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Composting Cranberry Leaves

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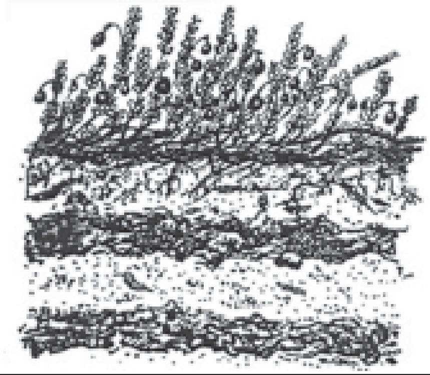

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Natural by-products of harvesting and handler operations are cranberry leaves that have abscised (either naturally or mechanically) from the cranberry plant and have fallen on the bog floor. During the harvest flood and post-harvest trash flood, leaves and small fruit may be removed from the bog surface. Leaf piles may contain up to 12% fruit (mostly small berries). This debris is commonly stockpiled in close proximity to the actual producing farm acreage.

Piles of leaf trash can be found at almost every commercial cranberry farm operation. It is estimated that one acre of bog can generate 0.5-1.5 cubic yards of leaf trash each year. A local handler facility reported that they receive 10,000-30,000 cubic yards of leaves each year. Thus, leaf trash piles may accumulate on-site very quickly.

Leaf trash has been identified as a source of secondary inoculum for many fungi that can cause fruit rot in cranberries (Oudemans et al., 1998). Trash piles can also serve as a secondary source for weed seeds that can blow back onto and re-infest the cranberry beds. Presently, pest management BMPs recommend removal of trash piles to sites at least 1/4 mile away from the bog. However, this can be difficult or impossible.

Once established, trash piles tend to persist, decomposing slowly, if at all. It is likely that the thick waxy epidermis (Croteau and Fagerson, 1971) of cranberry leaves may slow the natural decomposition of abscised leaves (assuming no additional amendments).

Composting may offer a reasonable alternative to facilitate the management of these leaf piles. Composting hastens natural breakdown processes associated with biological materials. Farm-produced compost fits well as part of a more sustainable food production system. The organic matter produced from the composting process could be incorporated back into the cranberry production system, used in other agricultural settings, or marketed to the public as a soil amendment or mulch.

Owners of both large and small cranberry operations could incorporate composting into their current farm activities. The overhead is usually minimal and any necessary equipment is typically present on site.

Before beginning a composting process on a large scale, check local and state requirements and obtain any necessary permits. Specific information relating to bringing materials onto your farm from off-site locations is given on Page 4.

Recommended Practices

- **Select an appropriate site.**

  The location of the compost site should allow easy access and a minimum of travel and materials handling. A firm surface to support heavy vehicles under various weather conditions is preferable. The convenience of a site must be weighed against other factors such as proximity to neighbors, visibility, drainage, and runoff control. The best site may not be the most convenient or a convenient site may need modification.

  Choose an upland site with well to moderately drained soil and a slope of 1-4% to prevent ponding or runoff. If your site is subject to surface runoff, a berm or diversion can be constructed to divert surface runoff away from your compost pile. Runoff leaving your site can be filtered through vegetated buffer strip that will reduce the velocity of your runoff and prevent sediment from moving offsite. Contact Natural Resource Conservation Service (NRCS) for assistance in developing your compost site.

♦ Promote optimal composting conditions.

Composting is most rapid when conditions that encourage the growth of microorganisms are established and maintained.

• Organic materials are appropriately mixed to provide the nutrients needed for microbial activity and growth, including the proper carbon-to-nitrogen (C:N) ratio.

• Appropriate oxygen levels are maintained to support aerobic organisms.

• The material is moist, but not saturated, to permit biological activity without hindering aeration.

• Temperature is high enough to encourage vigorous microbial activity from thermophilic (heat-loving) organisms.

Table 1 lists the recommended conditions for rapid composting.

♦ Include a high nitrogen source in your recipe.

