Guide to Small Batch Composting

TABLE OF CONTENTS **PAGE**

INTRODUCTION

Throughout the centuries composting has been an essential part of growing our food. However, since WW II and the advent of large scale farming, the focus on composting has declined. As people are becoming more aware or sensitive to their environment and the foods they consume, the importance of the composting is again becoming apparent. Composting at home of yard waste and food scraps is a good beginning in solving the solid waste crisis facing most of our landfills, saves people money, improves the quality of the earth and gives people a simple way to become directly involved in their immediate environment. To be effective, composting at home needs to be part of a "life style" and is an on-going process.

Most experts recommend a compost pile be no smaller than 27 cubic feet for the best results and over 50 cubic feet would be even better. I certainly agree with them. However, in urban settings, this is just not practical for many people and is not even allowed by regulations in many communities. Millions of people have purchased composters that hold well under 27 cubic feet of material. For many, it is the only way they will compost. Given that, this guide is tailored for people composting in smaller batches using enclosed or semi-enclosed composters. There are several million small batch composters in backyards now with over 500,000 either being purchased or built in backyards every year.

I began collecting notes from a number of great sources and put them in this guide for an easy reference on the best of small batch composting. The best tips from some of the industry's most thorough resources are included in this manual, including Cornell University's website (www.cornell.edu), **Composting In The Class Room** by Nancy Trautmann & Marianne Krasny of Cornell University, ***Let it Rot!*** by Stu Campbell, ***Backyard Composting*** by Harmonious Technologies, and a few others.

Besides a personal interest in learning about composting, my vested interest in doing this guide was to support the use of the Urban Compost Tumbler (UCT). The UCT and similar small composters were designed for those people who want to compost, but do not have the space, time or inclination to create and maintain a large backyard compost pile. Yes, it is also for people like me, who would rather play golf on the weekend than play in compost, but still need and want to make a difference in the environment and the health of my family.

WHAT IS COMPOST?

Compost is a dark, crumbly and earthy-smelling form of decomposed organic matter. It is composed of organic material ranging from leaves and wood chips to household refuse. When broken down, these materials become one of nature's best garden fertilizers and richest mediums for potted plants. It is made up of waste material that is generally high in either carbon or nitrogen. While frequently referred to as yard and kitchen waste, it could be argued in fact it is not waste at all but a valuable resource for composting/recycling. The only real waste is not to recycle it.

An important issue with composting in small batches is -- when is it really compost? While an over simplification, if you do everything right you can produce fresh compost in about 2-3 weeks in many of the fully enclosed compost bins. However if you want cured compost it will take at least another 2-3 months. You can empty your compost bin and set the compost aside to cure for 2-3 months before using or for outdoor applications, just spread/mix it on the ground and let it finish curing in place. For indoor applications (e.g. house plants) you might consider curing it outside for at least 30-days before using it in a living space. Curing time will vary based on temperatures and conditions.

WHY COMPOST?

Below are just a few of the excellent reasons why so many gardeners and horticulturists are taking advantage of this time-tested practice.

- Ideal for growing organic herbs, fruits and vegetables.
- Saves money on fertilizer and other store-bought gardening products.
- A good alternative to chemical fertilizers for parents, pet-owners and others concerned with safety and health.
- Conserves dwindling landfill space.
- Easy, convenient way to dispose of garden refuse (often prohibited from landfills).
- Helps wards off pests and weeds without chemical pesticides or herbicides.
- Improves plant growth and quality.
- Reduces erosion and nutrient run-off.
- Restores nutrients back into the soil.
- Helps loosen soil and can be used as mulch.
- Breaks down clay based soils.

HOW-TO-COMPOST (INCLUDES RECIPES)

Small batch composters, such as the Urban Compost Tumbler (UCT), fit nicely into an urban setting where people have neither the space nor the time to maintain a traditional backyard compost pile. It specifically addresses growing regulations concerning compost piles that have forced many communities to ban or consider banning the open mounds. A fully enclosed design keeps pests out (e.g. rats, mice, raccoons and large insects), nearly eliminates odor, and helps aid in moisture control as well as insulation for heating of small batches of material.

