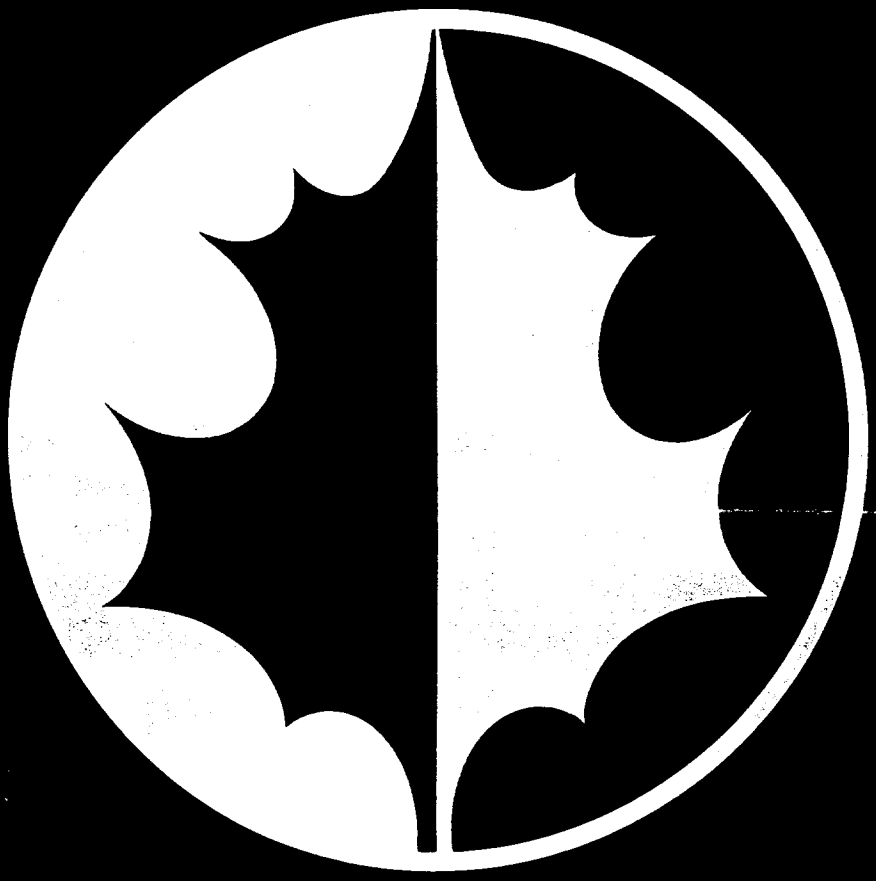
Municipal Leaf Composting

A Solid Waste Recycling Program



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CONTENTS

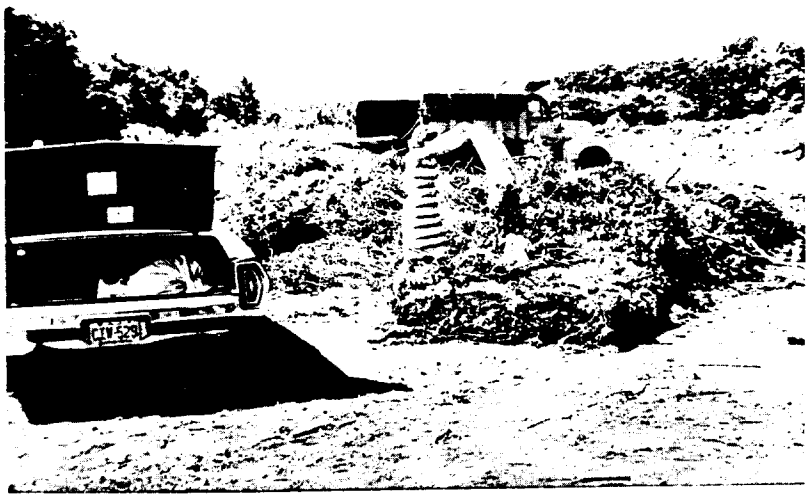
Developing this successful program for composting required careful planning in all phases of the operation:

1. site selection,
2. design of a collection system,
3. management of composting materials,
4. utilization of finished materials
5. community involvement.

This guide outlines the major considerations in each phase of a municipal leaf composting program. Each community still must prepare an individual detailed plan for operations and for development of public support.

SITE SELECTION

A community usually has to select a composting site from a limited number of available locations. The decision must be based upon the projected traffic, as well as the basic physical requirements. Growth in the volume of leaves collected and, possibly, expansion to a complete ecology center should be anticipated.



Residents and commercial vehicles will bring material to the site. An attendent will be required during "open" hours to ensure other trash is not dumped.

