

Composting



Its Recycling...



Naturally

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What is composting?

Using the natural process of decay to change organic wastes into a valuable humus-like material called compost



Composting -

Speeding up the natural decay process

A compost pile or bin allows you to control

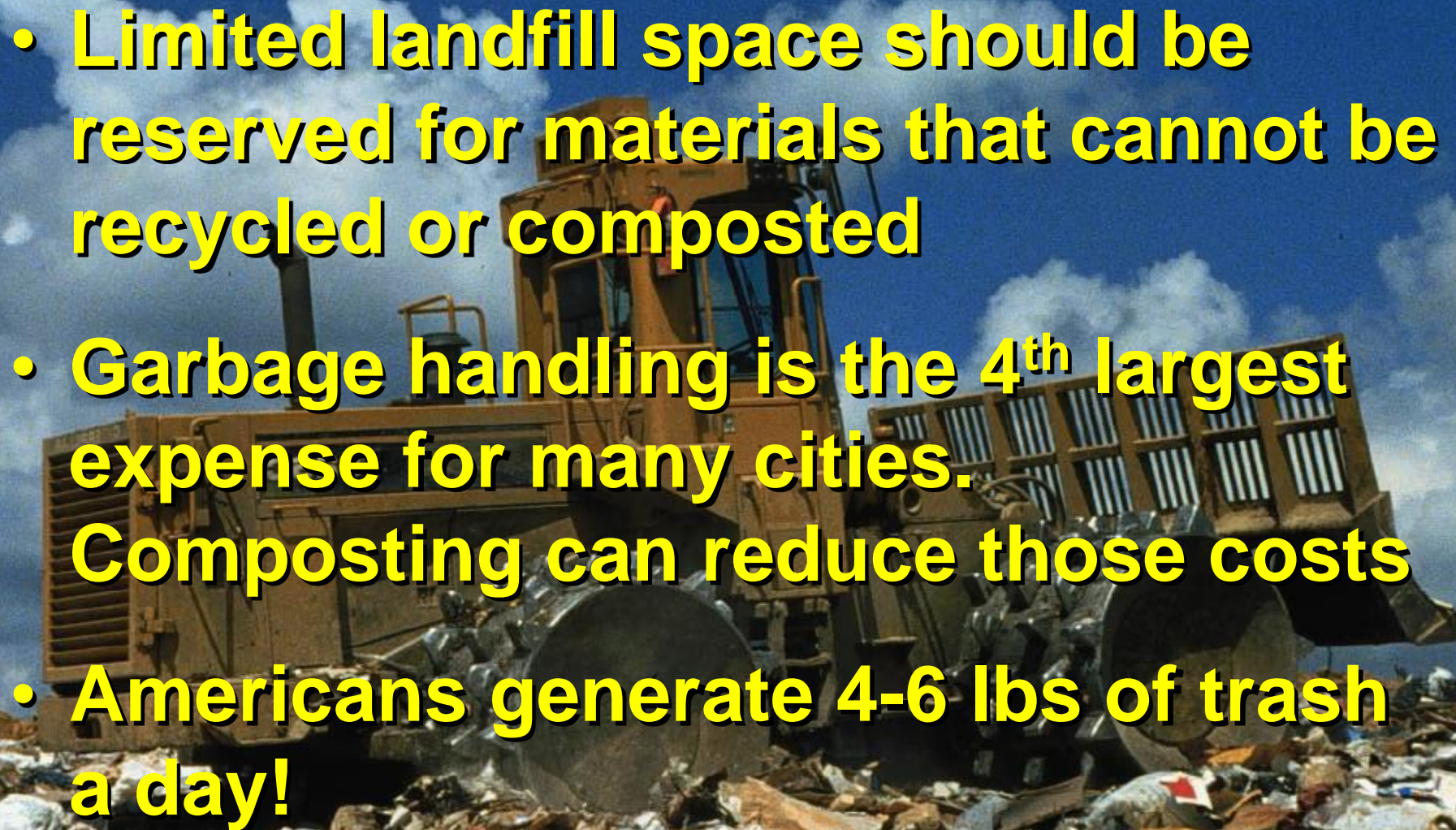
- Air (oxygen)
- Water
- Food, and
- Temperature



