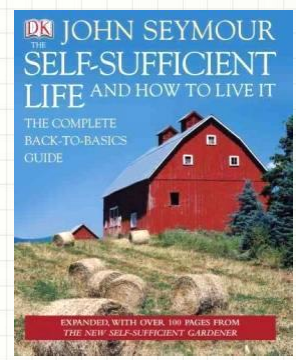
Tennessee MASTER GARDENER

COMPOST & SOIL HEALTH

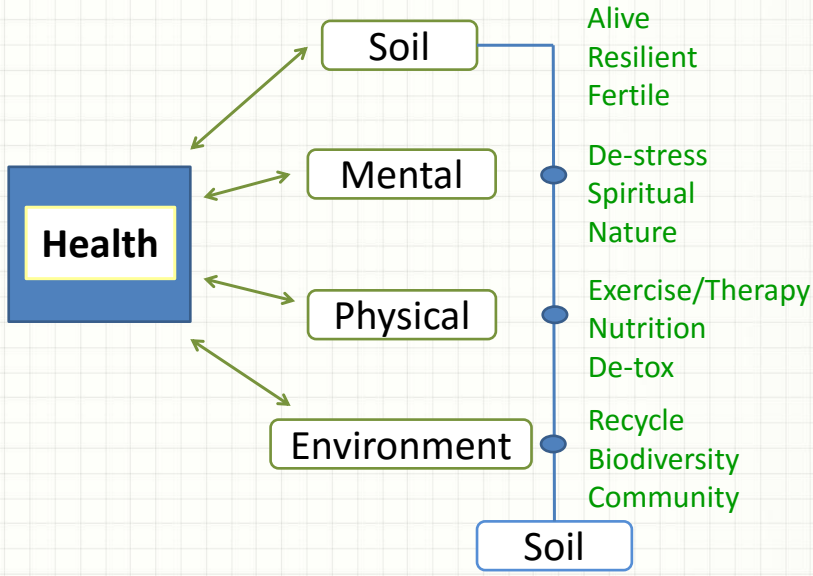
by Mark Murphy
contact: mark.tnmg@gmail.com

"…always remember that the compost pile is the foundation of a successful garden."

John Seymour,
the Self-sufficient Life and How to Live It



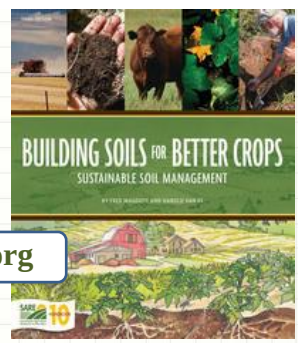
Gardening and Health…



Building Soils for Better Crops, Sustainable Soil Management

USDA Sustainable Agriculture Research and Education (SARE)

Free download: **www.sare.org**

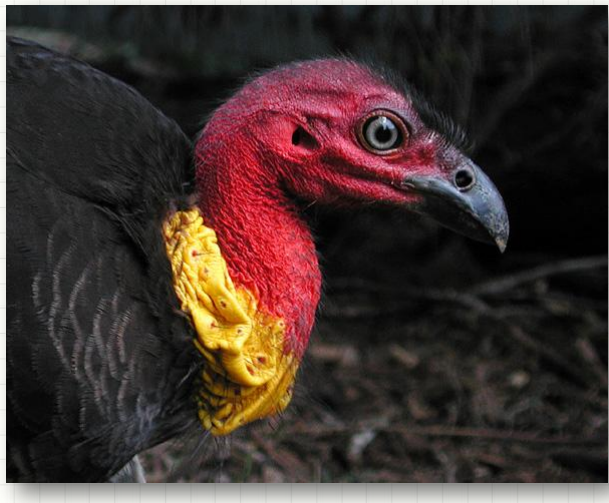


Fred Magdoff and Harold Van Es

*"**Organic matter** is the key to healthy soils."*

*"**Composts** are excellent organic matter amendments for soils."*

*"Composting is the **art** and **science** of combining available organic wastes so that they decompose to form a uniform and stable finished product."*



Australian Brush Turkey

The male **Brush Turkey** of Australia gathers leaves, small branches, moss, and other litter and builds a **mound about 3 feet high and 5 feet across**. It then digs holes into the mound repeatedly and refills them; helping to fragment and mix the debris. … The female lays her eggs in a hole dug into the pile, which heats up to close to 100°F around the eggs…

The heat of the composting process frees the birds from having to sit on the eggs to incubate them.

