

# Compost Maturity

*Compost maturity is so important to product performance that it was chosen as one of the parameters for determining the grade of compost in Canada. Immature compost may stunt, damage, or even kill plants, rather than enhancing their growth. Maturity is not equivalent to quality, but indicates to what stage in the composting process the material has progressed.*

## Key Concepts

**Mature compost** is material in which biological activity has slowed. All of the easily degraded molecules have been broken down, leaving the complex organic material behind. It is difficult to identify the original feedstock materials. A fine texture, dark colour, and a rich earthy smell often characterize mature composts.

As organic material composts, large complex molecules are broken down in a series of steps. The final products are simple, stable molecules which make up the humus-like matrix of nutrients and organic matter that we call compost. While this finished product is very beneficial to plants, some of the intermediate stages may **temporarily** produce compounds, such as organic acids, that can be harmful to plant growth. **This is why even compost made of high quality materials that is applied too soon to lawns or gardens may appear to “burn” leaves, stunt growth, or even kill sensitive plant species.**

**Immature composts** continue to break down once they are incorporated into the soil. This can affect plant health by consuming or tying up two resources that growing roots need. The high level of microbial activity in unfinished compost requires a large intake of **oxygen**, and the microbes may pull this from the surrounding soil, essentially suffocating the roots. The high carbon to nitrogen ratio (C:N ratio) of immature compost also means that, as the carbon compounds continue to break down, microorganisms will draw on **soil nitrogen** to assist in the process, leaving the root zone temporarily nitrogen-poor.

It is therefore crucial that responsible compost producers ensure that their compost has time to fully mature before selling it to most customers [see note on Bioactive Compost below], **as compost that is still “hot” when it is applied can do serious damage to both customers’ plantings and your reputation!**



## Establishing Maturity

The CCME guidelines [see *Guidelines* in Useful Tools] offer three ways of establishing compost maturity. These methods all attempt to confirm that the composting process has actually run its course rather than simply stalling due to lack of either nitrogen or moisture. The first two methods are best measured in a professional laboratory and require a compost sample that is properly collected and shipped. The third method can be done on-site but requires diligent monitoring of the composting material to ensure that ideal conditions are maintained, since compost which is not reheating due to lack of moisture or insufficient nitrogen is cannot be considered mature.

**TABLE 1: CCME Guidelines for Compost Maturity**

Required Tests of Compost Maturity (Compost must be cured* for a minimum of 21 days, and must conform to <u>one</u> of the following three requirements)	Significance
1. Oxygen uptake less than or equal to 400 mg O <sub>2</sub> /kg organic matter/hour.	Like humans, aerobic microbes consume oxygen and release carbon dioxide when they are active, and the rate of these processes slows as the material approaches maturity.
2. Carbon dioxide produced at a rate less than or equal to 4 mg carbon in the form of CO <sub>2</sub> /g organic matter/day	(as above)
3. The composted material will reheat to less than 8°C above ambient (surrounding air) temperature.	Microbial activity produces heat. When pile is no longer heating up, even though sufficient moisture is present, the level of microbial activity has dropped.

\* The conditions of the curing pile “must be conducive to aerobic biological activity”—that is, there must be sufficient oxygen and moisture to allow microbial activity to continue.

In addition, there are several on-site methods for **estimating** maturity that can be used prior to submitting samples for lab testing. Like temperature, these methods can be useful in tracking the progress of composting materials, but these methods do not fulfill the maturity requirement on their own.

**TABLE 2:** Options for estimating compost maturity

Tests to Estimate Compost Maturity	Significance
1. Germination of cucumber or tomato seeds in compost equal to more than 90% that of control sample, <i>and</i> plant growth rate in soil/compost mix not less than 50% that of control sample.	Cucumber ( <i>Cucumis sativus</i> ) and tomato ( <i>Lycopersicon esculentum</i> ) seeds are sensitive to phytotoxic (plant-damaging) substances like the organic acids temporarily present in immature composts.
2. Compost must be cured* a minimum of 21 days and organic matter must be reduced by at least 60% by weight.	As composting progresses, water vapour and carbon dioxide are given off, resulting in a lighter, denser product.
3. Use a Solvita® kit according to manufacturer's instructions. ( <i>Available from Woods End Laboratories, <a href="http://www.woodsend.org/aaa/solvita.html">http://www.woodsend.org/aaa/solvita.html</a></i> )	Test measures both carbon dioxide and ammonia given off by composted material—estimate of maturity is complete in four hours.

## Stability

The term stability is often used interchangeably with maturity. They are not really equivalent, however, and you must be sure you are assessing maturity, rather than simply stability, when monitoring your own process.

**Maturity:** biological activity has slowed, as most remaining molecules are difficult to break down any further.

**Stability:** biological activity has slowed, but this may be due to a variety of factors—the material may be mature, or it may lack adequate nitrogen or water for the process to continue. In this case, if the missing factors are added, biological activity will resume at active levels.

## Bioactive Compost

There are some applications where a less mature product is actually preferable. These include such projects as biofilter construction and landfill daily cover, where the high level of biological activity in the compost is desirable since it provides enhanced air filtering capability. And while sensitive plant species and seedlings require a high degree of maturity, other plants, such as many field and row crops,

orchards, pastures, and turf, are more tolerant of a compost's continuing biological activity. This can be an advantage to compost producers as it allows some compost to be sold more quickly, and alternatively may provide a value-added market opportunity for very mature compost which requires extra time to finish.

## Useful Tools

Guidelines: <http://www.ccme.ca/publications/newpublications.html>

National Standards: <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](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](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/>

**For further information, contact Resource Conservation Manitoba's *Compost Action Project***

**Toll-free in Manitoba: 1-866-394-8880 or (204) 925-3776**

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