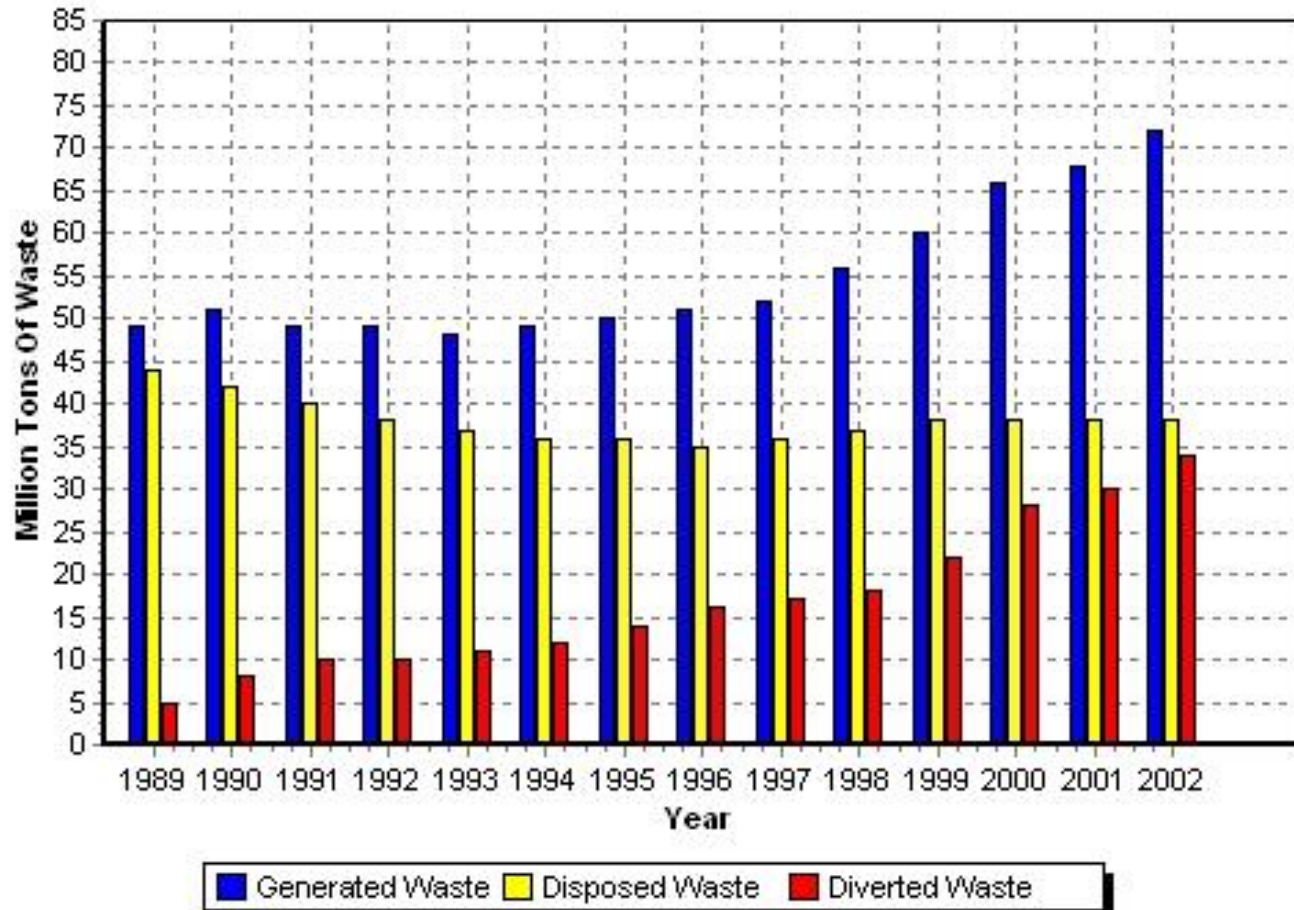
By managing these factors you can speed up the otherwise slow natural decay process

Why compost yard and kitchen wastes?

- CA's goal was to divert 50% of organic matter destined for landfills
 - National Composting Council estimates the average U.S. household generates 650 lb of compostables every year.
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- A photograph of a large landfill filled with various types of waste, including plastic, paper, and organic matter. In the foreground, several black and white bags of compostable waste are visible, some lying on the ground and others stacked. The background shows a vast expanse of trash stretching towards a blue sky with scattered white clouds.

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- A large yellow landfill compactor is shown in the process of compacting a massive pile of trash. The compactor has a large front wheel and a smaller rear wheel. The trash pile is composed of various materials, including plastic bags, cardboard, and other debris. The background shows a blue sky with scattered white clouds.
- Limited landfill space should be reserved for materials that cannot be recycled or composted
 - Garbage handling is the 4th largest expense for many cities. Composting can reduce those costs
 - Americans generate 4-6 lbs of trash a day!