There are many different approaches to composting so some experimenting is a good idea. With so many different materials that are available for composting, you can create a number of recipes (combinations of materials).

You can assemble all your material at one time (batch composting) or add it over time to your composter. Both approaches work (the material will eventually compost), but adding material all at one time in a batch will typically have a much shorter composting time and provide higher quality compost. The primary reason is "heat." Properly heated compost (130 degrees F or more) destroys more of the unwanted weed seeds, root structures and pathogens, and breaks down material faster than cold composting.

Effective composting recipes will involve several factors to varying degrees:

1. Material rich in carbon, typically brown (leaves, straw, woody materials)
2. Material rich in nitrogen, typically green (grass, food scraps, manures)
3. Microorganisms to consume and breakdown the material (bacteria, fungi, microbes)
4. Air to keep the microorganisms alive and active
5. Water to soften material and provide transport for microorganisms
6. Material/Amendments to aid in heating (cow manure, blood meal, compost starter …etc…)
7. Outside temperatures need should be above 50 degrees
8. Optionally: macro organisms may help (earthworms, insects), but in a small batches using a hot recipe should be used with care and probably only after the primary heating phase. (e.g. earthworms die at about 130 degrees F)

I. C/N Ratio

The key to a successful recipe is to get the right balance of ingredients, with the first concern being the carbon (C) to nitrogen (N) ratio (C/N). A 30:1 ratio is generally considered to be the norm. However for small batch processing in enclosed composters, we recommend starting with a 25:1 ratio to aid in heating. That is 25 parts carbon to 1 part nitrogen (by weight). Weighing your material can be difficult, so it may be simpler to consider estimating by volume. The important point to remember is that "most" of the material you put in your mix should be brown (carbon) material. In most cases, brown (carbon) material will be lighter

than green (nitrogen) material. By volume, start with 30 to 40 percent green and the rest brown material. If you get much higher than 30 parts carbon (75% volume) composting will be slower. If you get too high on the nitrogen side of things it will compost faster, but it may become smelly (ammonia gas) and slimy to the touch. As composting proceeds you should end up with finished compost with a 10-15:1 ratio.

Even before mixing materials, remember that each material itself has a C:N ratio to start with. It is important to understand this ratio to keep from having a compost mix either too high in carbon or nitrogen. Here are three tables showing examples of material high in carbon, high in nitrogen, and the leaves from different trees with their approximate C:N ratios:

MATERIALS HIGH IN CARBON	**C:N**
Autumn leaves	40-80:1
Sawdust	200-750:1
Wood chips or shavings – hardwood	450-800:1
Wood chips or shavings – softwood	200-1300:1
Bark – hardwood	100-400:1
Bark – softwood	100-1200:1
Straw	50-150:1
Mixed paper	100-200:1
Newspaper	400-900:1
Corrugated cardboard	600:1

MATERIALS HIGH IN NITROGEN	**C:N**
Vegetable scraps	10-20:1
Fruit wastes	20-50:1
Coffee grounds	20:1
Grass clippings	10-25:1
Cottonseed meal	10:1
Dried blood	3:1
Horse manure	20-50:1

TREE	**C:N of LEAVES**	**TREE**	**C:N of LEAVES**
Alder	15:1	Birch	50:1
Ash	21:1	Aspen	63:1
Elm	28:1	Spruce	48:1
Black elder	22:1	Beech	51:1
Hornbeam	23:1	Red oak	53:1
Linden	37:1	Pine	66:1
Maple	52:1	Douglas fir	77:1
Oak	47:1	Larch	113:1

Remember, when mixing compost material, the more varied the material the richer the compost. When possible, try using a variety of “green” and “brown” materials in the mix. Following is a list of materials to give a general idea of ingredients you can use in composting. Note that the “NOT” recommend material here refers more to composting in open piles and is the safest. In a fully enclosed composter, some of these materials (e.g. meat, bones, fish, dairy products, etc) can be used with care.