—R.S. Seymour

future composter …

what is **Compost**?

A mixture of organic residues that have been piled, watered and are partially decomposed. It is a dark, easily crumbled collection of plant and animal products with many of the characteristics of humus, the relatively stable organic component of soils.

- *University of Tennessee*

Compost is…

Soil Conditioner

- **Physical structure**
- **"Tilth" or "crumb"**

-or-

Compost is…

Soil Conditioner

- Physical structure
- “Tilth” or “crumb”
- Aeration
- Root Penetration
- Water Infiltration and Availability
- Reduced Surface Crusting

Compost is…

Soil Conditioner

Fertilizer

- Natural, organic
- complete: contains Macro, Secondary, and Micro nutrients
- Slow Release

Compost is…

Soil Conditioner

Fertilizer

"Green" / Sustainable

- **discarded organic matter = Waste**
- **recycled organic matter = $$$ Value**

Compost is…

Soil Conditioner

Fertilizer

"Green" / Sustainable

Pest and Disease control

- **Life supports Life**
- **Biodiversity**

Compost is…

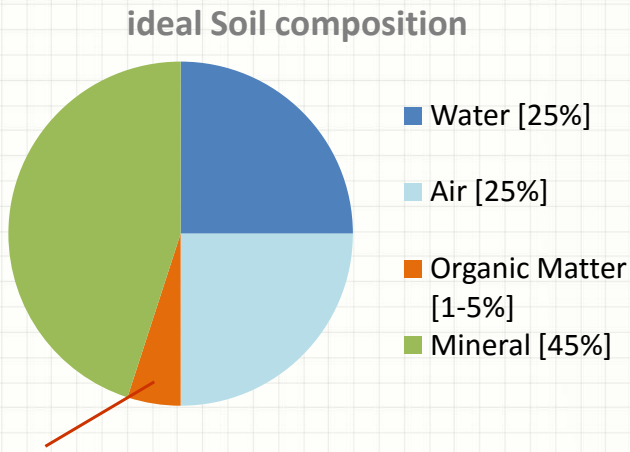
- Soil Conditioner
- Fertilizer
- "Green" / Sustainable
- Pest and Disease control
- Health
  - **Exercise**
  - **Nutrition**

…healthy soil
…healthy plants
…healthy people

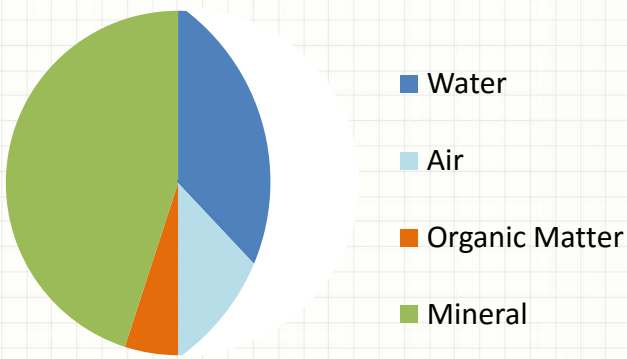
uses for Compost …

- ingredient for **Potting Soil** or **Containers**
- ingredient of **Seed Starting Mix**
- **Mulch** or "side dressing" for plants
- **Soil Amendment** at planting time
- layer or amendment for **Lasagna Garden**
- amendment to **Garden** plot or beds
- to make **Compost Tea**
- *… anywhere you have or need Soil*

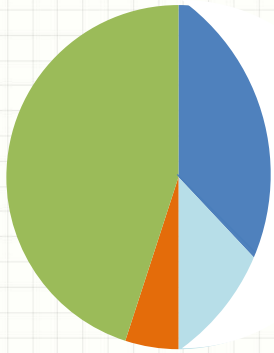
what is soil **Organic Matter**?



