

SHEET LEAF COMPOSTING

The Land Application and Incorporation of Leaves on Cropland

In addition to bringing leaves to conventional leaf composting facilities, municipalities have the option of working with a local farmer who practices sheet leaf composting as another method of leaf recycling. This primer was generated to provide basic information to municipalities and farmers interested in practicing “Sheet Leaf Composting” (SLC). A literature review on SLC was conducted, compiled and is presented in the following pages for use as a guidance document for interested individuals.



Sheet leaf composting is the application and incorporation of leaves on cropland actively devoted to agricultural production, as a soil amendment and mulch. Studies comparing the cost of conventional windrow composting to SLC conclude that SLC is a considerably less expensive option for recycling leaves. The availability of cropland in October and November, during the bulk of the municipal leaf collection season, makes sheet leaf composting a viable option for many municipalities and farmers. Municipalities now have the opportunity to support local agriculture through public/private partnerships with farmers for the recycling of leaves. These partnerships can be mutually beneficial as outlined below.

Benefits to the Farmer

- Additional income through tipping fees or contracts
- Cropland improvements in soil tilth, moisture holding capacity, structure and nutrients
- Additional compensation for the use of cropland, equipment and man-power that may be underutilized during the post harvest season
- Contributions to sustainable agriculture

Community Benefits

- Lower disposal costs
- Minimal hauling expense
- Eliminating the liability and expense associated with the operation, maintenance and management of a leaf compost facility
- Supporting local farmers

Environmental Benefits

- Decreased soil erosion resulting from increased soil aggregation and surface residue from the practice of sheet leaf composting
- Improved soil nutrient holding capacity reducing leachate and runoff concerns
- Decrease in potential environmental and nuisance problems sometimes associated with poorly operated compost facilities

Municipality, Community and Farmer Cooperation

Farmers and municipalities should work together to overcome the obstacles that could arise with the application of leaves to farmland. The municipality must be responsive to the needs of the farmer and work with the haulers and the community to keep the leaves free of trash and other physical contaminants. This will be an ongoing concern for the farmer. Tipping fees should be adequate to offset the added time

and expense incurred in the handling and incorporating leaves.

The farmer must provide all-weather access to the field locations where the leaves will be applied. The field should have ample access to either directly apply the leaves, or enough area to temporarily stockpile the leaves prior to application. Modifications to crop rotations, field layouts, and access areas may be necessary to accommodate the arrival of leaves. Well-drained land is best suited for the delivery of leaves in all weather conditions.

Considerations for the Farmer

In addition to the labor and time involved with the distribution and incorporation of leaves, other factors can create problems for farmers that incorporate leaves. Potential problems include:

- Removal and disposal of extraneous materials mixed with the leaves during the collection process
- Coordinating land availability and access
- Availability of equipment and labor to distribute and incorporate the leaves to the field in a timely fashion
- Accounting for additional fertilizer which may be needed especially in the first season [Maynard (1)]
- Reduction in the effectiveness of pre-plant herbicide, so other weed control may need to be considered with applications of more than 30 tons (dry weight basis) of leaves per acre [Whitacre]

Municipal Considerations

Municipalities wishing to recycle their leaves should be aware that farmers accepting leaves need to charge the municipality a tilling fee to offset the expense of land application and incorporation.

Municipal considerations are:

- Compensation to the farmers that accept leaves
- Educating the leaf collectors, haulers and the community to reduce extraneous materials when collecting leaves
- Scheduling the deliveries and access to farm field locations
- Cropland may not be in close proximity to the leaf collection areas

Leaf Preparation

Leaves must be free of trash and other physical contamination such as glass, bottles, cans, plastic, large tree limbs, leaf collection bags and branches. A farmer may only apply leaves at agronomic rates that will not adversely affect the farming operation.

Education

Education of all participants is critical to the success of a sheet leaf composting operation. The farmers and the municipalities must reach a mutual understanding as to the responsibility of each party. The municipalities must have a site in close proximity to the leaf source that is accessible in all weather conditions. The public must be educated to recognize the importance of keeping trash and debris out of the leaf collection. When raking leaves to the curb for collection the public must be considerate of the farmer's needs and work to keep the contamination to a minimum. The haulers and collectors must be considerate of the farmer's needs. Communication between the participants is critical to achieve a mutually satisfying public/private partnership.

