UMassAmherst Outreach UMass Extension

Waste Management and Composting

Introduction:

Waste management is all about how to dispose of all the things you don't want on the farm. Composting is a sustainable waste management practice that converts any volume of accumulated organic waste into a usable product. When organic wastes are broken down by microorganisms in a heat-generating environment, waste volume is reduced, many harmful organisms are destroyed, and a useful, potentially marketable, product is produced. Organic wastes may include manure from livestock operations, animal bedding, yard wastes, such as leaves and grass clippings, and even kitchen scraps. In the state of Massachusetts it is required by the Department of Agricultural Resources (MDAR) for all agricultural facilities that compost or compost materials other than their own, to register with MDAR's Farm Composting Program. The program is comprised of guidelines to ensure environmentally sound management practices. Facilities that do not register are otherwise subject to the Department of Environmental Protection Site Assessment as a solid waste facility.

A Carbon:Nitrogen (C:N) ratio of 30:1 is considered ideal.

What is Composting? Composting is a process by which organic wastes are broken down by microorganisms, generally bacteria and fungi, into simpler forms. The microorganisms use the carbon in the waste as an energy source. The degradation of the nitrogen-containing materials results in the breakdown of the original materials into a much more uniform product which can be used as a soil amendment. Heat generated during the process kills many unwanted organisms such as weed seeds and pathogens. Advantages of composting include reduction of waste volume, elimination of heat-killed pests, and the generation of a beneficial and marketable material. Adding compost to soil increases organic matter content. This, in turn, improves many soil characteristics and allows for the slow release of nutrients for crop use in subsequent years.

How to Compost:

Compost materials must be turned frequently to provide optimum temperatures and air for microbial activity.

Materials for successful composting are many. In order to facilitate composting, a suitable environment must exist. The microorganisms which degrade organic wastes use carbon for energy, and nitrogen for protein. Organic matter contains carbon and nitrogen in varying amounts and ratios. A Carbon:Nitrogen (C:N) ratio of 30:1 is considered ideal for composting. Too much carbon or very large particle size slows the process down. When too much N is present, the compost may become too hot, killing the composting organisms. A table of C:N ratios of commonly composted materials is shown in Table 1.

When making a compost "pile", size determines how the system will be managed. Very small scale composting can be achieved in a small plastic bucket. Large scale composting can be done using long rows of waste, moved by tractors using "windrowing" equipment. In between are piles which can be managed with a manure fork or a bucket loader attached to a tractor.

Take care when considering composting diseased plants.

Attaining composting temperatures is key to successful composting. The composting microorganisms i.e. bacteria and fungi, operate best in a warm, damp, well aerated environment. This environment will not likely exist on the very outside of a pile of organic wastes. Thus it is important a) to have a large enough volume of composting material to create a warm interior and b) to mix up or turn the pile periodically. A volume of three feet square is generally adequate. Smaller volumes can be successfully composted in black containers (earth machines) placed in a sunny location. Larger volumes can be handled in windrows.

Mixing/turning strategies depend on volume. Small black plastic bins may rotate on axles or simply be shaken. A larger pile can be turned using a manure fork or bucket loader. Attachments to tractors can be used to turn windrows of composting materials. Frequency of turning will be a function of materials being composted, water, aeration, weather conditions, and microorganisms present. Water is necessary for the microorganisms to live and work, but too much water can create anaerobic conditions which are not conducive to the composting process. Water can be controlled by either watering the pile if too dry (<40% moisture=crumbly), or covering the pile loosely if too rainy. Heat is very important in the killing of weed seeds and other harmful organisms. Heat generation also indicates that the composting process is working. A final temperature of 160° F is ideal. Higher temperatures may kill the composting organisms. When the temperature reaches 160° F, turn the pile. When the compost texture is uniform, and turning the pile no longer results in a temperature rise, the compost should be done! A compost thermometer with a long probe for reaching the interior of the pile is useful for monitoring.