Compost Materials		
Nitrogen-Rich (Green)	**Carbon-Rich (Brown)**	**Not Recommended**
• Algae • Bread • Coffee grounds • Egg shells (crushed) • Feathers • Flowers (fresh) • Food scraps (vegetation only) • Fruits or Vegetables • Grass clippings (fresh, not chemically treated) • Hair • Leaves (green) • Manure (from healthy herbivores *only*) • Pasta (cooked) • Rice (cooked) • Seaweed • Tea-bags • Weeds (not bearing seeds or with pervasive root structures)	• Buckwheat hulls • Brown Paper bags (shredded) • Cereal boxes • Coffee filters • Conifer needles • Corn cobs • Cotton/wool/silk scraps • Egg shells (crushed) • Dry leaves and grass • Hay (dry - chopped) • Newspaper, shredded (black ink only) • Paper napkins & towels (with no cleaning fluids) • Paper plates (non-coated) • Peat moss • Saw-dust • Straw (chopped) • Wood chips or shavings (untreated) • Wood ash (from untreated wood only)	• Any plant or wood material that has been chemically treated • Bones • Barbecue ashes /coal/charcoal • Cheese or any dairy products • Diseased or insect-infested plants • Dishwater • Fish • Fat (oils, grease, etc.) • Food scraps from ill people • Kitty litter • Meat • Manure from dogs, cats, birds, humans or sick herbivores • Rhubarb leaves • Thorny plants such as blackberries or roses • Treated paper (slick or glossy) • Walnut shells • Waxy plants such as ivy, laurel or rhododendrons • Weeds that have "gone to seed" or with pervasive root structures

II. Microorganisms and Particle Size – producing a high quality yield.

Your compost mix is a direct result of what you put in it. Better quality and varied organic matter yields higher quality compost. Practically anything growing in your yard will compost, as they all contain carbon and nitrogen in varying degrees.

Microorganisms use the carbon as an energy source and nitrogen contains the raw element of protein to build their bodies. You might say the nitrogen eats the carbon and in the process produces heat based on the speed they do it. Each material has its own C/N ratio. For example, sawdust (avg. 500:1) composts very slowly. Typical food scraps from your table (approx. 15:1) composts very fast. The molecular structure of the material also affects the process. For instance, straw is high in carbon, but its structure makes it more difficult for the microorganisms to consume than grass that has a simpler structure.

Particle size plays a role in any composting effort, but is even more important in small batch composting. In general, the smaller the particle size the greater the surface area of the material is so the faster and more completely it will compost. As you increase the surface area of the material, you are providing more access for the microorganisms to do their work. For best results, material should be shredded to particles sizes less than an inch (the smaller the better). Newspaper and cardboard should be in less than one inch strips and will still compost slowly. Wood products should be in very small chips or sawdust size particles.

The downside of real small particle sizes is the material can become more compact limiting access to oxygen. Having smaller practical sizes then makes it even more important to keep good moisture control and more frequent aeration. This is one of the benefits of a tumbler type composter as it encourages more frequent aeration by making it simple. If the compost is not aerated frequently you would actually be better off keeping some larger particle sizes in the mix to aid in holding air in the mix.

III. Moisture

Moisture in the mix is very important, as it softens material and allows microorganisms to move about. Not enough moisture and you get very little movement (hence, very slow composting). Too much moisture and it fills all the spaces and pores between compost particles and limits access to oxygen. When adding moisture to the mix, use rain water if possible, rather than chemically treated municipal water. Remember, municipal water is treated to suppress bacteria growth. The mix should be as damp as a wrung-out sponge. It should feel wet, but you should not be able to squeeze out water. You need enough moisture for the microorganisms to thrive but not enough to block oxygen.

By weight, the best composting mix will be 50-60% moisture. Rather than adding water it would be better to have a material mix that contains the moisture needed. For example here are some common compost ingredients and their approximate moisture content by weight:

- 90% Fresh fruit
- 80% Fresh grass clippings
- 40% Leaves
- 40% Sawdust
- 15% Shrub trimmings

IV. Air

Air is critical to heating and increasing the speed of composting. There are two microorganisms to understand: aerobes and anaerobes. The most efficient microorganisms are aerobes and they require oxygen to live. Anaerobes do not require oxygen to live. The aerobes are fast eaters and produce more heat. The anaerobes are slow eaters that produce much less heat – resulting in long composting times. Without good aeration the aerobes die and the anaerobes take over the composting effort – ultimately reducing the speed at which your compost is created. Mixes with highly active aerobes will compost 90% faster than those with just anaerobes. If you want fast composting, then turning or aerating the compost frequently is important to keep the aerobes alive and eating away. Most studies show that a lot of the oxygen is burned off after just a few hours after turning.