Contract Requirements

A contract between the parties involved in the sheet composting process is essential. The contract should contain very specific requirements for both the farmers and municipality delivering the leaves. The contract should include but not be limited to the following items:

- Tipping fee and method of payment
- Quantities of leaves that will be accepted
- Specific requirements for the delivery of de-bagged leaves free of physical contaminants
- Time period and locations for delivering the leaves to the farm
- Procedures and individuals responsible for the handling and disposal of unacceptable materials delivered to the farm
- Record Keeping
- Provisions to review and amend the contract as conditions may change
- Other operational and site specific requirements

DEP Requirements

Section 22a-208i(a)-1(g) of the Regulations of Connecticut State Agencies (RCSA) concerning the composting of leaves pertains specifically to sheet leaf composting. The regulation requires that:

- The person practicing SLC must have an Agricultural Sales Tax Exemption Permit issued pursuant to chapter 219 of the Connecticut General Statutes.
- The person practicing SLC must comply with the reporting requirements for recycling facilities pursuant to section 22a-208e(c) of the Connecticut General Statutes.
- DEP must be notified within 30 days before the acceptance of leaves for SLC. A special notification form has been developed and is available through the DEP Recycling Program and on the DEP website.
- No material other than leaves can be used for SCL.
- SLC must be conducted only on land actively devoted to agricultural production.
- Leaves must be delivered to the agricultural land unbagged.
- Prior to the application of leaves to the land, any non-leaf material intermixed with the leaves must be removed and properly disposed.
- Leaves must be applied to the land within fourteen (14) days of delivery and must be spread in a layer no higher than six inches.
- No land may receive, as a result of SLC, more than six inches of leaves within any 12 months. DEP has estimated that this is equivalent to approximately 800 cubic yards or 200 tons of leaves per acre.
- All leaves applied to land must be incorporated into the soil no later than the next tillage season following the time the leaves were applied, unless the leaves are intended as ground mulch.

Anyone interested in practicing sheet leaf composting should become familiar with this regulation. A copy is available through the DEP Recycling Program or on line at

<http://www.dep.state.ct.us/wst/recycle/regshome.htm>

Nutrient Management

Thorough mixing and incorporation of the leaves with the soil is critical to accelerate mineralization of the leaves, and to avoid carbon nitrogen imbalances in the soil. Leaves collected and applied in the fall have a carbon-to-nitrogen ratio between 40:1 and 80:1. When the carbon-to-nitrogen ratio in the soil exceeds 30:1 the rate of leaf degradation is slowed and the nitrogen available



for plant growth is reduced [Peterson (1)]. Most studies indicate that a decrease in crop yield due to nitrogen immobility can result on land where large quantities (greater than 10 to 20 tons dry tons per acre) of leaves have been applied. Nitrogen application rates should be increased to compensate for the nitrogen immobility expected due to heavy leaf applications [Nally, Maynard (1)]. The mineralization rate can be hastened and nitrogen immobility averted, if during incorporation the leaves are thoroughly mixed into the soil profile inoculating the leaves with soil microorganisms [Peterson (2)].

Agronomic benefits to farmers who apply leaves to cropland will vary depending on the existing soil fertility, management practices, soil type, and crop grown. When calculating the application rate of leaves to the land a conversion rate of 4 cubic yards per ton has been a standard. However, the actual conversion rate will depend on the moisture content and density of the leaves at delivery. Loose, dry leaves can measure 10 cubic yards per ton and tightly packed, moist leaves can measure 2 cubic yards per ton.