The organic portion of the soil;
both living and dead organisms.



Clay Soil behavior



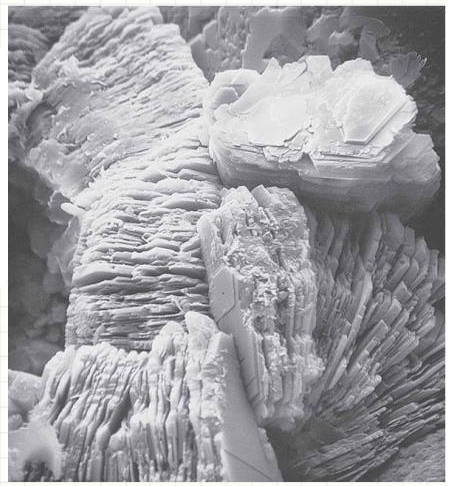
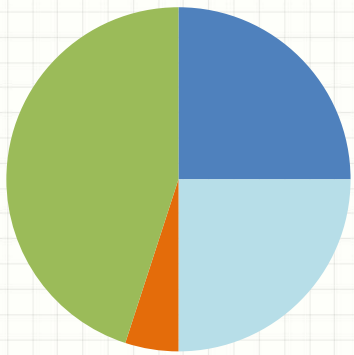
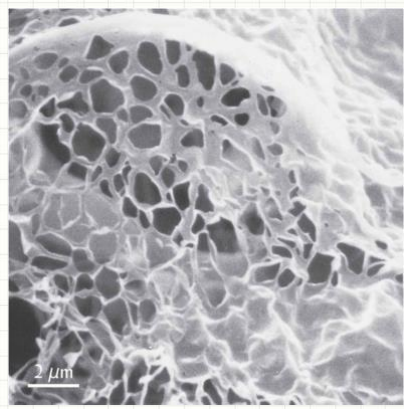


