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SSMSW Compost Benefits and Issues from an Agricultural Perspective

Compost Council of Canada, Moncton 2015

Canada 

- **Outline of Presentation**
 - **Some history in Nova Scotia and the National Compost Trials in Nova Scotia (Some Results)**
 - **Issues then and are they prevalent today.**
 - **Solutions ??? (Discussion)**



History (Nova Scotia)

- **In the early to mid 90's many the landfill sites were nearing the end of their life expectancy. New landfills were costly engineered facilities.**
- **Many municipalities were evaluating other options.**
- **One option was diversion of beneficial organics from landfill.**



- **Meeting was held in Ottawa in 1995 to discuss the formation of the National Compost Trials.**
- **There were researchers (from the various provinces), Susan (from the Compost Council of Canada) and representatives from municipalities either composting or about to start composting.**



- **Researchers/Compost Council of Canada/ Nova Scotia Department of Environment and Municipalities formulated plans and submitted proposals through the Agriculture and Agri-Food Canada's MII program.**



- **In Nova Scotia: Vernon Rodd, Peter Hickleton, Phil Warman, Ken Webb and Dave Langille- Researchers**
- **Susan Antler- Compost Council of Canada**
- **Barry Friesan- Nova Scotia Department of Environment**
- **Ray Halsey- Municipality of Lunenburg**



Trials Conducted

- **SSMSW Compost vs Manure for cereal production: Rodd/ Hicklenton/ Warman/ Webb/ Langille (Nappan)**
- **SSMSW Compost as a container medium for ornamentals: Hicklenton/ Rodd/ Warman (Kentville)**
- **SSMSW Compost for vegetable production: Warman/ Rodd/ Hicklenton (Onslow)**



Nappan Trial

- **Split, Split plot factorial with four reps**
 - **Type of organic amendment (Manure vs Compost)**
 - **Rate of organic amendment (0, 50, and 100 kg PAN/ha) (PAN assumed to be 50% for manure and 15% for compost)**
 - **Rate of fertilizer addition (0, 50, 100 and 150 kg N/ha)**
 - **Barley in year 1 and wheat in year 2**



Variate: v[1]-> Boot Stage Chlorophyll

Source of variation	d.f.	s.s.	m.s.	v.r.	F pr.
Rep stratum	3	339.000	113.000	49.24	
Rep.mPlot stratum					
gManure	1	130.008	130.008	56.65	0.005
Residual	3	6.885	2.295	0.73	
Rep.mPlot.sPlot stratum					
Rate	3	17.672	5.891	1.86	0.172
Lin	1	14.520	14.520	4.59	0.046
Quad	1	2.761	2.761	0.87	0.362
Deviations	1	0.390	0.390	0.12	0.729
gManure.Rate	3	24.309	8.103	2.56	0.087
gManure.Lin	1	24.180	24.180	7.65	0.013
gManure.Quad	1	0.101	0.101	0.03	0.860
Deviations	1	0.028	0.028	0.01	0.927
Residual	18	56.916	3.162	0.83	
Rep.mPlot.sPlot.ssPlot stratum					
Fert	3	309.339	103.113	27.12	<.001
Lin	1	304.152	304.152	79.98	<.001
Quad	1	0.003	0.003	0.00	0.978
Deviations	1	5.184	5.184	1.36	0.247
gManure.Fert	3	28.539	9.513	2.50	0.066
gManure.Lin	1	16.512	16.512	4.34	0.041
gManure.Quad	1	11.883	11.883	3.12	0.081
Deviations	1	0.144	0.144	0.04	0.846
Rate.Fert	9	31.874	3.542	0.93	0.504
Lin.Lin	1	9.835	9.835	2.59	0.112
Quad.Lin	1	4.727	4.727	1.24	0.269
Lin.Quad	1	9.025	9.025	2.37	0.128
Dev.Lin	1	0.224	0.224	0.06	0.809
Quad.Quad	1	0.845	0.845	0.22	0.639
Lin.Dev	1	0.104	0.104	0.03	0.869
Dev.Quad	1	0.352	0.352	0.09	0.762
Quad.Dev	1	6.202	6.202	1.63	0.206

Deviations	1	0.562	0.562	0.15	0.702
gManure.Rate.Fert	9	24.509	2.723	0.72	0.692
gManure.Lin.Lin	1	6.248	6.248	1.64	0.204
gManure.Quad.Lin	1	2.426	2.426	0.64	0.427
gManure.Lin.Quad	1	0.121	0.121	0.03	0.859
gManure.Dev.Lin	1	1.940	1.940	0.51	0.477
gManure.Quad.Quad	1	2.000	2.000	0.53	0.471
gManure.Lin.Dev	1	5.265	5.265	1.38	0.243
gManure.Dev.Quad	1	0.003	0.003	0.00	0.977
gManure.Quad.Dev	1	6.360	6.360	1.67	0.200
Deviations	1	0.146	0.146	0.04	0.845
Residual	72	273.789	3.803		
 Total	 127	 1242.840			



