

Science-Based Composting Practices

BSAAO Supplemental
Resources: Module 2





Objectives

- Identify the difference between untreated and treated Biological Soil Amendments of Animal Origin (BSAAO)
- Describe the value of compost, including how it reduces BSAAO risks and improve soil health
- Describe the science behind key treatment strategies and how they reduce risks from soil amendments
- Discuss considerations for successful treatment

OREI: Balancing Soil Amendments, Soil Health, and Food Safety



Soil Amendments



Biological Soil Amendments of
Animal Origin: Manure, post-consumer
vegetative waste

Other Soil Amendments:
Chemical, mineral, pre-consumer
vegetative waste



Treated:
(Validated) Compost,
heat treatment

Untreated:
Raw manure, compost
tea with additives
(Last week's webinar)



Importance of Treated BSAAOs

- Treated BSAAO can reduce microbial risks
- FSMA PSR has different requirements depending on if a BSAAO is treated or not treated. These impact:
 - Handling practices
 - Contact with harvestable portion of crop
 - Application timing and harvest intervals
 - Recordkeeping





Current BSAAO practices by organic growers

- 48% of organic growers surveyed used compost
 - Major soil amendment used in growing fresh produce (57%)
- The majority of compost was purchased commercially (75%), followed by on-site production (50%) and local non-commercial (24%)
- What main treatments are growers using to make compost?
 - Windrow (65%)
 - Aerated static pile (22%)
 - Other or not composted on site (8%)
 - Static enclosed composting (6%)



Reasons To Compost BSAAO

- Destruction of human pathogens, plant pathogens, insect larvae, and weed seeds
 - Thermophilic temperatures (131°F+) kill pathogens
 - Environmental organisms may outcompete pathogens
- Improved handling and storage
 - Reduced volume and weight
 - Reduced odors and microbial activity
 - Uniform, fine-textured soil amendment
- Nutrient stabilization
 - Less susceptible to leaching and N loss



What Happens During the Composting Process?

- Aerobic microorganisms break down compost feedstock
 - Bacteria thrive in early stages of composting
 - Fungi and actinomycetes move in toward end of process, break down resistant materials
- Thermophilic temperatures are a sign of healthy composting
 - “Managing beneficial microorganisms”

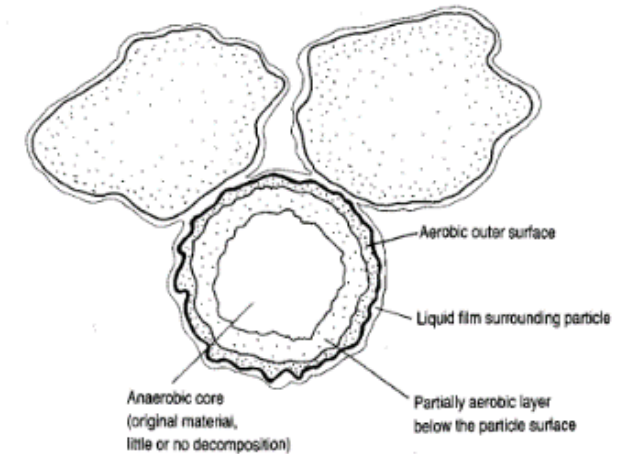


Figure 2.4
Decomposition of solid particles.



Treating BSAAO to Reduce Risk

- Growers may use a BSAAO that has undergone a scientifically validated treatment to reduce risks
- FSMA PSR outlines two composting methods, but allows for other validated, risk-reducing processes to be used
 - High temperatures (131°F+) help kill human pathogens
 - Oxygen-loving microorganisms efficiently process feedstock
- Align with acceptable methods in USDA National Organic Program

