

Compost: Quality Considerations



Outline

- Parameters we can easily measure ourselves
 - During
 - “Done-ness”
 - After
- Where to send samples for nutrient analysis and/or pesticide testing



What is Composting?

- ... the controlled biological decomposition of organic materials.
- ... primarily by the action of microorganisms and, to a lesser extent, worms and insects.



Composting is usually done under aerobic conditions.

**Aerobic
(with oxygen)**

**Anaerobic
(without oxygen)**

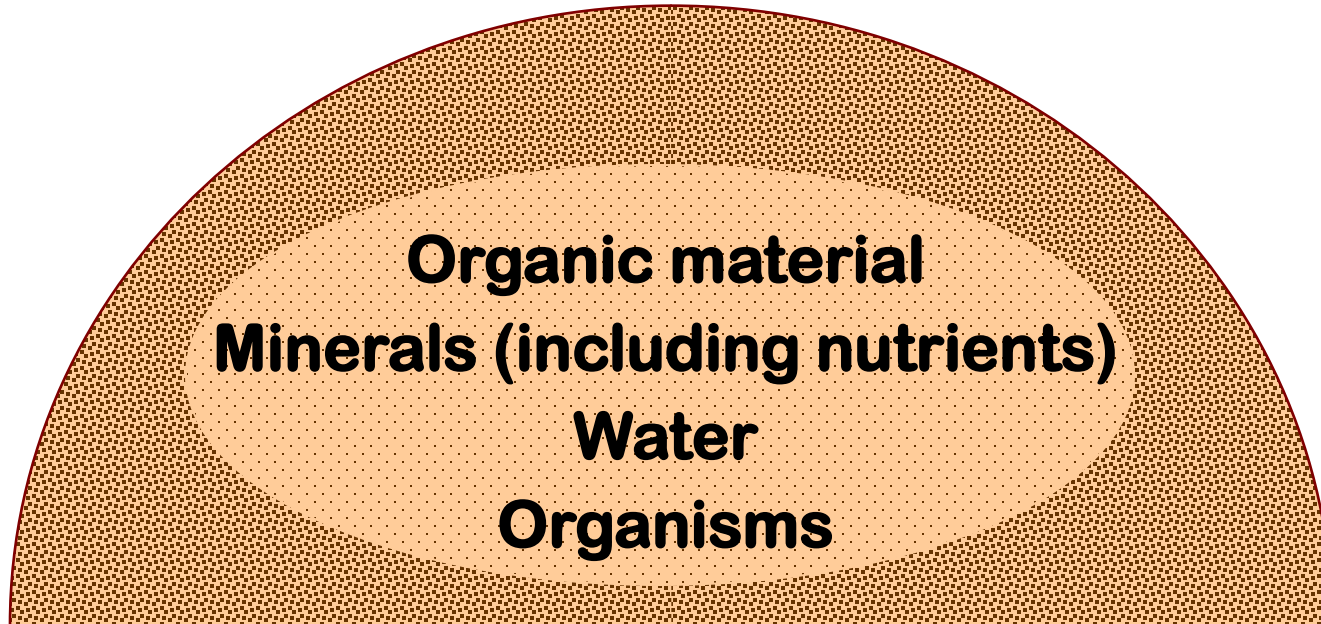
Most compost piles are at least part anaerobic
at least part of the time.



OXYGEN

HEAT WATER

CO₂



**Aerobic organisms require oxygen.
The primary byproducts of aerobic composting are
compost, heat, water, and carbon dioxide.**



Major Aerobic Composting Factors

- Oxygen
- Nutrients (C:N)
- Water
- Temperature
- Acidity (pH)
- Time



Oxygen

- **50% free air space**
- **Ideal range: 5% - 10%**
- **Need mix of particle sizes**
- **Prevent water saturation**

To deal with problems:

- **Turn/aerate frequently**
- **Mix coarser material**
 - **Anyone have woodchips?**



Nutrients

C:N = Carbon:Nitrogen Ratio

Ideal C:N = 30:1

(30 parts carbon to 1 part nitrogen)

