Cornell Waste Management Institute

Department of Crop and Soil Sciences
Cornell University

Rice Hall • Ithaca, NY 14853
(607) 255-1187

E-mail: cwmi@cornell.edu
http://cwmi.css.cornell.edu

COMPOST QUALITY FACT SHEET #4:

Testing Composts

COMPOST FACT SHEET SERIES 2004/2005

For these fact sheets and other compost information: http://cwmi.css.cornell.edu/Composting.html

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Marketing Composts and Meeting Consumer Needs

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Cornell Waste Management Institute Staff:
Ellen Z. Harrison, Director
Jean Bonhotal, Sr Extension Associate
Mary Schwarz, Research Support Aide
Lauri Wellin, Program Aide

Testing compost is key to understanding its characteristics.

Overview

There are two situations in which a compost manager should have their product tested: 1) If certification is being sought; and 2) If the composter wants information for consumers or for themselves. Testing compost is important because many consumers need to know the characteristics of a product before using it. Fact Sheet #1 in this series describes the variety of different end uses for compost. Testing is also important to producers who want to use results to identify changes in management that might be desirable (see Fact Sheet #3) or to monitor changes in the compost product. Testing can also help the producer address customer questions or complaints.

Table 1

Compost Parameter	Typical NYS Range		Description
PHYSICAL PROPERTIES	**Dairy***	**Poultry****	
Water holding capacity (%)	88-243	88-173	The amount of water that can be retained by compost and is available to plants.
Organic matter (%)	18-70	24-54	Material in compost that came from, or is, living matter and is composed of plant residues, microorganisms, and humus. Organic matter can often be used to determine the extent of decomposition in a compost pile. Very low organic matter may indicate heavy mixing of non-organic soil matter.
Carbon to nitrogen ratio (C:N)	11-19	4-16	A value obtained by comparing total carbon to total nitrogen. This value is one of several factors used to measure the rate of compost decomposition, though it should never be used as the only indicator.
Density (lb/ft^3)	38-58	30-60	Provides a measure of how easily air and water can move through a compost pile. Lower means better flow and higher means poorer flow.
Moisture (%)	23-53	51-78	Measure of water content. Moisture content changes over time as organic matter is broken down, but ideal range is 60% to 80%.
Inert or oversize matter (%)	1-11	1-10	Any material that does not have nutritive or chemical value in compost, such as rocks, pebbles, glass, plastic, and other debris or matter.
PLANT NUTRIENTS	**Dairy***	**Poultry****	
Total nitrogen (%)	1-3	1-7	A measure of total nitrogen. This value includes both organic and inorganic forms of nitrogen in compost. In mature composts, most nitrogen should be organic, which indicates that a compost is mature.
Organic nitrogen (%)	1-3	1-7	The fraction of total nitrogen that is chemically associated with carbon in some form. In mature composts, organic nitrogen should explain most of total nitrogen presence.
Phosphorus (%)	0.2-1	0.3-2	An important plant macronutrient and mineral. In excess, a potential environmental contaminant.
Potassium (%)	0.2-2	0.3-3	An important plant macronutrient and mineral. Important for water movement into and out of plant cells.
Calcium (%)	1-6	6-15	An important macronutrient. Component of plant cell walls and enzymes.
Magnesium (%)	0.4-1	0.5-1	An important macronutrient. Important part of plant energy production from sunlight.
Nitrates (ppm)	<2-878	<2-2033	A form of inorganic nitrogen that is readily available to plants.
Nitrites (ppm)	<2-3	<2-<2	A form of inorganic nitrogen produced under certain conditions from ammonia that is toxic to plants. Elevated levels in compost may cause damage to plants.
Chloride (ppm)	137-6650	270-10471	Plant micronutrient. Important for cellular water transport and plant energy production.
Sulfates (ppm)	<4-898	55-3060	A form of sulfur, which is a plant macronutrient. Important for general plant functions.
Copper (ppm)	26-572	16-93	Plant micronutrient, but toxic to plants at elevated levels. If copper sulfate is used in agricultural settings, then compost should be tested for copper.
Iron (ppm)	1106-13886	293-10765	Plant micronutrient.
Zinc (ppm)	99-349	171-597	Plant micronutrient, but toxic to plants at elevated levels.
Ammonia	4-18	644-2347	Toxic to plants. In compost, animal excretions are a common source. A source of available nitrogen.
HEALTH CONCERNS	**Dairy***	**Poultry****	
Cadmium (ppm)	1-4	2-5	A potential health risk and potential environmental contaminant.
Arsenic (ppm)	<6.5-14	<6.5-15	A potential health risk and potential environmental contaminant.
Fecal coliforms (most probable number/gram)	<3-6580	<3-7	An indicator or relative health risk from bacteria that grow in conditions matching that of the human digestive tract. Note – Many fecal coliforms don't cause illness, but grow in similar conditions as those microbes that do.
Salmonella (most probable number/4 grams	1.2-3.0	1.0-1.1	An indicator of relative health risk. Note – only select species of *Salmonella* cause illness, and conditions must also be ideal for sickness to occur.
PLANT RESPONSE	**Dairy***	**Poultry****	
% germination	88-105	9-102	Percent of cress germinating in control vs compost (diluted to standard salinity).
% growth	57-102	12-113	Weight of cress grown in control vs compost (diluted to standard salinity). Expressed as %.
Weed seeds	0-16	0-12	Weed seeds are undesirable in gardening, potting soils, and other applications. Weed seed counts are valuable for ensuring low values.

