant and animal matter**. The decomposition that these bacteria and fungi provide is a necessary part of lifecycles and a healthy garden ecosystem.
- ☞ **Reducing or eliminating the need for chemical insecticides and fungicides**. Chemical pesticides don’t discriminate between the insects and fungus that help plants and those that hurt plants, so they kill beneficial organisms that make your garden healthy. They can also be expensive and, worst of all, toxic- so they should never be used in gardens intended for children, and should be avoided if possible in gardens intended for only adults. Compost doesn’t kill these healthy organisms, but in fact promotes their growth. In turn, the healthy organisms can out-compete pests, fungi, and diseases that would hurt your plants.
- ☞ **Reducing or eliminating the need for chemical fertilizers**. Chemical fertilizers will make plants grow very quickly or free of pests for a short time after application, but will hurt the overall and long-term health of the soil and organisms that grow in it, including your plants. Chemical fertilizers can also be expensive and dangerously toxic, especially for children.
- ☞ **Retaining nutrients in the soil** and continuing to feed plants long after synthetic fertilizers would have washed away. Compost also offers a wider range of nutrients, which helps plants in the same way that eating different kinds of food helps people.



Diverting waste: Benefits beyond the garden

Composting also has a strong, positive environmental impact. Forty percent of food in the US is wasted - from harvest/production to transport to consumption to landfill. In fact, food waste is the single largest component of municipal solid waste. Currently, only three percent of total food losses are composted.

Putting food scraps and yard waste in the landfills leaves no opportunity for those materials to be repurposed. When food decomposes without oxygen in landfills, it releases an explosive and potent greenhouse gas called methane. Twenty-three percent of US methane emissions are caused by rotting food in landfills. Prior to be covered by soil, food waste in landfills also attracts disease vectors - playing host to parasites, pathogens, insects, and vermin.



Methods and Tools

Traditional methods

Compost materials are piled up and left for bacteria and other microorganisms to decompose. Piles can be square, round or rectangular. Square piles should measure three to five feet in all dimensions; smaller piles will work but with reduced efficiency. On a commercial scale, compost is produced in very long heaps called windrows.

Sheet composting is a method where compost materials are spread out to a shallow depth, around six inches, over a large area. Sheet compost won't reach the high temperatures that piled compost will, but is less labor-intensive relative to the amount of compost produced.

Alternative methods

Vermicomposting and larvae composting are two alternative forms of composting that use animals, red wiggler worms and black soldier fly larvae respectively, to digest compost materials. Composting with worms and larvae requires more attention than traditional composting.

Read more!

Vermicomposting: <https://lancaster.unl.edu/pest/resources/vermicompost107.shtml>

Larvae composting: <https://www.gardeningknowhow.com/composting/basics/soldier-flies-in-compost.htm>

Location

Compost piles, like gardens, should be located as close to the house as possible. Remember “out of sight, out of mind.” Proximity to the garden is a more important consideration when siting compost piles than whether they will be in shade or full sun. The more convenient the location, the more likely you will put the effort into maintaining the compost. That being said, don't select a site that is extremely low and wet or exposed.

Maintenance

Compost heaps can be turned to introduce air into the pile and speed along the process. The organisms that decompose plant matter need oxygen, just like us. Compost can be made successfully without turning, but it will take longer than compost which has been turned.



Tools

A pitchfork is the best tool for turning compost piles by hand. When the compost is mature, it can be shoveled into buckets or a wheelbarrow and spread on the garden, using a rake to even it out.



Compost Contents

Soil

Many successful composters recommend including up to 10 percent soil when making compost. An average loamy topsoil should suffice. Soil provides clay particles for the formation of stable clay-humus complexes, collections of small soil particles bound to nutrient-rich organic matter. When it rains, the plant nutrients in well-humified compost do not readily leach out of the soil as compared to water-soluble chemical fertilizers.

Leaves

Fall leaves are high in carbon and minerals as well, owing to trees' extensive root systems. Leaves are a good addition to compost; alternatively, they can be composted by themselves, resulting in what we call "leaf mold". Leaf mold however, takes longer to mature than compost with more green materials. Leaves can be shredded to speed up their decomposition.

Food waste

Most food waste can and should be composted - these are your food scraps from vegetable cuttings to gristle. Food waste tends to have a wet, heavy nature and should be mixed with brown materials such as straw or leaves to keep the pile from becoming anaerobic (wet and stinky).