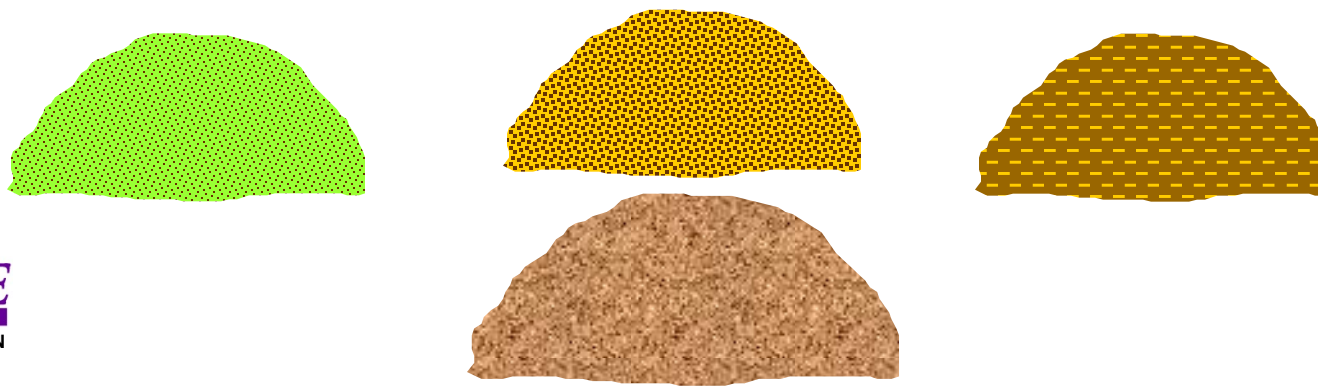
Range 20:1 - 40:1

Manure 15 - 20

Yard Waste 20 - 80

Wood Chips 400-700

***May need to mix several materials to achieve the right
C:N ratio***



Moisture

Ideal moisture about 50%

Range: 40 - 65%

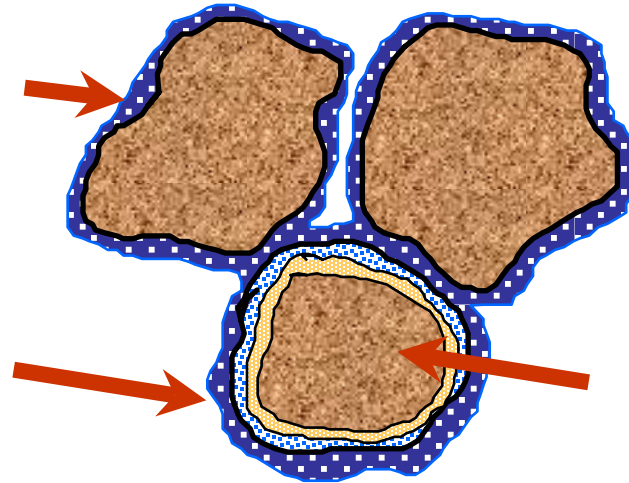
Above -- Saturation resulting in anaerobic conditions

