UMass Extension

CHECKLIST
ORGANIC WASTE MANAGEMENT - COMPOSTING

- ✓ Follow all state and local regulations regarding composting. Contact Massachusetts Department of Agricultural Resources Composting Program for more information http://www.mass.gov/agr/programs/compost/index.htm.
- ✓ Most organic waste materials generated by a greenhouse can be composted.
- ✓ Avoid composting grass clippings that has been treated with herbicides.
- ✓ Compost piles should always be distant and downwind from sensitive neighbors and not sited close to residential property.
- ✓ Piles should be protected from surface water and storm water runoff.
- ✓ Proportions of carbon to nitrogen are critical to successful composting. The materials being composted will determine the exact recipe for any given operation. Materials with high carbon to nitrogen ratios, such as 100:1, should be balanced with materials having low carbon to nitrogen ratios, e.g. 15:1.
- ✓ Regular turning of the pile will mix the nutrients and re-establish pile structure.
- ✓ Moisture content can be adjusted during turning.
- ✓ After the compost has gone through several heating and cooling cycles and the original waste has decomposed, the compost process should slowly finish in a curing pile.
- ✓ Activities that tend to release odors should be scheduled to minimize negative impacts.
- ✓ Consider wind conditions before opening compost piles. Stronger winds can disperse odors but also create dust concerns. Care should be taken to control dust when grinding and turning piles.
- ✓ Most odor problems can be avoided, controlled, or minimized by keeping the compost pile aerobic, porous, well aerated, and well mixed. Odor problems are most likely when anaerobic decomposition is occurring.

ORGANIC WASTE MANAGEMENT

Composting is a managed process which utilizes microorganisms naturally present in organic matter and soil to decompose organic material. These microorganisms require basic nutrients, oxygen, and water in order for decomposition to occur at an accelerated pace. The end-product, compost, is a dark brown, humus-like material which can be easily and safely handled, stored, and used as a valuable soil conditioner. The composting process is dependent upon several factors, including: the population of microorganisms, carbon to nitrogen ratio, oxygen level, temperature, moisture, surface area, pH, and time.

Aerobic Composting

The composting process involves microorganisms feeding on organic material and consuming oxygen. The process generates heat, drives off moisture, and reduces bulky organic waste into a beneficial soil-like material containing nutrients, humus and microorganisms in just a few months. Material in an unmanaged pile of organic debris will eventually break down but the process will take a long time and may result in odor or other nuisance problems due to poor aeration.

Regulations

With a few, specific exceptions, solid waste facilities require a "site assignment" from the Massachusetts Department of Environmental Protection ("MassDEP"). At issue in past years has been whether farms, when undertaking the time-honored agricultural practice of composting "wastes" from their own operations and other sources, have been engaging in solid waste management activities and are, thus, subject to the regulatory control of MassDEP. In order to recognize the legitimate agricultural nature of such on-farm composting operations, and avoid unnecessary regulatory control, MassDEP and MDAR have undertaken the joint responsibility for agricultural composting registration oversight. Specifically, MassDEP has granted conditional exemptions under the Solid Waste regulations (310 CMR 16.00) for agricultural composting operations, and MDAR has established an Agricultural Composting Registration process.

Any agricultural operation which is only composting its own on-site generated waste materials does not need to register with MDAR. An agricultural operation only needs to register with MDAR if it is planning to bring waste materials on to its property from off-site to compost with waste materials which are generated on-site. Persons composting organic materials without a registration are subject to the Department of Environmental Protection's site assignment requirements. The registration application should be completed and mailed to The Department of Agricultural Resources. Yearly Annual Reports will be required in order for a composter to remain registered with the Department. For more information, contact the Massachusetts Department of Agricultural Resources at (617) 626-1700, Agricultural Composting Program at (617) 626-1709 http://www.mass.gov/agr/programs/compost/index.htm or the Massachusetts Department of Environmental Protection at (617) 292-5500.

The Massachusetts Department of Agriculture Resources may register agricultural composting operations if the Department determines that:
1) the compost operation is located on agricultural unit;
2) the applicant has submitted a completed application;
3) the applicant agrees to a site visit; and
4) the applicant demonstrates knowledge and capability to conduct the agricultural composting operation to produce a stabilized compost product.
Details on agricultural composting are available from "The Guide to Agricultural Composting" which was updated in 2010 and is available from:
http://www.mass.gov/agr/programs/compost/docs/Guide_to_Ag_Composting2010.pdf

What to Compost
Most organic waste materials generated by a greenhouse can be composted. Large material will need to be shredded before it is added to a carefully-constructed compost pile. Some material may begin to decompose in a storage pile but full composting will not occur until the material is mixed and managed in the correct proportions of carbon to nitrogen (C:N ratio), with adequate airflow and moisture.

Composting is an excellent method of recycling grass clippings. However, do not compost grass clippings or any other plant residues that have been treated with herbicides. If carried out properly, it can reduce the potential weed seeds and diseases from being reintroduced into the fields. The finished compost is a stable organic material which is a useful soil conditioner or nutrient source. Due to the characteristics of fresh grass clippings (high-moisture, high-nitrogen content and small particle size), co-composting with a high-carbon bulking agent is essential.

