AEROBIC COMPOSTING

UNDERSTANDING THE PROCESS

July 17, 2013

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Johnson County Environmental Department
Johnson County K-State Research and Extension

The Solid Waste Problem

- Johnson County Landfill at I-435 & Holiday Dr. was projected to close no later than 2027 but has been extended to 2043.
  - About 800 trucks per day deliver 5500 tons of trash.
  - This is 82% of Johnson County's solid waste.
- There are no plans to build any large landfills in the Kansas City area.
- Alternate landfill options are about 50 miles on either side of the state line.
- New landfill costs 100k/sqft to build

Johnson County New Solid Waste Management Plan

Date of implementation : **January 1, 2012**

- Residential trash haulers will pick up an <u>unlimited</u> quantity of recyclable materials as part of the basic fee.

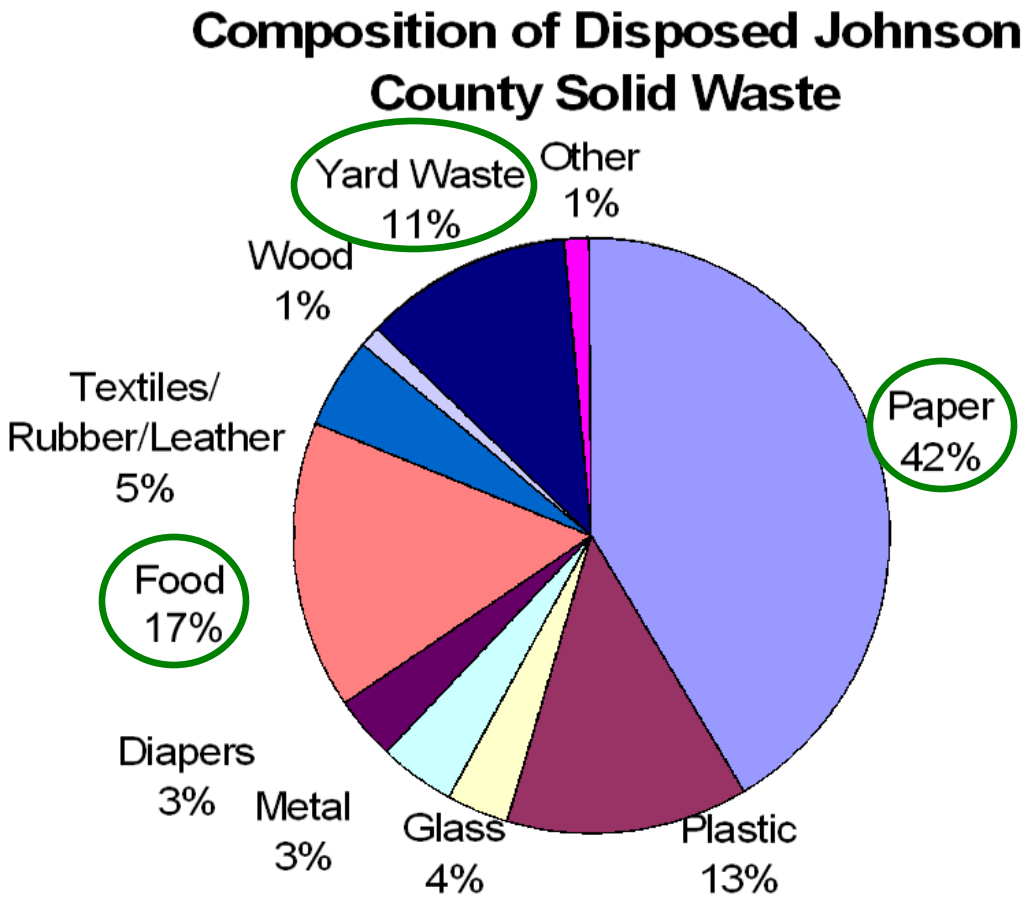
Johnson County New Solid Waste Management Plan (cont.)

- Trash charges will be based on the volume of waste put out for pick-up (commonly called Pay-As-You-Throw). More bags or containers will cost extra.

- Trash haulers will be prohibited from collecting yard waste with other residential trash for disposal in a landfill.

- Yard waste must be bagged or bundled by residents, and haulers may collect it separately for composting or mulching. Check with your hauler for details.

What we throw away…



- About **70%** of material going to the landfill is organic.
- Organic material can be managed outside of the landfill by composting.

 Refuse-Reduce-Reuse-Recycle-Compost-Discard

What is Composting?

the breakdown of organic material into simpler forms of matter by bacteria, fungi, worms and other organisms

- Organic Waste → Humus

Why Composting ?