Annual California Waste Disposal, Diversion and Generation



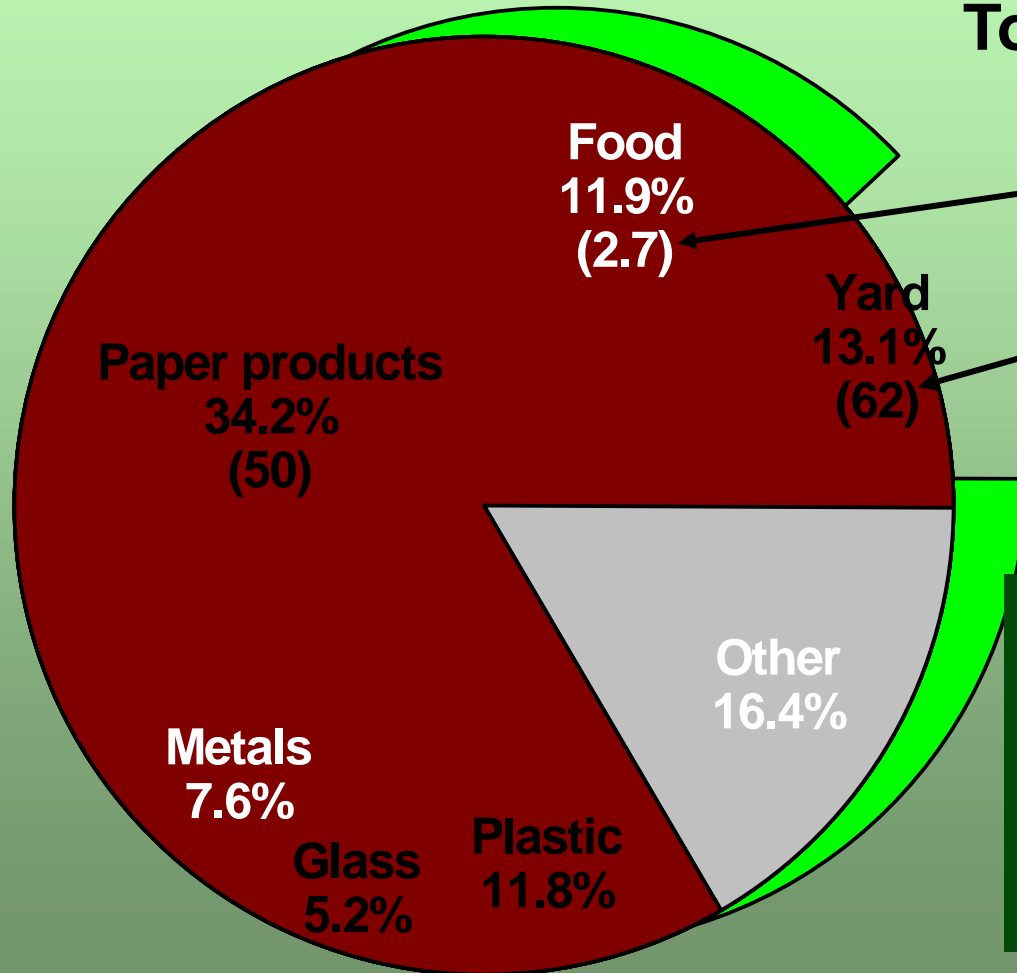
Composting Yard Wastes

- **In CA, yard wastes are the largest component of municipal waste**
- **Grass clippings comprise approximately half of the yard trimmings deposited in state landfills.**
- **An average California lawn produces 300 to 400 pounds of grass clippings per 1,000 square feet annually, which equates to as much as 8 tons per acre.**

- **When Including commercial landscape greenwaste, the total equals over 13 percent of the waste stream (1.7 million tons) annually.**
- **Composting also recycles millions of tons of crop residues, stable bedding materials, manures, food wastes, and other organic materials in a sustainable and environmentally beneficial manner.**

2005 Municipal Solid Waste Production in the U.S.

Total = 245 million tons/yr
(4.6 lb/person/day)



Percent of category that was recycled

The overall recycling rate was 32% in 2005

Backyard composting can increase recycling of yard and food wastes.

History of Composting

- **Composting can be traced back to Marcus Cato, a farmer, and statesman from Rome, who lived 2,200 years ago. He reported the virtues of compost for enhancing agricultural productivity.**
- **George Washington was an avid composter on his farm at Mount Vernon, New York.**
- **By the 19th century, composting was commonly practiced to restore organic matter to soils.**

The number of licensed composting facilities in the U.S. has tripled since 1990, to over 3,000.

What do you need to make compost?



- Decomposers – Your composting work crew. These are the microbes (mainly bacteria and fungi) that do all the work for you.
- Food for the decomposers
The organic materials to be composted
- The right amount of air, water, and warmth to keep the work crew happy

Where do the decomposers come from?