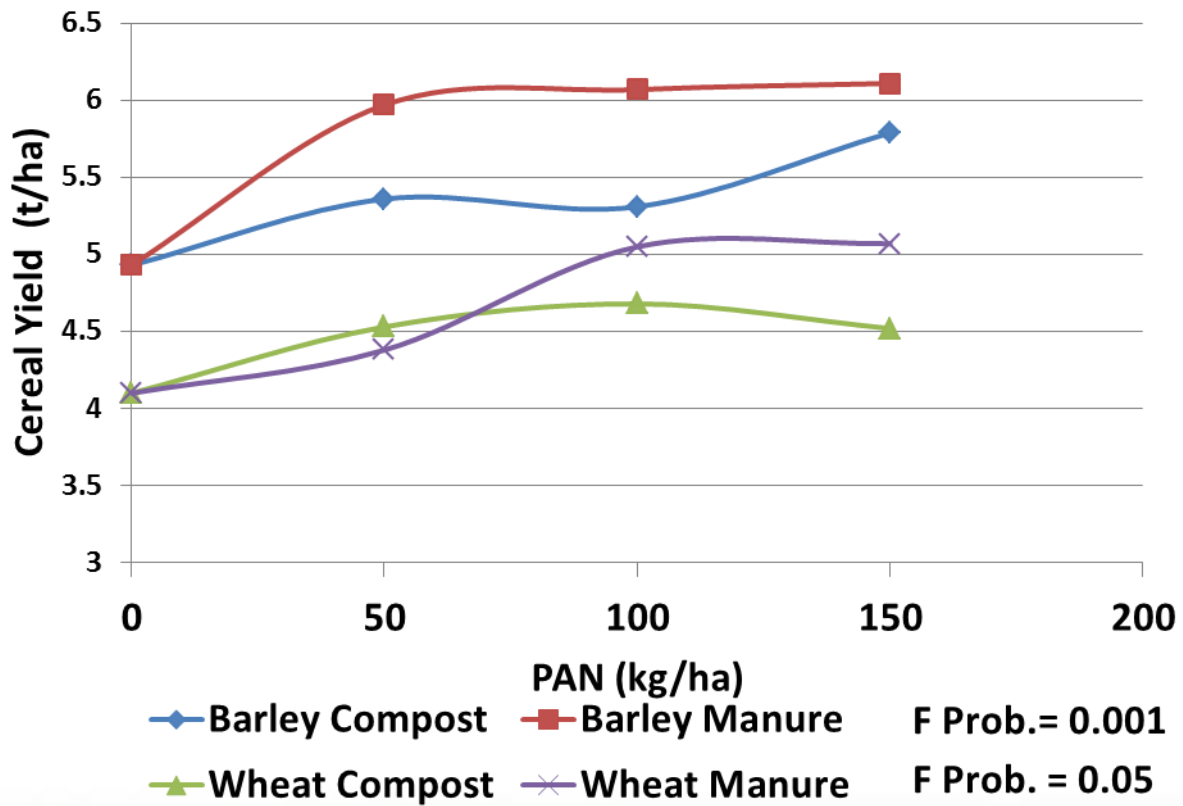
Variate: v[1]-> Boot Stage Chlorophyll

Grand mean 38.60

gManure	Compost	Manure				
	37.59	39.61				
Rate	0% N	50% N	100% N	150% N		
	37.98	38.67	38.82	38.93		
Fert	0 N	50 N	100 N	150 N		
	36.62	37.65	39.57	40.57		
gManure	Rate	0% N	50% N	100% N	150% N	
Compost		37.57	37.85	37.57	37.37	
Manure		38.38	39.49	40.07	40.49	
gManure	Fert	0 N	50 N	100 N	150 N	
Compost		35.42	36.22	38.37	40.37	
Manure		37.82	39.07	40.76	40.78	
Rate	Fert	0 N	50 N	100 N	150 N	
0% N		35.20	37.60	39.29	39.82	
50% N		36.44	37.37	39.91	40.96	
100% N		36.94	37.29	40.11	40.96	
150% N		37.90	38.32	38.95	40.55	
gManure	Rate	Fert	0 N	50 N	100 N	150 N
Compost	0% N		35.32	36.47	39.32	39.17
	50% N		35.17	36.17	38.65	41.40
	100% N		35.42	35.80	38.20	40.88
	150% N		35.75	36.42	37.30	40.03
Manure	0% N		35.07	38.72	39.25	40.47
	50% N		37.70	38.57	41.17	40.52
	100% N		38.45	38.78	42.02	41.05
	150% N		40.05	40.22	40.60	41.07