V. Adding Supplements to Your Compost

Heating of small batches is more difficult as they typically will peek at about 120 degrees F. However, fully enclosed composters provide insulation that helps in heating to higher temperatures. To effectively kill most of the unwanted pathogens the compost should reach 130 degrees F or more. Finding supplements that will aid in heating can be important in small batch composting and a side benefit is that many of the supplements also improve the quality of the compost.

Some approximate temperatures to keep in mind:

- 50 degrees F is the lower limit for most microbe growth and activity. Active composting really starts here.
- Around 70 degrees F it supports a mixture of bacteria, fungi, actinomycetes, protozoa, and nematodes
- Around 104 degrees F is the upper limit for mesophilic microbes to be active
- Around 120 degrees F is the optimal temperature for compost decomposition
- Around 130/140 degrees F is the upper limit for fungi support and minimum temperature for killing pathogens
- Around 160 degrees F is the upper effective limit for bacteria and actinomycetes to remain active at composting
- Around 175 degrees F most growth of microorganisms stop

Some composting supplements can be all natural, such as healthy herbivore manures and others that are purchased boxed or packaged. The nutrients added to your compost are then added to the soil where you spread the compost. In large batches, it is questionable whether activation supplements help composting much.

However, in small batch composting, it can help a great deal in the heating process. For example, we recommend using all natural organic products like a good Compost Activator (4-4-2) when using boxed supplements. A good activator speeds composting while adding nitrogen, phosphorous and potassium to the finished product. Add Blood-Meal (13-0-0) or Alfalfa-Meal to your compost and the additional nitrogen will speed composting even more, while providing plants with the nutrients to develop a rich, dark green leaf color. Obviously, if you are already adding a lot of high nitrogen material to your mix, you may not need to add anything additional for faster composting.

The timing of when you add a supplement to the mix can be important. You should add supplements that increase heating right away. Other supplements may actually slow the composting process, even though they give you richer compost. For example, add Prilled Dolomite Lime to the mix to "sweeten" soil when too acidic. It also helps control odor and insects in the composting process. Dolomite Lime is a good source of calcium and magnesium, two important plant nutrients. However, adding too much lime early could slow the composting process.

When adding boxed/packaged supplements, you will need to watch the NPK. NPK describes the content of the major nutrients necessary for plant life and growth: nitrogen (N), phosphorus (P), and potassium (K). For example, a fertilizer with NPK numbers of 20-10-5 contains 20% nitrogen, 10% phosphorus, and 5% potassium.

Nitrogen is perhaps the most important nutrient of all, because plants contain a lot of it. Unfortunately for plants, nitrogen easily escapes from the soil, either in the form of gas or by being washed away. Composting restores nitrogen to the soil. Phosphorus stimulates growth, flowering and root development. Potassium (potash) is necessary for the development of chlorophyll and makes photosynthesis possible.

ELEMENT	FUNCTION IN PLANT	DEFICIENCY SYMPTOMS	EXCESS SYMPTOMS
Nitrogen (N)	Gives dark green color to plant. Increases growth of leaf and stem. Influences crispness and quality of leaf crops. Stimulates rapid early growth.	Light green to yellow leaves. Stunted growth.	Dark green. Excessive growth. Retarded maturity. Loss of buds or fruit.
Phosphorus (P)	Stimulates early formation and growth of roots. Gives plants a rapid and vigorous start. Is important in formation of seed. Gives hardiness to fall-seeded grasses and grains.	Red or purple leaves. Cell division retardation.	Possible tie-up of other essential elements.
Potassium (K)	Increases vigor of plants and resistance to disease. Stimulates production of strong, stiff stalks. Promotes production of sugar, starches and oils. Increases plumpness of grains and seed. Improves quality of crop yield.	Reduced vigor. Susceptibility to diseases. Thin skin and small fruit.	Coarse, poor colored fruit. Reduced absorption of magnesium and calcium.