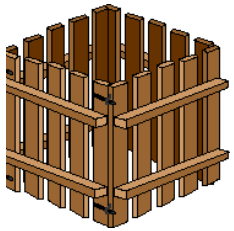
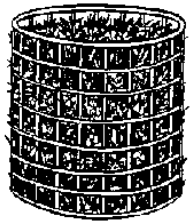
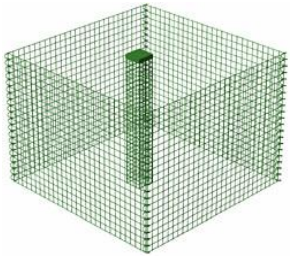
- Provide partial solution to our landfill issues
- Converting waste into beneficial product for gardening, landscaping, or houseplant
- Good for our pocket book and our health

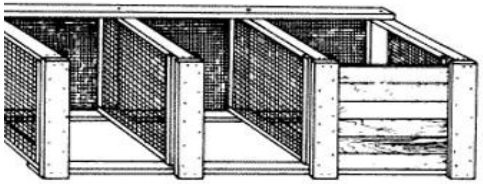
Compost Building Blocks

- Know the Five Rules of Rot
- Know your Carbon and Nitrogen sources
- Take care of your compost "workers"
- Do it because you want to – Composting is rewarding only for those who want to do it!

Compost Bins & Tumblers

- Bins don't make compost, microbes do.
- They just hold the material during the process.
- Find or build one that meets your needs:
  - Size
  - Shape
  - Design
  - Cost
  - Aesthetics



Homemade Compost Bins

Material:

4-ft Fencing Wire

Twist ties

4ft diameter + overlap

= 14ft per bin.

100ft fencing wire made 7 bins

Building a Compost Bin

Easy to assemble and disassemble, this bin can adapt to the size of your compost pile

by Lee Reich

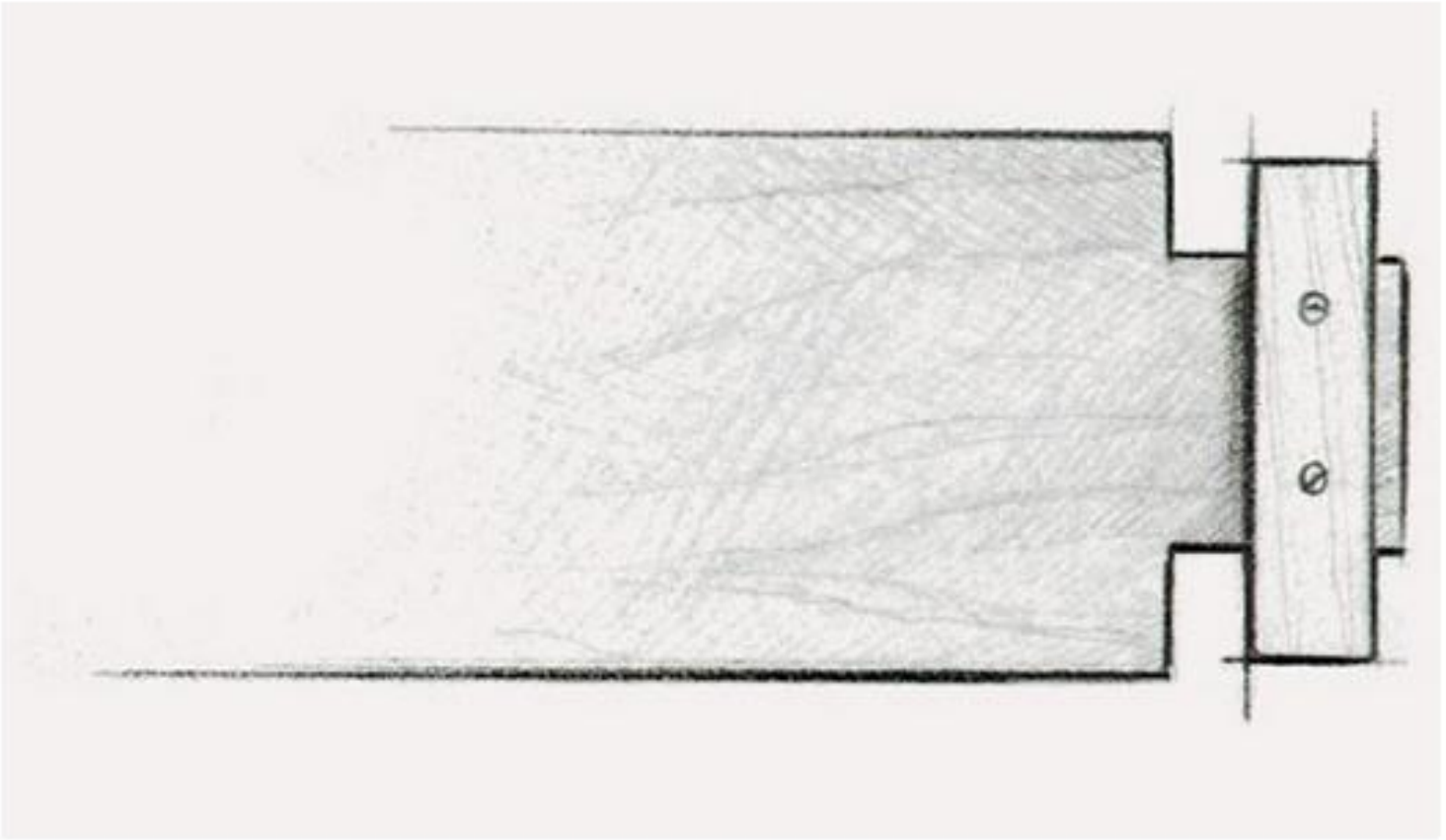
A compost pile is not a garbage pile, and one way to clearly differentiate between the two is with an enclosure -- a compost bin. The ideal bin retains heat and moisture, is easy to fill and empty, and fends off raccoons, stray dogs, and other animals.

