Composting Principals

Southern New England Chapter of the Soil & Water Conservation Society
Friday August 5th, 2016
Bear Path Farm (Whately, MA)
and UMass Amherst

Geoff Kuter, Ph.D.
Agresource Inc.
www.Agresourceinc.com

Agresource Inc.
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
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