VI. Composting Recipes

Based on volume and listed in approximate descending order from hottest to least hot mixes:

Recipe #1

2 parts	Dry leaves
2 parts	Straw or shredded newspaper (black print only)
1 part	Manure
1 part	Fresh grass clippings
1 part	Fresh garden weeds
1 part	Food scraps
1 cup	Compost starter/activator per 20 lbs of material
1 cup	Blood or Alfalfa meal per 20 lbs of material

Recipe #2

3 parts	Dry leaves
1 part	Fresh grass clippings
1 part	Fresh garden weeds
1 part	Food scraps
1 cup	Compost starter/activator per 20 lbs of material

Recipe #3

6 parts	Dry leaves
3 parts	Food scraps
3 parts	Fresh grass clippings
2 lbs	Finished compost and/or 1 cup compost starter/activator per 20 lbs of material

Recipe #4

3 parts	Dry leaves
3 parts	Fresh grass clippings
2 lbs	Finished compost and/or 1 cup compost starter/activator per 20 lbs of material

Recipe #5

3 parts	Dry grass clippings
3 parts	Fresh grass clippings
1 part	Peat moss
1 cup	Compost starter/activator per 20 lbs of material
2 lbs	Coffee grounds per 20 lbs of material (include filters)

Recipe #6 (experiment more)

4 parts	Fresh grass clippings
1 parts	Peat moss
3 part	Shredded newspaper or cardboard
2 lbs	Coffee grounds per 20 lbs of material (include filters)
1 part	Food scraps
1 cup	Compost starter/activator per 20 lbs of material
1 cup	Blood or alfalfa meal per 20 lbs of material

These are just some starter recipes. The list of combinations could go on forever. Note that adding too much finished compost to a new batch of compost material may slow composting time some, but it adds a lot of good microorganisms to the mix. Adding a shovel full of your local soil will do the same.

KNOWING YOUR pH IS IMPORTANT

The pH of your soil is important to know as it should influence what you put in your compost mix. The term pH describes the alkalinity (sweetness) or acidity (sourness) of soil or compost. The pH scale runs from 1 (indicating pure acidity) to 14 (which is purely alkaline). Something neutral would be a 7. Most plants like, and microorganism operate best in, a pH median between 6 and 7. Average garden soils range from 5 to 7. A swamp peat is around 3, arid desert soils range 9 to 11 and pure water is 7.0.

A NOTE ON COMPOST TEA

Compost Tea, also known as liquid gold by many horticulturists, is used in place of commercial liquid fertilizers for your flowers, herbs, vegetables, and practically anything else that grows. Compost tea is used to feed plants, restore plants, enhance soil microflora, and can be sprayed onto the foliage to control foliar disease. For many gardeners, compost tea can be even more valuable than the actual compost.

Compost Tea

- For outdoor and indoor vegetation
- Improves plant growth
- Provides nutrients to plants and soil
- Provides beneficial organisms
- Helps suppress diseases
- Replaces toxic garden chemicals

In the early stages of composting you may have a dark colored solution that leaches out of the mix and can be drained out of the bottom your composter. This especially occurs if you have a lot of moisture in the barrel. However, this is not compost tea. It is compost leachate and may contain pathogens. Compost leachate usually needs further bioremediation and is not suitable or recommended as a foliar spray. It can still be used as a fertilizer, but with care. Unless you specifically need to reduce the moisture content in your composter, do not drain it until you have finished compost.

Compost tea should be made from mature compost in a brewing process (which is why it is called tea). Try 1-part mature compost (in a burlap bag) with 5-parts water (non-treated is best) in a large bucket and add an ounce or so of molasses or kelp powder. Aerate the bucket with a couple air stones and air pump (like one used in an aquarium) for 7 days in above 60-degree temperatures.