COLLECTION SYSTEM

A municipal composting program requires a leaf collection system separate from other solid waste pick-up. Initially, the system probably will be a modification of existing procedures determined by the budget available for specialized equipment and for crews. Whatever system is adopted, the co-operation of residents and private collectors will be necessary.

Equipment

Efficient vacuum leaf collectors are available to pick up loose leaves along residential streets. Vacuums are available as complete units and as satellite units to be used with existing trucks. Compared to other equipment, vacuum loaders have the advantage of compacting the loose leaves, reducing the number of trips required to the composting site. A volume reduction of 5-to-1 is normal.

Communities without vacuum equipment have utilized street sweepers and front-end loaders for the leaf collection program. In fact when leaves are wet, these units may be required to complete the pick-up of the leaves. Manufacturers of collection equipment can provide detailed specifications and can assist in planning pick-up schedules.

Crews and Schedules

To provide an example of a collection system, Royer compiled data from several communities in the metropolitan New York area. Here, the collection period is 6 to 8 weeks, and, typically, collections are once a week. Five-man crews, with two trucks (16 cu. ft. boxes) and 1 vacuum collector are used in the example: 2 truck drivers, 1 operator for vacuum collector, 2 rakers.

With the trucks alternately collecting and delivering to the composting site, the average crew will service 4 to 6 curb miles per day. The total number of crews required will depend upon the frequency of pick-up and total curb miles. The average costs for the communities in this example were $30 to $37 per curb mile for each pick-up – $180 to $222 per curb mile per season. This includes labor, maintenance, and equipment depreciation for an average of 6 pick-ups per season.

In another example with three-man crews and one truck per crew, the total costs are approximately the same. Idle time while the truck is enroute offsets the saving of the smaller crew.

Policies

Establishing a successful leaf collection and composting program requires community education, cooperation and possibly some ordinance changes. Residents must be in instructed to rake leaves to the curb, coordinating with published collection schedules. Provision should be made to allow

residents and private collectors to deliver leaves and other woody material at the compost site. Generally, a fee is charged for commercial users, such as landscape contractors. Specific rules must be established and enforced to prevent the composting site from becoming a dump for all types of solid waste. Plastic bags should not be permitted for curbside collection or direct delivery. Leaves sealed in plastic will putrify instead of decomposing through composting. In addition, the bags are difficult to separate from the finished humus. If bags are necessary for collection, bio-degradeable paper bags are available. These might be distributed by community organizations such as scout groups.

COMPOSTING OPERATIONS

Even with a large volume of leaves careful management of the composting operation will ensure that decomposition is rapid and the site is available for the next season's leaves. Composting is a natural process - very little mechanical handling is required. The leaves will be converted to a useful humus, leaf mold. 1000 cu. yds. of leaves produce about 165 cu. yds. of finished humus.

Windrow Composting

Municipal leaf composting is a natural aerobic decomposition of organic material in specifically designed piles, or windrows. "Aerobic decomposition" simply means that in the presence of air and mositure, natural microorganisms will break down the leaves. Although the biology and chemistry of the process are very complex, composting can be effectively and efficiently managed if a few simple factors are understood. The windrows are designed to maintain the air, moisture and temperature required for composting and to minimize space requirements.

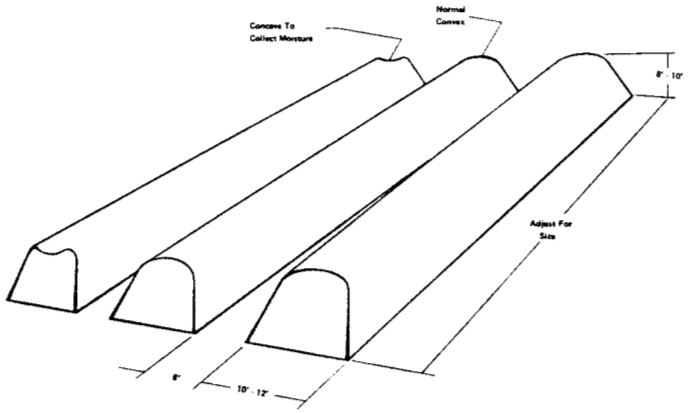


Figure 1: Windrow Construction. Recommended dimensions are noted. Surface leaves insulate the interior and help to maintain composting temperatures.

