Resource Conservation Manitoba
A non-profit centre for applied sustainability

Testing and Monitoring

Because composting relies on biological processes to accomplish the breakdown of organic material, it cannot be switched on or off like a mechanical system. The best approach to ensure a high-quality end product is a proactive management strategy: being familiar with the characteristics of incoming feedstocks, monitoring the composting process, and testing the final product.

Key Concepts

In order to optimize a composting facility's operation, useful information can be collected at three stages of the process:

- **incoming feedstocks**
- **active composting of feedstock mix**
- **final product**

Depending on the capability of your on-site testing facilities, some of these tests may best be handled by an independent laboratory; others are simple to perform on-site. The results of all tests, whether performed by facility staff or off-site lab, should be systematically recorded so that particular batches of compost can be identified and tracked. Accurate record-keeping can provide valuable insight if a specific mixture develops problems. A log of test results can also form a key part of your operations log, a detailed record of daily management that can provide proof of responsible facility operation.

Incoming feedstocks

The primary purpose in testing incoming feedstocks is to identify the characteristics of the material you will be working with. This information will help you to make informed management decisions on the most balanced recipe mix you can produce and the final product you can expect. Whether a facility is receiving batches of variable material or a continuous supply of a consistent feedstock, knowing the materials' physical and chemical characteristics is vital to successful processing decisions.

Manitoba Conservation

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Information drawn from
The Composting Council of Canada's website
http://www.compost.org/ccc_alberta_factsheet.html

COMPOSTING Council of Canada
Conseil canadien du COMPOSTAGE

Examples of feedstock tests Canadian operators have found helpful include:

- **carbon : nitrogen ratio (C:N)**
- **trace element levels**
- **pH and electro-conductivity**
- **moisture content**
- **specific contaminant check, if the feedstock type is subject to problems**

These characteristics can be used to determine if the material is one you wish to accept at your facility—some materials with high levels of trace elements, for example, can result in composts which exceed the limits set in the national quality standards for compost that can be applied to land.

Other characteristics aid in "recipe" formulation, allowing operators to blend different materials together to create a mixture whose characteristics fall within the recommended limits [see *Recipe Formulation* in Useful Tools].

If the processing leachate is being collected and used to re-wet the composting material, checks on the leachate's trace element content will help you avoid concentrating undesirably high levels of problem elements into your finished product.

Composting Material

Once the material is mixed and composting is underway, measurements can be taken to monitor the actual process. Temperature, moisture content, and oxygen levels can inform decisions on composting activities such as turning, aerating, or adding moisture. These tests can be performed quite simply on site, giving quick feedback—from minutes for temperature or oxygen to overnight for moisture content.

Temperature: The rise in temperature in a composting mass is the result of heat given off by the micro-organisms as they break down the material. Temperature is simple to measure and the equipment is relatively inexpensive—though it does not give specific information on which factors may be out of balance (C:N ratio, moisture, or oxygen), it provides a quick check on how active the composting process is (see Temperature, Useful Tools).

Equipment commonly in use to monitor compost temperature in Canadian facilities includes stainless steel probes attached to either a mechanical dial or to a computerized reader, and thermocouples connected to either a hand-heal reader or a centralized computer. Some systems are left in place between compost turnings, while others are inserted and removed for each set of measurements. Whatever type of equipment is chosen, temperature should be measured in the center of the composting mass: the outside or top layer is likely to be both drier and cooler, and so is not representative of the majority of the material. Probes should be inserted deep into the material and given time to stabilize before readings are recorded.

Temperature pattern	Possible cause	Management options
Temperature failing to rise	▪ Material too dry ▪ Material too wet ▪ Insufficient nitrogen ▪ Air temp too low	▪ Check moisture content; add moisture ▪ Mix in dry material; spread material out to dry ▪ Check C:N ratio; mix in feedstock high in nitrogen ▪ Insulate: use larger piles or add a "blanket" of finished compost; wait for warmer weather
Temperature exceeding 65^0C	▪ Process overactive: composting will be less effective; risk of fire.	▪ Introduce air to material: turn, aerate ▪ Add moisture if material is drying out ▪ Add carbon source if C:N ratio is low

Moisture: moisture can be measured accurately at any stage of the composting process using the 24-hour drying method [see Moisture content measurement—procedure in Useful Tools]. Once a mixture is actively composting, a basic squeeze test is often enough to reassure the operator of sufficient moisture for effective breakdown: squeeze a handful of the material tightly in your fist. The material should feel like a wrung-out sponge, releasing at most only a few drops of moisture.

Finished Product

Finished product testing can provide reassurance that your product meets Canadian composting product standards with regards to trace element levels, foreign matter content, maturity, and pathogen destruction [see *National Standards* in Useful Tools]. Testing can also go beyond these basic measurements of product safety to provide a dynamic marketing tool—knowing your finished product's agronomic capabilities can help you target the end users of your compost, as they are often looking for specific product characteristics to enhance their plantings. Tests which Canadian facility operators and compost marketers have found helpful include:

1. **<u>Product safety/national quality guidelines</u>:**
   - **trace element content**
   - **foreign matter content**
   - **maturity**
   - **pathogen testing**

2. **<u>Agronomic capabilities</u>:**
   - **total fertilizer value (N, P, K)**
   - **total organic matter content (%)**
   - **water-holding capacity, especially in arid regions**
   - **electro-conductivity**
   - **growth trial results with particular crops as appropriate to your market area (e.g. turfgrass, field crops, orchard crops, etc)**
   - **pH**

note: these critical characteristics are measured under the Compost Quality Alliance (see below).

QUALITY ASSURANCE AND CUSTOMER CONFIDENCE

Compost Quality Alliance program, launched by The Composting Council of Canada in 2005, provides a way for compost producers to assure customers they are getting the best possible product for their projects. This voluntary program focuses on end product qualities—established through regular standardized testing at certified labs—that ensure not only environmental safety but agronomic capabilities, allowing consumers to match product characteristics to their needs. For more information on this national industry initiative, contact The Council at 1-877-571-GROW (4769) or through their website at www.compost.org

USEFUL TOOLS

Recipe formulation:

http://compost.css.cornell.edu/calc/simultaneous.html [contains spreadsheets]

Temperature:

http://compost.css.cornell.edu/monitor/monitortemp.html

Moisture content measurement—procedure:

http://compost.css.cornell.edu/calc/moisture_content.html [first step can be used at any stage during composting to determine moisture content].

National Standards

http://www.ccme.ca/publications/newpublications.html CCME Compost criteria

http://www.composting.ca/regulations.html Regulations across Canada

ADDITIONAL INFORMATIONAL LINKS

The Composting Council of Canada: http://www.compost.org

Composting.ca (a Manitoba-based resource site): http://www.composting.ca/

US Composting Council: http://compostingcouncil.org/index.cfm

Cornell Composting: http://compost.css.cornell.edu/Composting_homepage.html

US Environmental Protection Agency Composting: http://www.epa.gov/compost/

The Composting Association of the UK: http://www.compost.org.uk/dsp_home.cfm

Washington State University Compost Connection: http://csanr.wsu.edu/compost/

Compost Education and Resources for Western Agriculture: http://www.aste.usu.edu/compost/

Recycling and Composting Online: http://www.recycle.cc/