HEALTH & SAFETY GUIDELINES

There are two potential hazards in working with compost. The first concerns the materials used in composting that could contain disease-causing organisms or pathogens. For example this is why it is best to avoid meat, dairy products and the other materials listed as not recommended. While not a wide spread problem, the second concern relates to allergic reactions to airborne spores. Here are some specific points from Cornell University's *Guidelines for Prudent Composting*:

1. Avoid certain inputs to the compost pile such as raw poultry or meat wastes, pet feces, and plate scrapings from people who are ill.
2. Consider managing your composting system to ensure that it gets and stays hot long enough to reduce pathogens.
3. Practice good personal hygiene when handling compost. Proper personal sanitation is the most effective method for controlling the impact of any pathogens that may be in the compost. Wash hands after handling compost and/or use gloves. If the compost is particularly dusty, watering is an option.
4. Persons with weakened immune systems or medical conditions that compromise the body's ability to fight infection should use caution when handling compost.
5. If possible, allow composts that are produced in a small-scale setting to age for at least a year before use.

TROUBLESHOOTING COMPOST

Most trouble can be avoided by following the recipe guidelines, having the right C/N ratio, keeping it moist but not wet, and keeping it aerated. Here are some possible symptoms, causes, and solutions:

SYMPTOM	POSSIBLE CAUSE	POSSIBLE SOLUTION
Compost is not heating up	Small compost batches are harder to heat so more care is needed. Be sure you prepare and add material all at one time to create a single batch.	If you add your material slowly over time, you may need to live with cold composting.
	Not enough nitrogen in the mix	Mix in fresh grass clippings, manure, blood meal or other material high in nitrogen.

	Not enough oxygen	In small, confined batches oxygen can burn off very quickly when it does start to heat. Keep mix aerated.
	Not enough or too much water	If mix is dry or too wet, microorganisms cannot do their work. Maintain proper moisture balance.
	Particle size is too large	Large bulky pieces of wood or stocks compost very slowly. For best results, keep particles in small batches less than one inch and wood products in sawdust size. Screen out large material.
	Compost may be finished	If it looks dark and crumbly and smells earthy, it may be done.
Mix is dry throughout	Lack of water	Add water and mix. Mix should be as damp as a wrung-out sponge.
Matted or clumps of material	Material is too compact and/or poor aeration	Break up clumps and mix material. Aerate more frequently.
Compost has a bad odor, like a mixture of rancid butter, vinegar and rotten eggs.	Not enough oxygen, or too wet, or too compacted.	Mix in some dry carbon material. Maintain proper moisture control.
Compost has a bad odor like ammonia.	Most likely it has too much nitrogen in the mix.	Mix in some dry carbon material. Maintain proper moisture control.
Compost is attracting rats, raccoons, dogs, or other pests.	Occurs when including food scraps, meat, or dairy products in the mix.	Avoid composting meat, dairy, and fatty materials. Use care when kitchen scraps are added. Keep compost screened or enclosed.
Compost contains earwigs, maggots, slugs or other insects.	Insects are a good sign of a productive compost mix.	Let the insects add to the composting process. A light sprinkling of lime may reduce them on the surface if desired.

CONCLUSION

There are many benefits for you and your community if you compost at home. Composting reduces trash disposal and saves limited landfill space and fuel to transport refuge. When gardening, it provides valuable nutrients and improves the quality of soil. Wet clay soils drain better and sandy soils hold more moisture when amended with compost. Compost encourages the growth of earthworms and other beneficial organisms whose activities help plants grow strong and healthy. Composting can help your garden and potted plants by improving yields of fruits, vegetables, flowers, and herbs.

We hope small batch composters like the Urban Compost Tumbler (UCT) will entice you to try composting and provide incentive to continue composting for years to come. We can make a difference, both in our lives and communities, by becoming more aware of our environment and nurturing the land we live on and harvest.

I hope this guide will help and would appreciate any corrections and additions to improve it.

Thanks
Lloyd Phillips

GLOSSARY

Acid – A substance with pH between 0 and 7.

Actinomycetes – A type of bacteria, distinguished by their branching filaments called mycelia. Include both mesophilic and thermophilic species. In composting, actinomycetes play an important role in degrading cellulose and lignin.

Aeration – The process through which air in compost pores is replaced by atmospheric air, which generally is higher in oxygen.

Aerobic – (1) Characterized by presence of oxygen, (2) Living or becoming active in the presence of oxygen, (3) Occurring only in the presence of oxygen.

Anaerobic – (1) Characterized by absence of oxygen, (2) Living or functioning in the absence of oxygen, (3) Occurring only in the absence of oxygen.