A compost pile is not a garbage pile.

Boards can be added or removed depending on how full the bin is.

Creating the notches

Cut the corners out of each board to create tabs at both ends. The screw a foot-long piece of 1x3 board across the end of each tab to create a notched end. The notches will keep the boards in place when stacked.

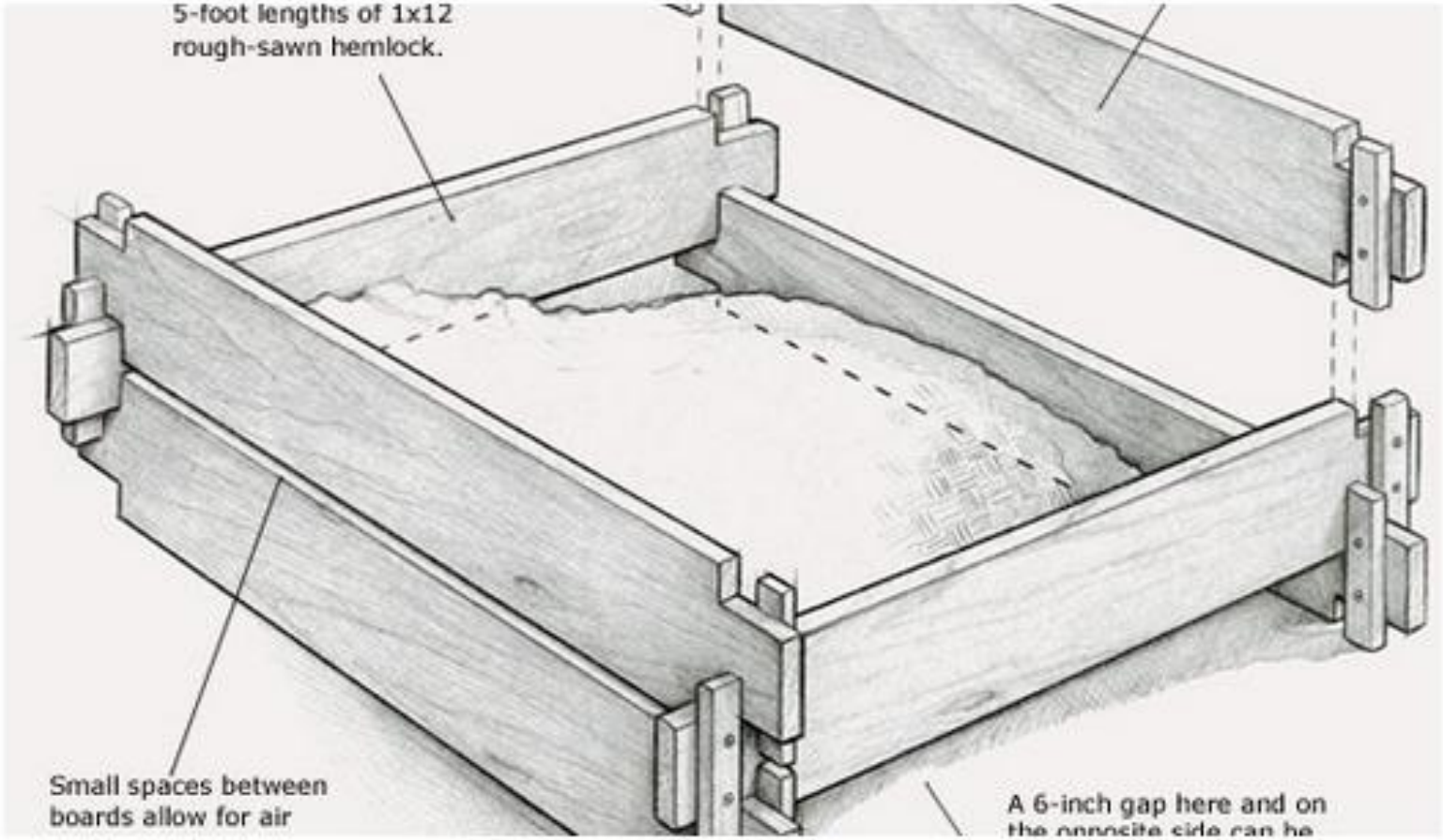


Photos: Virginia Small; drawing: Bob LaPointe

From *Fine Gardening* 81 , pp. 47

Assembling the bin

The boards that form the sides of the bin stack like Lincoln Logs. Click on the image below to enlarge it and see the additional information about spaces between boards, gaps at the bottom, adding and removing boards, and specs for the side boards.



