

COMPOSTING

1. **Benefits of Compost (1)**

- Improves soil properties
- Provides nutrients to plants
- Conserves water
- Can extend growing season
- Helps control soil erosion

2. **Uses of Compost (2)**

Top Dressing

- Apply compost on top of the soil at the base of flowers, vegetables, shrubs, and trees
- Leave stems free for air to circulate
- With larger trees, keep compost six inches from the tree's trunk to just beyond the drip line.
- Aerate the lawn in the spring and rake 5 cm (2") of screened compost over the lawn surface.

Mulching

- Mulching with 5-10 cm of compost adds plant nutrients and organic material
- Helps retain moisture in the soil, inhibits soil compaction and smothers weeds (Compost which has been heated to above 120 degrees will have fewer weed seeds)

Compost Tea

- Fill a cloth bag with a litre or so of compost
- Tie bag and soak in a drum/can or garbage bag full of water
- Steep overnight and use "tea" as a liquid fertilizer
- (If the tea steeps longer it may need to be diluted before use)

Transplanting

- Dig a hole twice the size of the root ball
- Mix compost with an equal part of topsoil
- Fill in around the root ball & tamp down just enough to eliminate air pockets
- Water gently

Veggie Patch

- Spread 5 to 10 cm of compost on the surface of veggie patch
- Turn in prior to planting.

3. **Finished Compost (3)**

- Dark in colour, sometimes called "Black Gold"
- Sweet and earthy smell
- At least 30% organic matter
- Crumbly texture which allows air to penetrate and water to drain away
- Few weed seeds and pathogenic organisms

4. **Common Compost Problems (4)**

- See Table on page 46 of Victoria Compost Manual

5. Composting Tip: Alternative Composting Methods (5)

Mulching

- Organic material (e.g. compost, grass clippings, straw, hay, seaweed, sawdust, wood chips) is placed on the soil to finish breaking down. . This mimics what happens on the forest floor where leaves and needles drop to the ground, break down over time and then are taken back up into the plants as food. Slow but efficient
- Wood chips, leaves from deciduous trees and shrubs, lawn clippings and sawdust are suitable mulch materials around perennial plants.
- Around vegetable and annual flower gardens, it is best to use nitrogen-rich materials (green) like lawn clippings, weeds and other green garden trimmings.
- Mulch with organic materials to discourage weeds, to keep plant roots cool and moist, to protect plants from frost, to prevent soil erosion and compaction and to reduce the need for watering in the summer.
- For heat loving plants, pull the mulch back from the planting bed and allow the sun to warm the soil in the Spring, before planting and re-mulching.
- To deal with possible nitrogen shortage, add an additional source of nitrogen, such as bloodmeal or cottonmeal.
- You may experience an increase in the snail and slug populations, especially if the weather is wet. Pull back the mulch, pick the slugs into a container, freeze and add to your compost.

Trenching/Soil Incorporation

- Trenching is a simple system for composting waste, especially vegetable and fruit trimmings, coffee grinds, tea leaves and egg shells.
- Dig a hole 18 inches deep, chop food waste and empty into the hole. Cover with 12 inches of soil.
- Pet feces can also be dealt with in this way.
- Decomposition is largely anaerobic and will take anywhere from a few months to a year or two depending on soil temperature, available microorganisms and the size of the material.
- Planting isn't recommended over the burial site until the composting is finished because bacteria will compete with the growing plants for nitrogen. For this reason, trench may be more appropriate and practical for large gardens.
- Leaching of nutrients may be a problem during periods of high rainfall.

6. Earthworms (6)

- Earthworms ingest and digest organic matter. An earthworm eating its way through a compost pile passes organic matter through its body, grinding it with the help of tiny stones in its gizzard, and leaves dark, fertile, granular "castings" behind.
- A worm can produce its weight in castings each day. These granules are rich in plant nutrients that might otherwise be unavailable to plants.
- Earthworms have a symbiotic relationship with bacteria. They do a lot of digesting for the bacteria, and the bacteria do a lot of digesting for them and provide food themselves.
- As earthworms eat decaying matter, they also take in and metabolize many of these microorganisms. "A worm is like a cow grazing on a field of bacteria. A bacterium is an unbelievably nutritious organism...fat-free...60 percent protein."
- The presence of earthworms in either compost or soil is evidence of good microbial activity.

