Composting Principals

Southern New England Chapter of the Soil & Water Conservation Society

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Bear Path Farm (Whately, MA)
and UMass Amherst

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Agresource Inc.
www.Agresourceinc.com
Since 1984, providing organic waste management services to municipal and corporate clients

- Land application of biosolids, wastewater and water treatment residuals from municipal and industrial sources.

- Operation of regional composting facility in Ipswich MA

- Compost marketing services for municipal and private facilities
Compost as the Product

Compost vs. the Process: Composting

- Composting is the process of recycling organic residues (wastes) into a product: Compost

- Compost is more readily usable and has a higher value.

- Convert raw organic matter to a more stable form, reduce pathogens and weed seeds.
What is Compost?

Compost is a soil amendment that:
• Provides organic matter
• Supplies nutrients
• Stimulates microbial activity

Compost added to soil changes:
• Soil physical properties
• Soil chemistry
• Microbial activity
Composting

A process for converting and recycling “wastes” that includes:

- Temperatures favoring the growth of thermophilic microbes (35 to 60 C or 105 to 160 F).
- Under aerobic (the presence of oxygen) conditions.
- Controlled process.
Putting organic matter in a pile and letting it decay is **not** composting.
Composting Temperatures

• Temperatures are high enough and for long enough time to kill pathogens and destroy weed seeds (55 C for 3 days).

• Not too high as to slow microbial growth or generate fires.
Aerobic Conditions

• Adequate oxygen to favor aerobic over anaerobic metabolism.

• Carbon oxidized to carbon dioxide not organic acids or methane.
Aerobic Respiration

\[
C_6H_{12}O_6 + 6O_2 \rightarrow 6H_2O + 6CO_2 + \text{energy}
\]

(glucose + oxygen → water + carbon dioxide + energy)
Composting Process Control

Control temperatures (cool down piles) and provide oxygen by introducing air.

• Turning piles.

• Aerating piles (forced aeration) with blowers.
Different Ways to Make Compost
Composting Methods

• **Windrow**
  Simplest approach with least process control and largest land requirement

• **Aerated Static Pile**
  Moderately simple requirements for equipment and space with moderate level of process control

• **In-Vessel**
  Typically mechanized with process control and containment and treatment of odors
Composting Steps

• Preparation of the input mix
• Active composting phase
• Curing phase
• Screening and product preparation
• Compost storage
Composting

• Adequate bulking agent to absorb moisture and insure pile has adequate porosity
• Piles turned and mixed to insure exposure to microbial activity and break open particles and expose all portions to high temperatures.
Bulking Agent

• Provides “structure” and porosity
• Allows air movement
• Source of carbon
• Absorbs excess moisture
Air Filled Pore Space

Good Air-Filled Pore Space

Poor Air-Filled Pore Space
Active Composting

• High rate of microbial activity requiring oxygen to maintain aerobic conditions and aeration to cool piles

• Aeration requirements dependent on rate of biodegradation and microbial activity

• The amount of air needed to supply oxygen is less than that needed to remove heat and maintain temperatures

• Active piles will have temperature gradients
Curing

• Curing follows the active composting stage and allows time for further degradation of materials
• Curing may not require forced aeration as degradation rates are lower
• During curing temperatures may remain at thermophilic conditions
• Curing may be associated with further drying
Screening

• Large pieces of bulking agent may remain largely intact even after curing
• Removal of both un-compostable debris and bulking agent using with ½ or ¾ inch screen improves acceptance of the product
• Oversized pieces (screenings) can be recycled to supplement supplies of bulking agent
• Screening can be performed prior to curing
Storage

• Storage is required to account for the variability in demand for product
• Compost in storage should be protected from run-off and run-on
• Area should allow oldest material to be removed first
• Prior to distribution from storage areas compost should be tested
Source Separated Food Wastes

Food wastes received and mixed using front end loader with leaves.
Food Wastes Characteristics

- High Moisture Content
- Contaminated (Comingled) with Plastics
- Highly Putrescible and Potentially Odorous
Contamination
Source Separated Food Wastes
Source Separated Food Wastes
Conclusions

Multiple approaches to making compost

Successful operations require:

• Understanding and selecting appropriate feedstocks

• Making the compost mixture

• Managing the process to produce a consistent product