Cereal Yields



Estimated Soil Organic Matter Ranges for Total Land Area on PEI

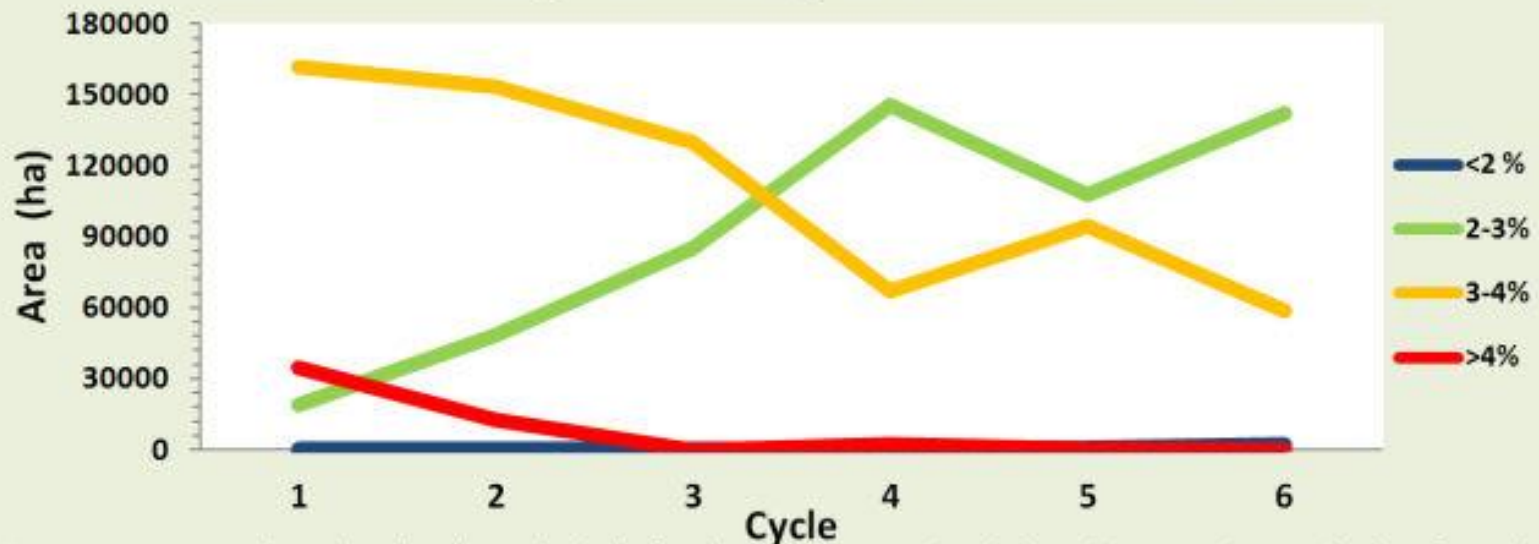


Figure 2. Estimated total PEI land area (in ha) of soil organic matter levels based on sampling cycle data from the PEI Soil Quality Monitoring Project from 1998-2015. Data analysis performed using the Geostatistical Analyst extension to the ArcGIS 10.3 software from ESRI. (Source: J. Nyiraneza, AAFC, Charlottetown PE, 2015).



Bucket Numbers

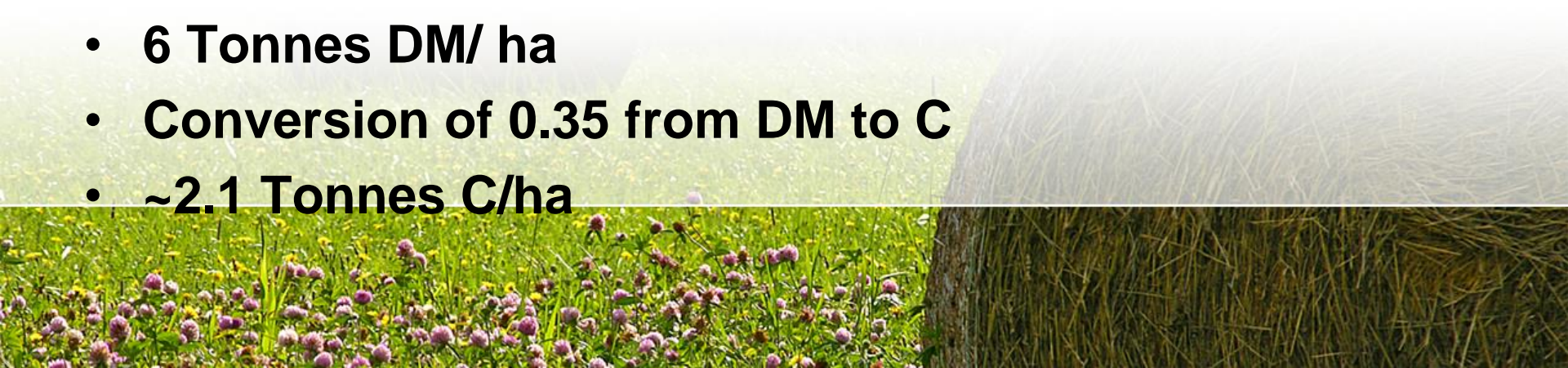
- Hectare furrow slice ~2,000,000 kg ($D_b = 1.3 \text{g/cm}^3$)
- Raise OM of Soil 1% = 20,000 kg
- Ratio of C to OM ~0.58 Therefore need 11,600 kg/ha of carbon.