Table 1. Carbon to Nitrogen Ratios for Selected Materials (by weight)

Materials with high N content	C:N Ratio
Vegetable wastes	10-12:1
Coffee grounds	20:1
Grass clippings	12-25:1
Cow manure	20:1
Horse manure	25:1
Poultry litter	13-18:1
Materials with high C content	
Leaves	30-80:1
Corn stalks	60:1
Straw	40-100:1
Bark	100-130:1
Paper	150-200:1
Wood chips and sawdust	100-500:1

The above table is taken from the publication, FSA-6036, http://www.uaex.edu/Other_Areas/publications/pdf/FSA-6036.pdf , of the University of Arkansas, Division of Agriculture, Cooperative Extension Service
Note that the C:N ratios given for cow and horse manure do not include bedding. Addition of sawdust bedding will raise C:N ratios significantly. Look for a mix of materials which will result in an overall 30:1 C:N ratio.

What not to Compost (and what do with it):

Many hazardous materials are not suitable for composting. A small amount of an unsuitable product can destroy a large amount of compost.

When grass clippings are added to the compost pile for increasing N content (decreasing C:N) the lawn should be chemical free, otherwise plants receiving the compost may seriously damaged. Plants with especially damaging diseases, such as late blight of tomato and potato, which is caused by the fungus Phytopthera, should not be composted, because if the disease is not killed in the composting process, the resulting spread of the disease can be devastating. If entire plants are plowed under, the disease likely cannot overwinter in Massachusetts' climate. Burning is sometimes recommended as a way to eliminate late blight. However, burning is not allowed in all areas. Generally a burn permit is issued by the local municipality when there is minimal wind and adequate moisture in the area to control the fire.

Materials such as pressure treated lumber contain heavy metals (arsenic) and should not be composted. Proper disposal in Massachusetts is described as follows: http://www.mass.gov/dep/toxics/ptwoodqa.htm "Small amounts" of such materials may be taken to landfills.

Pesticides can only be composted if it is clear from the label that the material in question will break down into harmless components in the composting process and will not kill the composting microorganisms. Pesticide labels should list proper disposal methods.

Inorganic materials cannot be composted. Plastics must be recycled or disposed of in a landfill. Retailers in Massachusetts are required to accept used motor oil in the quantity you purchased from them, BUT ONLY IF YOU HAVE THE RECEIPT. Tires, metals items which cannot be separated according to specific content (aluminum, steel, etc.), and plastics are difficult to dispose of, but hard to manage without. It is possible using Internet websites to find businesses which will recycle tires and sorted metals.

Meat and other animal products may be composted in some situations. In a large scale system, even large livestock carcasses may be composted (see http://www.umass.edu/cdl/publications/a_an_compost.htm). However, caution should be taken when composting animal products in home compost piles, as the short-term odors may attract compost-disrupting wildlife and dogs.

Resources:

"Composting". University of Arkansas Cooperative Extension Service. http://www.uaex.edu/Other_Areas/publications/PDF/FSA-2087.pdf

"Composting Horse Manure". University of Massachusetts Amherst Extension. http://www.umass.edu/cdl/BMPs/Compost%20Horse%20Submitted%2008-46.pdf

"Compost Fundamentals". Washington State University. Whatcom County Extension. http://whatcom.wsu.edu/ag/compost/fundamentals/index.htm

J.I.Rodale, editor in chief. 1960. The Complete Book of Composting. Rodale Press, Emmaus, PA.

"Late Blight Occurrence and Management in Potatoes and Tomatoes in the Northeastern United States in 2009". McGrath, Margaret Tuttle. 2009. Cornell University, Department of Plant Pathology. Ithaca, N Y. VegetableMD.http://vegetablemdonline.ppath.cornell.edu/NewsArticles/Tom_LtBlt_2009.html

Massachusetts Department of Agricultural Resources Composting Program. http://www.mass.gov/agr/programs/compost/index.htm

For more information visit www.umass.edu/cdl

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