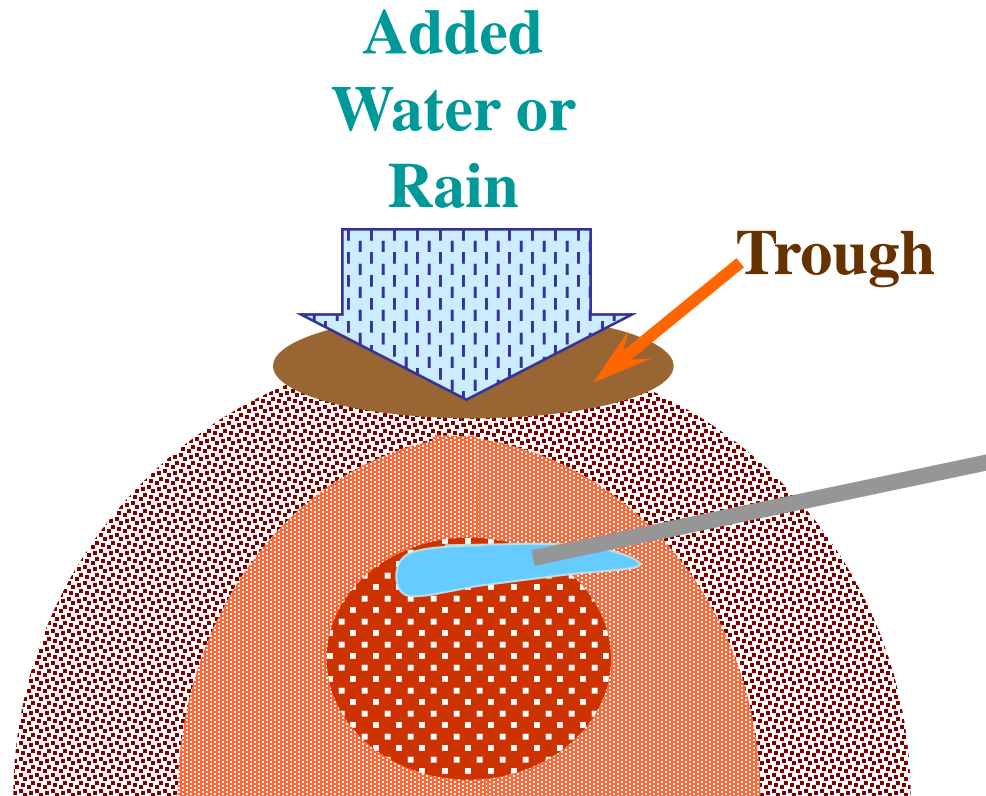
Below -- Microorganism activity slows

Add water to dry materials.

Add dry material or aerate wet material

Complete mixing is critical.





A trough in the top of pile will allow rain or added water to soak in rather than running off. Or choose to inject water into pile and then mix thoroughly.



Estimating Moisture

Squeeze test:

50% moisture is just moist enough that tightly squeezing a handful of it barely produces a droplet of moisture.

Drying methods:

Air drying - (4 oz sample dried 24-72 hrs).

Not precise but ok for most situations.

Conventional oven - (4 oz sample dried at 212°F for 24 - 72 hours). Test your oven for actual drying times.

Microwave - (4oz sample at high power for 8 minutes).

Will vary by oven. Calibrate time for your own oven.

$$\% \text{Moisture} = \frac{\text{Wet wt.} - \text{Dry wt.}}{\text{Wet wt.} - \text{Container wt.}} \times 100$$