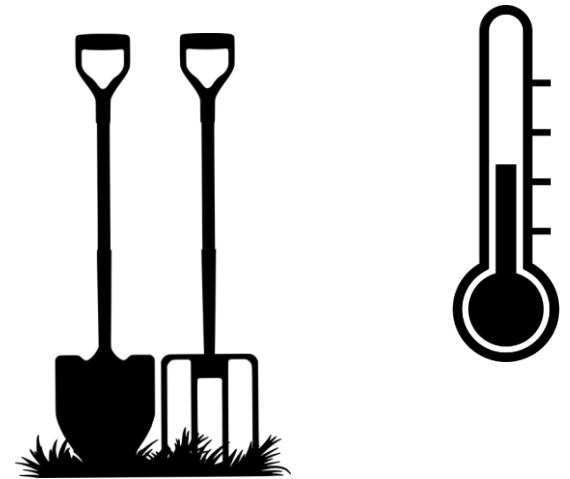
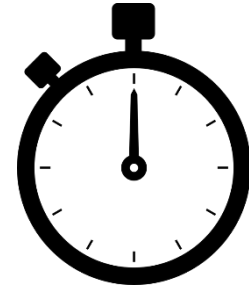


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Composting Options: Time, Temperature, and Turning

- Scientifically valid composting methods in the FSMA PSR:
 - Turned (Windrow) Composting:
 - **Time:** 15 days (can be non-consecutive)
 - **Temperature:** Minimum of 131°F (55°C)
 - Minimum of 5 **turnings**, followed by adequate curing
 - Aerated Static composting:
 - **Time:** 3 consecutive days, followed by adequate curing
 - **Temperature:** Minimum of 131°F (55°C)
 - No necessary **turns** to maintain aerobic conditions





Key Composting Treatment Variables

- Temperature
 - Maintain thermophilic temperatures
 - Turning
 - Facilitates aeration
 - Aids in temperature distribution
 - Time
 - Depends on the health of the composting process
 - Compost feedstock (C:N ratio)
 - Oxygen availability
 - Moisture
- These additional variables should be managed to ensure a healthy composting treatment!**