**If you build it,
they will come...**

- Soil
- Leaves
- Food scraps
- Manure, and
- Finished compost

**Each of these will add
microorganisms
to the compost pile**



One teaspoon of good garden soil to which compost has been added contains

- 100 million bacteria**
- 800 feet of fungal threads**



Numerous additives and starters are available but are not needed for good or rapid composting



What is the best food for your decomposers?

All organic materials will compost, but not all should be added to a backyard compost pile

Organic wastes that should be composted include:



Garden trimmings



Grass clippings



Leaves



Kitchen scraps

Also

- Used potting soil
- Manure
- Sawdust
- Hair

Materials to avoid...

Avoid organic materials that could cause problems during or after composting

- **Oil, fat, grease, meat, fish or dairy products, unwashed egg shells (tend to attract pests, vermin)**
- **Hard to kill weeds (bindweed, quackgrass) and weeds that have gone to seed (could infest garden area when compost is used).**

Materials to avoid...

**Cat or dog waste
(attracts pests, could spread disease)**



**Diseased or insect ridden plants
(could infect or attack garden
plants when compost is used)**

Materials to avoid...

- Lime (increases compost pH and promotes ammonia odor problems)
- Wood ash, add sparingly to the pile (will add some potash to compost but will increase pH and ammonia odor problems)



Is shredding necessary?

Smaller particles decompose faster



Have greater surface area per unit volume

Allows microbes to get at more of the food

Chipping or shredding coarse materials (twigs, stems) will speed up the rate at which they decompose

Is shredding necessary?

but...

Smaller particles will also decrease airflow into the pile

- May lead to anaerobic conditions**
- Pile may need to be turned more often**

More about food for your decomposers

Your compost workers will thrive if you give them a balanced diet.

- Composting will be most rapid if the decomposers are fed a mix of carbon rich and nitrogen rich materials.
- Carbon rich organic wastes are known as “**browns**”
- Nitrogen rich organic wastes are known as “**greens**”

Browns

High carbon materials such as

Leaves (30-80:1)

Straw (40-100:1)

Paper (150-200:1)

Sawdust (100-500:1)

Animal bedding
mixed with manure
(30-80:1)



Greens

High nitrogen materials such as

Vegetable scraps (12-20:1)

Coffee grounds (20:1)

Grass clippings (12-25:1)

Manure

– Cow (20:1)

– Horse (25:1)

– Poultry (10:1), with litter
(13-18:1)

– Hog (5-7:1)



Browns

- **Decay very slowly**
- **Coarse browns can keep pile aerated**
- **Tend to accumulate in the fall**
- **Tie up nitrogen in soil if not fully composted**
- **May need to stockpile until can mix with greens**

Greens

- **Decay rapidly**
- **Poor aeration – may have foul odors if composted alone**
- **Tend to accumulate in spring and summer**
- **Supply nitrogen for composting**
- **Best composting if mixed with browns**

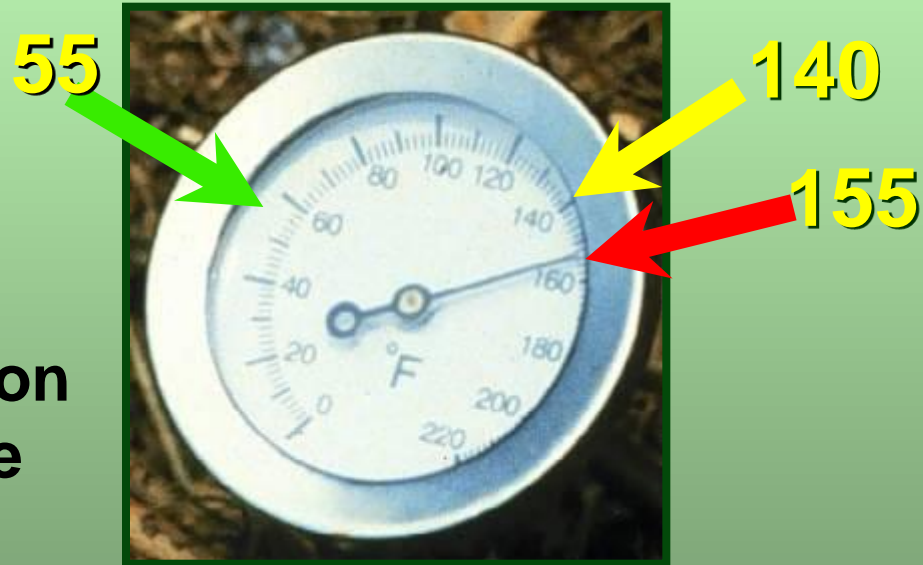
Aerobic composting

- Composting with decomposers that need air (oxygen)
- The fastest way to make high quality compost
- Produces no foul odors
- Aerobic decomposers produce **heat**



Aerobic composting and temperature

- Active composting occurs in the temperature range of 55°F to 155°F
- Pile temperature may increase above 140°F but this is too hot for most bacteria and decomposition will slow until temperature decreases again.