http://www.finegardening.com/how-to/articles/building-compost-bin.aspx

Cold/ Passive Composting (6-24months)

- Keep a supply of Brown material year round (i.e. bags of shredded leaves)
- Build the layers as you accumulate nitrogen material
- Keep particle size 1-3 inches if possible
- Always top with brown layer for good compost hygiene and insulation
- Manage moisture (keep like a damp sponge)
- Let Mother Nature do her thing

Hot/ Active Composting (2-12 weeks)

- Build the pile at once.
  It's like baking a cake- mix well.
- Keeps Five Rules of Rot optimal
- Turn pile as it is cooling
- Manage moisture (keep like a damp sponge)
- Add more **nitrogen** and/or water while turning and **carbon as needed**
- Add coffee ground (**N**) or Organic Fertilizers* in each layer to keep temperature up longer

* i.e. Alfalfa Meal or others readily available material.

The Five Rules of Rot

- Mass / Particle size
- Carbon to Nitrogen Ratio
- Moisture
- Oxygen
- Time

Rule #1: Mass/Particle Size

- The smaller the particle, the quicker it breaks down. (Mow the leaves & catch with bagger)
- Decide the size of a compost pile based on your family needs.
- Optimal Mass for hot composting is

  3'x3'x3' to 5'x5'x5'

A critical mass is needed to support the decomposers for food and insulation.

- Mass 3'x3'x3' → 5'x5'x5'
- Particle size 1 inch → 3 inches

Rule #2: Carbon/Nitrogen Sources

- **Browns** (Carbon)
  - Brown grass clippings
  - **Fallen leaves**
  - Straw
  - Paper products
  - **Saw dust**
  - Pine needles
  - Corn Cobs
  - Dryer lint, vacuumed household debris

- **Greens** (Nitrogen)
  - Green grass clippings
  - Fresh leaves
  - Vegetable & fruit waste
  - **Coffee grounds**, tea bags
  - Herbivorous Animal Manures – cow, horse, rabbit, and chicken
  - Hair
  - Alfalfa meal, Soy meal etc.
  - Urea fertilizer (46-0-0)

Optimal C:N ratio is 30:1

Leaves and grass are good partners

- Leaves 40:1 (C:N)
- Grass 20:1

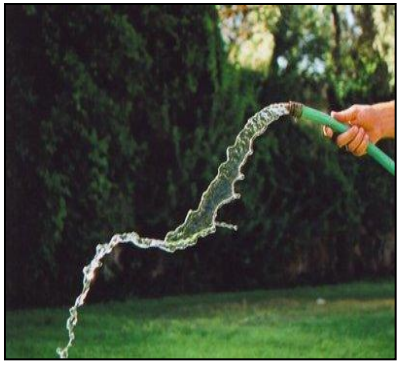
1-2 bags of leaves
\+ 1 bag of grass
= optimal ratio of 30:1

An easier way – follow your nose . . . if it smells:
too much N (**Greens**); add more C (**Browns**)

Nitrogen ⟶ **Carbon** is a continuum

Rule #3: Moisture

- The compost organisms are the most active when your compost pile is moist.
- Keep your compost as wet as possible but not too wet to impair oxygen exchange
- This will make it feel like a damp sponge



Rule #3: Moisture

- Lack of moisture slows the progress.
- Ideal moisture content is 60-65% (15% minimal to 85% moisture content of most kitchen scraps)
- Water saving tips:
  - Wet the carbon material in the bag before adding to compost pile
  - Soak paper material in a bucket of water before adding to compost pile

Rule #4: Oxygen

Aerobic (Oxygen) vs. **Anaerobic (Absence of oxygen)**

- Compaction of material will not deprive pile of oxygen.
- Small pockets trap oxygen during compaction process.
- Turn pile to increase oxygen.

Aerobic → Anaerobic

Rule #5: Time

- Active – Fast compost (2-12 weeks.)

  . . . Pile gets **hot**

- Passive – Slow compost (6-24 mos.)

  . . . Pile stays **cold**

Slow – layer your material as you get them & let it rot

Fast - layer your material at once and manage the five rules of rot optimally.