7. Macro-organisms – the creatures you can see (7)

- These include earthworms, mites, grubs, insects, spiders, and nematodes. They dig, chew, digest, and mix compostable materials.
- Insects eat organic matter and increase the surface area for the bacteria and fungi to get at by chewing it into smaller pieces. Their excrement also is digested by bacteria, causing more nutrients to be released.

8. Fungi and Actinomycetes (8)

- Cool-temperature fungi start breaking down tough cellulose and lignin along with the psychrophilic bacteria while the pile is still cool.
- Heat loving fungi usually appear in the pile four to six days after the pile has been constructed.
- *Actinomycetes* have been described as “half-breed organisms” – part bacteria, part fungus - that operate at medium temperatures or in the moderate heat zones of the pile. As you look inside your pile, you may notice a grayish “cobwebby” look among some of the fibrous material there. These are actinomycetes. They are easy to spot and become most evident during the later stages of decomposition.
- Actinomycetes give nearly finished compost a pleasing earthy smell. Anaerobic mold has a very different and distinct odor which, I assure you, you will recognize immediately as anything but pleasant.
- In many ways the fungi and actinomycetes do the dirty work, cleaning up after the bacteria, consuming what they leave behind. They decompose the very toughest things: the remaining cellulose, starches, proteins, and lignin.

9. Enzymes (9)

- The enzymes produced by the bacteria continue working away at the cellulose and lignin long after the microorganisms that produced them have died and become just another part of the compost.
- While the bacteria are alive, the enzymes apparently assist in breaking down complex carbohydrates into simpler forms, which the bacteria can use as a food. Later, these enzymes help the fungi and actinomycetes that are trying to accomplish the same thing.

10. Volume (10)

- A pile should be large enough to hold heat and small enough to admit air to the centre. As a rule of thumb, the minimum dimensions of a pile should be 3' x 3' x 3' to hold heat, and maximum dimensions of 5' x 5' x 5' to allow air into the centre of the pile.

11. Bacteria (11)

- Temperature is an important variable in composting. As temperatures rise and fall in the compost, different bacterial species will become more or less active.
- The psychrophiles (cold lovers) are the first to go to work. They work in temperatures from -20°C to 14°C. They are a cooler temperature aerobic bacteria that burn or oxidize carbon and generate some heat. Often they generate enough heat to make conditions tolerable for the next group of bacteria called mesophiles.
- Most decomposition work is done by mesophilic bacteria. These are the mid-range bacteria that operate in temperatures between 15° and 40°C. Heat generated as a by-product of the mesophiles' work will raise the temperature in the pile even more, creating conditions suitable for thermophilic composting.

- The thermophiles do “hot” composting. They start to take over when temperatures reach 40 to 45°C and will continue to work in temperatures up to about 70°C when their numbers start to decline. Thermophiles work quickly and don’t live long, three to five days at most. Turning the pile will provide oxygen (O²) and allow the thermophilic bacteria to continue their activity. As temperatures drop and thermophiles die off, the compost moves into a more mature stage.

12. Composting Tip: Location of Bin (12)

- Easily accessible by paths
- Reasonably near a water supply
- Reasonably close to the kitchen
- On level ground with good drainage
- Best in some sun, but not essential

13. Compost Tip: Selection of a Compost Bin (13)

- Materials and Construction: minimum wall thickness of 1/8” (.32 cm) in plastic and 1/2” (1.3 cm) in solid cedar.
- Usability: requires solid secure lid, base that allows for drainage, good access for turning materials and removing finished compost and sized appropriately for the amount of waste which is being produced..
- Convenience : The compost bin should be easy to assemble and operate.
- Pest Exclusion : no opening greater than ½” (1.3 cm) and a secure lid and base.
- Aesthetics: design and colour should be attractive to the eye and fit into the landscape.
- Safety : should be free of any sharp edges or protrusions
- Recycled Content: should have a percentage of recycled material.

