Composting for Master Gardeners

(Star-stuff management for intelligent carbon-based life forms)

(Joe Yetter; February 4, 2020)

- **What is compost?**
- **Why should I compost?**
- **How should I compost?**
- **What's going on in that pile, anyway?**
- ***I'm* supposed to manage all that chemistry and biology?**
- **O.K. The chemistry and biology worked! Now, what am I supposed to do with this stuff?**
- **What are the risks of composting?**
- **What are the outer limits of composting?**
- **Too disgusting, complicated, and risky. So, what are the alternatives to composting?**

What Is Compost?

---partially decomposed organic matter; dark, easily crumbled; earthy aroma

---product of biological processes in which soil-inhabiting organisms break down organic vegetable and animal matter via aerobic and anaerobic processes

How is soil different from compost?

--more mineral, less organic matter (healthy soils consist of >5% organic matter), by volume; compost-pile and soil processes are similar, but occur faster in compost

Why should I compost? The benefits of composting.

---waste-stream reduction (less to haul, less to landfill; nutrients saved and don't go into groundwater)

---improved health of soil

---use as mulch, top-dressing, or incorporated into soil by you, or by earthworms (who never suffer from back pain)

N.b.: compost is not a fertilizer. Get your soil tested, and add fertilizers as needed

The Science of Composting

--- speeds the natural decomposition of organic material, with some measure of control.

----raw organic materials are converted to compost by a succession of organisms: bacteria; actinomycetes; fungi and protozoa; centipedes, millipedes, sowbugs, earthworms and other organisms continue the decomposition.

---Days 1-3: microbial metabolic activity raises temperature (110-140 ^{O}F), lowers pH (pH 4.0-4.5)

--- Week 2-3: pile begins "settling", cools, and pH rises (6.0 to 7.2)

---Weeks to months: larger organisms move in

---each time you turn the pile, you tend to re-boot the process

---heat kills most pathogens and weed seeds in hot-composting, especially if pile is turned for maximum mixing.

---large amounts of nitrogen are consumed; it may be necessary to add nitrogen at some point

Building the Pile: use anything that lived and is safe for you to incorporate: sod, grass clippings, leaves, hay, straw, weeds, manure (warning: manure may contain pathogens that may not get killed in a backyard compost system, and might contain herbicides), chopped plant materials, sawdust, shredded white office paper and newspaper, wood ashes, hedge and garden clippings, used potting soil, animal hair, straw, dryer vacuum lint (natural fibers), pine needles, used napkins and towels, shredded cardboard, coffee grounds, seaweed and many kinds of plant refuse from the garden. **Get the ratio right**: Carbon to Nitrogen (C:N) ratio of about 30:1, by choosing "green" and "brown" in proper proportions. A table is in your book; calculators are available on-line: http://www.puyallup.wsu.edu/soilmgmt/CompostMixCalc.htm ; http://www.klickitatcounty.org/solidwaste/fileshtml/organics/compostcalc.htm

Chop, mix, and stack: make it at least 3'x3'x3'; smaller piles lose heat. You want particles that are pretty small (1/8"-1/2")—for efficient mixing and getting the carbon and nitrogen near each other—but you want room in between particles for air! Exclude: grease, fat, meat, bones from home-composting. Wet the pile to the dampness of a wrung-out sponge; it's usually easiest to add water while stacking. Enclosures can be wood (pallets work well), metal (e.g., field fence), masonry (cinder blocks, etc), plastic (lots of commercial alternatives), and so on. Make sure the pile will be easy to access for turning (if you are hot-composting), and that air can get to those living organisms you have working for you.

Wait: Actinomycetes and the other hungry organisms will go to work. As composting proceeds, the pile will heat, then begin to cool. Turn the pile, and it will re-heat; after a few cycles, it will heat less, and other organisms will take over the process. The C:N ratio gradually decreases from 30:1 in the raw materials to 10-15:1 for the finished product.

Trouble-shooting (the Yaseetimmies): Pile just sits there: too dry, too cold to start, too much carbon. Pile stinky and slimy: too much nitrogen, not enough air/bulking agents, particles too fine. Pile never gets hot: not enough nitrogen, pile is too small or dry. Pile very slow to process: high lignin (e.g., straw, corn stalks, paper); or too dry.

Cook it 'til it's done: Your compost is ready to use when at least 8 weeks have passed since initial mixing, the pile no longer heats when turned, and the material looks dark and crumbly. You can use a screen, made of 1-inch wire mesh to help sort out incompletely decomposed materials from the finished compost. Twigs decompose slowly. Remove them from the finished compost and return them to your active compost heap.

Looks delicious! How should I serve it? Incorporate into soil, use as topdressing, make tea, use in potting soil, mulch.

***Cold Composting*:** slower, easier, but does not kill pathogens nearly as well. Stack and forget for a year or so; ignore it until it's done.

Compost Teas: produced by combining composted plant and animal materials with water and a nutrient (e.g., molasses); generally aerated—anaerobic metabolism stinks. Use/benefits controversial. Our organization sells it and uses it, and many members swear by it.

Adding Biochar! Scott McKain is a superb resource. Google biochar, and consider subscribing to http://ubetbiochar.blogspot.com

Composting with Worms (Vermicomposting):

Great for home food wastes (fruit and vegetable peels, grains, pasta, baked goods, coffee grounds and coffee filters), and can even be done in the kitchen, under the sink. *Eisenia fetida* convert organic material to rich compost. Worm castings provide abundant, beneficial microorganisms and nutrients to the soil. Vermicomposting can provide up to 4% more nitrogen to the soil, relative to conventional composting. You need: worm bin, bedding (shredded newsprint), food wastes. http://extension.oregonstate.edu/news/story.php?S_No=35&storyType=garde

Green Cones: yet another convenient way to compost food scraps. The cone is a plastic, rodent-proof composting unit with an attached underground basket. http://www.peoplepoweredmachines.com/greencone/

Risks of composting: injury (e.g., while chopping, lifting); disease (fecal contamination (parasites, bacteria), allergy to fungal or other allergens, infection with *Aspergillus fumigatus* or *Actinomyces spp*., etc), fires (spontaneous combustion, etc.), attracting nuisance animals and predators, chemicals (methemoglobinemia, *Brugmansia*, etc), neighbors' objections, restrictive covenants. Dogs can be poisoned by eating (mostly due to mycotoxins)

Outer limits of composting: Municipal/farm composting, humanure and composting toilets, composting human bodies.

Combining composting and other functions: heat and CO_2 source (greenhouses, cloches); biochar incorporation

Alternatives to composting: sheet-mulching, feeding to livestock, tossing in woods, burying in garden, mulching mowers; mushroom cultivation.

For More Information: fire up your Google machine, and also try these sites:
Oregon State University, of course: https://extension.oregonstate.edu/gardening/techniques/composting-publications-resources-plans

Cogger, C. G. and Sullivan, D. M. 2009. Backyard Composting. Washington State University Extension Guide. EB1784E.

Compost-heated greenhouse: http://attra.ncat.org/attra-pub/compostheatedgh.html

Martin, D. and Gershuny, G. 1992. The Rodale Book of Composting – Easy methods for every gardener. Rodale Press Inc. ISBN 0-87857-990-7.

Rynk, R., ed. On-Farm Composting Handbook. Northeast Regional Agricultural Engineering Service, NRAES-54. Ithaca, N.Y.: Cooperative Extension, 1992. (186 pp.)

Starbuck, Christopher 2010. Making and using compost. University of Missouri Extension Bulletin G6956.

Large-scale composting: http://www.bae.ncsu.edu/topic/composting/large-scale/