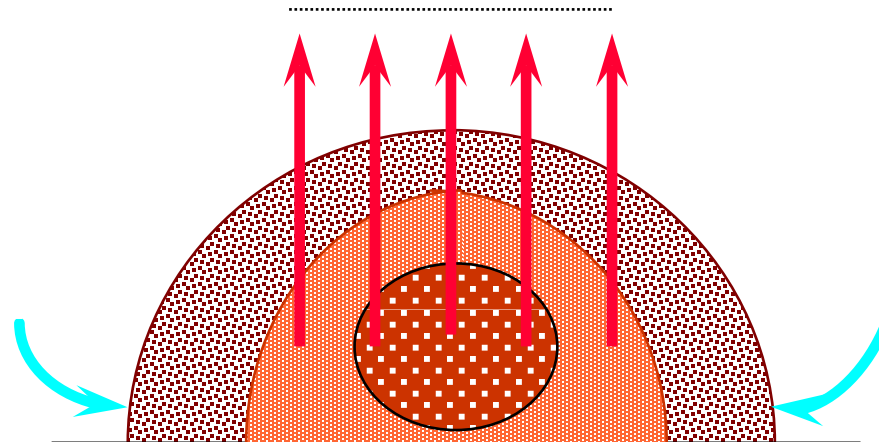
Temperature

Optimum range: 120 - 140 °F

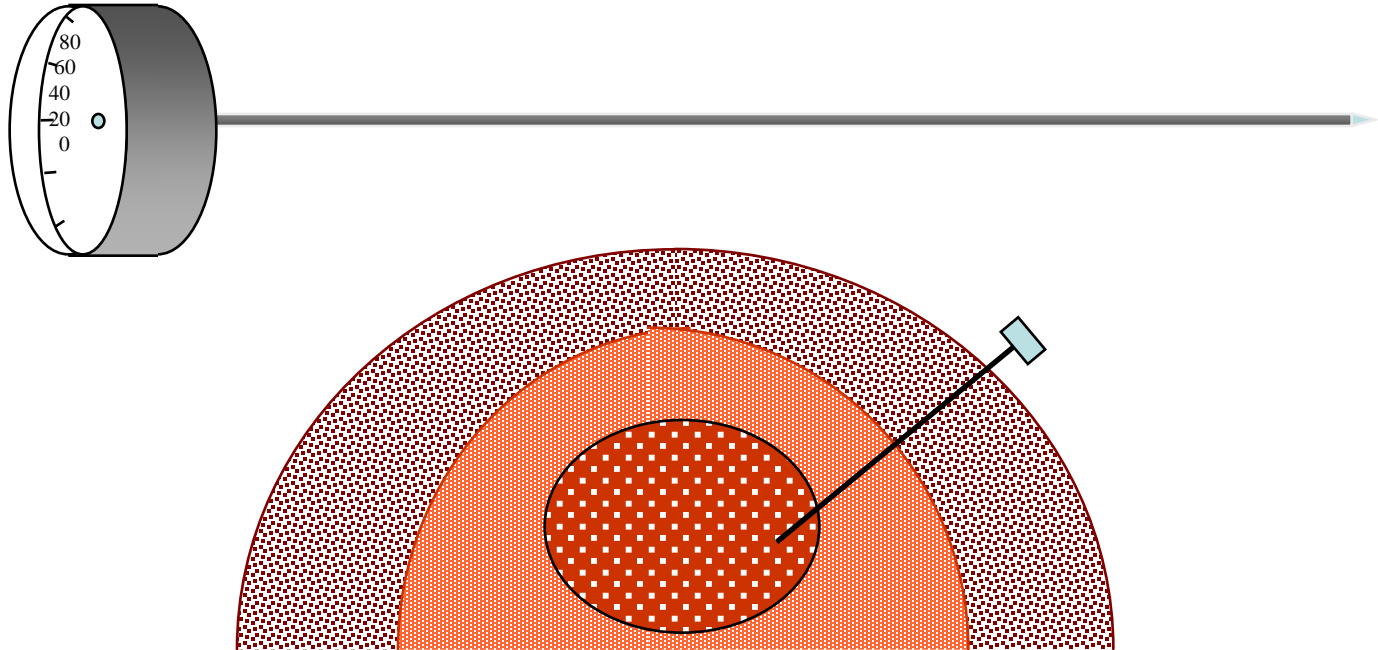
To kill weed seeds 145°F - 1 day five turns

To kill pathogens 131°F - 3 days five turns

Above 150°F for any length of time is likely to destroy microorganisms necessary for composting.