14. Building a Hot Compost Pile (14)

Hot piles are useful for composting food and yard wastes together without pest problems, killing soil diseases and weed seeds, and producing compost in a short period of time.:

- Gather all the materials needed to make a pile that is at least 3 feet cubed. Use both green and brown materials to approximate the 30:1 carbon to nitrogen balance.
- Run materials through a shredder or chop them with a spade or machete on a piece of plywood, to increase surface area. Brown leaves may be run over with a rotary lawnmower to break them down, or shredded with a “whipper snipper”.
- Start building the pile with a 4” to 6” base of carbonaceous material. If the pile is going to sit for a few weeks or more use coarse material (small branches, cornstalks, etc.) for this base layer, to let air into the pile. Moisten materials.
- Next, add a 4” to 6” layer of high nitrogen materials. If the greens are not very fresh, sprinkle on a small amount of blood or cottonseed meal, poultry manure or other high nitrogen source. Food wastes may make up a part of this layer. Mix these green layers together so bacteria can feed on both simultaneously.
- Continue alternating and mixing layers of green and brown materials, adding water and extra nitrogen if needed, until the pile is 3 to 4 feet high (fill the bin).
- Close the bin or cover the pile and wait. Monitor temperature in the interior of the pile on a regular basis. It should peak between 120-160 degrees Fahrenheit, about 4-7 days later.

- When the temperature starts to decrease, turn the pile. Take materials from the outer edge and top of the pile and place them at the base and middle of the new pile; those from the middle should be on the outside edges and top of the new pile.
- Continue monitoring the temperature in the pile.
- About one week later the temperature should peak: turn the pile again. After another week the compost should be finished.
- Piles made this way without food wastes do not need to be turned: they will be finished in 3 to 4 months.

15. Compost Creatures (15)

16. The Pile (16)

17. Compost Tip: (17)

- Veggie cooking water is good for moistening compost. Dish water is not!

18. Water (18)

- All life on earth needs a certain amount of water and air to sustain itself. The amounts of air and water in a compost pile must be balanced for rapid decomposition to take place.
- Less than 40% moisture in the pile causes the bacteria to slow down their activity.
- More than 60% moisture and there are not enough air pockets in the heap; the aerobes will drown, and anaerobic bacteria will take over the pile.
- **Compost should be about as moist as a wrung-out sponge: it should be obviously moist to the touch, but yield no liquid when squeezed**
- Too dry? - Try soaking it from above with a trickling hose. A more effective practice is to turn the pile and re-wet the materials in the process. Some material will shed water, or absorb it only on its surface. Dead leaves, sawdust, hay, straw and some dried weeds and vegetables must be gradually wetted until they glisten with moisture, then mixed until water is absorbed.

19. Air (19)

Air penetrates only the first several inches along the top and sides of the compost pile. Air must get into the centre of the pile, however, so that the aerobes there can live. You can aerate your pile in several ways:

- ventilation stacks or layers of coarse material
- Compost aeration tool
- Turn and restack with pitch fork
- Poke holes with broom handle

20. Oxygen (20)

- When not enough oxygen is available, the most efficient bacteria, called *aerobes* cannot survive and the *anaerobes* take over. Once this happens, decomposition slows by as much as 90 percent.

Aerobic Bacteria

- More complete job of composting

- Break down carbon compounds into carbon dioxide and water (which are immediately available to plants),
- Produce a lot of energy
- Can use this energy to grow that much faster themselves and decompose that much more material
- Excrete plant nutrients such as nitrogen, phosphorus, and magnesium, to name just a few.

Anaerobic Bacteria

- Produce carbon dioxide, water, energy, and nutrients in much smaller quantities than aerobes.
- Produce a lot of useless organic acids and amines (ammonia-like substances), which are smelly, contain unavailable nitrogen, and in some cases are toxic to plants
- End products include hydrogen sulfide (which smells like rotten eggs), cadaverine, and putrescine

21. Food (21)

22. Compost Tip (22)

- Moisten as you build.
- Dampen each new layer with a gentle spray.
- If it is properly moistened at the beginning, it is likely to stay that way.

23. Compost Tip (23)

- Cover your open compost piles over the rainy winter period otherwise pile will go cold and anaerobic and nutrients will leach out the bottom of the pile.