The nutrient analysis for leaves on a dry ton basis can typically range from 15 to 18 pounds nitrogen, 4 to 5 pounds phosphorus and 10 to 12 pounds potassium. The actual nutrients available for plant growth are released quite slowly. Similar to other soil amendments, the availability of nitrogen, phosphorus and potassium present in leaves depends on soil temperature, pH, soil type, previous crop residues, moisture and other factors. More study is needed to determine the long-term effect of annual leaf applications on nitrogen availability, pH and metals content in the soil. Studies indicate:

- The application of leaves on cropland had no net effect on soil pH [Kluchinski (2)].
- No increases in metal content of the crop or soils were detected with the application of leaves [Whitacre].
- Well drained sandy soils can receive the greatest benefit from the addition of leaves due to increases in organic matter, water holding capacity and overall tilth [Maynard (2)].
- Organic matter content and fertility of the soil is improved with leaf applications [Peterson (1)].
- The incorporation of leaves on cropland will enhance the long-term fertility of the soil.
- Application rates of 20 and 40 dry tons per acre were incorporated into a silt loam with a rototiller and no nitrogen immobility was encountered [Peterson (2)].

A soil nutrient analysis should be performed on all cropland prior to planting to determine crop specific fertilizer recommendations.

Application Methods and Equipment

Practicing farmers should be prepared to experiment with the equipment available to them to determine the most successful leaf application methods for their specific operation. Reports on the best type of equipment for spreading vary. A conventional rear unloading spreader was reported as the best method for uniform distribution [Kluchinski (3)]. Reportedly, spreading leaves with a conventional manure spreader can be quite time consuming due to the capacity of the spreader in comparison to the volume of leaves. Considerable time and expense can be incurred in the loading and land application of the leaves using small capacity conventional spreaders [Nally]. The use of a conventional manure spreader will require the temporary leaf stockpiles to be located convenient to roads and close to the fields where the material is to be spread.

Since leaves are collected in all weather conditions, it is important to site stockpile and application areas with wet weather access in mind. Cropland access should be rotated to address changing weather and site conditions. Well-drained field locations or access areas can be held in reserve for deliveries during wet weather conditions. Appropriate farming practices should be used to minimize trafficking on saturated fields to reduce compaction and rutting.

During dry weather conditions and on well-drained cropland, placing truckloads of leaves at intervals on the cropland can be an effective way to deliver the leaves for direct incorporation [Eisenhauer]. Pushing or grading the leaves piled on the cropland has, in some instances, provided adequate distribution. Saturated leaves can become bunched or unevenly dispersed when front-end loaders are used for distribution.

The grinding of leaves prior to land application allow for the leaves to be uniformly graded with a bucket loader. Leaves are easier to spread and incorporate into the cropland if they are previously shredded [Peterson]. A "Brush Hog" attachment has been used to grind stockpiled leaves in the field to volume reduce the leaves and aid uniform distribution [Robertson].

Incorporation Methods and Equipment



The successful incorporation of leaves into the soil depends on the thickness of the leaf layer, the uniformity of application, moisture conditions of the leaves, whether leaves are shredded, soil type, and the volume and consistency of the existing crop residue. Two passes with a chisel plow proved the best method to incorporate leaf material into the cropland [Kluchinski (3)]. With an application rate of 6 inches it's best to apply the leaves in two three-inch applications incorporating the leaves thoroughly after each application. The use of a rototiller attachment has been effective in incorporating applications of leaves at under 40 tons per acre [Peterson (1)]. Reports indicate harrowing and moldboard plowing are less successful in the incorporation of leaves in greater than 3-inch layers or non-uniform applications. Reports indicate little trouble with the incorporation of 3-inch layers of leaves, however, layers greater than 5-inches proved to be more difficult. Leaves are easier to incorporate if shredded first. The pre-tilling of the cropland to reduce residue interference will aid in the incorporation of leaves, however, the extra tillage will result in higher incorporation costs. Reports indicate the complete incorporation and mixing of the leaves into the soil profile is critical to the uniform growth of the subsequent crop.

Summary

Sheet leaf composting can be a viable alternative for the recycling of municipal leaves in a beneficial manner. The entire community can take pride in conserving local agriculture by supporting the potential for increased on-farm income through sheet leaf composting. By fostering the private/public partnership, local agriculture can help provide another method to recycle leaves.

For More Information

The Connecticut Department of Environmental Protection Recycling Program prepared this SLC primer. For information on sheet leaf composting, the sheet leaf composting notification form, or for information on Connecticut's leaf composting program and requirements, please visit the DEP Composting and Organics Recycling web page at <http://www.dep.state.ct.us/wst/compost/comindex.htm> , or contact:

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