CHEMICAL PROPERTIES	Dairy*	Poultry**	
pH	7.1-8.4	6.9-9.2	A measure of acidity. Ideal range for most plants is slightly acidic to neutral. (6.5-7.0)
Carbonates (1=low, 3=high)	2-3	3-3	Describes the buffering capacity of a compost. Also referred to as "lime."
Conductivity (mmhos)	1-8	3-22	A measure of soluble salts. Sodium, potassium, chloride, nitrate, sulfate, and ammonia may contribute to soluble salt.
Maturity (1=very immature and unstable, 8=highly mature and very stable)	4-7	1-7	A measure of compost respiration and ammonia production. A mature compost will not have highly active microbial respiration, and most ammonia will be volatilized.

References:
Woods End Research Laboratory, Inc. 2000. Interpretation of Waste and Compost Tests. http://www.woodsend.org/pdf-files/compost.pdf

* Range shown is the 10th-90th percentile values based on ~125 compost samples obtained from 20 NYS dairy operations from 2001-2004.

** Range shown is the 10th-90th percentile values based on ~35 compost samples obtained from 7 NYS poultry operations from 2001-2004.

What To Test For

A compost manager is faced with a large range of possibilities when testing. Parameters often include pH, soluble salts, organic matter content, percent solids (or conversely percent moisture), total nitrogen, water holding capacity, phosphorus,C:N ratio, maturity and density. Others may include carbonates, ammonia, heavy metals, pesticides, herbicides, bacteria (generally fecal coliform and *Salmonella*), and more**.** Some labs offer a testing package that includes a particular group of analytes.

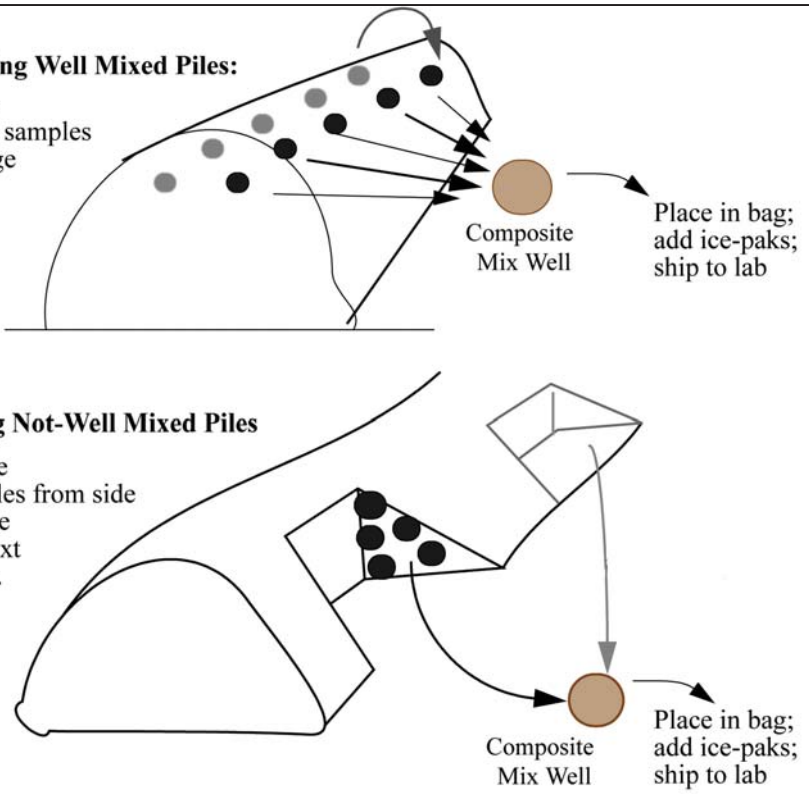
To help compost managers better understand the tests available for compost, Table 1 provides a brief definition of compost parameters, and a short explanation of why information obtained from such a test is important. It also includes data on NYS dairy and poultry manure compost obtained as part of a CWMI study. The data shows a wide range.

