FACTSHEET
Poultry Litter Composting For Food Safety & Soil Nutrient Management

Prepared by E.E. Milligan, W.D. Temple, and A.A. Bomke
Faculty of Land and Food Systems, University of British Columbia, Vancouver, BC

Why Compost?

Composting kills pathogens and weed seeds, improves characteristics for land application, stabilizes the nutrients, and is required under the certified organic regulations for livestock manures used on crops for human consumption.

Composting Requirements

Important: Compost pile management must result in temperatures of **>55ºC**. The pile must be turned no less than five times over a period of no less than 15 days during this high temperature period to ensure complete pathogen and weed seed reduction.

Recipe for Successful Composting

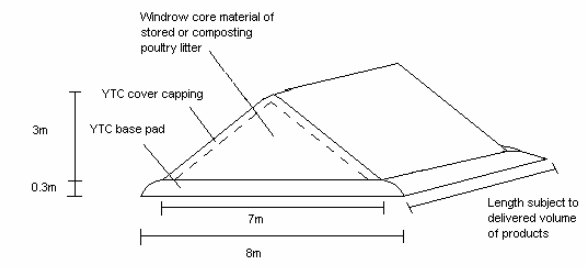
In order for the compost pile to heat up above 55ºC the correct balance of carbon, nitrogen, oxygen and water are required. To achieve this you should:

- Begin with a mixed feedstock carbon/nitrogen (C/N) ratio of 25 to 30.
  - Poultry litter has a C/N ratio of approximately 10 to 15. Thus, you will need to mix in a high C feedstock, such as horse bedding rich in straw, wood chips, fruit rind, etc.
- Begin with a moisture content of 35 to 50% (when squeezed it feels like a damp sponge)
  - This may require adding water or allowing rainfall to dampen dry poultry litter or other feedstocks prior to turning. Also, fresh delivered poultry litter will quickly heat up on its own and loose moisture rapidly.
- Once you establish a consistent feedstock supply, have it analyzed periodically by an analytical laboratory to determine your exact C/N ratio and moisture content.
- Thoroughly mix the feedstocks to ensure adequate homogenization and aeration.
- Construct a windrow of no more than 7m wide and 3m high, length may vary.
- Monitor the core temperature (80 cm into pile at waist height) of the pile.
  - The pile temperature will drop immediately after turning and then quickly rise again from the outside edge into the core. Once the core temperature has reached 55ºC wait 2-3 days and then turn the pile again.
- Repeat the turning procedure 5 times over a period of 2-3 weeks.
- Cure the compost for at least 6 weeks and cover from intense over-winter rainfall to avoid runoff to any surrounding waterways and/or ditches.
  - Over-wintered windrows must be located at least 30m away from waterways/ditches.

Recommendations for Temporary Field Storage of Poultry Litter Compost

- Each year, compost and store poultry litter on a ≈30 cm thick base pad of City of Vancouver yard trimmings compost (YTC); and do not reuse the YTC base pad for subsequent storage
- Cover the poultry litter with a tarp or a 15-20 cm thick layer of YTC
- Timing → be sure to shape the pile into a windrow and cover it by early October, prior to the onset of the heavy fall rains, when the soils are still trafficable

