ENVIRONMENTAL
Fact Sheet

NEW HAMPSHIRE
DEPARTMENT OF
Environmental
Services

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SW-3 2020

Municipal Composting of Yard Waste

Background Information

Composting is an aerobic (oxygen-dependent) degradation process by which plants (leaves, vegetable trimmings, lawn clippings, and similar garden debris) and other organic wastes (kitchen refuse, sludge) decompose under controlled conditions. It is not a new process but has been an accepted agricultural practice for years. As a natural process, it can be carried out with as little, or as much, intervention and attention as desired. The basic parameters that influence the composting process are oxygen, temperature, moisture and the carbon-to-nitrogen ratio (C:N).

Waste composition studies indicate that yard waste represents from 10% to 30% of municipal solid waste. A study conducted for the U.S. Environmental Protection Agency found the total amount of yard waste produced in the United States to be 18% by weight of the total amount of municipal solid waste generated. Yard waste represents a greater percentage of the waste stream (from 35% to 40%) during certain times of the year.

Yard waste composting has many benefits. These include:

- Reducing waste disposal costs.
- Conserving natural resources.
- Producing a valuable soil amendment.
- Reducing environmental impact.

New Hampshire Leaf & Yard Waste Disposal Rules

In 1992, the New Hampshire Legislature passed House Bill 646, Chapter 266, which prohibits the disposal of leaf and yard waste in both landfills and incinerators, effective July 1, 1993. The rationale for this restriction is that leaf and yard waste can use precious capacity in our solid waste management facilities. Leaf and yard waste is also easily composted, which allows us to treat the material as a **resource** rather than a **waste**.

Composting facilities at which only leaf and yard waste and/or animal manure are processed are not subject to the New Hampshire Solid Waste Rules and in most cases will not require a permit. However, facilities that incorporate select food waste and/or other solid wastes in a compost pile are subject to the rules and may require a permit. Contact NHDES at (603) 271-2925 to obtain permitting information.

Establishing a Municipal Composting Program
When planning a municipal yard waste composting program, the following areas need to be addressed: quantity of material, equipment, material collection, facility siting, staffing, public education and marketing/end use.

1. **Quantity of Material:** Determining the amount of yard waste that will be available can be done through the use of established generation rates or actual weight studies. Since yard waste does not occur at a constant rate throughout the year, care must be taken in the analysis of collected data. In most cases, existing generation rates should be adequate.

2. **Equipment:** Equipment for a composting program must be able to handle movement, turning, watering, screening, and monitoring of the material. Specialized equipment is available for collection and windrow turning, but is not necessary. The use of a screen does, however, create a uniform sized material which helps in the marketing of the end product.

3. **Material Collection:** Collection of yard wastes for a municipal program can be separated into three categories: drop-off, curbside pickup in bags or other containers, or bulk pickup where the leaves are collected loose off the street. If bags are to be used for collection, it is advantageous to use biodegradable plastic or paper. This type of bag can be shredded and mixed into the compost while non-degradable plastic bags must be removed prior to composting. Bulk collection requiring the material to be scooped, raked, swept or vacuumed off the street, can be slow and may contain contaminants from the street. The choice of collection methods should be determined by cost, convenience, household participation rate, and the amount and type of yard waste to be collected.

4. **Facility Siting:** Land requirement will be dependent on the volume of yard waste to be collected and the level of technology to be employed. As the level of technology increases, the amount of land required for processing decreases. In general, one acre of land can support 4,000 to 6,000 cubic yards of loose material. Criteria to be considered for a composting site are: location, size accessibility, soil drainage, surface water, topography, buffers and security. It is important that the site be adequately sized to handle all of the current and future material that will be received at the facility.

5. **Staffing:** A staff that is dedicated and that understands the material and the composting process is needed to ensure a successful program. Of the staff's responsibilities, the areas of windrow monitoring, recordkeeping, and quality control are the most important.

6. **Public Education:** Education is a vital component of any successful composting program. Education and promotional programs should start as soon as the planning process is initiated. The information should answer these basic questions: what, when, why, how and where. Information can be distributed in a number of different manners with each targeting a different

audience. Education should not stop once the program has started, but be a continuous process with updates and reminders to maintain interest and participation.