Corn

- Corn yield ~ 7 tonnes/ha @ 35% DM ~20,000 kg of dry matter (DM).
- Assume conversion ratio of DM to C = 0.40
- 1 tonne of C added/ha or 1,000 kg.

Red Clover

- 6 Tonnes DM/ ha
- Conversion of 0.35 from DM to C
- ~2.1 Tonnes C/ha



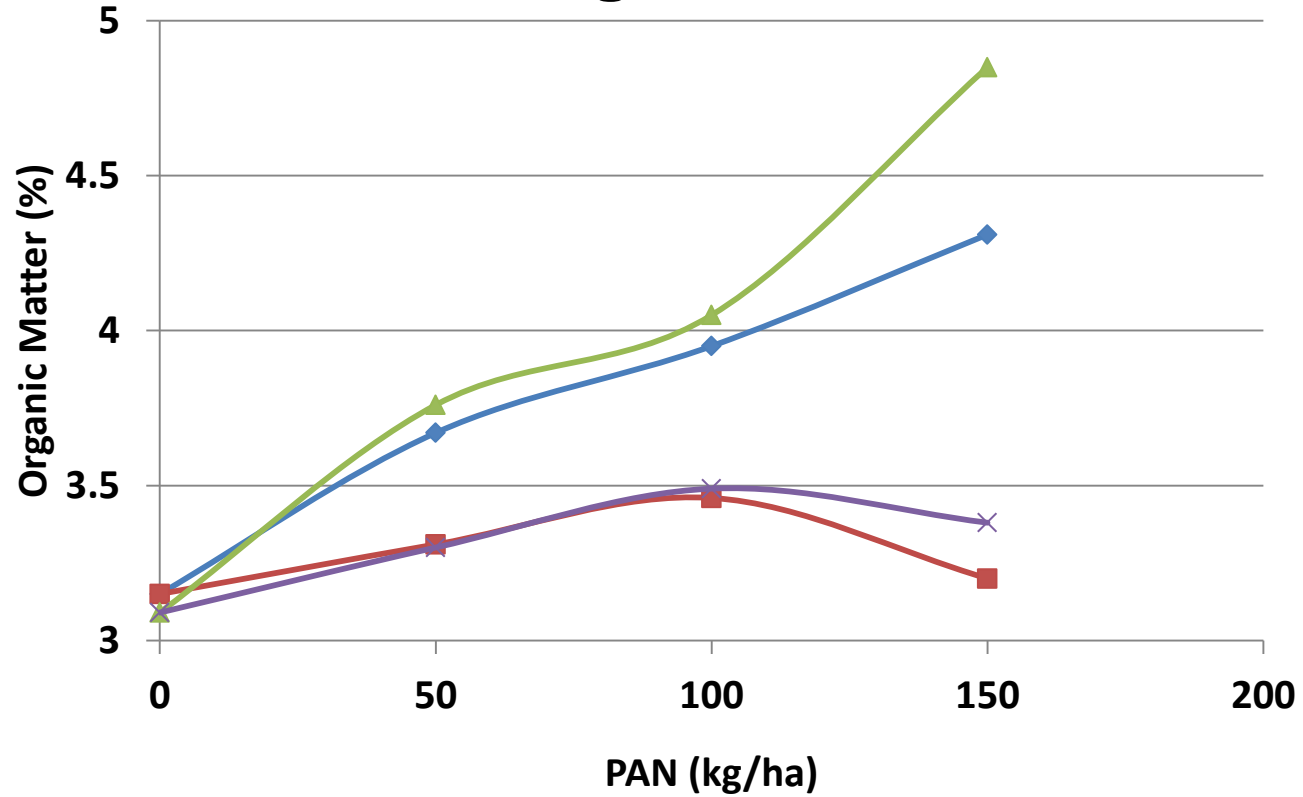
Increases in Organic Matter with Various Crops (Quebec CRAAQ) 2003

Crop	Yield (t/ha)	Organic Matter Increase (kg/ha)
Grain Corn (stalks and cobs)	6	720
Grain Corn (roots)	3	450
Total		1170
Alfalfa	5	850