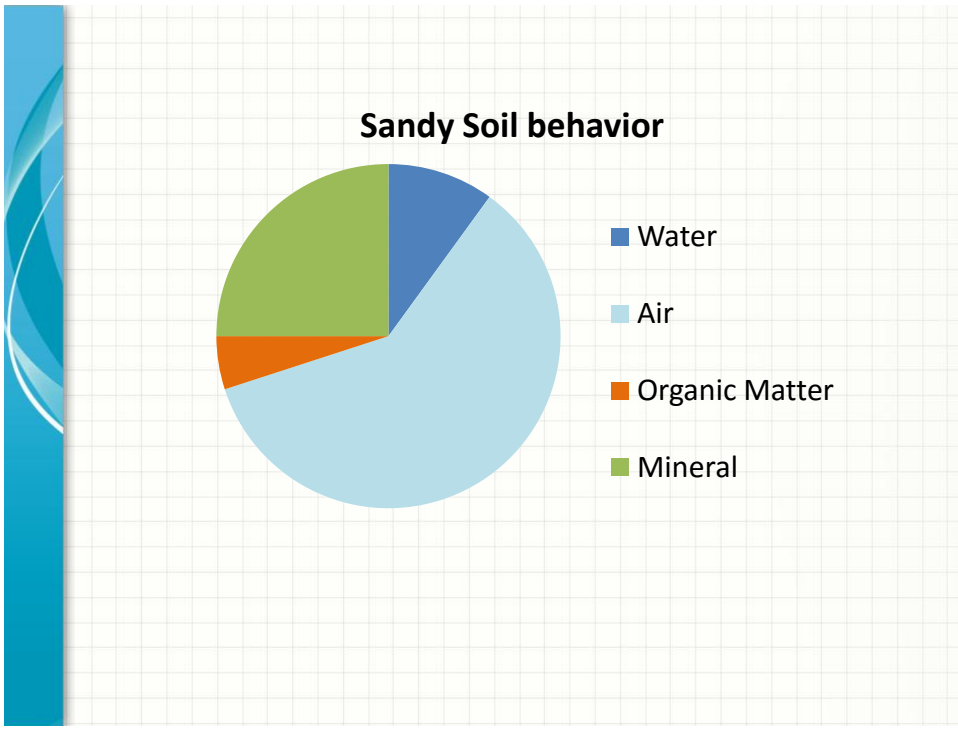
photo: Yavapai College

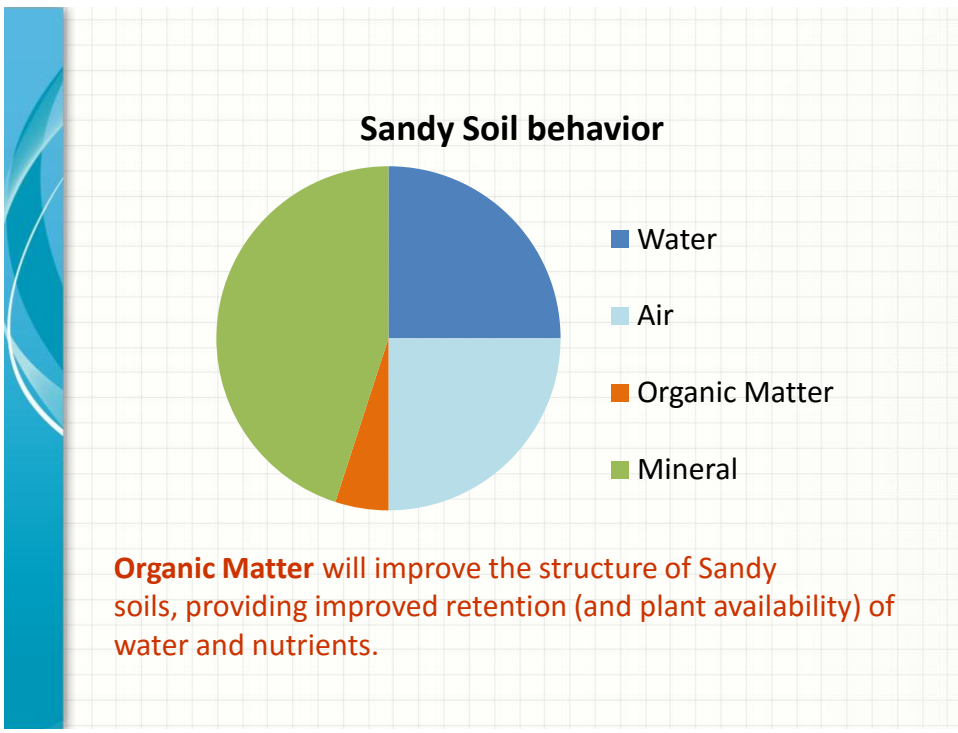
Clay Soil behavior





Organic Matter will improve the structure of Clay soils, providing improved drainage and water availability, and better air infiltration.





Organic Matter will improve the structure of Sandy soils, providing improved retention (and plant availability) of water and nutrients.

add Organic Matter in every way that you can!

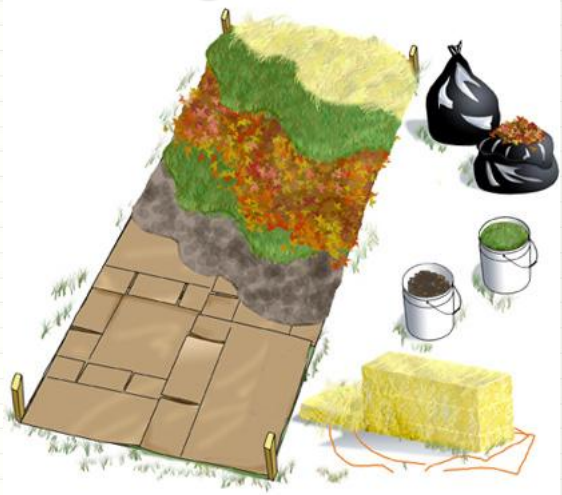
Compost…

Cover Crop…

Mulch…

add Organic Matter in every way that you can!