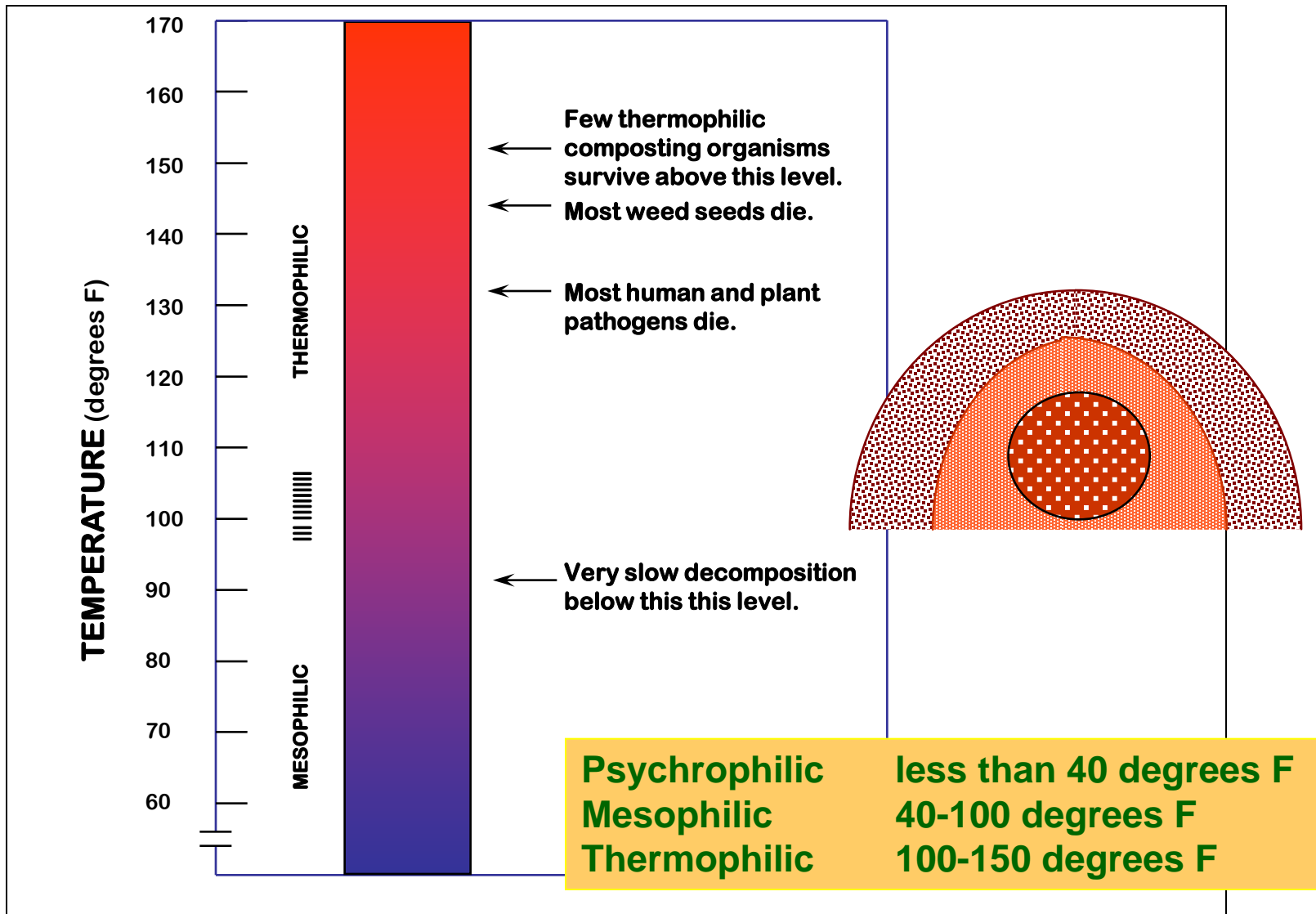
A thermometer is the most basic necessary tool in composting.



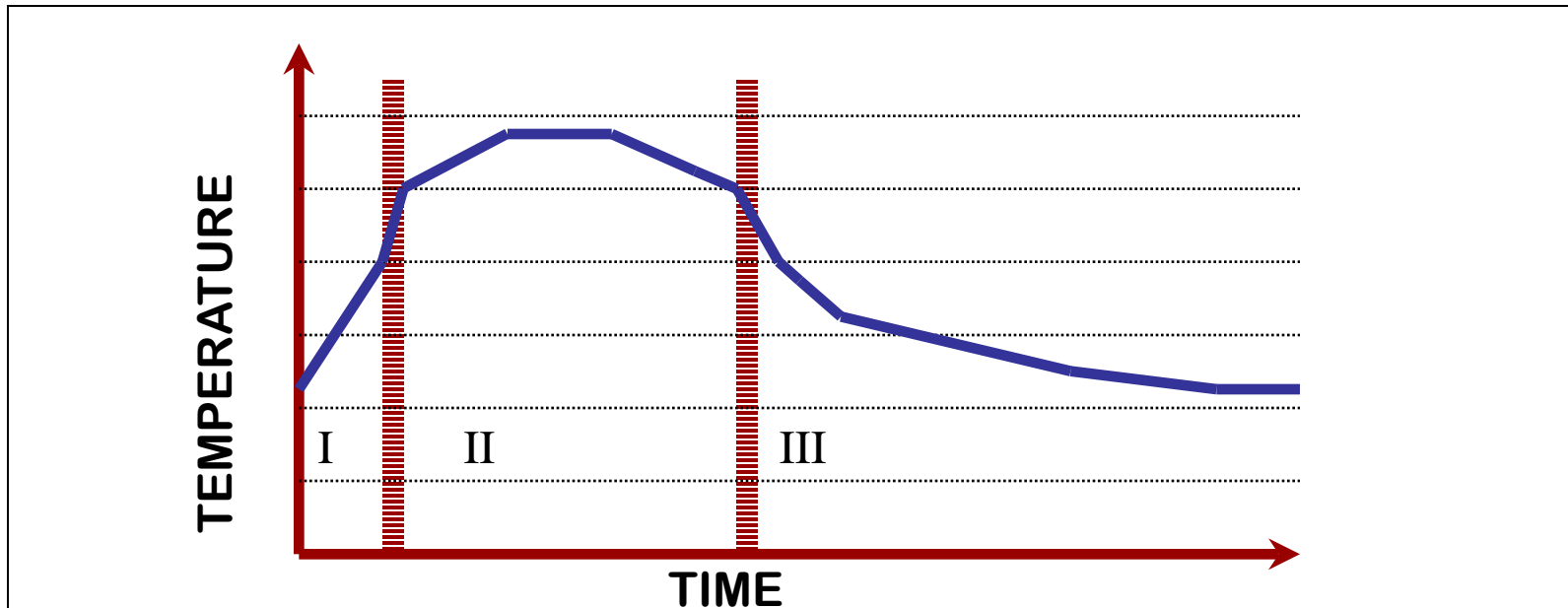
A stainless steel, long-stemmed dial thermometer is inserted into the center of the pile at several locations to measure temperature.