Table 2

STA Approved Labs Using TMECC Methods (December 2006) http://tmecc.org/sta/sta_labs.html Name	Contact
A & L Canada Laboratories 2136 Jetstream Rd London, Ontario Canada N5V 3P5 *www.alcanada.com/main.html*	Robert Deakin (519) 457-2575 *phone* (519) 457-2664 *fax* rdeakin@alcanada.com
A & L Great Lakes Labs 3505 Conestoga Dr Fort Wayne, IN 46808 *www.algreatlakes.com/lab_hom_com.asp*	Lois Parker (260) 483-4759 *phone* (260) 483-5274 *fax* lparker@algreatlakes.com
A & L Western Laboratories 1311 Woodland Ave, Ste 1 Modesto, CA 95351 *www.al-labs-west.com*	Robert Butterfield (209) 529-4080 *phone* rbutterf@AL-Labs-West.com
Ag Analytical Services Lab Penn State University Tower Rd University Park, PA 16802 *www.aasl.psu.edu*	Ann Wolf (814) 863-0841 *phone* (814) 863-4540 *fax* amw2@psu.edu
Colorado Analytical Lab 240 S Main St Brighton, CO 80601 *www.coloradolab.com*	Shane Nielson (303) 659-2313 *phone* (303) 659-2315 *fax* info@coloradolab.com
Control Laboratories 42 Hanger Way Watsonville, CA 95076 *www.controllabs.com*	Frank Shields (831) 724-5422 *phone* (831) 724-3188 *fax* frank@compostlab.com
Energy Laboratories 2393 Salt Creek Hwy, PO Bx 3258 Casper, WY 82602 *www.energylab.com/*	Jim Yocum (888) 235-0515 *phone* (307) 234-1639 *fax* jyocum@energylab.com
Louisiana State University AgCenter **ODRAL** 1300 Dean Lee Dr Baton Rouge, LA 70820 *www.lsuagcenter.com/callegari*	David Schellinger (225) 765-5155 *phone* (225) 578-2478 *fax* dschelllinger@agcenter.lsu.edu
Tarleton State University, Compost Analysis Lab Box T-0050 Stephenville, TX 76402 www.tarleton.edu/~dweindorf/weindorf%20compost.htm	David Weindorf (254) 968-9298 *phone* (254) 968-9228 *fax* weindorf@tarleton.edu
Woods End Research Laboratory, Inc. 1850 Old Rome Rd Mt. Vernon, ME 04352 *www.woodsend.org*	Will Brinton (207) 293-2457 *phone* (207) 293-2488 *fax* compost@woodsend.org

What Laboratory to Use

Compost testing requires special consideration. Testing compost is not the same as testing soils or manure, and the US Composting Council (USCC) has published a standardized set of methods for compost testing. The program is called Test Methods for the Examination of Composting and Compost (TMECC). The USCC also has a laboratory certification program as part of their Seal of Testing Assurance (STA) Program. Not all qualified labs are enrolled, but these labs may be a good option, since oversight is provided (see Table 2). If you choose not to use an STA-certified lab, at least make sure TMECC methods are used. This will ensure compost samples are analyzed using established methods.



A. Well Mixed Piles: Take 8 sub-samples each from each side of pile; mix well in bucket and remove 1 gallon and ship to lab with ice packs.

B. Not Well-Mixed Piles: Cut cross-section with loader; take 6 sub-samples each from side-wall of cut; repeat operation at 3-5 other locations; remove 1 gallon and ship to lab with ice paks.

Figure1. Material Sampling schematic.

Courtesy of Woods End Research Laboratory, Inc. 2004

How To Sample

No matter what compost is tested for, it is very important that the results represent what is actually in a compost pile or finished product.

Collecting a single grab sample or bucket full of compost at one location in the pile will not be "representative" of the entire pile. CWMI recommends that each sample submitted to the laboratory be a composite – or mixture – of at least 16 sub-samples taken from throughout the pile. See Figure 1 for details.

Generally, the more samples submitted the better; at least two are recommended. Submitting one sample does not give a sense of variation within the compost pile, and compost can be highly variable. Using data from at least two samples provides a better sense of the range of possible values a product will have. The number of samples needed depends on the variability and the degree of confidence desired in the results.

Cross-contamination of samples must be avoided, especially when compost samples will be tested for bacteria. CWMI recommends the following guidelines to maintain sample integrity:

1. Use a bucket or other container of suitable volume, lined with a clean heavy-duty garbage bag, to collect each sample. Using a clean bag every time eliminates the hassle of washing buckets after each sample. Garbage bags also provide an easy way to mix samples well before packing for shipment.