To compost cranberry leaves, you need to add a moist, high-nitrogen source, which helps to establish a reasonable carbon-to-nitrogen (C:N) ratio. On-site demonstration cranberry leaf piles at the Cranberry Experiment Station were successfully composted when hydrolyzed fish waste (obtained from a local distributor) was added as a nitrogen source. A recipe using 10:10:1 or 10:10:2 ratios of cranberry leaves:horse bedding and manure:liquid fish fertilizer was capable of producing temperatures within the reasonable range (110-150°F) for 20-30 days. Both recipes prevented the germination of several common cranberry weed seeds (see Table 2). Other researchers have reported similar results (Eghball and Lesoing, 2000).

Continued experimentation by researchers and growers will most likely yield other suitable amendments.

♦ Proper blending of feedstock materials facilitates the composting process.

The proper initial mixture can be achieved by adding the feedstocks (in the proper proportions) to a manure spreader, feed wagon, or by utilizing a loader or backhoe.

If a well-constructed pile, made with a good recipe, is maintained at the proper moisture and is thoroughly blended, a static compost pile (see Figure 1) should need to be minimally turned. If conditions are just right, the pile may not need to be turned at all until the composting process is complete. A properly blended mixture will allow air and moisture to move uniformly through the pile allowing the microbes to do their job.

Table 1. Recommended conditions for rapid composting (from: On-farm Composting Handbook, p. 7.)

Condition	Reasonable range[z]	Optimal range
Carbon to Nitrogen (C:N) ratio	20:1-40:1	25:1-30:1
Moisture content	40-65%	50-60%
Oxygen concentration	greater than 5%	Much greater than 5%
Particle size (diameter in inches)	1/8-1/2	varies[y]
pH	5.5-9.0	6.5-8.0
Temperature (°F)	110-150	130-140

[z] Recommendations for rapid composting. Conditions outside these ranges can also yield successful results.
[y] Depends on the materials, pile size, and/or weather conditions.

Table 2. Percentage seedling germination of weed seeds placed in various cranberry leaf compost recipes[z].

		Percentage germination			
Seed	**No. planted**	**Potting soil**	**20:0:0**	**10:10:1**	**10:10:2**
Common goldenrod	200	5	0	0	0
Dodder	200	4	2	0	0
Lurid carex	100	2	17	0	0
Narrow-leaved goldenrod	100	10	2	0	0
Nut sedge	200	13	8	0	0
Poison ivy	50	26	30	0	0
Switchgrass	100	6	0	0	0

[z] Unpublished data from Sandler, Mason, Shumaker, and Caruso (UMass Cranberry Station).

- **Strive to achieve a balanced C:N ratio.**

Microorganisms use carbon for energy and nitrogen for protein synthesis and reproduction. It is important to provide these nutrients in the appropriate proportions. The optimum C:N ratio is in the range of 25-30:1 (see Table 1). Tested cranberry leaves fell in the range of approximately 35-40:1. The horse manure/bedding material used in the test piles had a C:N of 55:1. These values are certainly acceptable and will give good results.

Materials will release their carbon at different rates and this will affect the composting process. For example, straw releases its carbon more quickly than woody materials (that contain lignin, such as stems and cranberry leaves), but more slowly than the simple sugars found in fruit wastes.

See Table 3 for a list of common raw materials used in composting and their associated C:N ratios.

- **If using new or innovative materials, consider analyzing the materials prior to use.**

Commercial laboratories are available that will analyze raw materials as well as finished compost. If you are using materials from a new or unknown source, the lab analysis may provide you with valuable information. Most labs test for bulk density, C:N ratios, pH, moisture content, and other indicators of a material's potential as a successful compost pile ingredient.

- **Composting trash piles should be well aerated.**

This is particularly important in the initial stage of the process when oxygen demands are the highest. The most readily degradable raw materials are rapidly metabolized in the beginning and the microbes performing these activities need oxygen. If the supply of oxygen becomes limiting, the composting process slows. Therefore, it is most critical to monitor the pile in the beginning to insure that the most favorable conditions (adequate oxygen, moisture, and temperature) prevail.

Consider adding a 6” or 8” perforated pipe to the base of the pile (see Figure 1). A perforated pipe will encourage air movement through the pile and act as a drain for excess moisture. If water is coming out of the pipe, the pile is too wet.

- **Regularly turn the compost pile.**

Consistent turning exposes all of the raw materials to the high internal temperatures. This permits the breakdown and conversion of the materials into a useable product. Regular turning promotes aeration.