- A thermometer is a nice tool but is not essential for good composting

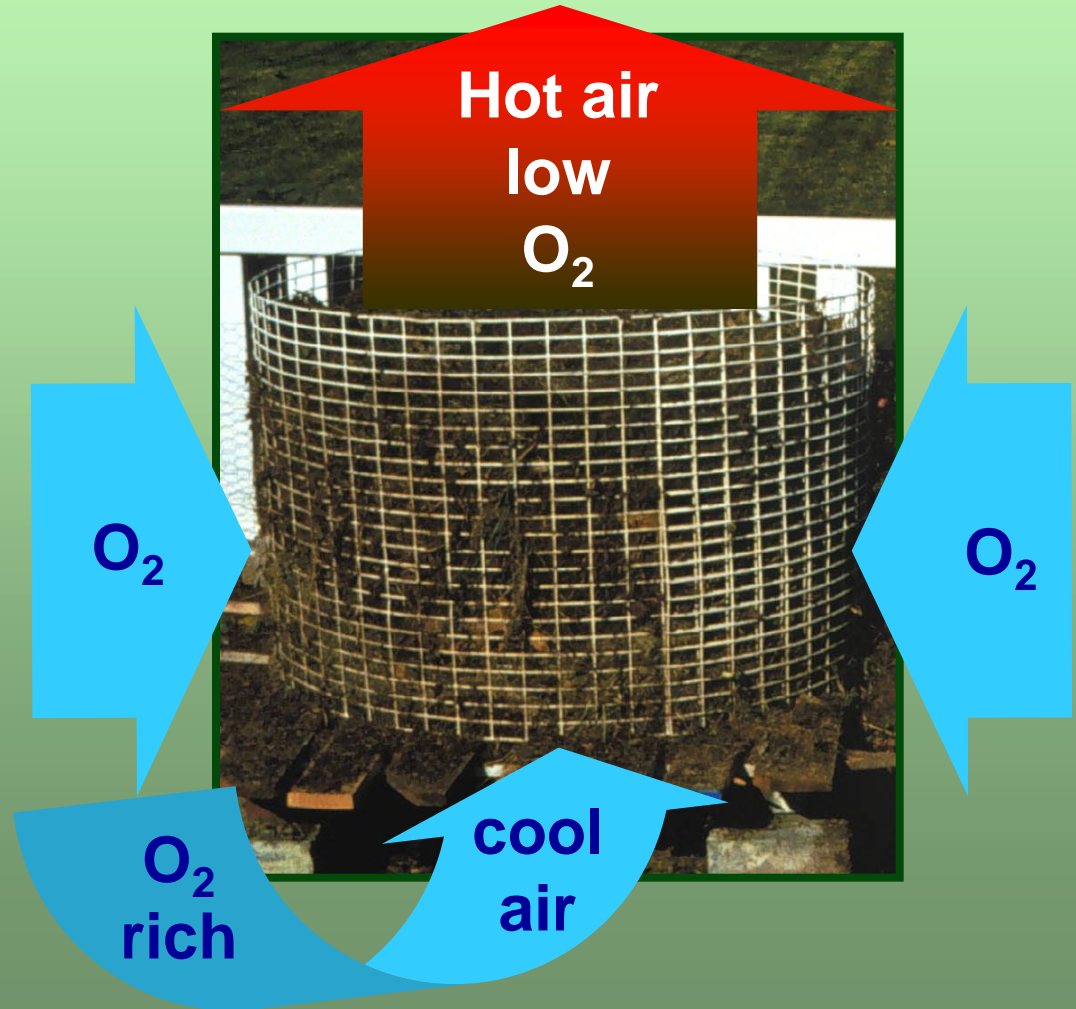
Does my compost pile have to get **hot?**

- **Good compost can be made in a pile that never gets hot, but...**
 - Decay will be slower and it will take longer to make compost
 - Not enough air, too little or too much water, or too many browns in the mix could all keep a pile from heating.
- **High pile temperature provides the benefits of**
 - The most rapid composting
 - Killing pathogenic (disease causing) organisms
 - Killing weed seeds

