

Evaluating the Benefits of Municipal Greenbin Compost for Crop Production

(Interim Report)

Purpose:

This project is evaluating the use of municipal compost produced from organics recycling (municipal greenbin collection) as a source of organic matter (OM) and nutrients for field crop and horticulture production. The economic value of crop and soil benefits as a result of OM level increases with compost additions over time have been overshadowed by quicker crop nutrient responses to fertilizer products. This study will evaluate these potential benefits while exploring logistical solutions to timely, cost effective transport and application of these materials to crop land.

Methods:

The project is a cooperative effort between OSCIA and local associations, producer cooperators, Compost Council of Canada and OMAFRA to evaluate compost application benefits and with yield and soil analysis follow-up at up to 25 sites across the province.

The project will investigate:

- municipal compost (i.e., greenbin) is applied at a “once in the rotation” rate (target rate of 10 to 15 tons/ac)
- replicated treatments (3 reps recommended) that include
 - normal fertility program
 - regular rate of compost
 - regular rate of compost with some additional nitrogen to meet corn crop needs
 - half rate (or double rate) compost for crops other than corn
 - horticulture (site specific)
- Analysis of compost sample at time of application to determine the value of available nutrients, bulk density, OM and analysis of soil for nutrients and soil health
- Collect yield data at harvest from treatments for year of application and year(s) after application
- Collect crop input data, economics of compost use and observations/suggestions from process obtaining and using municipal compost
- Establishment of on-line network listing farmers/custom applicators with application equipment available to apply municipal compost

Figure 1: Application and Response of Crops to Additions of Greenbin Compost



Peel Region - Calibrating High Rate Application

Wainfleet – Aerial view of compost treatments – mid July

Results:

Composting is the process of decomposing organic matter, whether manure, crop residue or municipal organic wastes, by a mixed microbial population in a warm, moist aerobic environment. The organic matter is decomposed by the successive action of bacteria, fungi and actinomycetes. In the final stages of decomposition, redworms assist in the production of stable humus. (*definition from Organic Field Crop Handbook*)

Greenbin compost is made with municipal food waste mixed with high carbon materials (ie wood chips) and composted in-vessel under specific environmental conditions to meet MOE un-restricted compost guidelines. Analysis will vary for each facility and by time of year, depending upon the input materials, the process used and the length of curing.

Benefits of Compost:

- Increases organic matter in the soil
- Increases microbial diversity in soil
- Increases nutrient holding capacity
- Increases water holding capacity
- Improves infiltration
- Weed control

Approximately 15 sites were established with compost applications in the fall of 2011 or spring of 2012. These fields will be monitored for yield and soil quality over the rotation to determine if there is an organic matter benefit detectable. Yield results from the initial project year (2012 growing season) consistently showed at least a 3 bushel yield advantage to the compost treatments for most of the plots. The compost and soil analysis have not been completed so a detailed plot summary is not included in this interim report. Two site reports have been included to demonstrate the negative and positive results that have been documented and the reasons behind the results.

A more detailed research plot was initiated at the Kemptville research station where compost from Orgaworld in Ottawa was compared to biosolids pellets and fertilizer. The results are shown below but demonstrate that a yield increase does not always occur (Table 1).

Table 1: Greenbin, Biosolid Pellets, Fertilizer Response on Corn Comparison

2012 Treatments on Grain Corn	Average bu/ac	
150 kg/ha N (using Urea)	220	a
22.5 wet t/ha (10 t/ac) of Orgaworld compost AND 150 kg/ha N using Urea	216	a
2.2 t/ha Biosolid Pellets AND 128 kg/ha additional N fertilizer (Urea)	209	a
22.5 wet t/ha (10 t/ac) of Orgaworld compost AND 76 kg/ha N using Urea	185	b
No compost, pellets or N fertilizer	163	c
45.5 wet t/ha (20 t/ac) of Orgaworld compost	155	c
<i>U of Guelph - Kemptville (data compiled by Benoit Lebeau and Scott Banks)</i>		

Soil Analysis2008: pH 6.4; OM% 4.9; P 23ppm; K 181 ppm

Compost Analysis (~ lbs/ton): DM 68%; N avail 5 lbs; P₂O₅ (available) 8 lbs; K₂O (available) 14; C :N ratio 35 :1