7. **Marketing/End Use:** There are a number of uses for compost. As a soil amendment, it improves the texture, porosity and water holding capacity; it also increases the organic content of the soil. For mulch, it is placed around plants to suppress weeds, modify soil temperature, and conserve soil moisture. On slopes, it can be used for stabilization and reducing soil erosion. In a greenhouse or nursery, it can be used as one of the components of a potting soil mix.

The product can be given away, sold, or traded to residents, landscapers, nurseries, greenhouses, and local governments. It is usually distributed in bulk with pick up at the composting site by the user. As with any product, the higher the quality, the easier it is to market. Nurserymen and landscapers are more apt to reject a product with extraneous material in it, so if they are to be a major outlet for the compost, they should be contacted in the initial planning stages to ensure that an acceptable product is produced.

Composting by Windrows

Processing of compost in windrows (see Figure 1) can range from a low level of technology to a highly sophisticated system. As the technology increases, labor and equipment requirements also increase. As a trade off, the higher levels of technology require less land, and the breakdown of the material occurs at a more rapid rate. A low level of technology may be most adaptable for New Hampshire communities. For this technology, material is placed in windrows and turned every 4-8 weeks with a front-end loader. A marketable product is obtained in 6-12 months.

The general concept behind the processing of yard waste is the formation of a windrow (Figure 1) or pile so that the proper biological conditions are created.

Figure 1. Windrow profile and construction. The space between each windrow is generally dictated by the type of equipment. For example, a tractor will need at least 20' on one side of the windrow to be able to maneuver. The minimum amount of space between each windrow should be no less than 2'.

It is the naturally occurring microorganisms found in the yard wastes and soil that break down a windrow into a friable material. There are two major categories of microorganisms in an aerobic composting process. Mesophilic organisms are active at temperatures above freezing and their activity causes temperatures within the windrow to increase. At temperatures above

110 F, thermophilic organisms become active and decomposition increases. Above 140 F, these aerobic, oxygen-loving organisms begin to die and decomposition decreases. These organisms are dependent on oxygen, temperature, moisture and the proper carbon-to-nitrogen (C:N) ratio to carry out this natural process. The optimum level of oxygen for aerobic organisms to effectively breakdown leaf and yard waste is 5%. Levels below this result in the organisms dying off and less efficient decomposition by anaerobic organisms.

As indicated above, the **temperature** in the compost pile should be between 100 and 140 degrees F. It is the natural digestion process by organisms that results in increased temperatures within the compost. If properly constructed, the temperature in a windrow will be self-sustaining until the compost is stabilized. Thermometers can be used to monitor the temperature of compost and to indicate how decomposition is progressing (Figure 3).

A **moisture content** of between 40% and 60% by weight is optimal. This will be like the consistency of a wrung-out sponge. Moisture is necessary to dissolve nutrients for use as a food source by the microorganisms. Excessive moisture creates an undesirable anaerobic condition. Water may need to be added when the windrows are initially formed, and turned, to maintain the proper moisture content.

A **C:N ratio** of 20:1 to 30:1 is ideal. Leaves tend to have a C:N ratio of 60:1 to 80:1 which results in slower decomposition. Materials high in nitrogen can be added to improve the ratio.
The windrow or pile is then turned to maintain these conditions and speed decomposition (Figure 4). Turning the windrow can be done as little as once a year to as frequently as once a week. It should be noted that the less frequently a compost pile is turned, the greater the problem of odors due to the anaerobic state that exists within the pile.

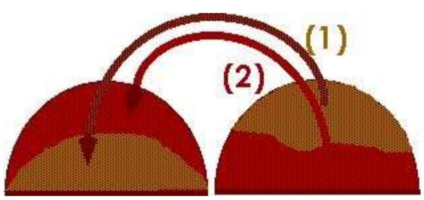


Figure 2. The principle is to move the top of the windrow so it forms the new bottom, mixing the leaves in the process.

Additional steps can be added before and after windrow formation. Pre-processing may involve removal of unwanted material and conditioning of the waste by grinding, shredding, wetting and/or mixing. Post-processing is shredding and/or screening as an additional means to remove unwanted material plus prepare a product for distribution. These additional steps will cut the composting time, reduce the volume, and improve the quality of the end product. The time frame for a stable marketable product will range from a few months to three or more years, depending upon the climate, as well as the frequency of turning.