Getting air to your decomposers

Warm air rising through the pile draws fresh air in from bottom and sides

Wind can stimulate aeration



Pile aeration

Depends upon adequate porosity

- Porosity is the air filled space between particles
- “Browns” help to maintain good porosity in the pile
- A compacted pile has lost porosity, can be increased by turning
- Aeration can be increased by inserting sticks, cornstalks, or perforated pipes into or under the pile

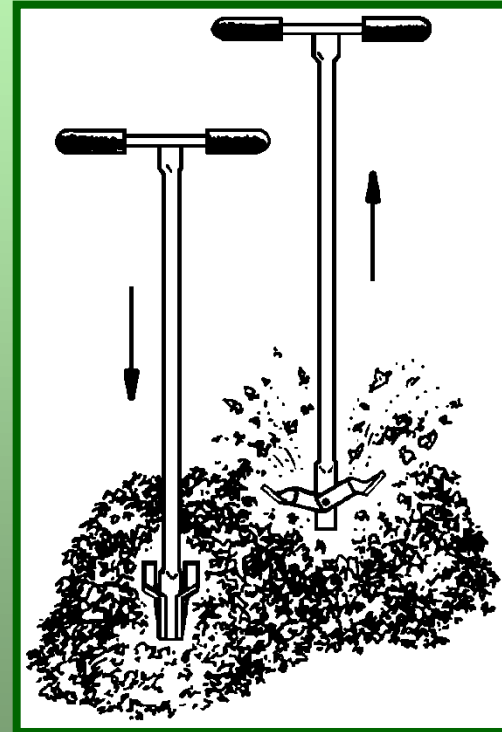


Pile aeration

Getting air to your work force



- Turning the pile mixes fresh air into the pile



- Turning tools can make the job easier

Water

- **Rapid decomposition requires optimum water content**
 - If too dry, bacterial activity will slow or cease
 - If too wet, loss of air in the pile will lead to anaerobic conditions
- **Pile water content should be at 40-60%**
- **As wet as a squeezed out sponge**
- **If too dry, add water as you turn the pile**
- **If too wet, add browns and/or turn the pile**



Taking care of your compost pile

- The most rapid composting is achieved by
 - Adding mixed browns + greens
 - Regularly turning (mixing) the compost pile
 - Controlling water content
- When pile no longer heats after mixing, allow it to cure (stand without mixing) for at least 4 weeks before using the compost



Making compost the fast way

(Instructions for active composters)

- **Turn the pile every 5 to 7 days,**
 - **move outer material to the pile center**
 - **add water if needed**
- **During the first few weeks temp should reach 140°F**
- **After about 4 weeks less heat will be produced and compost will maintain lower temp (100°F)**

Making compost the fast way

(Instructions for active composters)

- **After about 4 more weeks the pile will no longer heat after turning and volume will be about one third of original.**
- **Allow the pile to cure (stand without turning) for 4 more weeks before using the compost**

When is compost finished?

Compost is mature when

- The color is dark brown
- It is crumbly, loose, and humus-like
- It has an earthy smell
- It contains no readily recognizable feedstock
- The pile has shrunk to about 1/3 of its original volume



Simple tests for finished compost

Bag test: sealing compost in a plastic bag for several days should produce no foul odor



Germination test: will seeds germinate in the compost? (good test to use if compost will be part of a potting mix)

Where should I put my compost pile?

- Shaded area will help prevent drying out in summer
- Avoid areas that will interfere with lawn and garden activities
- Adequate work area around the pile
- Area for storage
- Water available

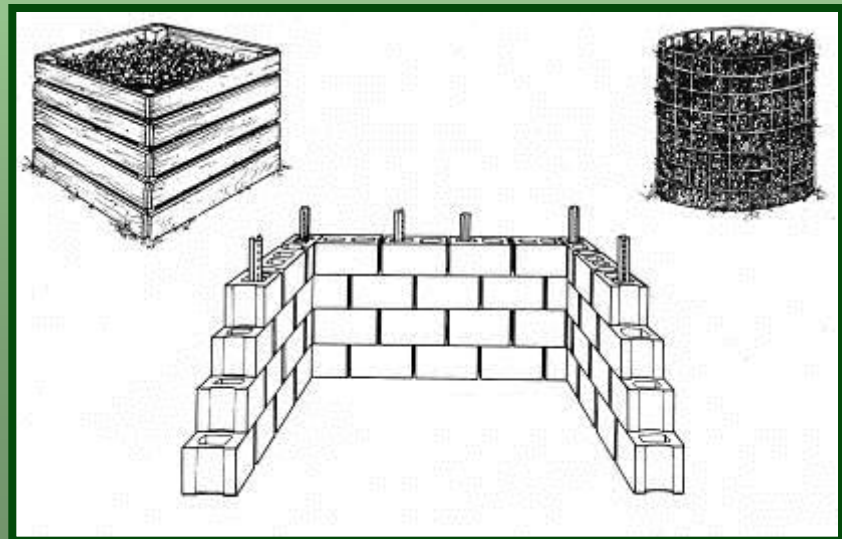
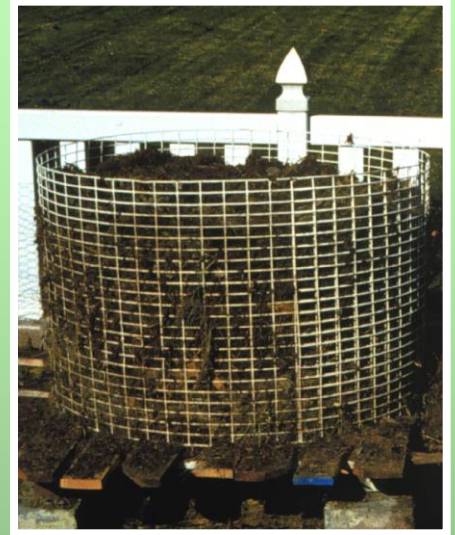