Lasagna Garden



- Build anytime
- Free materials
- No-till
- "zero-maintenance" composting

Photo: fifth season gardening

Stealth Composting

- Trench composting

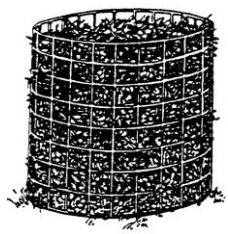
- Sheet composting

VermiCompost

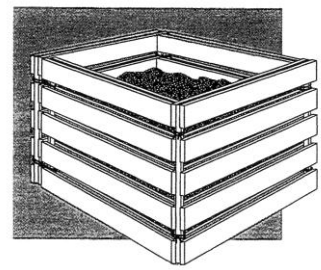
- Red Wiggler worm bin

- eXtension.org

Compost containment

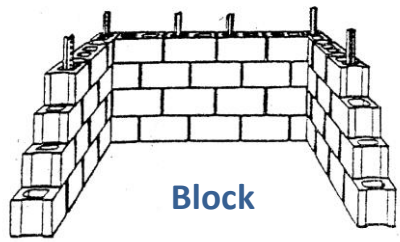


Wire



A four-sided pallet compost unit.

Wood or Pallets



Block

Compost Tumblers

ComposTumbler

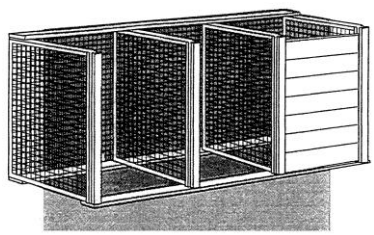
Earth Machine

Sun-Mar

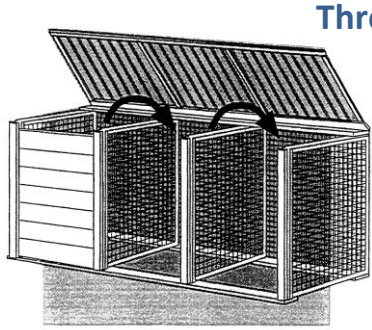
CompoSpin

"Do it Yourself"
Trash Can or **Barrel** Compost Tumblers

Compost containment



Three-Bin Composter



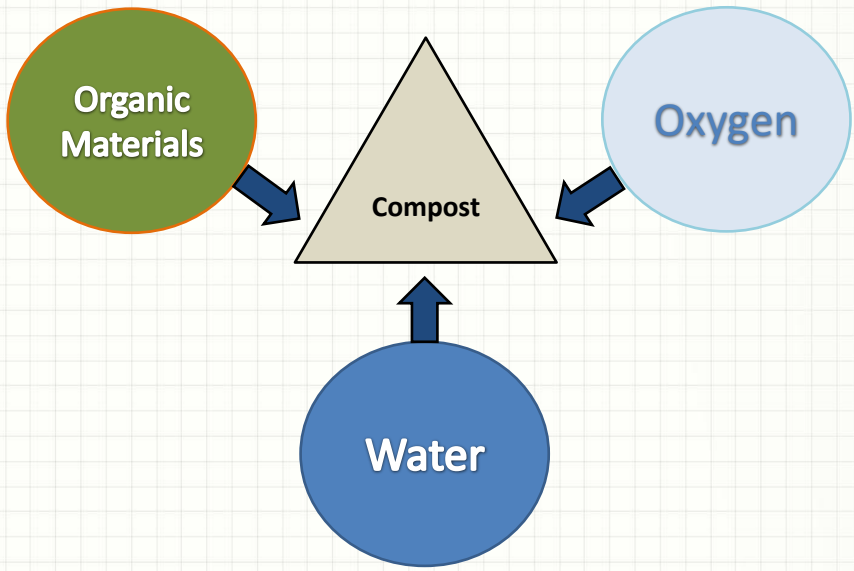
Three-Bin Composter
with Lid

overall dimensions,
4' high x 3' deep x 9' wide.