Biosolid Pellets Analysis: DM 95%; N avail 30 lbs; P₂O₅ (available) 82 lbs; K₂O (available) 3 lbs; C :N ratio 8 :1;

Material from Orgaworld in Ottawa has a higher C:N ratio (35:1 compared to 12 to 14:1 ratio for Peel, Miller, Orgaworld (London) and AIM compost materials. The study results demonstrate that a high C:N ratio tied-up nitrogen from the soil which resulted in lower yields. Material from Orgaworld in Ottawa is composted with less source separated organics (SSO) and more leaf and yard waste which results in less available nitrogen. Material from other facilities (e.g. AIM and Orgaworld London) leaves the municipal facility to be land applied as “green compost” without significant curing. This results in a higher ammonium nitrogen level and higher available nitrogen.

Biosolids pellets used in the comparison are produced using a process that takes digested sewage to biosolids cake (dewatered, thickening agents added) then pelletization (heating and drying) process occurs. They are regulated through CFIA and treated as a fertilizer. They are relatively dry with a low C:N ratio, which suggests that the nitrogen is released readily during the growing season to a crop.

The 2012 growing season was a good example of the importance of organic matter as a means of improving nutrient and water cycling in the soil for crop uptake. Research studies on sandy, low organic matter soils and heavy clay soils have shown this benefit and have also shown a resiliency to conditions that are too dry or too wet.

Soil quality benefits of organic matter management were most evident where compost was added to a field near Dunnville with a long term (17 year) focus on improving soil quality. Mushroom compost was surface applied at approximately 7 ton/ac to strips in the spring. Salt content in the analysis resulted in about 200 lbs. of sodium concentrated at the soil surface. In a dry spring season, this salt had an impact on soil microbial activity and resulted in poor growth to soybean seedlings and required replanting some of the soybeans.

Some plots were irrigated, while others were not. Yield results were surprising in that the irrigated treatments did not outperform the non-irrigated plots. This illustrates the impact of organic matter on water holding capacity and nutrient cycling in the soil.

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“The headland was used as a test strip since it was the only place in the test plots that did not have compost. Our rain fall from planting to August 1st was 2.5” and the irrigation was done in July.

1. Headland – no compost, no irrigation, not in corn – 72 bu.
2. Replanted – compost, no irrigation, not in corn – 47 bu.
3. Replanted - compost, 3" irrigation, in corn – 57 bu.
4. Not replanted — no compost, 1" irrigation, in corn – 57 bu.

The corn was not affected as badly by the salt but there appears to be less worm activity and a lot of variability in yield between adjacent plots.

1. Highest Yield – compost, 3" irrigation – 301.88 bu.
2. 2nd Highest Yield – compost, no irrigation – 294.63 bu.
3. Average – compost, 3" irrigation – 283 bu.
4. Average – compost, no irrigation – 275 bu.
5. Full strip across the farm — 1.5 acres, no compost, 1" irrigation – 248.97 bu. “

(Soil fertility: pH ~ 7.0; P>30 ppm; K>120 ppm ; OM range 3.1 - 5.7)

These results show the resiliency of soils where buildup of organic matter is pursued. The question this project will continue to address is “can a similar benefit occur with one application of compost”? How much organic matter is required to make a difference?

Summary:

The yield comparisons measured from the 2012 growing season for the most part showed a positive response to compost. Moisture holding capacity improvements were anticipated with larger yield differences between treatments, but results did not support this. Large improvements take more than a one-time application of organic materials and the addition of organic amendments should be accompanied by other management practices including rotation, cover crops and residue management to achieve a healthy more resilient soil.

The yield comparisons also demonstrated the importance of understanding the nutrient and C:N ratio of the material, especially when applied to a corn crop, so that additional nitrogen can be applied to compensate for short-term tie-up in the soil. The comparison

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sites also demonstrated the need for good weed control and the importance of an analysis in determining application rate and application of additional nutrients.

Next Steps:

Continue with 2nd year of the project

Acknowledgements:

Thank you to the Crop producers, who participated and contributed their time and effort, Mike Lishman (AIM Environmental), Compost Council of Canada, Kyle Schumacher (Miller Compost), Matt Stevens (Peel Region), Dean Glennie, Scott Banks, Benoit Lebeau, Stacie Irwin (OMAFRA summer student)

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