Considerations for locating the compost pile

- **Good drainage**
- **Away from any wells**
- **Near where finished compost will be used**
- **Be a good neighbor**
 - **Make your composting area attractive, or**
 - **Keep it out of your neighbors' view**

Bin/pile construction

- Ideal size is approximately a 3 foot cube
 - Promotes sufficient aeration
 - Retains sufficient heat to maintain warm temps
 - Piles larger than 5 x 5 x 5 feet are difficult to turn and tend to become anaerobic in the center



Manufactured bins



The Earth Machine Bin



Compost Troubleshooting

Odors

Odors are one of the most frequent but easily avoidable composting problems.

- Rotten odor

- Putrid smell or rotten egg smell
- Usually results from anaerobic conditions
- Excess moisture, compaction
- Turn pile, add dry porous material (browns), cover kitchen scraps

- Ammonia odor

- Too much nitrogen (greens)
- Add high carbon material (browns), turn pile

Compost Troubleshooting Temperature

Low pile temperature

- Pile too small, cold weather, too dry, poor aeration, or lacks nitrogen
- Make pile bigger or insulate sides, add water, turn the pile, add greens or manure

High pile temperature

- Pile too large, insufficient ventilation
- Reduce pile size, turn

Compost Troubleshooting

Pests: raccoons, rats, insects

- Presence of meat scraps or fatty food waste
rotten odors
- Remove meats and fatty foods, cover with sawdust or leaves, turn the pile
- Compost in an animal-proof bin
 - Covered bin, trash can bin, cone bin, or barrel bin
 - Wire mesh sides and floor (1/4 – 1/2 in openings)
- Use worm composting (vermicomposting) for food scraps



Benefits of compost

Promotes soil health

- **Supplies organic matter to soil**
- **Attracts earthworms**
- **Stimulates beneficial soil microorganisms**
- **Increases soil water holding capacity**
- **Increases soil nutrient retention**



Benefits of compost

Promotes soil health

- **Improves soil tilth and friability**
- **Improves soil drainage**
- **Loosens heavy clay soils**
- **Suppresses soil-borne plant pathogens (diseases)**

Benefits of compost

Plant nutrients

Compost is not a fertilizer, but does contain plant nutrients

- Nitrogen and phosphorus are mostly in organic forms
 - Released slowly to plants
 - Not readily leached from the topsoil
- Compost contains many trace nutrients that are essential for plant growth



Using finished compost

- Soil amendment

- Be sure that compost is mature, has an earthy smell (no ammonia or rotten smell), looks dark and crumbly with no recognizable feedstock
- Compost improves soil health when mixed in the top 4 to 6 inches (work in no more than a 2" layer of compost)
 - Will improve water and nutrient retention of sandy soils
 - Will loosen compacted clay soils and make them more friable

Using finished compost

- Surface mulch in the garden/landscape
 - Maximum 3” depth
 - Start 3-4” from trunk
 - Extend out to dripline
- Mulch provides
 - Protection from temp extremes
 - Slows moisture loss from soil
 - Provides some slow release nutrients



Using finished compost

- Lawn topdressing

- Be sure compost is very mature to avoid harming the lawn
- Use fine (screened) compost, ¼” depth raked over lawn
- Best if lawn is cored before applying compost
- Retains moisture, supplies slow release nutrients, prevents soil compaction

- Potting mix

- Compost must be very mature to avoid injury to plants
- Use fine textured compost
- Mix no more than 1/3 compost by volume

Avoid root bound trees!