2. Always start at the base of a pile and work upward when collecting compost sub-samples to avoid unintentional contamination by shoes.

In addition to these guidelines, it is very important to properly ship compost samples being tested for

microbes in a timely manner. Always call the lab in advance to be sure they are prepared to receive your samples. Always pack compost in insulated containers with ice packs to prevent bacterial growth during shipment. (Water frozen in plastic beverage bottles can be used to keep samples cool).

For an overview of these guidelines, visit:

http://compost.css.cornell.edu/market-label/guidelines/home.htm

When To Test

The best times to test depends on the purpose. Testing of feedstocks and testing during the composting process can help a producer determine an appropriate mix or make process modifications. Prior to marketing, the best time to test compost is when the product is "finished." "Finished" will have a different meaning to different people and for different uses. It is the point when the compost manager feels that a product is ready for intended use and reflects the product being offered to consumers. Technically, fully finished compost has reached the point when it is no longer thermophilic and it has gone through sufficient curing to be stable and mature.

Understanding Test Results

The interpretation of compost test results depends in part on the intended use. A compost that might be acceptable in an agricultural setting may not be appropriate for use as a component of potting mix. Therefore, the best way to interpret test results is by working closely with consumers, or learning what characteristics are most important, to see if a compost will suit its intended use. Professional help in interpreting results may be available through the laboratory providing the analyses or by qualified consultants.

Guidelines are also available through a variety of organizations. These suggestions may help compost producers and consumers gain a better sense of what is desirable for particular end uses.

Acknowledgement

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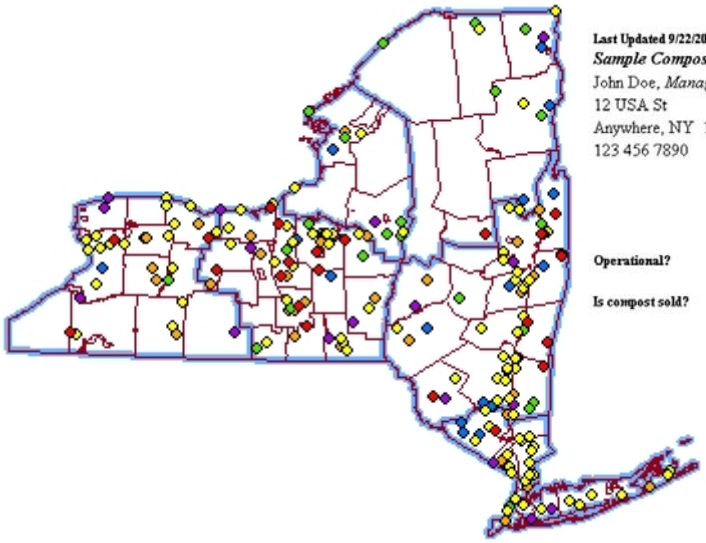
Maps of a database of NYS Compost Facilities can be accessed at: http://compost.css.cornell.edu/maps/simple-search.asp (see example below).

New York State Compost Facilities Search



Last Updated 9/22/2004
Sample Compost Site
John Doe, *Manager*
12 USA St
Anywhere, NY 12345
123 456 7890

Operational? yes

Is compost sold? no

Select a map to view facilities

All Compost Facilities
Yardwaste Composts
Manure Compost Facilities
Foodscrap Compost Facilities
Biosolids Compost Facilities
Compost Research Farms
Small Scale Compost Demonstration Sites

Compost Facility Search Results

Feedstocks		
Leaves	yes	Paper Products
Grass	yes	Floral Waste or Plant Trimmings
Brush and Branches	yes	Animal Manures
Logs, Stumps other Wood		Sewage Sludge
Pre-consumer Food Waste	yes	Paper Sludge
Post-consumer Food Waste	yes	Other Materials

Composting Method? windrow piles

Is compost free? yes
If yes, to whom? residents

Option #2

Select a county from the list below

None Selected

*Click "Submit" to send request

Submit

Composting Resources:

- **Farm-Based Composting: Manure & More - http://www.nraes.org/publications/nraes150.html**
- **Natural Rendering: Composting Livestock Mortality & Butcher Waste:**
  Fact Sheet - http://compost.css.cornell.edu/naturalrenderingFS.pdf
  Video - http://www.nraes.org/publications/nraes163.html
- **Co-Composter: http://compost.css.cornell.edu/CoCompost.html**
- **Compost...because a rind is a terrible thing to waste - http://compost.css.cornell.edu/FoodCompostpr.html**

For other composting resources see the CWMI web site at: http://cwmi.css.cornell.edu/Composting.html