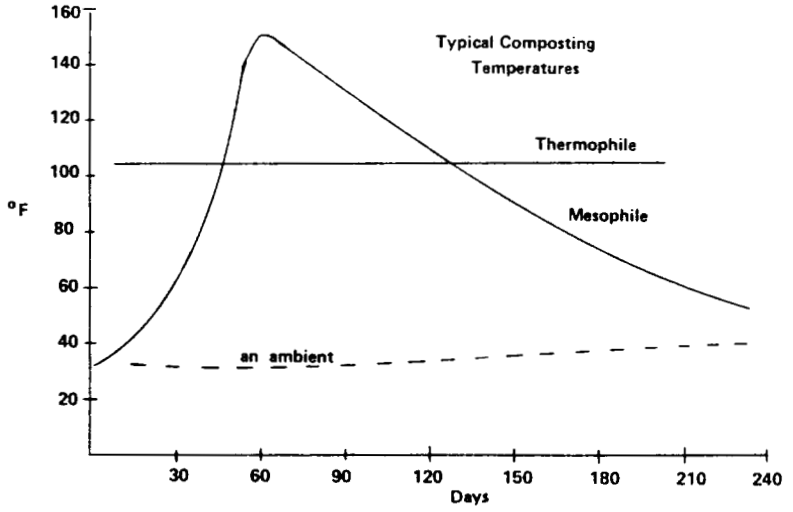


Figure 2: Typical Composting Temperatures. An adequate supply of air (oxygen) is required to maintain the elevated temperatures generated by composting.

rows, the breakdown will be completed in about one year. If necessary the composting can be completed within a few months by frequently turning and shredding. Shredding the leaves increases the surface area of the material and hence, the exposure to available air. Turning the pile also will help to overcome the natural compaction that takes place as the leaves breakdown. Shredding and turning also introduce fresh air within the pile. The optimum time for turning the composting windrows can be determined from observation of other factors - temperature and moisture.

Temperature

The temperature within a compost pile changes as different types of microorganisms become active. Initially, at ambient temperatures, mesophilic organisms begin the breakdown, and this activity increases the temperature. Above 110°F. thermophilic organisms become active, and the rate of composting activity increases. As the composting is completed, or if the available air and moisture are consumed, the temperature will return to the mesophilic range. Figure 2 shows a typical temperature/time relationship for composting leaves. To complete composting of leaves as quickly as possible, the windrow internal temperature should be retained in the thermophilic range (110°-160°F) until breakdown is nearly complete. The temperature within a windrow can be easily measured. If it falls into the mesophilic range prematurely, aeration probably is required. Temperatures will drop temporarily after the windrows are turned. The recovery is rapid (within days) and themophilic activity resumes.

tion may inhibit the decomposition. If an excessively acid or alkaline condition is suspected, samples of the compost should be submitted for a laboratory analysis and recommendations. For example, lime might be used to correct an acidic condition. pH correction seldom is necessary in leaf composting.

Carbon/Nitrogen Ratio

The carbon/nitrogen ratio (C/N) is a measure of the nutrients available for the micro-organisms causing decomposition. Carbon is primarily an energy source; nitrogen is utilized in converting cellulose. Of course, leaves have a high cellulose content. Studies with various materials indicate that composting is most efficient at a C/N ratio of 30 (30 parts carbon for 1 nitrogen). With leaves, the initial C/N ratio ranges from 60 to 80, and the finished humus has a C/N ratio from 10 to 20. Therefore, the C/N ratio changes continually during the composting process. The C/N ratio could be used to determine that composting is complete, however, laboratory test facilities are required. If composting is not proceeding normally, this test might reveal an unusual condition.

Mixtures of materials have been used to lower the initial C/N ratio and speed the composting. For example, grass clippings have C/N ratio of 20, sewage sludge of 6-10, Sludge alone cannot be successfully composted. Before mixtures are utilized, the properties of the finished humus should be carefully checked, to ensure undesireable foreign elements are not introduced.

Shredding and Turning

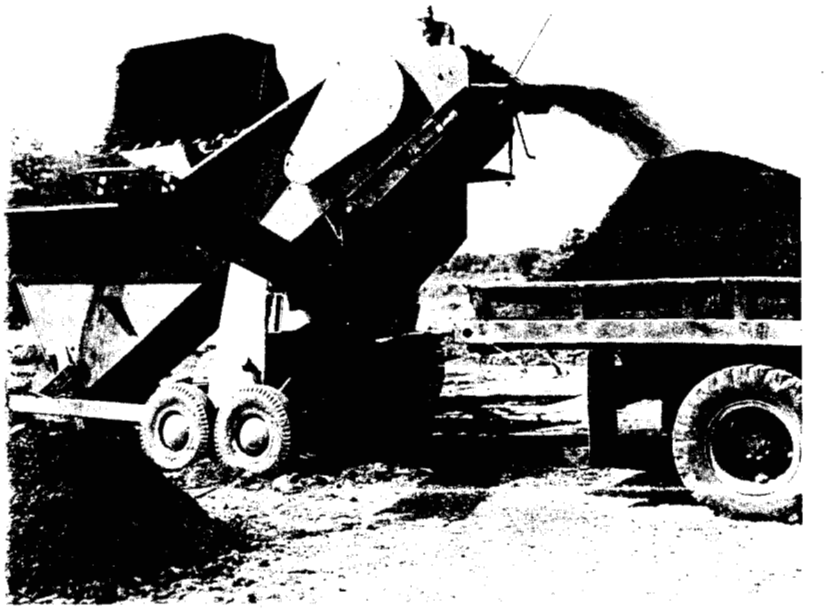
If composting windrows are properly constructed on a suitable site, the leaves will decompose naturally. All of the factors discussed above will be maintained near optimum conditions. After ten months, the leaves should be shredded and windrowed again. The volume will be reduced by about 5 to 1.