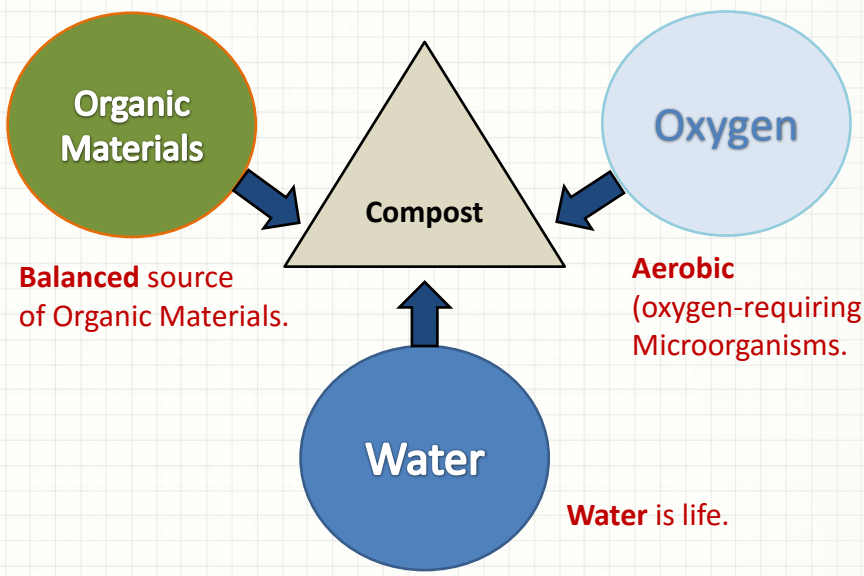
holds **4 cubic yards**
of material.

Images from University of Tennessee publication PB1578

Compost happens!



encourage beneficial **Microorganisms**



Balanced source of Organic Materials.

Aerobic (oxygen-requiring) Microorganisms.

Water is life.

things to Compost…

Grass Clippings

Green

things to Compost…

Grass Clippings

No Chemicals

things to Compost…

Leaves

Brown

things to Compost…

Fruit & Vegetable

Green

things to Compost…

Paper

Brown

things to Compost…

Paper

No
Glossy Paper

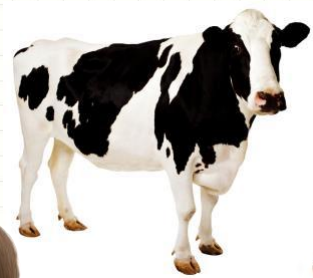
things to Compost…

Manure

Green

things to Compost…

Herbivore Manure



No Omnivore or Carnivore

things to Compost…

Eggshells

Coffee Grounds & Tea Bags

Green

things to Compost…

Sawdust

Straw

Wood Chips

Brown

things to Compost…

Sawdust

Straw

Wood Chips

No Pressure Treated

the good guys…

materials recommended for composting

- Grass clippings
- Sod
- Topsoil
- Leaves, Bark & Branches
- Hay or Straw
- Livestock Manure
- Coffee Grounds
- Egg shells
- Corncobs & stalks
- Peanut hulls
- garden Plant Residues
- kitchen Vegetable & Fruit wastes
- Newspaper
- Paper and Cardboard
- Pine Needles
- Weeds
- Sawdust
- Wood Chips
- Wood Ashes

Chop, Chip, or Shred

materials that are hard, dense or bulky.

Increased **surface area** speeds decomposition.