There are several more sophisticated types.





Temperature Phases



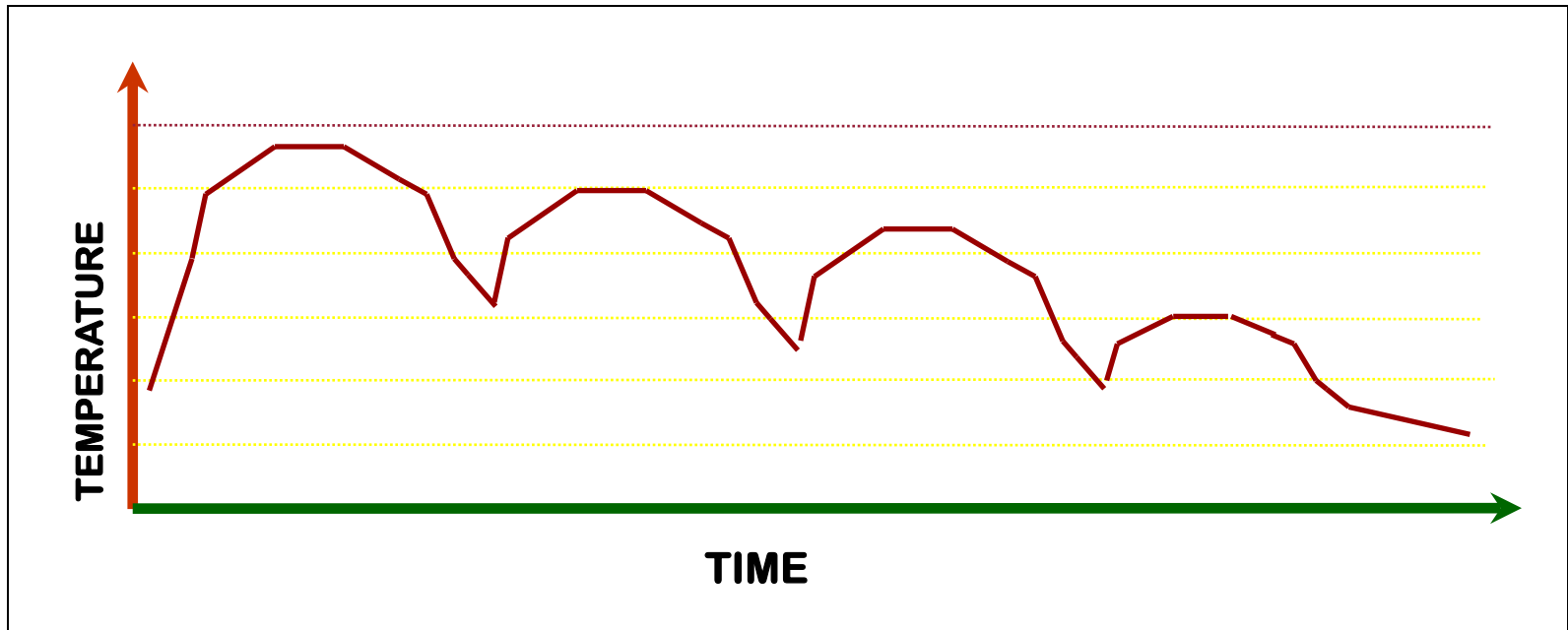
The first phase (**mesophilic**) may last only a few days as the compost heats rapidly.