Annelid – A member of the phylum Annelida, containing segmented worms.

Bacteria – Single-celled microscopic organisms lacking an enclosed nucleus. Members of the kingdom Monera. Commonly have a spherical, rod, or spiral shape.

Batch composting – Composting in which all of the ingredients are added at once rather than continuously over a period of time.

Biodegradable – Capable of being broken down through biochemical processes.

Biofilter – A filter that uses microbial action to reduce odors. Finished compost commonly is used as a biofilter to reduce potential odors from active compost systems. This can be a simple as layering finished compost over a pile containing fresh food scraps.

Carbon-to-nitrogen ratio – The ratio of the weight of organic carbon to the weight of total nitrogen in soil, compost, or other organic material.

Cellulose – The chief component of plant cell walls, cellulose is a series of organic compounds containing carbon, hydrogen, and oxygen formed into chains of 1000-10000 glucose molecules. Cellulose forms the fibrous and woody parts of plants and makes up over 50% of the total organic carbon in the biosphere.

Compost – To decompose organic materials under controlled conditions. The humus-like material produced by decomposing organic materials under controlled conditions.

Compost quality – The suitability of a compost for use with plants. Compost that impairs seed germination or plant growth is of low quality, either because it is not yet fully decomposed or because the initial ingredients contained contaminants that are phytotoxic.

Compost tea – An extract made of soaking finished compost in water using a brewing process.

Curing – The final stage of composting, after the period of rapid decomposition has been completed, in which slow chemical changes occur that make the compost more suitable for use with plants.

Detritus – Dead organic matter.

Endospore – A structure inside some bacterial cells that is highly resistant to heat and chemical stress and can germinate to grow a new cell when environmental conditions become favorable.

Fungi – Plural of fungus. A kingdom that includes molds, mildews, yeasts, and mushrooms. Unlike bacteria, fungal cells do have nuclei. Fungi lack chlorophyll, and most feed on dead organic matter. In compost, fungi are important because they break down tough debris like cellulose, and they grow well during the curing stage, when moisture and nitrogen levels are low.

Humus – The stable organic complex that remains after plant and animal residues have decomposed in soil or compost.

Inoculants – Microorganisms that are introduced into compost or other culture media.

Inorganic – Mineral, rock, metal, or other material containing no carbon-to-carbon bonds. Not subject to biological decomposition.

Leachate – The liquid extract that results when water comes into contact with a solid such as soil or compost. In composting, leachate contains dissolved and suspended substances drains from the system as organic matter decomposes.

Microorganism – An organism large enough to be observed with the naked eye.

Mesofauna – Soil-dwelling invertebrates that are intermediate in size. They live in the air-filled pores between soil or compost particles but generally do not create their own spaces by burrowing.

Mesophilic – (1) Organisms that grow best at moderate temperatures (50-104 degrees F), (2) The phase of composting that takes place at moderate temperatures, (3) The type of composting that does not reach temperatures exceeding 104 degrees F.

Microfauna – Soil protozoa and other microscopic fauna that are small enough to live in the thin film of water surrounding soil or compost particles.

Microorganism – An organism that individually is too small to be observed without magnification through a microscope.

Mulch – Any material such as compost, bark, wood chips, or straw that is spread on the soil surface to conserve soil moisture, suppress weed growth, moderate temperature changes, or prevent soil erosion.

Mycelia – Branching networks of fungal hyphae.

Organic – (1) Pertaining to or derived from living organisms, (2) Chemical compounds containing carbon-to-carbon bonds.

Pathogen – Any organism capable of producing disease or infection in other organisms.

pH – The degree of acidity or alkalinity of a substance, expressed as the negative logarithm of the hydrogen ion concentration. Expressed on a scale from 0 to 14. pH <7 is acidic, 7 is neutral, and >7 is alkaline or basic.

Protozoa – Single-celled, animal-like microorganisms belonging to the kingdom Protista. Many species live in water or aquatic films surrounding soil or compost particles.

Soil amendment – Any substance that is used to alter the chemical or physical properties of a soil, generally to make it more productive. Examples include compost, lime, sulfur, gypsum, and synthetic conditioners. Usually does not include chemical fertilizers.