- **Consider adding a bulking agent.**

On farms, a composting recipe usually contains a blend of materials. Bulking agents provide structure so that the material can stay in the pile without collapsing (provides aeration). Bulking agents increase pore space needed for air movement. Since cranberry leaves are so small, bulking agents (such as horse manure with bedding) are recommended.

If you have the bulking material on your farm, you can compost according to the Department of Food and Agriculture (DFA) guidelines, without registering with the DFA. If you need to bring in material from outside your farm, you need to register with the DFA (see following information).

- **If you need to bring in any bulking materials from off the farm or will be receiving fruit or leaves from another farm, you must register with the Department of Food and Agriculture as part of an agreement with the Department of Environmental Protection (DEP).**

In order to register, an application must be submitted to DFA. The application can be found in the Department's Guide to Agricultural Composting. To receive a guide, contact Craig Richov (DFA) 508.792.7711, x14 or the Cape Cod Cranberry Growers' Association (CCCGA) at 508.295.4895. The publication gives detailed explanations about what a grower would need to do. The application asks for information about acreage, land uses, vegetative buffers, and more. Growers may also join together to register as one composting unit.

Table 3. Summary of common raw materials that can be used for on-farm composting (from: On-farm Composting Handbook, p. 16.)

Material	C:N
Bark (hardwood)	110-435
Corrugated cardboard	560
Cattle manure	11-30
Corn stalks	60-75
Cranberry (leaves and stems)	35-60
Cranberry presscake	30-40
Finished compost	25-30
Fish processing wastes	2.5-5
Fruit wastes	20-50
Grass clippings	9-25
Hay	15-32
Horse manure	22-30
Leaves	40-80
Newspaper	400-850
Paper mill sludge	54
Poultry manure	7-10
Sawdust and shavings	200-750
Seaweed, other aquatic plants	5-27
Straw	50-150
Swine manure	9-19
Vegetable wastes	11-13
Wood chips (hardwood)	450-820

- **In most cases, water should be added to the cranberry leaf pile.**

Moisture is necessary to support the microbes that perform the composting activities. If the moisture content is below 15%, microbial activity will cease. Optimal moisture content is between 40-65%. Below 40%, microbial activity slows; above 65%, anaerobic conditions predominate.

A simple "squeeze" test gives a good estimate of a pile's moisture content. The material should feel damp to the touch with just a drop or two of liquid expelled when the material is squeezed tightly. If the pile is too wet, turn the pile. Adding dry materials may be helpful. If the pile is too dry, it can be rewetted with a trickling hose or similar device.

During field trials, water was added to the piles after the ingredients were initially mixed together. If rainfall is insufficient, additional water may be needed periodically (every 2-3 weeks). Monitor pile temperatures. A drop in temperature indicates decreased microbial activity. This may be due to lack of moisture.

Covers (e.g., burlap, tarps, non-spun row covers) can be used to maintain moisture.

- **Monitor pile temperatures.**

Probes should be used to check temperatures every few days. Many companies sell probes that can be successfully used in active compost piles. Consider monitoring the interior portion of the pile as well as the exterior. Depending on the size of the pile, use a probe with a 2 to 4-foot stem for monitoring interior temperatures. Probes with one-foot stems should be adequate for exterior pile measurements.

- **Make piles the correct size to encourage the compost process.**

  Piles less than 3.5 feet tall may fail to heat. On the other hand, piles taller than 8 feet or wider than 20 feet may overheat (temperatures exceed 150°F). Piles that are too large may become anaerobic, and therefore, excessively odorous.

  Identify the machine that you will be using to turn your piles and adjust the size of the pile accordingly.

- **Monitor the odors emanating from the pile.**

  Temperature and odor are probably the most important indicators of how well composting is progressing. Some odor is to be expected. However, if putrid odors persist, the pile has probably become anaerobic and needs to be turned.

- **Minimize odor concerns by properly managing the site.**

  Anaerobic conditions promote foul-smelling odors. To avoid problems with odors, use a good mix of materials, avoid overly wet mixes, monitor temperatures, and turn or aerate piles regularly.

  A key to minimizing odors is to start composting your raw materials as soon as possible and then keep them aerobic.