- Grass clippings
- Sod
- Topsoil
- **Leaves, Bark** & **Branches***
- Hay or Straw
- Livestock Manure
- Coffee Grounds
- **Egg shells***
- **Corncobs** & **stalks***
- Peanut hulls
- garden Plant Residues
- kitchen Vegetable & Fruit wastes
- **Newspaper***
- **Paper** and **Cardboard***
- Pine Needles
- Weeds
- Sawdust
- **Wood Chips***
- Wood Ashes

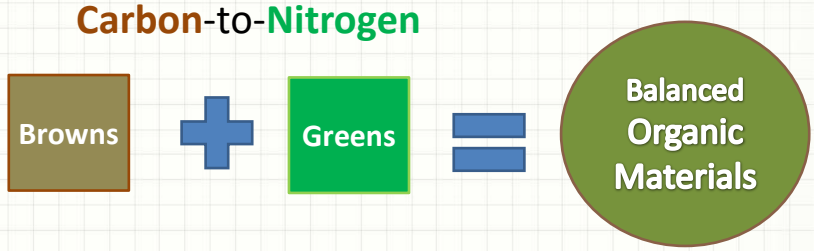
Image from University of Tennessee publication PB1578

the bad guys…

materials <u>not</u> recommended for composting

Material	Reason to Avoid
• Diseased plants • Plants with mature seeds • Invasive grasses and weeds (johnsongrass, bermudagrass, nimblewill)	Some seeds, invasive plant materials, and disease organisms may survive the composting process and pose a threat in the finished product.
• Grease, Lard, and Fat • Meat, Bones, or Fish • Dairy Products	Slow to decay and may be odorous. Can attract animals (dogs, cats, mice and rats, skunks, etc…)
• **Black Walnut** wood or sawdust • **Treated** wood or sawdust	• **juglone**, toxic to some plants • chemical residues
• Manure from Carnivores or Omnivores (dog, cat, pig, etc…)	may contain parasites, bacteria, or viruses harmful to humans
• Yards wastes treated with Pesticides or Herbicides	may contain chemical residues harmful to microorganisms, plants, and humans
• Magazines and “slick” paper	contains synthetic (plastic) compounds that will not decompose effectively

Balancing the ratio of Carbon-to-Nitrogen

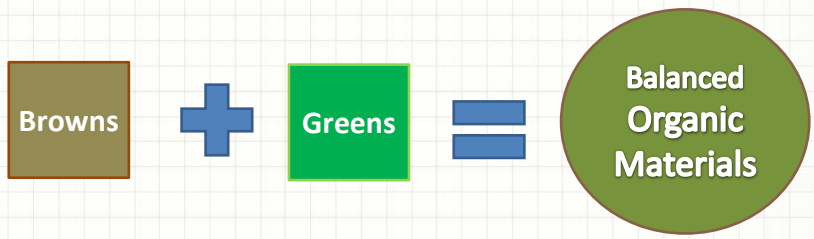


30:1 ratio of Carbon-to-Nitrogen

Browns — Organic wastes with a C:N ratio **greater than** 30:1

Greens — Organic wastes with a C:N ratio **less than** 30:1

Why is the **Balance** important?



too much Carbon — The Nitrogen is quickly used up, and the decay process then slows dramatically as the microorganisms die off.

too much Nitrogen — Microorganisms do not have enough carbon energy to use all of the available nitrogen. The volatile excess nitrogen is lost to the atmosphere, or leached by water.

typical **Carbon:Nitrogen** ratios of **Greens** and **Browns**

Greens	C:N	Browns	C:N
• Grass clippings	18:1	• Leaves	100:1
• Vegetable wastes	16:1	• Paper	175:1
• Fruit wastes	35:1	• Wood Chips	700:1
• Egg Shells	35:1	• Sawdust	400:1
• Coffee Grounds	18:1	• Bark	120:1
• Cow Manure	20:1	• Corn Stalks	60:1
• Horse Manure	25:1	• Pine Needles	90:1
• Horse Manure + Litter	45:1	• Peanut hulls	50:1
• Poultry Manure	10:1	• Peat Moss	58:1
• Poultry Manure + Litter	15:1	• Straw	80:1
• Topsoil	11:1		
• Alfalfa Meal or Pellets	15:1		
• Seed Meals	7:1		