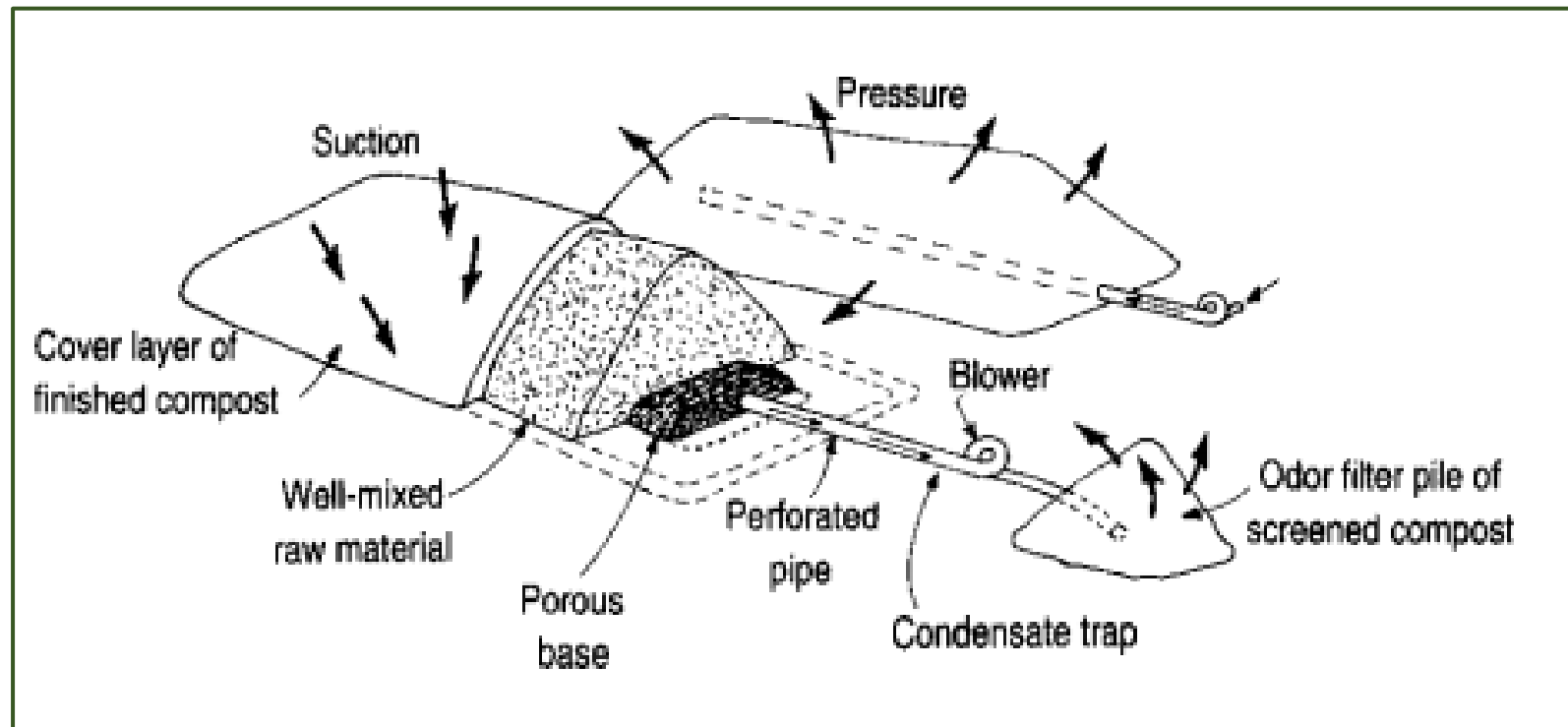
Planning for Success

- Source of Compost
 - Deciding on on-farm compost treatment system and curing
 - Sourcing BSAAO from third party
- BSAAO Application
- Handling and Storage
- Tools
- Recordkeeping



Composting System Example: Aerated Static Pile

- Compost pile built on a forced air system



Aerated Static Pile

- Ensure that the pile is homogenous with good structure and porosity
 - Allows even airflow through the pile
 - If amendment is too wet or dense, air channels may develop
- Cover the pile with a layer of finished compost for sawdust (odor control)
- Need monitoring and routine maintenance by trained personnel



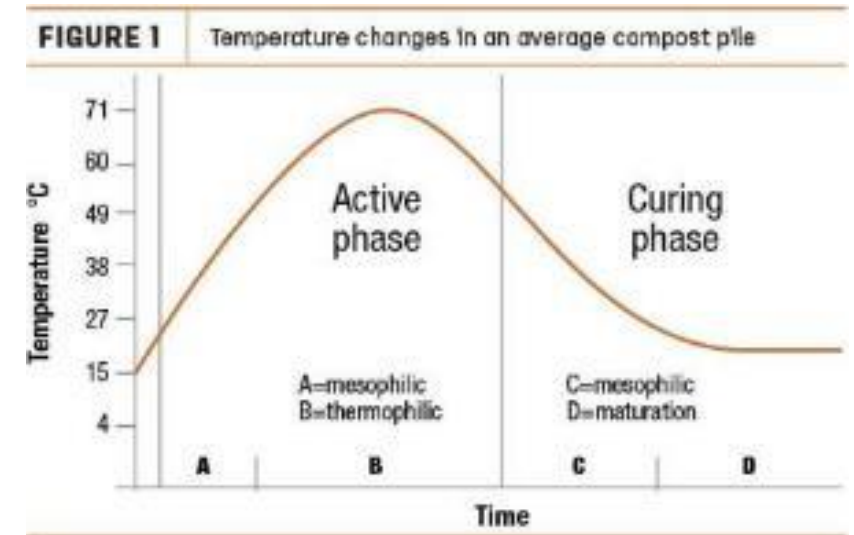
Composting System Example: Windrow/Turned Composting

- Place compost feedstock into piles or windrows
- Turn at regular intervals to regulate temperature and ensure efficient composting
- Turning improves aeration, rebuilds porosity, mixes pile, and distributes temperature
- Plan ahead to ensure necessary labor and equipment are available



Importance of Curing

- Allows compost to continue maturing after active treatment
 - Smaller piles facilitate air exchange
 - Breakdown of resistant materials, large particles, and clumps
- Critical to ensuring that compost is stable
 - Nutrients stabilize, preventing off-gassing and runoff
- Provides buffer for incomplete composting
 - Immature compost can damage plant roots when applied
- FSMA PSR requires curing to follow treatment