The second phase (**thermophilic**) is where rapid decomposition occurs over a few weeks to a few months.

Mesophilic conditions return during the third cooling and curing phase that may take several months.



Effect of turning on temperature



“Done” Compost Quality

- Odor
- Color
- pH
- Pathogens
- Heavy metals and chemical contaminants
- Organic matter content
- Inert contaminants
- Maturity/stability
- Soluble salts.
- Also – C:N, particle size, moisture, bulk density and nutrients.



Compost Quality

Odors

- **Compost should have little odor --sweet, earthy.**
- **No smell of original input materials.**



Compost Quality

Color

- **Uniform medium brown to dark brown color.**



Compost Quality

pH

- Compost will usually have a pH between 6.0 and 8.0.
- Material outside this range may cause problems for some plants depending on how compost is used.

If outside range, use smaller proportion of compost in blend, depending on soil pH and plant needs.



Compost Quality

Heavy metals and chemical contaminants

- Metals usually only a concern in biosolids –testing is required for biosolids
- Know the source of the inputs and quality of the process– nearly impossible to test for everything.

If it is a concern, limit compost proportions.



Compost Quality

Pesticide contaminants

- Pesticides are rarely a problem in composts. Most break down before they reach the compost pile or during composting. At the very least, they are greatly diluted.
- However, clopyralid and picloram herbicides have been a problem in a few places in the country. They are very persistent in the environment. They do not readily break down in composting. Small (ppb) amounts can affect plant growth.
- Testing is costly. Primary solution is quality feedstocks.



Herbicides

Though rare, certain types of herbicides are appearing as compost contaminants in some areas.



... herbicides containing **picloram** or **clopyralid** can damage some plants in very small concentrations in **composts & mulches.**



Compost Quality

Organic Matter

- Usually 25% - 70%
- Prefer > 50%.
- Low (<25%) indicates:
 - High soil or mineral content
 - Over composted (very mature)
- *May need to use larger amount of compost if raising soil O.M. is your goal. You should pay less for low O.M.*



Compost Quality

Inert contaminants

- **Trash – non-organic – plastic, metal, glass, rocks, etc.**
- **Often just an aesthetic concern. May not hurt anything in most uses.**
- **Quality compost should have less than 1%.**



Compost Quality

Maturity/Stability

- May have high C:N ratio. Nitrogen can be tied up due to excess available carbon.
- May have low C:N ratio. N may not be in organic form. (*leachable nitrates or high ammonia*)
- Organic acids or contaminants may not have broken down.
 - Read Solvita test

May need to limit compost concentration in soil blend.



Compost Quality

Soluble Salts

- Usually want range of 0 – 5 mmohs/cm (dS/m).
- *(based on saturated paste/media extract method)*
- The lower, the better.
- If have high levels:
 - Limit use on sensitive plants.
 - Water heavily to leach out salts.
 - Dilute compost greatly with soil or other material with low salts.
- *High nutrient content can contribute to high salts.
High sodium is the greatest concern*



Compost Quality

Other Concerns

- C:N

Usually about 15:1 – 25:1

- Particle size

Depends on use. Most uses demand less than 1". High quality uses may demand $\frac{3}{8}$ " to $\frac{1}{2}$ "

- Moisture

Usually marketed at 30% - 40%

- Bulk density

800 – 1000 lb/cy or 30 – 37 lb/cf. In reality, most is heavier on a wet basis.

- Major plant nutrients. $N - P_2O_5 - K_2O$



Good and Bad Compost?

- Compost is usually not either good nor bad – just different.
- Most compost has beneficial uses.
- Compost quality is related to the intended use.
- Compost used without consideration of its specific properties can cause problems.
- Compost use should be adjusted in relation to its specific properties.



Testing Labs

- Testing labs
 - KSU Soil Testing does NOT test compost
 - But they can provide contact information for other labs that do
 - Woods End Research Laboratory
 - <http://www.woodsend.org/>
 - Sell Solvita kits