Thanks Nyiraneza



Soil Health- Organic Matter Levels



—◆— Barley Compost

—■— Barley Manure

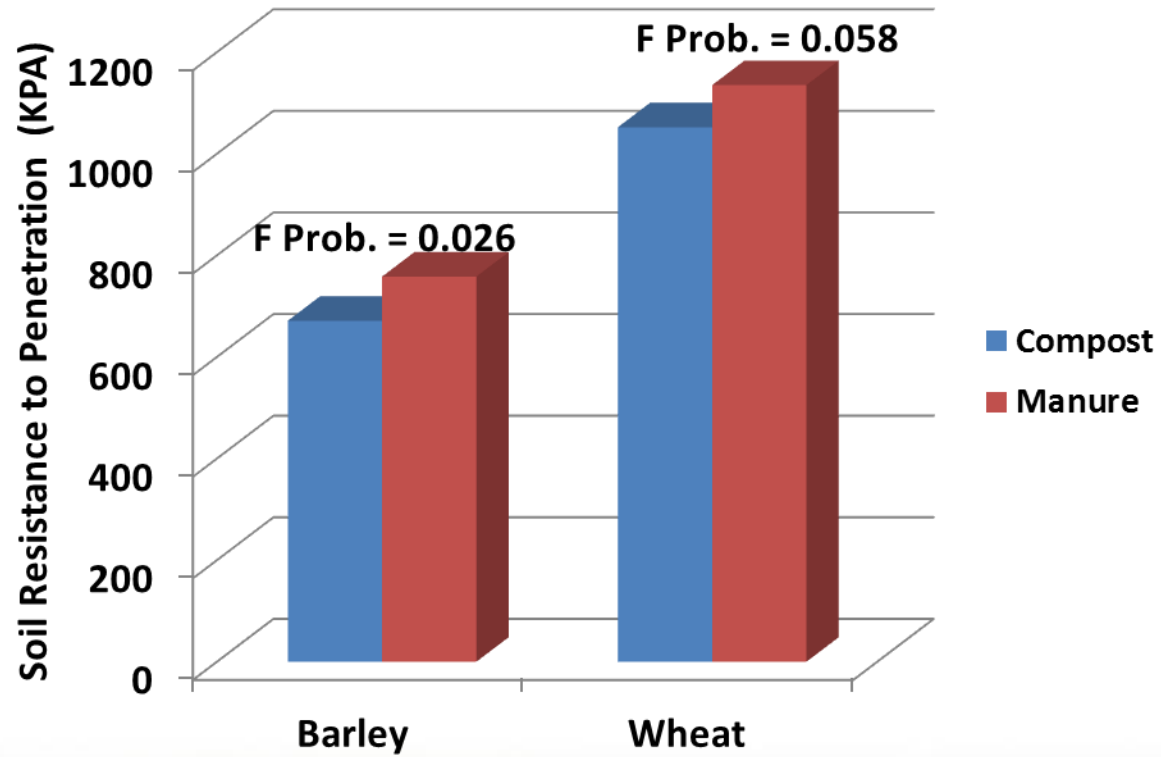
F Prob.= 0.001

—▲— Wheat Compost

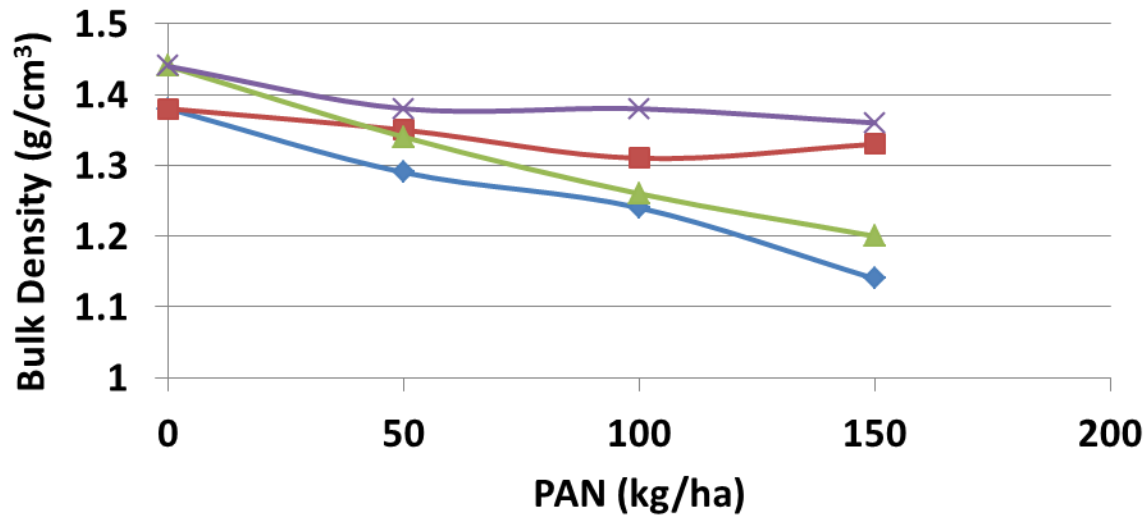
—×— Wheat Manure

F Prob. = 0.05





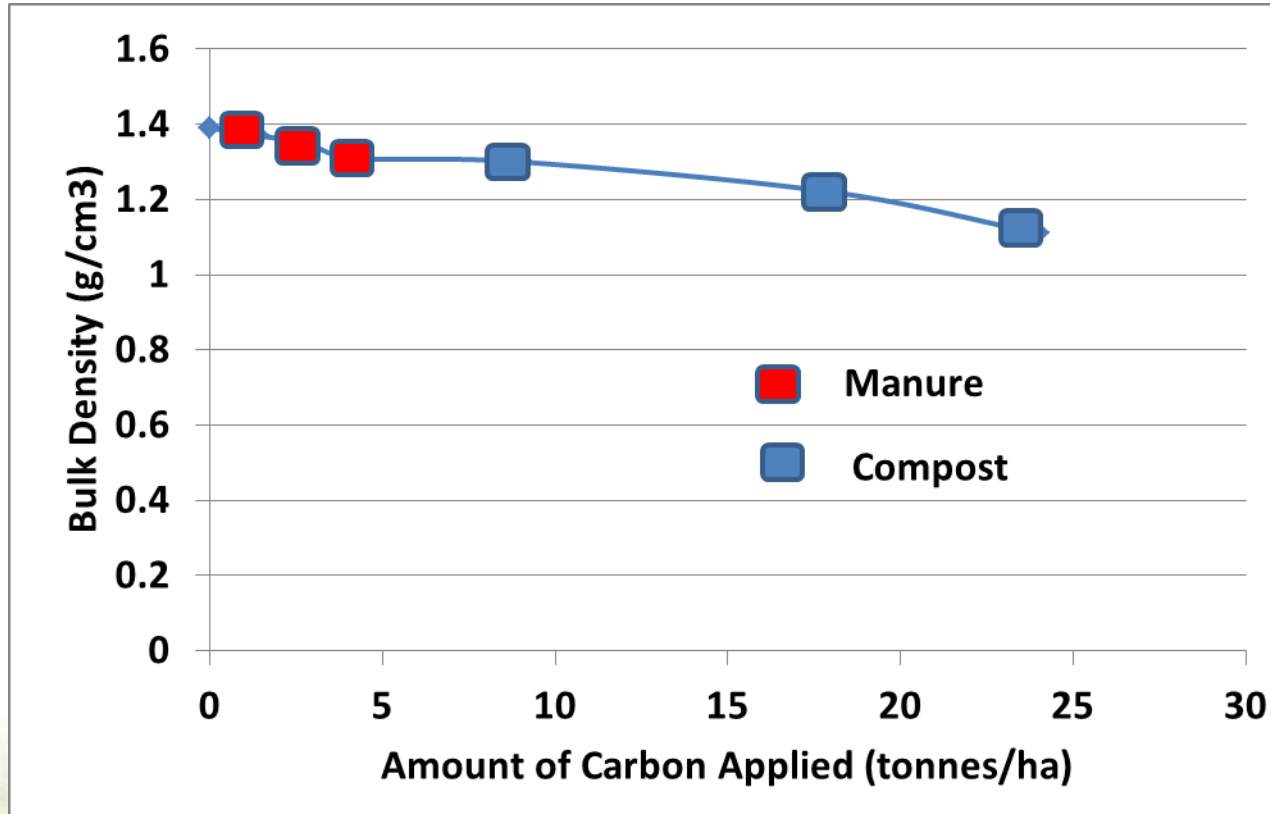
Soil Health- Soil Bulk Density



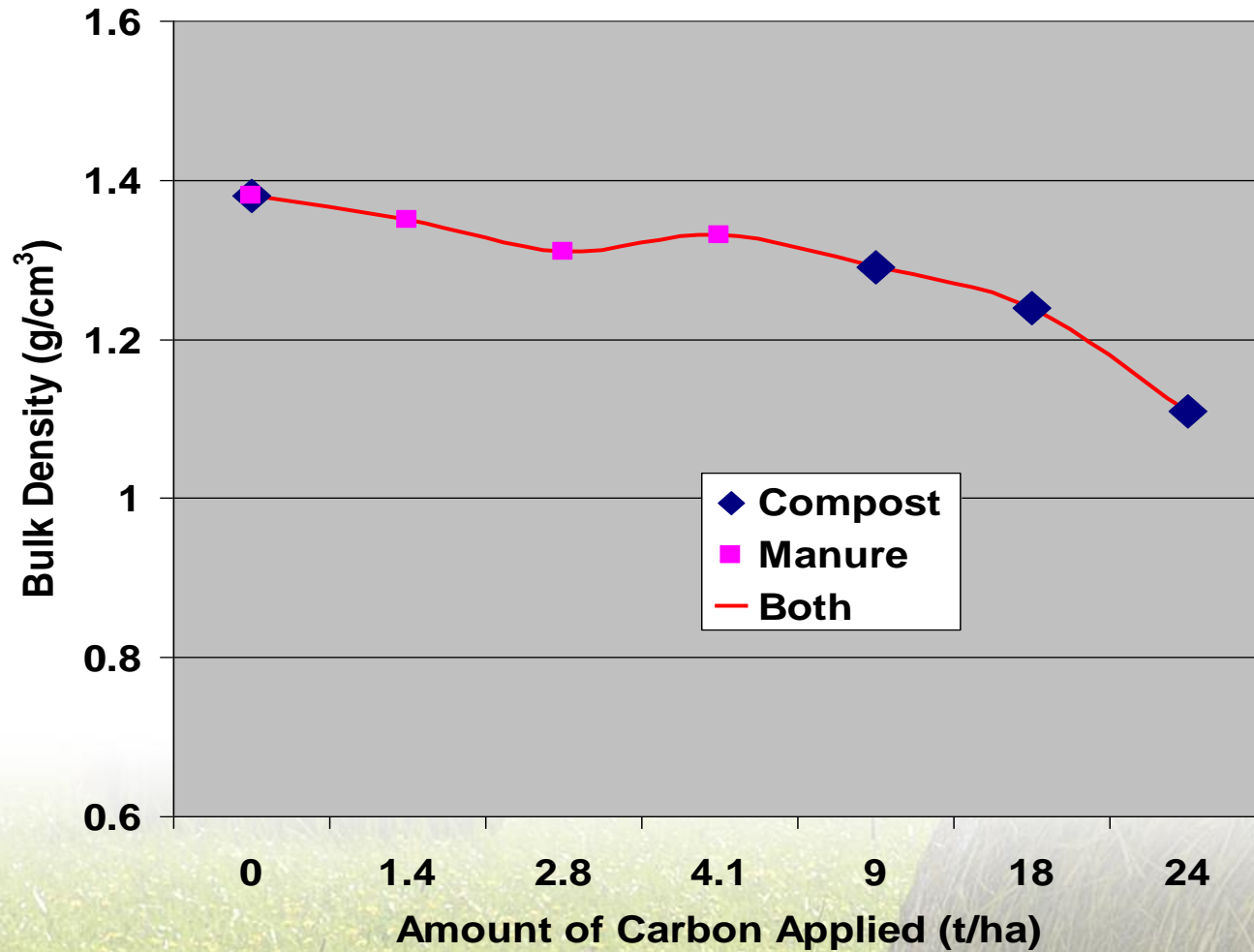
◆ Barley Compost ■ Barley Manure F Prob.= 0.001
▲ Wheat Compost ✕ Wheat Manure F Prob. = 0.001



Relationship of Bulk Density to Amount of Carbon Applied



Relationship of Bulk Density to Amount of Carbon Applied



Soil Health- Earthworm Populations (thousand/ha)

	Compost	Manure	F Prob.