24. Composting Tip: Chopping & Shredding (24)

- The composting process occurs faster when organic materials are chopped or shredded into small pieces
- With more surface area exposed, decomposer bacteria have more places to enter and infect the tissue
- This allows decomposer organisms to digest more material, encourages them to multiply faster and generate more heat
- A wide range of shredders and chippers are available, from large models used by tree services to small home-made hand-cranked types.
- Some homeowners purchase a small chipper jointly with their neighbours
- Chopping materials with a machete on a piece of plywood is adequate for many yard wastes.
- Just pounding with the back of hatchet will create entryways for decomposer organisms.
- A rotary lawn mower with its bag removed can be used to shred leaves on a hard surface, such as a driveway
- A lawn trimmer (the kind with a string on the end of a pole) placed in a garbage can full of leaves will shred the leaves in minutes.

25. Activators (25)

Natural

- Materials that are easily digested by bacteria and provide them with energy to start on tougher materials.
- Tend to be poor in structure and high in nitrogen.
- Eg.: grass clippings, comfrey leaves, poultry manure, dried blood, nettles, urine, seaweed, alfalfa meal, blood meal, bone meal, cottonseed meal, fish meal, fish waste, hoof meal, horn meal, leather dust, manure, tankage, crabshells, lobster shells.
- Finished compost and soil are activators because they contain microorganisms and enzymes.

Commercial

- 1) Chemical mixtures of lime and nutrients which raise pH
 - Useful if acidic conifer needles or large amounts of citrus pulp used
 - usually better to adjust pH after compost is finished and before applying to plants
- 2) Bacterial granules or tablets containing dormant bacteria and fungi, that are mixed with water
 - May increase speed of decomposition with less loss of ammonia and less leaching of nutrients
 - Helpful in areas of low rainfall, high heat, or extreme cold, where there is less bacterial survival

26. Compost Tip – Store Your Leaves till Spring (26)

- Collect leaves in the fall and save them in a bag or box by the compost
- Reduce the volume of leaves for storage by running a lawn mower over them or put leaves in a garbage can and use your weed eater.
- Cover food wastes with leaves in winter
- Layer remainder of leaves with grass from spring glut

27. Balancing the mixture (27)

- Nitrogen-rich materials are known as “greens” and include fresh grass clippings, plant trimmings, manure and food waste, such as vegetable and fruit peelings, coffee grounds, tea bags and rinsed-out egg shells.
- Carbon-rich materials are known as “browns” and include dry leaves, sawdust, straw, woody stems and dead plants, and coffee filters.
- The carbon:nitrogen ratio describes how much carbon a material contains in relation to nitrogen.
- The ideal C:N ratio is approximately 20 to 30:1 (20 to 30 parts carbon to 1 part nitrogen).
- When bacteria are fed organic material in this ratio they grow and reproduce quickly.
- Too much carbon and material will break down very slowly.
- Too much nitrogen and your nose will tell you. The compost will smell of ammonia and may turn slimy.

- When adding carbon-rich materials (browns), make sure you add equal amounts of nitrogen-rich material (green).

28. Rhubarb leaves (28)

Do not compost rhubarb leaves because they contain chemicals which may be toxic to organisms in the soil.

29. Carbon (29)

- carbon provides the energy food for the microorganisms in your compost pile.
- Includes most of the bulky plant material from your yard and garden.
- dry, tough, fibrous plant materials like leaves, straw, sawdust, and cornstalks..

30. Brown Material (30) (Carbon Rich)

- Dry leaves
- Straw
- Sawdust
- Dried grass clippings

31. Green Material (31) (Nitrogen Rich)

- Plant Trimmings
- Fruit & Vegetable Scraps
- Fresh grass clippings
- Coffee grounds and tea leaves

32. Nitrogen (32)

- Nitrogen materials are needed to build bacterial protein without which bacteria cannot grow and multiply
- Nitrogen materials are considered activators in your compost pile because they get things cooking.
- Manure, grass clippings, green vegetation, blood meal, and kelp meal are some high-nitrogen materials.
- In general, they are not as fibrous and bulky as carbon materials and need to be added in smaller quantities.