WINDROW MODEL WITH YTC BASE PAD & COVER CAPPING

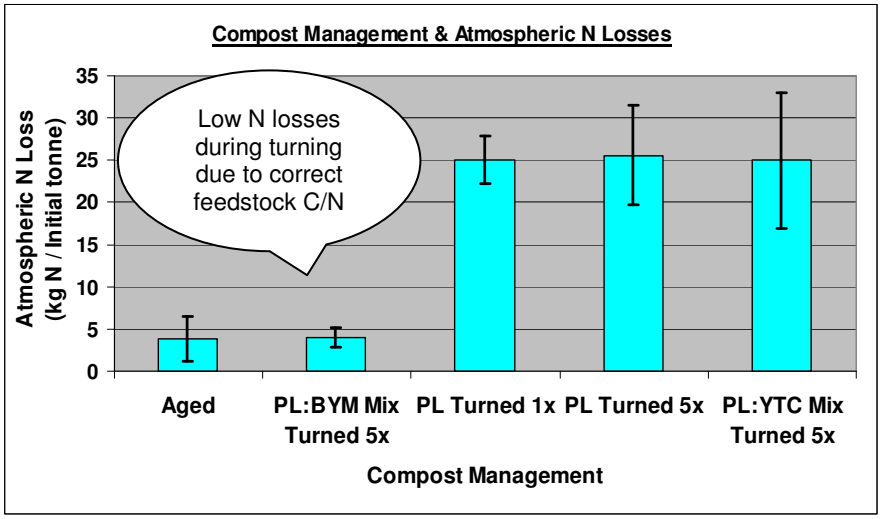


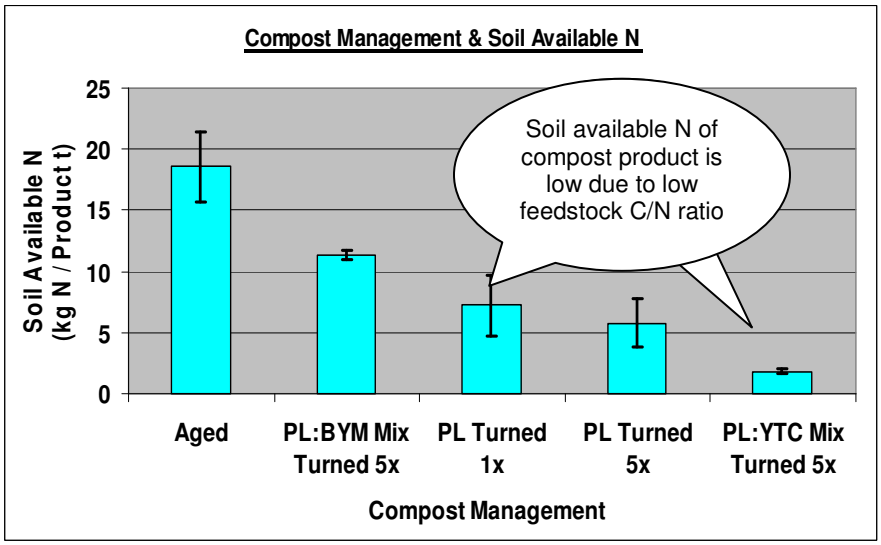
Typical Carbon and Nitrogen Analyses of Some Compost Feedstocks

	Fresh Poultry Litter (PL)	Municipal Yard Trimmings Compost (YTC)	Barn Yard Horse Manure (BYM)	Straw (Wheat)	Wood Waste
Total % C	32	28	38	56	>20
Total % N	3.7	1.6	0.9	0.4	<0.1
C/N Ratio	9	17	42	140	>200
% Moisture	25-33*	50	60	ND**	ND

*Broiler Litter = 25% moisture, Turkey litter = 33% moisture

**ND - indicates no data





C/N Ratio

The two graphs show the effects of C/N ratio on N losses during composting. Poultry litter has a low C/N ratio and thus experienced very high gaseous N losses when composted on its own (upper graph). When PL was mixed with a high C material, namely barnyard horse manure (BYM) (60:40 PL: BYM) the initial C/N ratio was increased and N losses during composting were decreased. This resulted in higher concentrations of soil available N in the finished PL: BYM compost as compared to the PL alone compost (lower graph).

Temperature

Common pathogens present in livestock manure

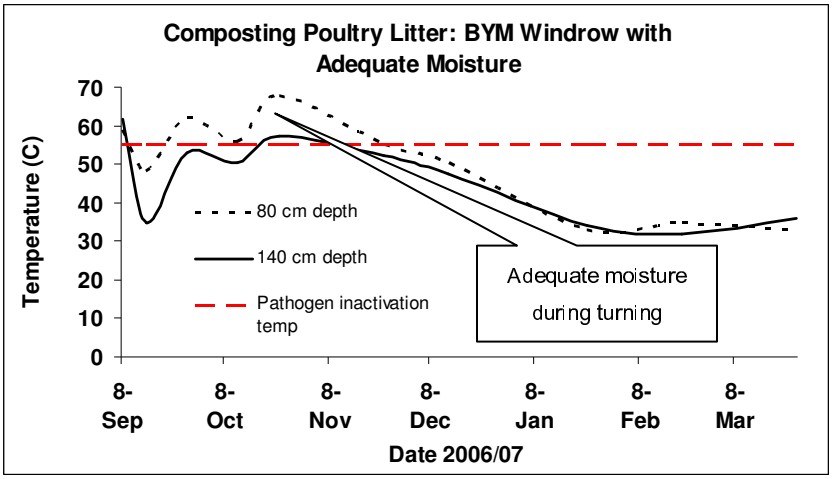
Pathogen	Inactivation Temperature (ºC)	Inactivation Time
Campylobacter **-** causes gastroenteritis	**50**	**Hours**
Salmonella **-** causes typhoid fever and gastroenteritis - can be fatal	**50**	**1 to 2 Days**
E. Coli **-** present in guts of mammals - causes intestinal and extraintestinal diseases - can be fatal	**50**	**1 to 2 Days**