Slow(without our help) → **Fast(with our help)**

Sweet Gum Balls

Constructing the Pile

- Layer Browns and Greens
- Mix and Moisten

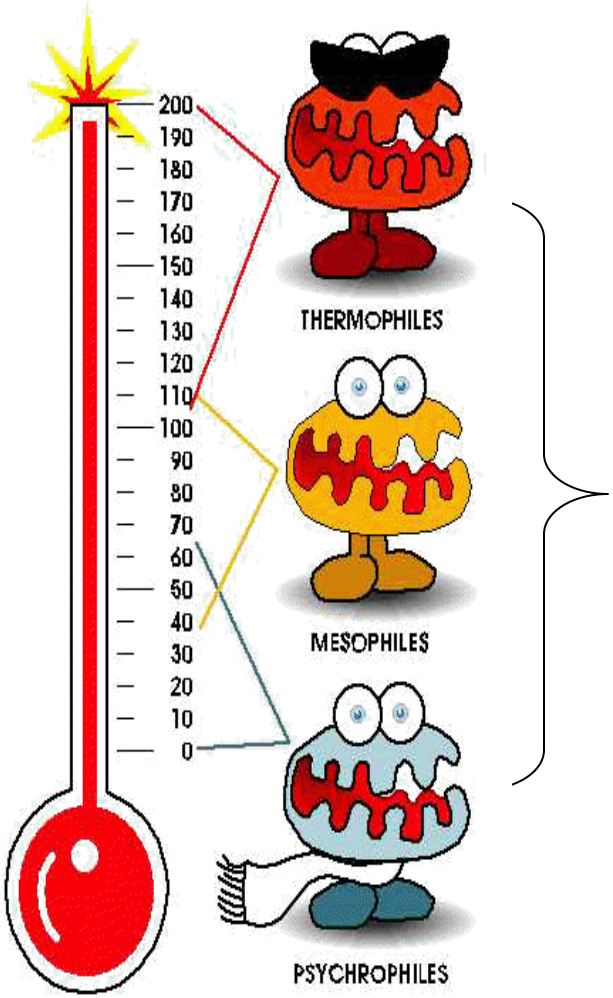
- Start and finish with Browns

TIPS: Coarser Browns in the bottom layers for better drainage and aeration. Start with 12 to15-inch thick layers of woody trimmings, leaves, shredded paper and Sweet Gum Balls etc.

Bottomless Garbage Bin

- Make a batch of Hot Compost
- Bury your kitchen waste in it
- Continuous hot compost top with cold bottom for earth worms

Microorganisms Composting Work Horses



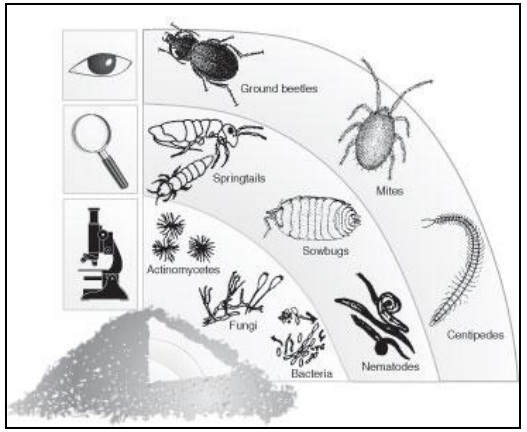
Compost is the most active @ **110°-160° F**

Various microbes are actively decomposing @0° to 200° F

Compost Thermometer

Compost Ecosystem

- Decomposition is a process in which organisms are kept in balance by natural process.
- All of the organisms in the compost pile, seen and unseen, are part of a complex food chain.



- Each level keeps the populations of the next lower level in check to maintain balance throughout the compost pile.

Compost Organisms

- Compost piles naturally teem with critters such as worms, centipedes, sow bugs, and snails.



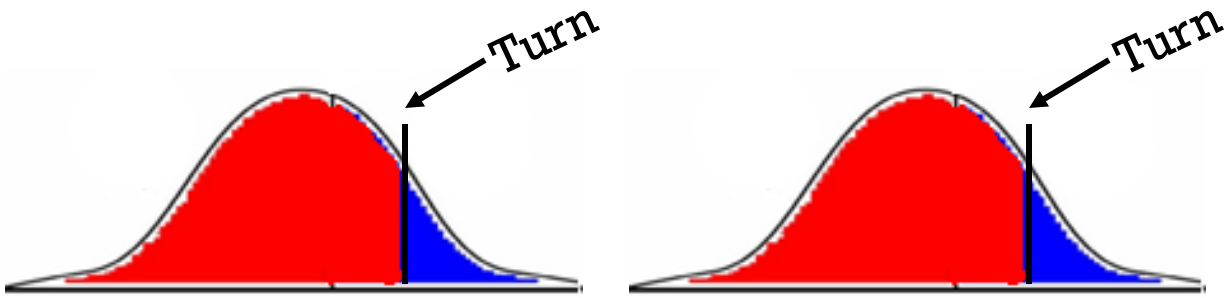

- Practice good compost hygiene:
  - Top layer should always be carbon (leaves) to avoid gnats and flies.

  - Make a hole to add kitchen scraps; re-cover.

Earth Worms

Life Cycle of a Compost Pile

- Compost Bell Curve
  - Pile heats up as microbes work, then cools down.
  - Turn pile as it's cooling
  - Most active composting – 110˚ to 160˚
- To Heat it Up
  - Add water
  - Add Nitrogen (**Greens**)
  - Turn pile (O2)



When Is It Finished?

