Dairy 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 a large volume of accumulated organic waste into a usable product. When organic wastes are broken down by microorganisms in a heat-generating process, waste volume is reduced by almost 50%, many harmful organisms including pathogens and weed seeds are destroyed, and a useful, potentially marketable product is produced. In a dairy operation, the majority of organic wastes will likely be manure combined with spoiled hay and feed, and animal bedding. Adding compost to soil increases organic matter content. This, in turn, increases the population and diversity of the beneficial microorganisms and earthworms in the soil and therefore improving many soil characteristics and allows for the slow release of nutrients for crop use in subsequent years.

Make sure C: N ratio is adequate.

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

How to Compost

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 25-30:1 is considered ideal for finished compost. Too much carbon (woody materials) 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. The C: N ratio will depend on the type of bedding used and the manure: bedding ratio. Table 1 below shows C: N ratios of some materials.

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

A compost thermometer with a long probe for reaching the interior of the pile is useful for monitoring temperature.

Attaining composting temperatures is the key to successful composting. The composting microorganisms i.e. bacteria and fungi, operate best in a warm, damp, well aerated environment. This condition will not likely exist on the very outside of a pile of organic wastes. Thus it is important to:

a) have enough volume of composting material to create a warm interior
b) mix up or turn the pile frequently. Large volumes can be handled in windrows which can be turned using a tractor mounted bucket

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 150-160^{o} F is ideal. Higher temperatures may kill the composting organisms. When the temperature reaches 160^{o} F, turn the pile. When the compost texture is uniform, and turning the pile no longer results in a temperature rise, the

compost is considered finished! A compost thermometer with a long probe for reaching the interior of the pile is useful for practical and easy monitoring.

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

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

The above table is an excerpt 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. Addition of sand bedding will not affect C:N ratio, but will increase the density of the finished compost. 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 for increasing N content (decreasing C: N) the lawn should be chemical free, otherwise plants receiving the compost may be 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 spread of the disease can be devastating. Materials such as pressure treated lumber contain heavy metals (arsenic) and should not be composted. Proper disposal in Massachusetts is described in following link: 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 searches to find reasonably local businesses which will recycle tires and sorted metals.

Animals and animal products may be composted in some situations. In a large scale system, even large livestock carcasses may be composted (see www.umass.edu/cdl/BMPs/DisposalofDeadLivestockandEquine08-14.pdf). Caution should be taken when composting animal products, as the short-term odors may attract compost-disrupting wildlife and dogs.

Resources

Frederick C. Michel, Jr., et al. Effects of Straw, Sawdust and Sand Bedding on Dairy Manure Composting. Department of Food, Agricultural, and Biological Engineering, Ohio Agricultural Research and Development Center, Ohio State University, Wooster, Ohio. www.cals.ncsu.edu/waste_mgt/natlcenter/sanantonio/Michel.pdf

Hirrel, Suzanne Smith, et al. *Composting.* University of Arkansas Cooperative Extension Service. http://www.uaex.edu/Other_Areas/publications/PDF/FSA-2087.pdf

Massachusetts Department of Agricultural Resources:

Composting Program Informatio: http://www.mass.gov/agr/programs/compost/index.htm

Guide to Agricultural Composting. Revised 2010.http://www.mass.gov/agr/programs/compost/docs/Guide_to_Ag_Composting2010.pdf

Washington State University has a web publication explaining the composting process very well. There are five separate sections of Compost Fundamentals as follow:

- http://whatcom.wsu.edu/ag/compost/fundamentals/consideration_destruction.htm
- http://whatcom.wsu.edu/ag/compost/fundamentals/consideration_pesticides.htm
- http://whatcom.wsu.edu/ag/compost/fundamentals/consideration_fly_control.htm
- http://whatcom.wsu.edu/ag/compost/fundamentals/consideration_reclamation.htm
- http://whatcom.wsu.edu/ag/compost/fundamentals/consideration_time.htm

For more information visit www.umass.edu/cdl

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