Unacceptable Materials for Composting
Chemically treated wood products
Plastic, e.g. pots, bags, and sheet film
Unprocessed sod and chunks of soil
Large and bulky items, (e.g. stumps, pallets, concrete, and asphalt)

Acceptable Materials for Composting
Green and woody plants
Clippings and trimmings
Soil and planting media
Untreated wood and uncoated paper scraps

Site Selection for Compost Piles

Proper site selection is a prerequisite to the establishment of safe and effective composting operations. The location of a composting operation directly impacts the amount of site preparation required and the measures needed to satisfy environmental and regulatory requirements.

Protection of Water Resources

Sites need to be evaluated for their potential impact on water resources. Of primary concern are proximity to public water supplies, wetlands, floodplains, surface waters, and depth to groundwater. Below are guidelines from the "Guide to Agricultural Composting"

1) Sites must not be located within 400 feet (Zone I) of a public drinking water supply well or within 250 feet of a private well. For sites located within a Zone II or interim wellhead protection area (½ mile radius), MassDEP may require that extra precautions be taken in the design or operations depending on the quantities and types of material to be composted. Sites within Zone II may not be allowed under certain circumstances.

2) Operations must be sited in accordance with the Massachusetts Wetlands Protection Act. Under the wetlands regulations, siting of composting and storage areas is considered to be "normal improvement of land in agricultural use" when it occurs on land in agricultural use when it is directly related to the production or raising of certain agricultural commodities, and when it is undertaken in such a manner as to prevent erosion and siltation of adjacent water bodies and wetlands.

3) Sites should be located at such a distance to ensure that there will not be any potential adverse impacts from compost site runoff into surface waters.

4) Soils should be permeable enough to minimize runoff, yet capable of filtering drainage water. Excessively drained soils (e.g., sand) should be avoided if possible, as they may lack the physical properties necessary for effective filtering of potential contaminants. Highly impermeable soils (e.g., clay) should also be avoided if possible, as this may lead to poor site drainage and excessive runoff or erosion.

5) Sites should be avoided where groundwater rises closer than 4 feet or where bedrock is closer than 5 feet from the surface. Such conditions may lead to an operating surface that is too wet, and it increases the potential for nutrients to leach into groundwater.

Buffer to Sensitive Land Uses

Buffers, in the way of distance and/or visual screens, can go a long way toward reducing the real or perceived aggravations of noise, odor, litter, and aesthetic objections often associated with composting operations. Compost piles should always be distant and downwind from sensitive neighbors and not sited close to residential property. A distance of at least 250 feet from the nearest residence to the composting area is recommended, and the composting site should be at least 50 feet from the property line. More importantly, the buffer must be adequate to satisfy reasonable neighbor concerns. Keep the activities as far away from the property line as possible.

Available sites should be analyzed for conditions potentially detrimental to production and access. There needs to be enough space to store and process waste, operate and turn active windrows or piles, and store and cure finished compost. A facility that is short on space will eventually experience problems. Composting can have off-site impacts.

Composting can also create water quality problems. Piles should be protected from surface water and storm water runoff. Piles may need to be protected from rain. This is because a compost pile can get saturated, stop working and, become anaerobic. This will create odor problems. Saturated piles will need to be remixed and rebuilt. Runoff from an active compost pile or stored compost can also create water pollution problems. Standing water can cause odor problems. Compost piles should always be sited so that runoff is minimized. Any runoff should be collected and used rather than allowed to leave the property.

State and Local regulations regarding composting facilities should be thoroughly investigated. Contact Massachusetts Department of Agricultural Resources Composting Program for more information http://www.mass.gov/agr/programs/compost/index.htm.

The Basic Composting Process

The general steps in the biological process which creates compost are the same regardless of the raw materials being composted or the size and complexity of the production facility. A compost must pass through all of the steps outlined here in order for it to be considered of high enough quality for use in organic potting mixes.

The progress of organic matter decomposition during composting can be followed by monitoring the temperature of the compost pile. During the initial phase of composting the temperature of the pile increases rapidly as the population and activity of decay microorganisms increases in response to the readily decomposable carbon in the raw materials. The goals are to reach a temperature between 131°F or more and to maintain this temperature range until the microorganisms begin to exhaust the readily available carbon. During composting the pile is turned and remixed several times to ensure complete heating and decomposition.

To comply with the National Organic Program standards compost piles must maintain 131-170ºF for at least 3 days (static pile) or at least 15 days (windrow, turned at least 5 times). High temperatures are necessary to kill any human pathogens especially if farm manure is a component. Also, weed seeds and plant diseases are most successfully killed at high temperatures. Most weed seeds are destroyed at 145°F.

Following the high temperature phase there is an extended period of gradual temperature decline until the pile reaches ambient air temperature. Now, if the pile is turned, reheating will not occur. At this point the compost is said to be "near maturity", but to ensure that the compost is stable and ready to use, most producers allow some extra time for the compost to "cure". How long composting lasts varies with the method. It could take about 1-2 years in a static unturned pile, 6-9 months if the pile is turned occasionally, or only 1-4 months the pile is turned frequently.