  Odors can be controlled by the choice of raw materials. For example, a layer of peat moss or finished compost can be placed on top of a composting pile to trap odors. Mixes with large amounts of sawdust, compost, or peat moss can help absorb odors coming from other ingredients.

  Build or use a site with a crown (~3%) to promote surface runoff. Puddling rain water promotes odors and inhibits your ability to properly work the pile.

- **Keep the site well drained.**

  Good drainage at a composting site must be a priority. Locate the site on moderately to well drained soil. Ideally, the site should have not have rocks. These can get mixed into the composting materials and damage machinery. If mud could be a potential problem, consider resurfacing the composting pad with gravel or sand.

  Consider sloping the site (1-4%) to facilitate water run-off.

  The site should be graded for handing surface runoff without creating erosion. Runoff, if needed, can be directed towards pasture areas, an infiltration area, or collected in a holding pond for later use. Runoff should be diverted away from the compost pad and storage areas.

- **Determine when the composting process has finished.**

  A sustainable drop in temperature is probably the most reliable indication that active composting has been completed. Failure to reheat after turning is also another indication that the compost has proceeded to the point that it can be cured. However, be sure that the lower temperature is not due to the lack of moisture or similar factors. This can be checked by placing a small sample in a sealed plastic bag at room temperature. If the compost does not emit a foul smell within one week, it can be considered stable.

  Commercial kits are also available from certain laboratories (see "For further information").

- **Use finished compost around the farm.**

  Finished compost can be used in many areas around the farm. Consider using compost as a dressing on sandy dikes to facilitate the establishment of grass cover.

  If enough finished material has been generated, it may also be used as part of the organic layer in the lining of new bed construction.

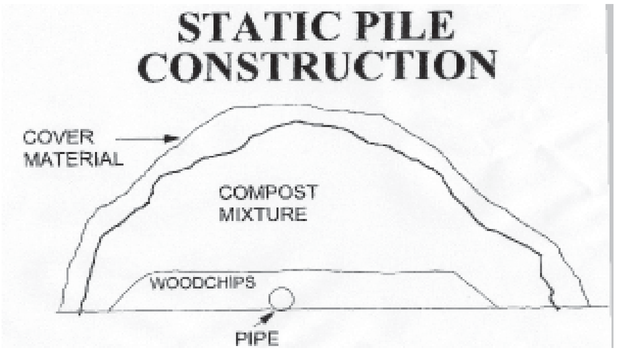

Figure 1. Diagram of a static pile construction with a perforated pipe insert.

Portions of this text were excerpted from:

On-farm composting handbook. 1992. Editor: R. Rynk. Natural Resources, Agriculture, and Engineering Service. Cornell Cooperative Extension, Ithaca, NY. NRAES-54. 186 pp.

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For further information:

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Cranberry Disposal Guidelines. 2000. Cape Cod Cranberry Growers Association Grower Advisory. Wareham, MA. Reference for fruit disposal and fruit composting.

Dickson, N., T. Richard, and R. Kozlowski. **Composting to reduce the waste stream-A guide to small scale food and yard waste composting.** Natural Resources, Agriculture, and Engineering Service. Cornell Cooperative Extension, Ithaca, NY. NRAES-43. 44 pp.

Dougherty, M. 1999. **Field guide to on-farm composting.** Natural Resources, Agriculture, and Engineering Service. Cornell Cooperative Extension, Ithaca, NY. NRAES-114. 118 pp.

Composting Program, Department of Environmental Protection. Contact: Sumner Martinson, Director, 1 Winter Street, Boston, MA 02108. 617.292.5969.

University of Maine Cooperative Extension Composting School. Multi-day workshop. Contact: Neal Hallee, Waste Management Specialist, 5741 Libby Hall, Orono, ME. 207.581.2722.

University of Maine Composting School Web Site. http://www.composting.org. Ask questions on-site and a Compost Team member will respond.

University of Massachusetts Soil and Plant Tissue Testing Lab. Compost analysis. West Experiment Station, Amherst, MA 02001. 413.545.2311.

Woods End Research Laboratory, Inc. Old Rome Road, Box 1850, Mt. Vernon, ME 04352. 207.293.2457. Lab analysis and suppliers of Solvita test kits for determination of finished compost.

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