- It is done when you can no longer recognize the individual ingredients.
- Compost is dark in color and has an earthy smell like soil.
- It is light and fluffy.
- It'll continue to decompose so best to use it sooner rather than later.

Compost Benefits the Soil

- Reduces clay soil compaction
- Improves absorbency
- Improves drainage
- Reduces water run-off & soil erosion
- Increases fertility by providing essential nutrients and minerals
- Increases beneficial soil microbes

Soil – More Than Just Dirt

Healthy soil is an ecosystem.

- Promotes healthy plants
- Develops deep, vigorous roots
- Improves soil moisture holding capacity
- Provides valuable nutrients
- Reduces disease and pest problems

Using Compost

- Apply finished compost to:
  - Lawns
    - Incorporate before planting
    - Spread a light layer over the lawn.
  - Trees and Shrubs as mulch
    - Prevents weeds
    - Provides nutrients

Make donuts, not volcanoes!!!

Using Compost (cont.)

- Flower and Vegetable gardens
  - Incorporate at planting or use as a top dressing around plants
    - Provides nutrients for growth
    - Builds healthy soils
  - Mulch
    - Conserves moisture
    - Prevents weeds
    - Provides nutrients

Compost Trouble-Shooting

Problem		Solution
Rotten odor	→	Add Browns
Ammonia odor	→	Add Browns
Low temperature	→	Turn pile, add Greens, and add water
Pests (raccoons, mice, etc.)	→	Remove meat, fatty foods; cover pile with Browns

Materials to Avoid:

- Plant and tree debris
  - Large branches and limbs — chip for mulch.
  - Woody perennial stems and diseased vegetable vines, weed seeds — beginners should avoid*.
- Pet waste—dog and cat
  - Carnivore manure can introduce diseases (especially Cat- may carry Toxoplasma gondii).
- Fatty foods and meats
  - Attract rats, raccoons, opossums, mice, etc.

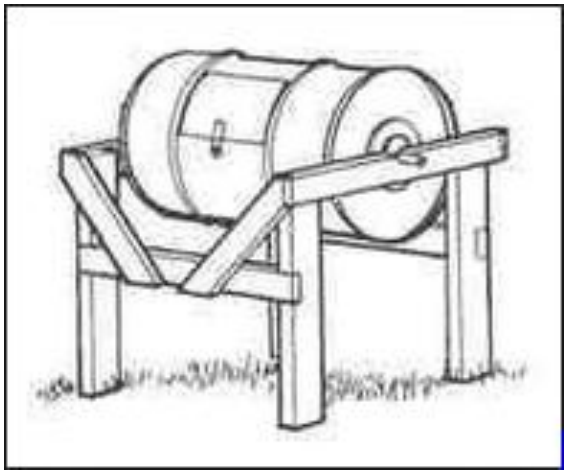
Bad Compost Hygiene

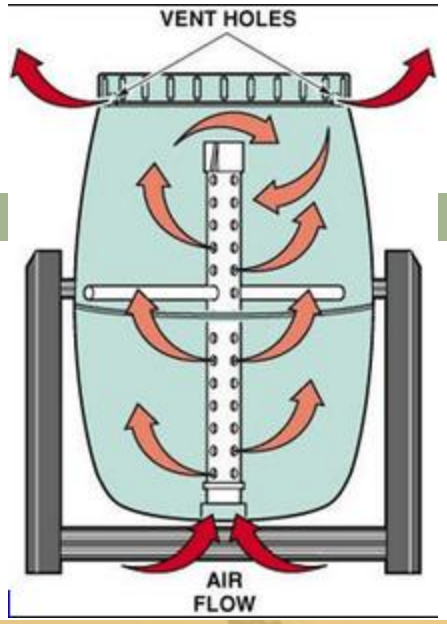
- Leaving Edibles Exposed Attracts Undesirable Critters