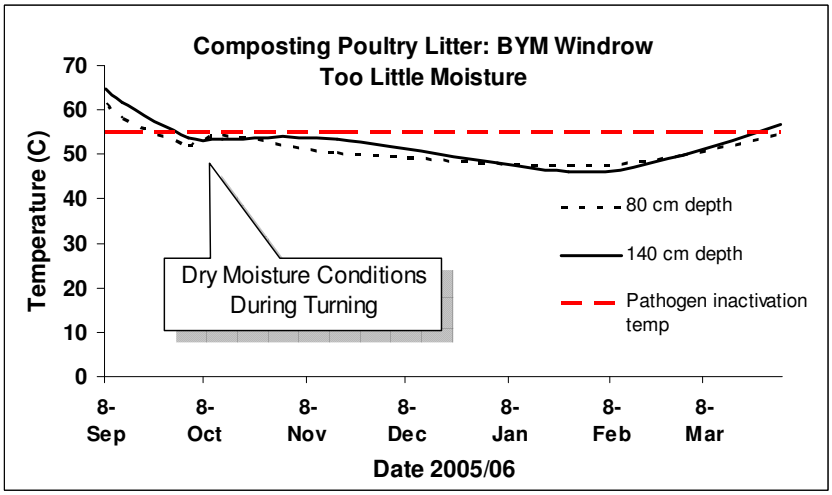
(Jeffrey et al, 2001)

Temperature

Due to the 2004 outbreak of Avian Influenza in the Fraser Valley and other high profile cases of bacterial contamination of vegetables, food safety concerns regarding the use of manures in crop production have increased. Poultry are known carriers of human pathogens, most notably *E. Coli*, *Campylobacter* and *Salmonella*. Therefore, achieving the regulated 55ºC during composting is critical to producing a food safe crop.

Moisture





Effects of Moisture on Temperature

The two graphs on the left show the effects of moisture on compost pile temperatures. Temperature measurements were taken at waist height, parallel to the soil surface, 80cm and 140cm into the pile. When moisture content was too low (lower graph) the pathogen inactivation temperatures were not reached. When the moisture content was adequate (upper graph) the pathogen inactivation temperatures were reached and exceeded. This reaffirms the importance of moisture management in the compost pile.

Total & Soil Available N- P- K Levels of Composted, Aged and Fresh Poultry Litter Products

	Nitrogen (N)		Phosphorus (P)		Potassium (K)	
	Total kg/t (dry)	Soil Avail.* kg/t (dry)	Total kg/t (dry)	Soil Avail.* kg/t (dry)	Total kg/t (dry)	Soil Avail.* kg/t (dry)
Composted PL:BYM turned 5X	**38±3**	**11±0**	**21±3**	**2.4±0.5**	**18±5**	**15±4**
Aged PL - unturned	**48±1**	**15±3**	**19±2**	**3.2±0.5**	**17±2**	**16±3**
Fresh PL	**49±7**	**17±3**	**17±1**	**2.7±0.8**	**16±2**	**16±3**

*Portion of total nutrient concentration which will be available for plant uptake in the soil.
****Conversion Factors:** 3.33 m^3/dry t; 1.30 yds^3/m^3; 2.47ac/ha; 2.2lbs/kg; 4.33 yds^3/ dry t; 1 t/ha = 0.45 ton/ac; 1 t/ha = 1.75 yds^3/ac

Composting Effects on Genetically Modified Materials, Pharmaceuticals and Pesticides

Pharmaceutical antibiotic residue levels were highest in fresh poultry litter (ppm range) and lowest in composted and aged products (ppb range). Genetically modified materials are also thought to be degraded during composting; however, this has yet to be demonstrated. The effects of composting on pesticides have been widely studied. Most pesticides registered for urban use are degraded during composting; and/or, provided the curing time is also adequate. The only pesticide detected in the City of Vancouver yard trimmings compost was "Mecoprop" (0.2 ppm) in 2004, which is a chlorinated herbicide found in "weed and feed" lawn additives.

Advantages and Disadvantages of Composting

Advantages	Disadvantages
Food safety issues are addressed – prolonged high temperatures reduce pathogen numbers	***Losses of C & N*** – these losses can be reduced by adjusting the C/N ratio of the feedstocks
Less wear and tear on spreading machinery – higher application rates mean lower ground speeds and more uniform applications are possible	***Higher application rates to meet crop nutrient demands*** – N losses during composting may lead to heavier application rates required
Better control of weed seeds and pests – high temperatures reduce these	***Composting adds to production costs***
Odors during spreading are greatly reduced	

Funding provided by:

References

The Composting Council of Canada has several helpful composting fact sheets on their website: http://www.compost.org/ccc_alberta_factsheet.html
Cornell University composting website: http://compost.css.cornell.edu/science.html
BC Ministry of Agriculture and Lands: http://www.agf.gov.bc.ca/resmgmt/publist/300series/382500-3.pdf
Haug, R.T. 1993. The Practical Handbook of Compost Engineering. Lewis Publishers, Boca Raton, Fl.