Yard waste

Yard waste is usually plentiful and can provide much of the bulk of compost. Grass clippings are a great, nutrient rich addition to compost, but, like food waste, should be mixed with plenty of brown materials.

Animal bedding

Animal bedding probably has a favorable C:N ratio for composting assuming it is a mixture of manure, liquid manure and straw. In that case, it can be piled without the addition of other kinds of materials.

Be cautious about using manure that is mixed with pine or cedar shavings. The wood



shavings can take years to decompose.

Other (paper, etc.)

Paper and plant fabrics, such as paper towels, can be composted, but should be shredded to speed up the decomposition process. Most ink these days is made from soy and should not be toxic. Avoid glossy paper.

Water

Achieving the right moisture content is important for making good compost. Too dry and biological activity is limited, too wet and there is no room for the necessary oxygen.

You should be able to take a handful of compost and squeeze it until just a few drops come out. Compost should be moist, neither soggy nor dry.

When building compost, dry materials can be wetted but remember that it is easier to water a compost pile during hot, dry weather than it is to fix one that is sopping wet. For this reason, you may want to cover the compost in some way in order to have more control over the moisture content. If you are composting in open piles this can be accomplished with tarps or a shed roof.

Safety note

Manure may carry pathogens that are dangerous to humans. The USDA recommends waiting 120 days between putting manure-containing-compost in your garden and harvesting crops that grow close to the ground, like lettuce and root vegetables. The rule is relaxed to 90 days for taller crops like berries, corn, or tomatoes.

No delay is required if you maintain a compost temperature between 131°F and 170°F for 15 days and turn the pile a minimum of five times within that 15 day period. The heat destroys any pathogens and turning ensures the cooler outside edges pass through the heating process.

If you are using a composting vessel, you only have to maintain the 131°F to 170°F for three days, since the whole vessel gets warm and there are no cool spots at the edges.



What not to compost

Everything can be composted eventually, but a few materials like wood chips, oils and citrus peels can take several years to decompose, even when mixed with food waste or grass clippings.

Do not put weeds which have gone to seed or aggressive spreading weeds such as Bermudagrass or Johnsongrass in compost. Soft annual weeds which have not gone to seed are OK. Remove any weeds that grow on your compost pile as quickly as possible.

Large chunks of meat are problematic. They smell bad as they rot and they attract neighborhood dogs, wild predators, and unwanted swarming pests like flies.

Large amounts of cabbage-type materials can be stinky, even when they are mixed with plenty of brown material. This is because plants in the cabbage family contain a lot of sulfur that is released upon their decomposition.

Plastics. Even the “compostable” plastics do not break down in home composting systems.

Composting Quick Guide

"Green" or Carbon-heavy Ingredients	"Brown" or Nitrogen-heavy Ingredients	Activators	Compost with care	What not to compost
fruit and vegetable scraps	torn-up cardboard	garden soil	table scraps	meat
coffee grounds	bark		dairy	bones
tea bags	paper towels without cleaning chemicals on them			oil
egg shells	paper			pet manure
plants from your garden, after harvest	paper napkins			
foods with mostly plant ingredients, like tomato sauce and vegetable soups	wood ash			diseased plants
grains (bread, crackers, pasta, rice, etc.)	sawdust			plants treated with pesticides
leaves (fresh)	leaves (dried)			glossy paper
grass clippings (fresh)	grass clippings (dried)			tough weeds
	twigs			weeds that have gone to seed
	lint			any part of walnut trees
				coal



Using Your Compost

When is compost ready?

After compost has passed through the heating phases discussed in the previous section, it is safe to use, but it isn't really done for several more weeks or months. Finished compost doesn't contain any pieces that still look like plant material. It is uniformly dark brown and it has a pleasant earthy smell. Even compost that is never turned gets to this stage, but it may take a year or more.

Placement

Compost can either be incorporated into the soil or left on the surface as a mulch without disturbing soil profile and structure. Add more compost to a new garden and less to maintain existing gardens. If compost is in short supply, 0.5 to 1 inch spread over the entire area will suffice as a maintenance ration.

How much compost you decide to add to a new garden will depend on available supply and the organic matter and fertility of the native soil. A reasonable goal is to spread compost 3-4" deep on a new bed.

In general, it is difficult to overapply plant-based compost. Compost made from

chicken manure can be a little thinner to avoid applying too much phosphorus. Don't forget to soil test every one to two years.