33. Composting Tip (33)

- Avoid composting grass treated with weed and feed for 3 to 4 cuts.
- Use finished compost on ornamental beds or wait a full year before spreading on a veggie patch.

34. Composting Tip: Solarize weeds and seeds (34)

- Place unwanted seed heads and spreading roots in a plastic bag
- Add water and put out in the hot sun for 2-3 weeks.
- Add to compost pile when material appears cooked

35. Materials NOT for Composting (35)

Barbecue ashes/coal – contain sulfur oxides; bad for garden. There is also concern with the chemicals applied to the barbecue bricks to assist ignition.

Cooked food waste – may contain fats which will attract animals.

Grab grass or other grasses with a rhizomatous root system – require thorough drying before adding to compost bin or they will grow again.

Dairy products (butter, cheese, mayonnaise, salad dressing, milk, yogurt, sour cream).

Dishwater – most dishwashing soaps contain perfumes, greases, sodium.

Dog, cat feces – may contain disease organisms. Cat droppings may contain *Toxoplasma gondii* or *Toxocara cati*, a roundworm. Both can cause blindness, particularly in children.

Fats, grease, and oils – putrify and smell bad as they break down.

Fish scraps – attract animals, fish a lot of fish oil and breaks down more slowly.

Grains – may contain fats which give off odour in their breakdown and attract rodents or other pests.

Kitty litter – likely to contain disease organisms.

Meat, bones – attract animals.

Peanut butter – attracts pests.

Walnut leaves – contains toxic Jugulan.

Weeds that have gone to seed – compost unlikely to reach temperatures high enough to kill off the seed.

Weeds like morning glory and buttercups – may live on in the compost unless thoroughly dried.

Do not compost meat, fats, dairy products.

36. Materials for Composting (36)

Alfalfa - good nitrogen source.

Apples – source of phosphorous and potash (potassium).

Banana skins – source of phosphorous (P) and Major potassium (K), decay quickly.

Beet wastes – source of magnesium, calcium and Nitrogen.

Blood meal – good nitrogen source (12%); helpful to add when material to be composted is carbon-rich.

Bone meal – good nitrogen source (2-12%), major phosphorous source (20-25%).

Citrus waste – minor P high in K, nutrient source.

Coffee grinds – nutrient source for the compost or can be used as mulch.

Corn cobs – will take a long time to break down unless finely shredded.

Food waste – vegetables and fruit – nitrogen-rich material, decompose faster when they are chopped into smaller pieces. Dig into centre of material and cover with carbon-rich material or soil.

Grapes – stalks and leaves minor nutrient source, adds bulk promoting aeration, cut into smaller pieces.

Grass clippings – best left on the lawn where they directly return the nutrients to the grass, excellent source of nitrogen in compost bins but be sure to mix them with brown materials like leaves so they do not turn smelly and mat. Caution: avoid use of clippings from grass treated with pesticides until after 3-4 cuts. Compost treated grass for one year before using on vegetable garden.

Hair – good source of nitrogen, mix with other materials. Do not use if hair has been chemically treated.

Hay and straw – high in carbon, chop or shred and wet for faster composting. Straw is better for air circulation as the stems are hollow and stiff.

Leaves – an excellent free source of carbon material. Collect in the fall for use during the gardening season. Mix with nitrogen-rich material.

Manures (horse, sheep, cow, chicken and guinea pigs) - good source of nitrogen and other nutrients. Best to compost before use as some manures will burn plants.

Mushroom manure – excellent soil builder, low in nutrient value. Possible source of pesticides. Check the source.

Newspaper – best to recycle, contains no nutrients but shredded can serve as carbon material.

Sawdust, wood shavings - good carbon-rich material for composting. Takes longer to break down.

Weeds – good nutrient source. Best to use when green and no seed heads. Pernicious/perennial weeds should be dried before Adding to compost.

Wood ashes – excellent source of potassium. Sprinkle directly into garden soil.

Seaweed – high potassium and trace minerals. Don't need to

wash

37. Composting Tip (37)

Cover food wastes with soil or mulched leaves to prevent fruit flies from being a problem.