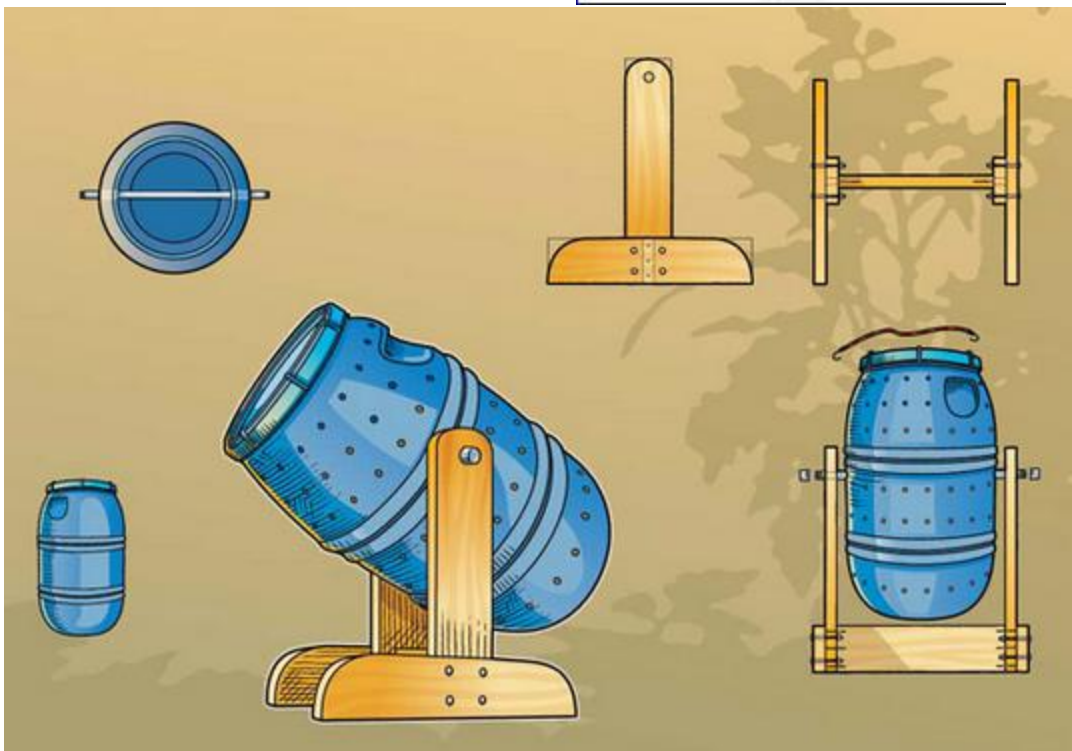
Good Compost Hygiene

- Always Top with Brown Material

Compost Tumblers







Compost Tumblers

PROS

- Sealed, pest proof
- Easier to turn, with proper aeration can speed up the process
- Easy harvest by inverting over a wheel barrow
- Natural fit for hot compost

CONS

- Can be costly
- Smaller volume for larger footprint
- Can be heavy to turn

Leaf Mold

- Decomposed Leaves
- Gardeners' Gold
- Not nutrient Rich
- Physically alter soil to make it spongier
- Hold air and moisture
- Heavenly environment for plant roots
- 2 years from start to finish

Material Reduction Strategies

- Don't Bag It – Mulch Mow!

  Grass clippings rapidly break down, returning valuable nutrients and moisture to the soil.

- Use grass clippings as a mulch layer around plants, trees and shrubs.
- Mulch mow leaves back into the lawn.

  Mown leaves that do not blanket the grass will filter into the soil and naturally compost.

- Rake leaves to use as a mulch layer around trees and shrubs.
- Shred woody debris to use as mulch.

Alternatives to Home Composting

- Curbside pickup
  - Available on a subscription basis in some areas
  - Contact your trash hauler for information on cost and pick-up schedules
  - CAUTION: Putting material at your curb does not mean it is being composted.
- Drop-off locations (call for prices)
  - Suburban Lawn & Garden, Deffenbaugh, Planet Marrs, and City of Olathe (residents only—free).
  - Visit http://www.jocorecycles.org/ for more details

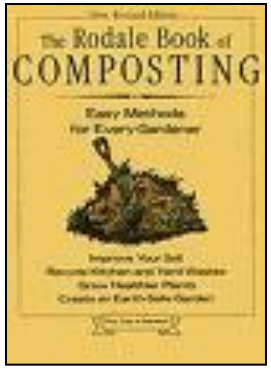
Composting Resources

- Johnson County K-State Research and Extension and Extension Master Gardeners
  - http://www.johnson.ksu.edu
  - Master Gardener Hotline (913) 715-7050

    Email: Garden.help@jocogov.org

- Johnson County Environmental Dept.
  - http://www.jocorecycles.org/
  - (913)715-6900

- The Rodale Book of Composting



What works for me

- To save time & effort
  - Stockpile fruit & veggie scraps in the kitchen
  - Take daily or every few days to compost pile
  - Buried deeply enough within the pile to avoid attracting undesirable critters.

Kitchen

Overflow

- Shredded paper makes great compost! (Soak in water first)

Final Thoughts

- Composting not an art nor a science.
- Rot simply happens.
- Thank you for doing your part!!

Questions?

Coffee Grounds

Coffee Grounds Perk up Compost Pile With Nitrogen

CORVALLIS, Ore. – Coffee grounds can be an excellent addition to a compost pile. The grounds are relatively rich in nitrogen, providing bacteria the energy they need to turn organic matter into compost.

About 2 percent nitrogen by volume, used coffee grounds can be a safe substitute for nitrogen-rich manure in the compost pile, explained Cindy Wise, coordinator of the compost specialist program at the Lane County office of the Oregon State University Extension Service.

"A lot of people don't want to use manure because of concerns about pathogens," said Wise.