# Mature	232	185	0.076
# Immature	1,227	796	0.011

Residual earthworm populations post amendment application



So Why is More SSMSW Compost Not Used on Ag Lands?

- **Issues Concentration of Heavy Metals**
 - Arsenic, Cadmium, Cobalt, Chromium, Copper, Mercury, Molybdenum, Nickel, Lead, Selenium, and Zinc. ** Criteria vary with individual elements and whether the compost meets Class A or B standard
 - The composting processes will concentrate non volatile trace elements.



Copper and Zinc

	Copper		Zinc	
Guidelines	A	B	A	B
1996	100	*	500	*
2005	400	1850	700	1850
Our Material				
Compost- Barley	170		370	
Manure- Barley	20		40	
Compost – Wheat	270		610	
Manure- Wheat	100		70	



Trace Elements- Copper and Zinc

	Copper		Zinc	
Compost- Barley	170		370	
Manure-Barley	20		40	
Compost- Wheat	270		610	
Manure- Wheat	100		70	
Guidelines	A	B	A	B
1996	100	*	500	*
2005	400	1850	700	1850



Foreign Materials

– Sharp Foreign Material

- **Category A-** Compost shall not contain any foreign material of dimension greater than 3mm per 500 mls.
- **Category B-** Compost shall have a content less than or equal to 3 pieces per 500 mls and the maximum dimensions shall be 12.5 mm.

– Other Foreign Material

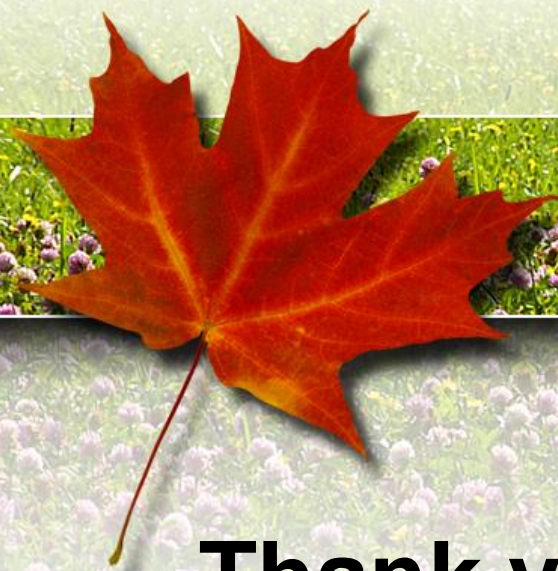
- **Category A-** No more than one piece greater than 25 mm in any dimension per 500 mls.
- **Category B-** Compost shall contain no more than 2 pieces greater than 25 mm in any dimension per 500 mls.