the Compost Pile

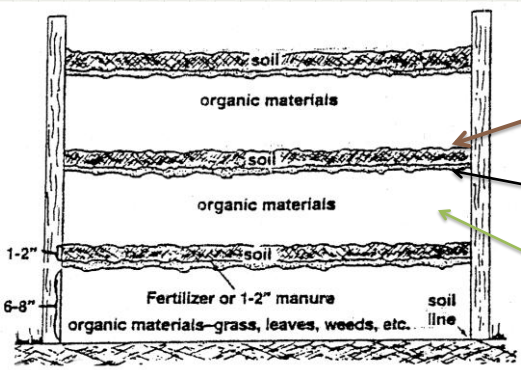


Figure 1. Cross section of proper layering in a compost bin.

Garden Soil

Manure

Balanced Organic Materials

This is one way…
not the only way!

the Compost Pile

typical “working” temperature 90-140 degrees (F)

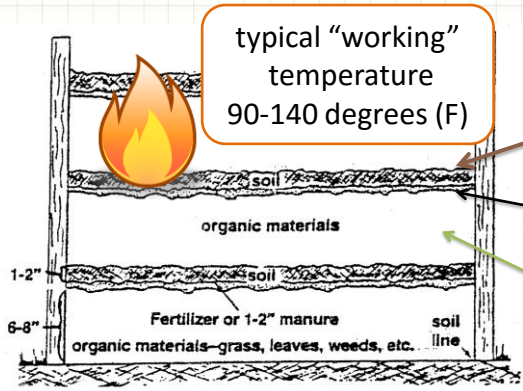


Figure 1. Cross section of proper layering in a compost bin.

Garden Soil

Manure

Balanced Organic Materials

Suggested **minimum** pile size for effective composting = 1 Cubic Yard.

“hot” Compost in action…

Ambient air temperature below 32 degrees.

When is Compost ready to use?

David Butler, Ph.D.,
Professor, University of Tennessee

- ***if it looks like mulch, it is ready to use as mulch***
- ***if it looks like soil, it is ready to be used as soil***

note: at the completion of the composting process, the material volume will have **decreased** by **50** to **80** percent !

compost pile Troubleshooting…

problem	possible causes
• Bad Odor	• too wet • Anaerobic, needs aeration • too many damp Nitrogen-rich organics, add more dry Browns
• not Decomposing	• too dry • material pieces too large • Carbon ratio too high; more Nitrogen needed
• too Cool	• pile too small • Carbon ratio too high; more Nitrogen needed
• Flies & general nastiness	• failure to seal the top of the pile with soil and/or “browns”

Composting in 5 Easy Steps …

1. **Gather organic materials** in a pile or container, at a convenient outdoor location.

2. If dry, **water** the materials until they are evenly moist, but not saturated.

3. Mix the materials "now and then" to **aerate** the ingredients. An active compost pile will get hot. (that's good)

4. Your compost is finished when it has a soil-like appearance and a pleasant "earthy" aroma.

5. Mix the compost into your garden beds or planters, and enjoy your newly improved soil !!!.

a Variety of Quality Ingredients = Better Compost

sources …

University of Tennessee sources:

- **Managing Landscape and Garden Wastes** PB1578, Tom Samples, David W. Sams, and Neal Denton
- **Making and Using Compost** P&SS Info #238, David W Sams
- **Composting Yard, Garden and Food Wastes** PB1479, Tom Samples and Mark A. Nash
- **On-Farm Composting of Poultry Litter** P&SS Info #319, Forbes Walker

other sources:

- Reggie Reeves, rain barrel Compost Tumbler photo

note: the **University of Tennessee** does not recommend or endorse "non-UT" publications, sources or products shown in this presentation.

Tennessee MASTER GARDENER