Contrary to popular belief, coffee grounds are not acidic. After brewing, the grounds are close to pH neutral, between 6.5 and 6.8. The acid in the beans is mostly water-soluble, so it leaches into the coffee we drink.

When coffee grounds made up 25 percent of the volume of their compost piles, temperatures in the piles stayed between 135 degrees and 155 degrees for at least two weeks, enough time to have killed a "significant portion" of the pathogens and seeds. In contrast, the manure in the trials didn't sustain the heat as long..

[10] http://oregonstate.edu/ua/ncs/archives/2008/jul/coffee-grounds-perk-compost-pile-nitrogen

Soil is more than just Dirt

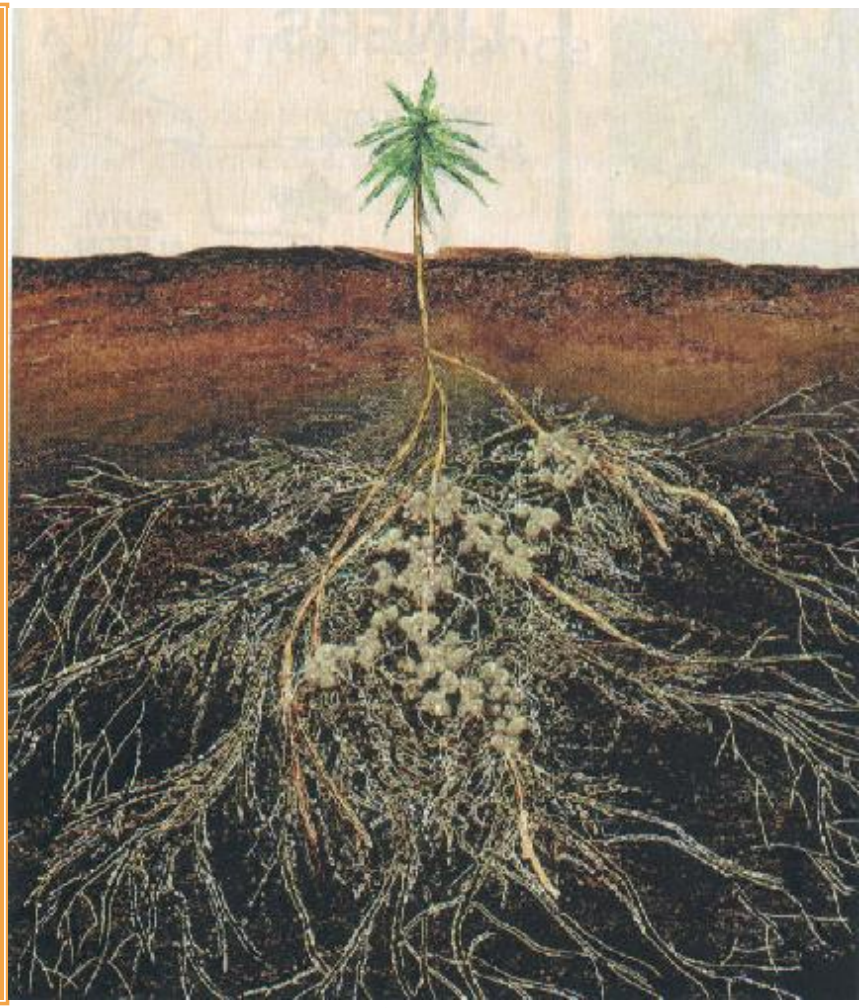
www.iheartsoil.org

It's an ecosystem

Take care of your Soil

Your soil will take care of your plants

Soil is an amazing substance. A complex mix of minerals, air, and water, soil also teems with countless micro-organisms, and the decaying remains of once-living things. Soil is made of life and soil makes life. www.soils.org



10 Mycorrhizae

Mycorrhizae help feed your plants

- Mycorrhizae are fungi that establish a graceful, symbiotic relationship with the roots of most plants. They invade the roots of vegetables, flowers, shrubs, and trees; connect them, one to the other; and then send out their filaments, called hyphae, as much as 200 times farther into the soil than the roots they colonize. Mycorrhiza has the ability to better mine this wider area for water and nutrients, especially phosphorus, which it transmits back to the roots. The plant pays for this service with the glucose the fungus needs.

- http://www.finegardening.com/how-to/articles/mycorrhizae-help-feed-your-plants.aspx

Eggshells- crushed finely

- Don't decompose well
- Contributes calcium in the soil
- Better usage: Bird feed
- Female birds need high calcium in their diet to lay strong eggs and to replenish themselves after laying eggs in the Spring.

Aerobic vs Anaerobic composting

- Aerobic- in the presence of oxygen
- What we learned in class was Aerobic composting
- Anaerobic- in the absence of oxygen
- Anaerobic composting: using fermentation
- Examples: Takakura and Bokashi methods
- Still needs to be finished in an aerobic system.

Thank you for Composting!

- Feel free to contact me should you need more info.
- Mae Christenson
- jocoemgsb@gmail.com