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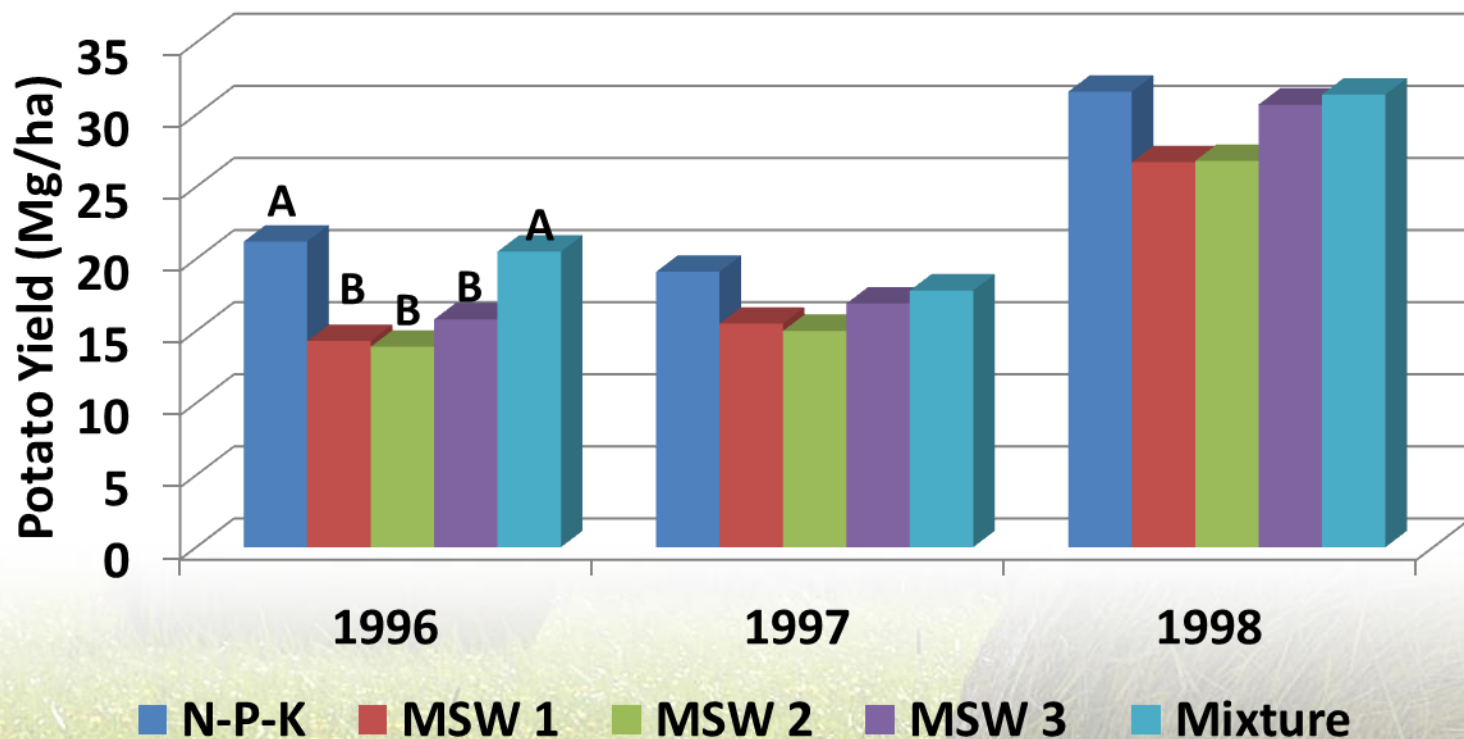
Thank you!

**For more information, please contact:
Vernon.Rodd@agr.gc.ca**

Canada



	N-P-K	MSW 1	MSW 2	MSW 3	Mixture
1996	130-63-38	21.7	43.4	8.9	10.85 + 65-32-34
1997	130-65-59	11.3	22.6	17.8	5.65 + 65-33-30
1998	130-75-68	8.9	17.8	26.0	4.45 + 65-38-34



	N-P-K	MSW 1	MSW 2	MSW 3	Mixture
1996	130-63-38	21.7	43.4	8.9	10.85 + 65-32-34
1997	130-65-59	11.3	22.6	17.8	5.65 + 65-33-30
1998	130-75-68	8.9	17.8	26.0	4.45 + 65-38-34