You can also make **compost tea** to water your plants, or put it in a spray bottle and spray on plant leaves to help prevent disease.

Compost tea

Collect it by draining liquid from your composter (easiest if you have a compost tumbler with a drain hole) and diluting it with 10 parts water to one part compost liquid.

OR

Make it by putting one gallon of finished compost in a five gallon bucket. Fill the bucket with water and stir it occasionally. After three to seven days, strain the liquid through cheesecloth or something similar into another bucket.

Timing

Late fall is a good time to spread compost to let earthworms and other soil organisms work their magic before it's time to plant in spring. And it's a time when summer crops are finished and the garden workload is usually lighter.



Involving Children

- ☞ Teach them the science! Compost activities supplement lessons about decomposition, ecosystems, nutrition, and more.
- ☞ Teach kids about waste, landfills, etc. and why it is better to compost than to throw away.
- ☞ Lists and visual representations of what can and can't be composted help kids learn how to compost and to think about how natural materials decompose and synthetic materials do not.
- ☞ Have kids put their food scraps from lunch or snack in the compost. If you can't take them to the compost right after lunch/snack time, you can collect the scraps in a large bowl, tupperware, five gallon bucket with lid, or other container until later when they can be taken out to the compost.
- ☞ Incentivize identification of compostable items, or reward children (even if it is just a "great job!") for asking if an item can be composted before they throw it away.
- ☞ Let kids help turn compost and check progress. Encourage them to observe what decomposes quickly versus items that can still be identified after a longer time in the compost, or make an activity out of tracking these observations.
- ☞ Identify insects found in your compost, particularly for open-bottomed compost piles. Off-the-ground compost bins have fewer insects.



HOW TO COMPOST

Composting is the combining and managing of specific waste materials so that they decompose. Once the materials are mixed together, microbes in the soil will start to breakdown the waste and turn it into the nutrient-rich material that helps plants grow. By composting, you are not only creating something that helps keep plants healthy, but you are keeping compostable waste products like food scraps and yard waste out of landfills.

WHAT YOU WILL NEED

Brown material to produce carbon:

Dead leaves, branches and twigs, sawdust or wood chips, coffee filters, cotton and wool rags, shredded pieces of paper, cardboard or newspaper and shredded nut shells.



Green material to produce nitrogen:

Grass clippings and leaves, fruit and vegetable scraps, hair, lint, tea and coffee grounds



Water



- 1 Select a dry, shady spot near a water source.**
Ideal size for your compost area is 3 feet wide by 3 feet deep by 3 feet tall (1 cubic yard). You can buy a bin, use chicken wire, or just isolate an area of ground for your compost heap.



- 2 Add brown and green material in alternate layers.**
Try and keep the ratio roughly 3 parts browns to 1 part greens. Make sure larger pieces of material are chopped or shredded.



- 3 Keep the compost moist [but not too wet].**
Moisture helps with the breakdown of organic matter.



- 4 Occasionally turn your compost mixture to provide aeration.**
This helps speed up the composting process and keeps things airy, which cuts the risk of things getting smelly.



- 5 As materials breakdown, the pile will get warm.**
There might even be steam. Don't be alarmed. That means it's working. Now you just have to wait.



- 6 All done!**
When material is dark with no remnants of food or waste, your compost is ready. Add it to lawns and gardens or anywhere that could benefit from some good soil.

WHAT NOT TO COMPOST

Metal, glass, and other products that do not easily breakdown, coal or charcoal ash, diseased or insect-ridden plants, black walnut tree leaves and twigs, pet waste, bones, meat, fats, oils dairy products and eggs (egg shells are OK), and yard trimmings treated with chemical pesticides.



What's vermicomposting?

Vermicomposting is a type of composting that uses red wiggler earthworms (*Eisenia fetida*) to break down organic material. Place worms in a container 8-16 inches deep, layered with dirt, newspaper, and leaves. Make sure the bin has small holes at the bottom (a quarter inch or smaller) to allow for ventilation and drainage. Fruit and vegetable waste will eventually be replaced with nutrient-rich excrement. This method requires far less space, so it's a good alternative for people who don't have enough room or the ideal conditions for a large compost pile.


NATURE[®]
WWW.PBS.ORG/NATURE
© 2013 THIRTEEN
ALL RIGHTS RESERVED