Circled Roots Under Mulch



Result of Circled Roots



High Quality Root System



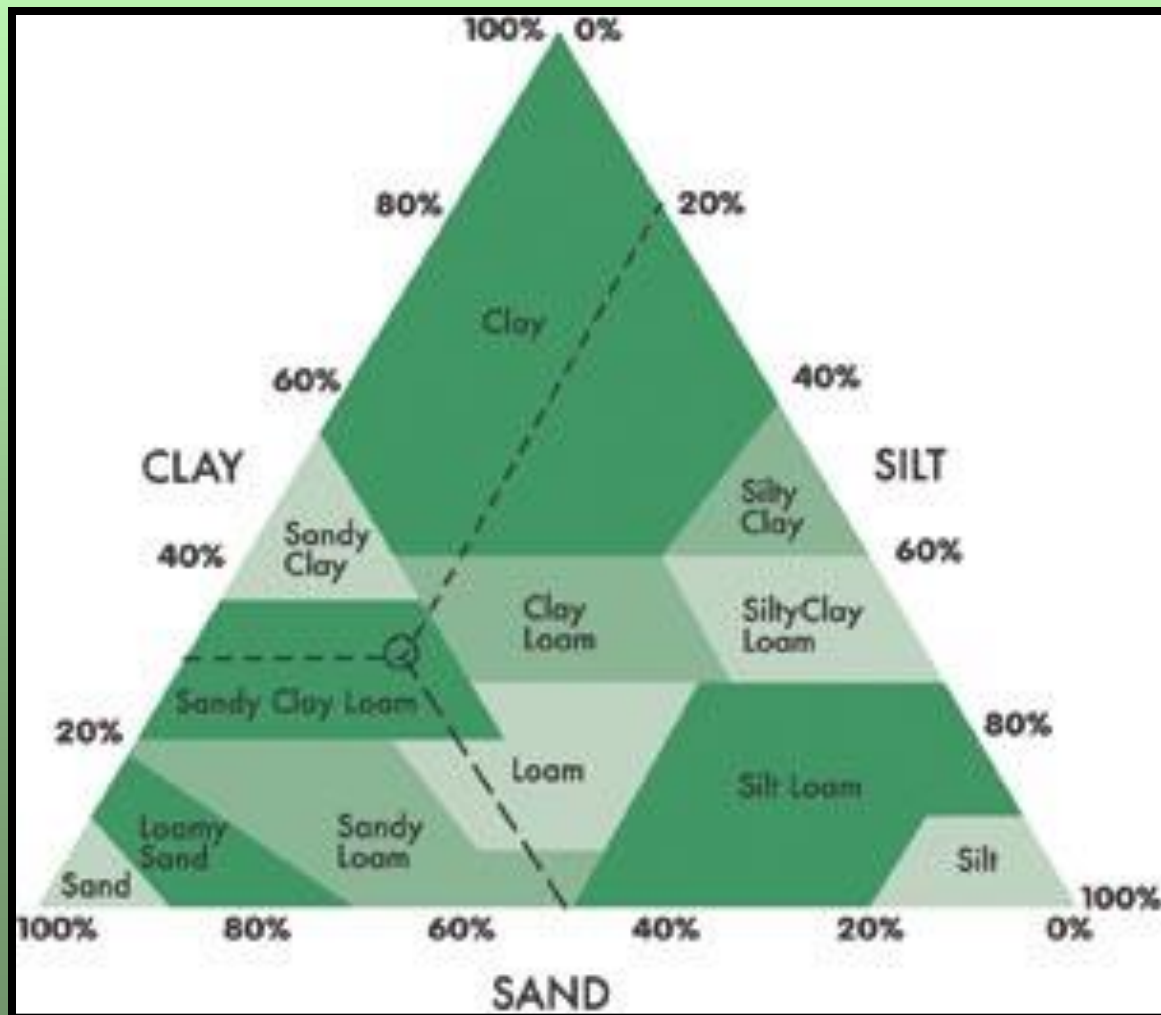
Plant twice as wide and at same level tree was in container



Soil Textures



Soil Textures (Types)





Composted Greenwaste



Figure 1. Composted greenwaste prior to amending into native sandy loam soil at University of California, Riverside.

Soil Amendments and Mulch

- **Soil amendments are added to the soil**
- **Mulch is placed on top**

Mulch

- **Reduces water evaporation from soil**
- **Buffers soil temperature**
- **Reduces weeds**
- **Prevents mechanical weed whip damage**

Mixed Landscapes Benefit from Mulches





Before



After





Want to Learn More?

**Contact a University of California Cooperative
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Gardener:**

Phone: 909.387.2182

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