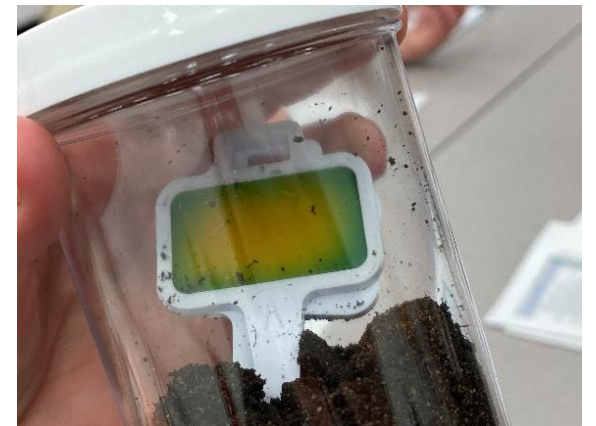
Keys to Effective Curing

- Transition from active composting to curing when:
 - Windrow: temperatures no longer reheat after turning
 - Forced aeration: temperatures show a steady decrease and approach mesophilic levels
- Piles should be smaller to allow for natural air exchange (maximum height of 6-8 feet)
- Store piles in a well-drained area to prevent moisture accumulation
- Curing may be complete when the temperature of the pile falls to near ambient temperatures
 - Cure for at least one to four months



Compost Maturity Tests

- Tests exist to test maturity of compost
 - Can help determine when curing is finished
- Traditional germination test measures compost phytotoxicity
 - Germinate sensitive seeds in compost mixture to determine quality
 - High levels of ammonia can be toxic and burn plant roots ...an indication compost is not mature
- Solvita Compost maturity index
 - Measures CO₂ and ammonia off-gassing in compost sample
 - Composting process is aerobic so an increase of CO₂ indicates that respiration is still actively occurring and the compost is not mature



Treated Soil Amendments: PSR Microbial Standards

- BSAAO treatment must conform to one of the two microbial standards
- **Standard 1:** No detectable *Listeria monocytogenes*, *Salmonella spp.*, and *E. coli* 0157:H7 (§112.55(a))
 - Can be applied in any manner, with no restrictions
- **Standard 2:** No detectable *Salmonella spp.*, and fecal coliforms <1,000 CFU in 1 g or 1 mL (§112.55(b))
 - Minimize potential contact during and after application
 - Compost treated via windrow or aerated static system is expected to meet this standard according to the PSR, **so batch testing is not required**





More than just FSMA PSR

- Product testing is not a requirement in FSMA PSR
 - Records need to be kept that demonstrate a validated treatment method was performed, handled properly
- FSMA PSR is often considered to be “baseline requirements”
- Reminder that industry standards may be more stringent, however existing records can support compliance
- National Organic Program may have additional requirements
- May be other buyer requirements too!



Other Common Practices: Vermicompost

- Earthworms and microorganisms used to break down feedstock into vermicompost (worm castings)
 - Nutrient-rich, microbially active soil amendment
- Improves soil aeration and drainage, increases water retention
- Science demonstrates the process does kill pathogens
 - However, not a thermophilic process
 - Pathogen reduction is due to mechanical grinding, enzymatic digestion, microbial competition



Vermicompost and Produce Safety

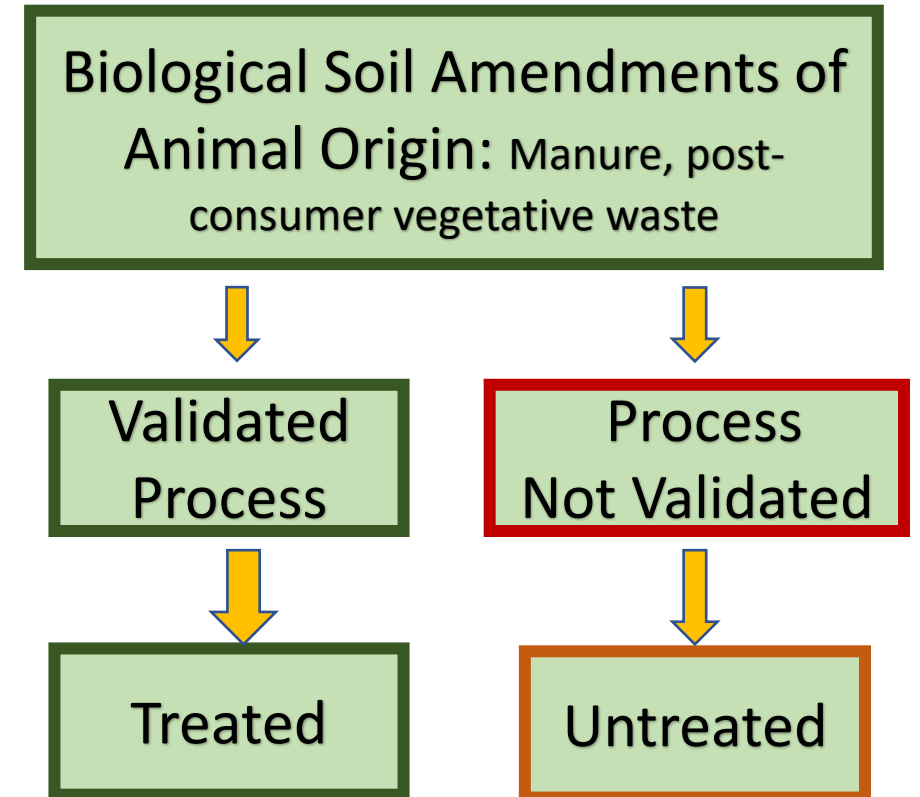
- Research is being pursued to standardize the vermicompost process (e.g., duration of treatment)
- Under FSMA PSR, currently considered an untreated soil amendment
 - Growers could follow-up with a valid thermophilic treatment