After the initial shredding, the temperature within the windrow will increase as the composting is resumed with a new supply of air. This humus will be fully composted and ready to use in the Spring. To accelerate the composting cycle, the windrows may be turned and shredded more frequently. Aeration prolongs the thermophilic composting activity.

A Royer Shredder is uniquely suited for shredding, cleaning and aerating the compost. The tumbling action on the cleated belt mechanically breaks the friable compost, and the discharge further aerates the material as it is piled. In addition, the Royer Shredder separates trash from the leaf mold. Cans, bottles, stones, sticks are removed so the finished humus is clean.

Finishing

When the composting cycle is complete, the leaf mold should receive a



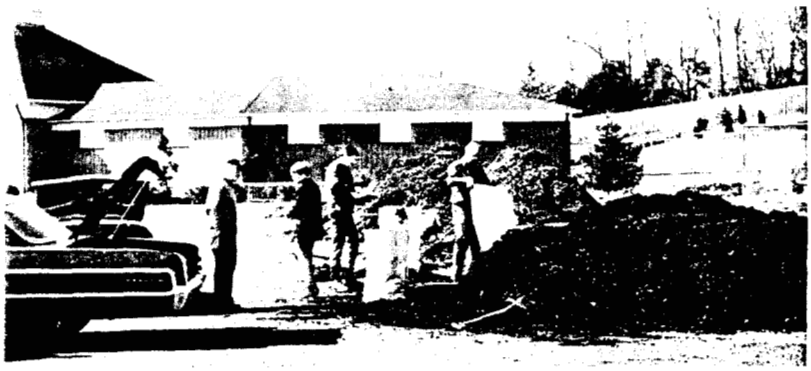
Finished compost should be aerated and cleaned before application or stockpiling.

Composting mixtures of leaves and other solid wastes is being evaluated by several groups. The initial results have been encouraging. The addition of sewage sludge and some industrial wastes, for example, could lower the initial C/N ratio and speed composting as well as add valuable nutrients. However, these mixtures must be tested very carefully because potentially dangerous materials might be introduced. For example, vegetables should not be grown in soil with high concentrations of the heavy metals that are found in some sludges. The studies with mixtures cannot be generalized, because waste materials vary from area to area. Each combination has to be evaluated individually. The high temperatures developed in composting destroy most, or all, of the potentially dangerous pathogens found in sewage sludge and industrial wastes. Therefore, composting has appeared attractive for disposal of these materials. Again, each situation must be considered separately. Communities seeking to solve a leaf problem should not jeopardize the composting program by introducing a technically complicated and potentially dangerous mixture of materials to be handled. Government, university and industrial research later may demonstrate how the composting program can be safely expanded.

COMMUNITY PROGRAMS

A municipal leaf composting program will require the cooperation of community residents. First, land must be committed for the composting site. Then, a budget for equipment and operations is necessary. Residents also will be required to cooperate in the collection of the leaves. As the program begins, some objections may have to be overcome, but strong public support can be developed.

A municipal composting program offers many opportunities for commitment in a popular "cause". Composting leaves is a natural recycling program. Ecology requires that organic materials be conserved, and composting eliminates the air pollution caused by burning. The composting site can even be part of an attractive park. The program will help beautify the community rather than create an unsightly dump and the utilization of the leaf mold in community projects will result in a measurable saving in material, a value which should be announced. Many communities have developed specific programs to involve civic groups such as scouts, horticultural societies, womens clubs. These might be beautification, distribution of collection bags, bagging humus for residential use, visitations to the composting site.



Successful community composting programs require public support. Distribution of the valuable humus is a direct return to the taxpayer.

The responsible agency should seek publicity for the leaf composting program. Local newspaper will cooperate and speaking engagements can be arranged. If other ecology programs are underway in the community, the leaf composting site might be part of an ecology center where glass, metal, paper, and other material can be collected. These centers can become the focal point of the community involvement. Responsible administrators should not underestimate the importance of this element. The local program can become part of the national campaign for recycling and ecology.

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