Many types of raw materials can be used for making compost; some common materials are listed in the following table. Pay close attention to the comments in the table.

It is important that the raw materials be properly prepared prior to mixing and the start of composting. Most organic materials must be shredded or ground to reduce particle size and help make them less resistant to decay.

Compost Material	Comments
Farm animal manure	Must be composted
Straw and bedding	
Crop residues	Must be pesticide free
Fruit & vegetable wastes	Must be pesticide free
Food processing wastes	
Seafood processing waste	
Grass clippings	Must be pesticide free
Sawdust & other wood wastes	Use in moderation, low nutrient value.
Newspaper	Black ink only, shredded, <25%
Leaves	Shredded

During composting, oxygen and moisture levels are critical factors in determining the degree of decomposition which takes place and the length of time it takes to reach a stable product. Oxygen levels below 5% and moisture levels above or below the range of 40-65% inhibit the composting process. Most composting operations aerate the piles (turn) and irrigate them if conditions favor excessive drying. Too little moisture will inhibit microbial activity and slow down the composting process, while too much moisture will restrict the flow of oxygen because all pore space is taken up by water instead of air, and anaerobic conditions will begin to develop. The volume of the finished compost is smaller than the volume of raw materials because of the breakdown of organic matter and the evaporation of water.

When is the compost ready for use? Currently there is no single widely accepted criterion to determine when compost is "done". Measurements of temperature, respiration, ammonia production, pH, and carbon to nitrogen ratio (C:N) are among the potential indicators of compost maturity, but no one factor is completely reliable. Generally, at the end of active composting (heating period) producers allow a “curing” period of about 1-2 months to make sure the compost is stable before it’s used.

Frequenty Asked Questions About Composts

What are the indicators of a good compost?
Much research and some controversy surrounds this question. Here are the major quality indicators that help answer this question:

- Producer can give details of the composting process.
- Raw materials should not be recognizable.
- No unpleasant odor.
- Compost temperature should not be more than 20ºF above air temperature after delivery.
- C:N ratio should be 15-20:1.
- pH should be no more than 8.0 (ideal 6.5) before mixing.
- EC (soluble salts) <6.0 mmho/cm before mixing with other components. The EC of the final potting mix should be <1.0.
- Ammonium level should be low.

The UMass Soil Testing Lab has a specific test for composts.

Can I use my cull pile as compost?
The answer is "yes" if you have treated your cull pile like a compost pile - turning it frequently to encourage heating and thus complete decomposition and killing of weed seeds and plant pathogens. Compost made from a cull pile should meet the standards of a good compost in Question 1.

Most of the time the answer to this question is "no" because the cull piles at most greenhouses have not been turned and allowed to heated and therefore the plant material is probably not completely decomposed and weed seeds and disease organisms are probably still alive. A static cull pile is not a compost pile, it's just a trash pile!

Can a compost medium supply all the nutrients for bedding plants and potted plants?
Often composts are described as being "nutrient rich". For the purpose of increasing the long term fertility of soil for outdoor field crops regular application of compost is effective. When used as a component in a potting mix, most of the time, the compost cannot supply enough nutrients and additional fertilizer must be applied.

Calibrachoa growing in Fafard 3B and 100% of two types of composted cranberry pomace. In some cases it may be possible to grow in 100% compost.

Photos: Douglas Cox, UMass

Marigolds (left) and tomatoes (right) were grown in Metro Mix (top) and wood products compost (bottom). No fertilizer has been applied to either flat since the seeds were sown about 4 weeks earlier. Low fertility accounts for the small plants growing in the compost.

Can I use 100% compost to grow bedding and potted plants?
It's possible, as the previous picture shows, but the commonly accepted guidelines suggest using compost at about 30-40% by volume. Most composts are too heavy, hold too much water or drain too much, or have too high a starting EC to be used 100%.

Other Components for Organic Media

Many materials used to make growing media in "traditional" greenhouses can be used for organic production. However, to be certain, check with your organic certifier. Consider the comments in the table when you choose a component.

Material	Comments
Field soil	No chemicals. Obtain from a certified organic source.
Sand	Clean coarse or "sharp" sand.
Sphagnum peat moss	No fertilizer or wetting agent.
Shredded newspaper	No color ink. No more than 25% by volume.
Alfalfa	Dried and screened, moistened, composted 20 days, and dried again.
Perlite or vermiculite	Use perlite for drainage and aeration. Use vermiculite for increasing water-holding capacity. Asbestos in vermiculite?
Coir dust or fiber	Salt content?

References

The Guide to Agricultural Composting
http://www.mass.gov/agr/programs/compost/docs/Guide_to_Ag_Composting2010.pdf

Cox, D.A. 2008. *Organic Growing Media and Fertilizers for Greenhouses.*
http://www.umass.edu/umext/floriculture/fact_sheets/greenhouse_management/dc_organic_fert.html