What if your treatment is not validated?

- If using a treatment process that is **not validated** to reduce microbial risks to achieve outlined microbial standards the soil amendment **must be considered untreated**
 - We talked about untreated BSAAO last week!





Applying Treated BSAAO to Produce Fields

- Survey shows organic growers are applying compost by:
 - Incorporated into the soil (53%)
 - Surface application (50%)
 - Sidedressing (28%)
- Under the FSMA PSR, compost treated with a validated process allows a zero day application interval
 - Depending on the treatment, it must be applied in a manner that minimizes the potential for contact with covered produce
 - Sidedressing runs the risk of directly contacting produce
- Remember, extending time between application and harvest reduces risks: focus on risk reduction

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Storing and Handling of BSAAO

- Minimize contamination between untreated and treated BSAAOs
 - Ensure treated BSAAO are handled before untreated BSAAO
- Prevent compost from getting too moist (turning anaerobic)
 - Shape pile to minimize water absorption
 - Turn pile more frequently to dry
 - May involve covering piles
- Designate specific equipment and tools for handling soil amendments
- Prioritize using tools on treated compost first, followed by incomplete compost and untreated manure



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Documentation Requirements for Treated BSAAO: FSMA PSR

- If composting on the farm, keep records of the composting treatment process
 - Time, temperature, turning
- Purchased compost must have a Certificate of Conformance provided by the seller at least annually. Provides assurance that:
 - Treatment is validated
 - Compost is handled in a way to reduce risk of contamination
- PSA has a factsheet on requirements with a template CoC



Documentation Requirements for Treated BSAAO: NOP



- NOP requires records of soil amendment use
 - Type and source
 - Documentation of treatment
 - Rates and dates of application
 - Handling and sanitation practices
- Some recordkeeping requirements overlap with FSMA PSR
- For all growers, recordkeeping helps ensure compost process is working, reducing risks, and has best crop benefit

Compost Treatment Record Template

Name and address of farm: _____

Type of compost method: Windrow Date piled: 9-15-2016 Date finished: _____ Row number: 2

List all ingredients added to compost: Poultry litter, kitchen scraps, dried leaves, straw

Use this record for on farm composting. Record the date piled, turning dates, and the temperatures maintained. Use one sheet for each pile or row.

Date Turned	Temp/Time Test Area 1	Temp/Time Test Area 2	Temp/Time Test Area 3	Temp/Time Test Area 4	Initials
9-25-2016	135 F/ 2:00 PM	138 F/2:07 PM	140 F/ 2:00 PM	135 F/ 2:04 PM	EAB
9-26-2016	137 F/ 2:15 PM	137 F/2:18 PM	138 F/ 2:19 PM	137 F/ 2:25 PM	EAB

PSA Website & Communications

<http://producesafetyalliance.cornell.edu/>



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Elizabeth A. Bihn, eab38@cornell.edu, 315-787-2625

Donna P. Clements, dmp274@cornell.edu, 909-552-4355