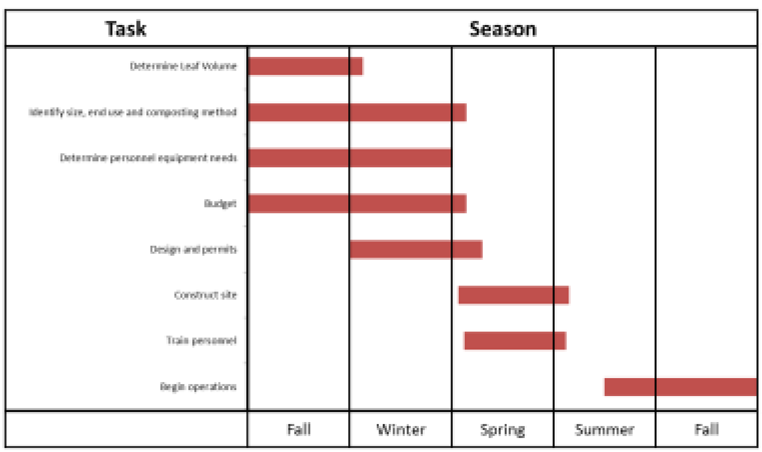
A finished product can be determined by two methods. The first method is to place a sample in a plastic bag for 24-48 hours at room temperature. If there is no significant odor on opening the bag after this time the process is complete. The second method monitors temperature or odor. If there is no odor, or the temperature in the windrow does not increase in seven days after turning, the compost can be considered stable. It may be desirable to test the quality of the finished product as a means to determine its value and whether market standards are met.

Cost-Revenue Analysis
No program should be started without a feasibility study. For a composting program, this should encompass reviewing the amount of material recovered, capital/start-up costs, operating and maintenance costs, avoided disposal and transport costs/revenues, and the net program cost/revenue. Each of these items should be reviewed in detail to make a responsible decision.

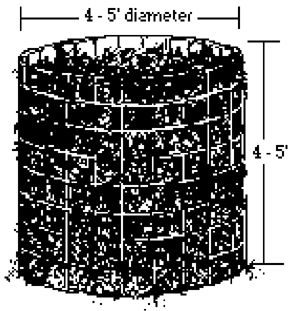
In the publication "Yard Waste Composting, A Study of Eight Programs," published by the EPA, the cost of composting ranged from $11-$102 per ton and the avoided landfill disposal fees ranged between $5-$137 per ton. The wide range stresses the need for each individual program to be viewed on a case-by-case basis.

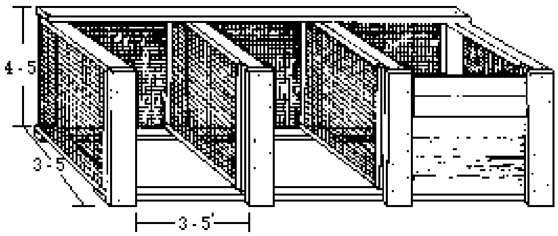
Time Schedule
Starting a composting program takes an investment of time. Figure 3 is an approximate time schedule for development of a successful municipal program. Note that this is an example and should be tailored for each compost facility.

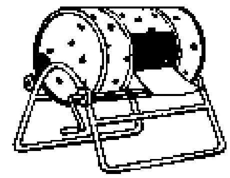
Figure 3. Example of a time schedule for developing a composting program.



Backyard Composting
Composting in the backyard involves the same basic principles as with a municipal program, except on a much smaller scale. Additional organic materials (garden and kitchen waste) can be added without creating additional effort. Although decomposition will take place in a compost pile on open ground, special structures can be constructed or purchased to save space and to hasten the process. The figures below illustrate the variety of materials that can be used and how simple or complex the structures can be.







Conclusion

Composting is a cost-effective means of dealing with the organic section of the solid waste stream and an essential part of an integrated solid waste management plan. The process can be employed on a larger scale for towns and cities to comply with the law and to treat the organic material as a resource rather that a waste. Citizens can establish a compost pile in their backyards using a variety of low and high technology methods with no regulatory requirements. Municipalities can implement leaf and yard waste composting with minimum regulatory oversight by NHDES.

For more information, contact:

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