Green Bin Compost - Does it Stack Up to Manure and Fertilizer?

Purpose:

When the food and other organic waste that comes from households and grocery stores within municipalities can be land applied, similar to livestock manure, it will be a win-win. Municipalities can divert the organic waste from land-fill to land application, while the crop producer can add organic matter to help sustain soil health and productivity while reducing commercial fertilizer costs.

In this project green bin compost was compared to other nutrient sources (including commercial fertilizer and other organic amendments including manure) to determine potential benefits for crop yield, nutrient availability and soil quality.

The information gathered from this comparison will help to determine the best economical and nutrient fit for green-bin compost, considering agronomic-economic applicability, logistics of transport and application as well as environmental impacts. The results of this project will continue to build on the knowledge of compost processes and nutrient availability for crops, as well as the soil organic matter potential for building healthier soils. Results will begin the development of BMP's for using municipal compost; specifically fertilizer replacement value, value in building soil organic matter, and economics of application (vs. distance traveled).

Methods:

Plots were set up at two sites to compare green bin compost to commercial fertilizer or to poultry manure and biosolids. Application rates were set to match two thirds to three quarters of the nitrogen needs, with the remaining nitrogen coming from commercial fertilizer. Soil samples – including organic matter - were taken before and after application. Application rates were measured to help with calibration. Plots were weighed with results shown below.

Results:

Green bin compost value based on available N-P_20_5-K_20 fertilizer equivalent value (Jan 2011 fertilizer prices) is about $18.50/ton based on the material used for the spring field comparisons. Value can vary based on season and inputs. Table 1 shows a comparison of available nutrients from various non-livestock amendments available for crop production.

The 2010 growing season was near perfect for planting date, moisture and heat. The benefits of added organic matter would be emphasized visually in a year where there is crop stress. Table 2 and 3 show the yield results from the two sites.

Table 1: Amendment Material Analysis

Fraction		Biosolids Pellets (Windsor)	Biosolids Pellets (Toronto)	N-Viro (Sarnia)	Municipal Greenbin Compost AIM - Hamilton
Dry Matter	%	94.8	95.1	77.0	47.8
pH		6.3	6.8	12.6	4.9
Bulk Density	kg/m^3	588	795	836	338
	lbs/ft^3	36.7	49.6	52.2	21.1
C:N Ratio		9:1	7:1	21:1	14:1
lbs per ton *(as-applied basis)*					
Total N		87	92	11.4	31
NH_4-N		3.6	1.3	0.5	4.5
Available N [1]		45	47	4	10
P_20_5		72 [2]	91	15	11
K_20		4	3	79	10
Calcium	Ca	32	68	322	33
Aluminium	Al	89 [2]	29	28	1.2
Iron	Fe	21	80	15	2.7
Sulphur	S	17	21	59	2.5
Magnesium	Mg	8	12	14	4
Manganese	Mn	1.1	0.7	0.4	0.2
Copper	Cu	0.6	2.0	0.2	0.1
Zinc	Zn	1.0	1.9	0.4	0.1
Boron	Bo	0.03	0.05	0.05	0.02
Sodium	Na	3	2	7	4
Total Salts		6	5	32	8
Organic Matter	OM	1320	1152	432	753
Added Carbon		783	644	240	434

[1] Available N is an estimate of available N in the year of application (fall or spring applied) – availability will vary with season of application, soil temperature and moisture conditions and C:N ratio.

[2] P205 availability could be reduced with hgh Aluminium levels when combined with low pH

Table 2. Corn Yields from Green Bin Compost Plot Results – Byng Site

Treatment	N	P2O5	K2O	Moisture %	Test Wt Lbs/bu	Yield Dry Bu/ac
	Total Applied All Sources (lbs.ac)					
Compost Only	204	139	139	20.5	56.1	189.9
Compost + Biosolids	317	300	147	21.0	56.0	191.5
Turkey Manure (spring) + Biosolids	307	460	230	20.2	56.7	197.6
Turkey Manure (winter) + Biosolids	296	460	230	19.2	-	202.5
Turkey Manure Only	194	300	222	19.3	-	199.7
Average				20.0	56.3	196.6

[1] Turkey manure @ 5.5t/ac (feb, may), biosolids @ 10.95wett/ac (may 5) (113-85-10), compost @ 13.5t/ac (may 3), may soil test ph6.5, om4.7, p9, k151 on a Lincoln heavy clay

Turkey Manure analysis		Total Nutrients	Available Nutrients
DM	59.8 %		
Total N	3.32 %	66.4 lbs/ton	**~23 lbs/ton N late winter applied**
NH4-N	7000 ppm	14.0 lbs/ton	~**25 lbs/ton N spring applied**
Phosphorus	1.33 %	48.9 lbs/ton P_20_5	~25 lbs/ton P_20_5
Potassium	1.61 %	34.8 lbs/ton K_20	~35 lbs/ton K_20
C:N	8:1		
O.M.	47.2 %	944 lbs/ton	
Carbon added		531 lbs/ton	

Table 3. Corn Yield from Green Bin Compost – Oakland Site

Treatment	Moisture	Test Wt lbs/bu	Yield (bu./ac)
140 lbs N	18.6	56.3	221
30 lbs N	18.8	56.1	185
High Compost	18.5	56.9	219
Compost (8t/ac) + 72 lbs/ac N	18.5	56.3	220
Compost (8t/ac)	18.7	56.9	193
[1] Corn was planted April 29th and harvested October 31, on a clay loam soil.			

Summary:

The results of the two sites compared demonstrated that in 2010 growing season the green bin compost behaved similarly to what would be expected from solid livestock manure. Yield results were similar to manure applied to meet two thirds to three quarters of the nitrogen needs. Organic matter additions will help build soil organic matter and lead to long term sustainable soil health, but improvements maybe difficult to measure in the short term.

To put organic matter contribution into perspective: It would take **35 years** to build soil organic matter by 1 % by adding 8 tons green bin compost once per rotation plus crop residues compared to **60 years** it would take to build SOM by 1 % by just returning crop residues

Calculations assumed a fine textured (clay) soil with 3 % soil organic matter (SOM) where all crop residues and roots are returned to the soil in a corn-soybean-wheat rotation and where ~1 ton carbon (~ 8 ton green bin compost at 45% dry matter content) added once per rotation (once in 3 years) and assuming a 2% decomposition rate. This would result in a 0.03% increase in SOM per year.

Benefits of Green bin compost:

- high O.M. product - good balance of available N-P-K and micros
- bulk density of about 20 lbs/cubic foot
- Uniform application is easier with compost
- odour and consistency is similar to corn silage
- more stable and effective in sandy soils than solid manure
- fits well when applied once in the rotation (after fall cereal harvest) at about 10-15 ton/ac

Challenges of Green bin compost

- Timing of product availability and application (logistics and economics)
- Temporary field storage can cause some compaction damage
- Contaminants – plastics
- Some variability in product – time of year input availability

Next Steps:

The project will continue with several municipalities to show benefits of compost in side-by-side comparisons. The next steps will focus on improving the logistics so that farms interested in applying the material will be able to receive and apply the material in time for planting. Economics of transport and application will also continue to be examined to determine price versus value for crop production.

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