

Rao, R., N. Herendeen, Q.M. Ketterings, and H. Krol (2007). Niagara Soil Sample Survey (2002-2006). CSS Extension Bulletin E07-36. 32 pages.

Soil Sample Survey

Niagara County

Samples analyzed by CNAL (2002-2006)



Summary compiled by

Renuka Rao, Nate Herendeen, Quirine M. Ketterings, and Hettie Krol



Cornell Nutrient Analysis Laboratory
<http://www.css.cornell.edu/soiltest/newindex.asp>

&

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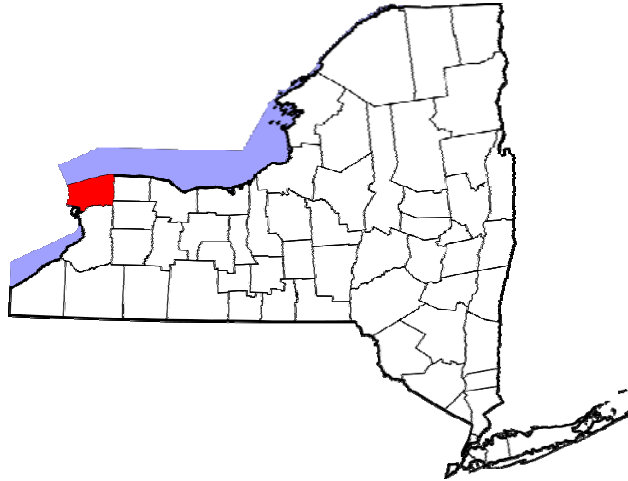
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1. County Introduction

Niagara County is located in the northwest corner of New York, north of Buffalo. It is bordered by Lake Ontario on the north and Ontario, Canada on the west. It contains over 339,000 acres of land area. Roughly 50% of the area is used for farm production.



Niagara County is noted for Niagara Falls where the north flowing Niagara River drops nearly 200 feet as it goes over the crest of the Niagara escarpment. The county lies entirely in the Ontario and Huron Lake Plains region. The northern lake plain begins at Lake Ontario, where the elevation is 246 feet above sea level. It extends to the foot of the Niagara escarpment. There the elevation increases sharply to crest of the escarpment, about 600 feet elevation. The Huron Plain part of the county extends from that crest southward into Erie County. It has a high point of 680 feet at Bunker Hill near the southeast corner of the county and a low of 575 feet at the mouth of Tonawanda Creek.

The soils in the north are dominated by glacial till that was greatly modified by glacial outwash and/or glacial lake sediments. The soils in the south are derived from high carbonate materials deposited by glacial advance across the Niagara dolomite limestone escarpment. However, glacial outwash materials and/or lacustrine sediments also modified much of this area.

Small areas of wetlands occur throughout the county, the result of massive glacial outwash during the period of glacial recession from western New York. Several small areas were drained and farmed as organic soils or muckland for many years. Most have been abandoned for agricultural purposes. Additional areas of wetlands are protected in the federal Iroquois Wildlife Refuge and the state Tonawanda Wildlife Area, in the southeast corner of the county. These areas are seasonal feeding and resting sites to many migratory waterfowl, especially Canada geese.

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The agriculture of Niagara County is diverse. Dairy farming is the largest single generator of farm income. Livestock producers market beef, hogs and sheep from Niagara County. Thousands of acres are devoted to field and forage crops to support the dairy and livestock industry. Hay, grain and soybean crops not used locally are exported to areas throughout the eastern United States.

Tree fruit production is next in farm income creation, with large acreages of apples plus smaller acreages of cherries, peaches, pears and plums. Apples are stored, packed and marketed throughout the eastern US and overseas markets from Niagara County facilities.

Vegetable crops comprise the next largest segment of the agricultural economy. Crops grown for processing include peas, snap beans, sweet corn and dry beans. Fresh vegetables produced include all of the above mentioned crops plus cabbage, potatoes, cucumbers, squash, pumpkins, peppers and tomatoes. Bedding plants and ornamentals are important commodities on farms with greenhouses and nursery stock. Small fruits such as strawberries and blueberries are grown for fresh market.

Niagara County has small and large dairy farms and several grass based dairy farms. There are a number of farms that have found niche markets for fresh produce and/or use their facilities for agri-tourism. The number of farms with recreational horse boarding and training facilities is on the increase.

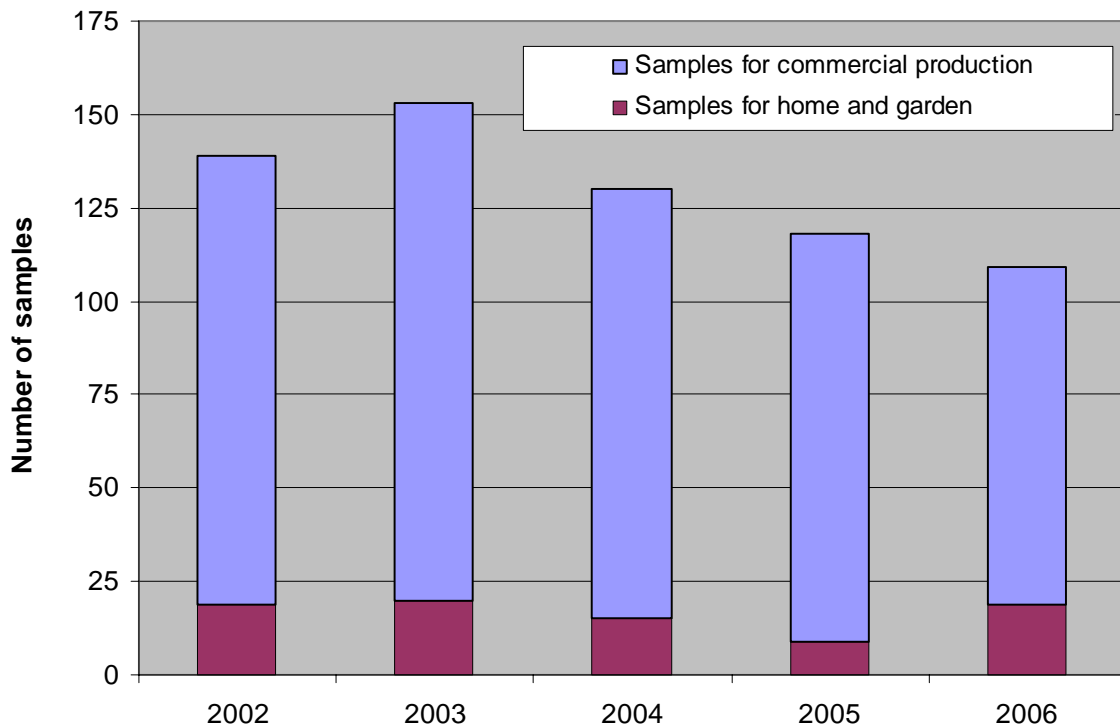
The wine grape industry has expanded rapidly in Niagara. There are now 12 estate wineries with related grape production. A "Niagara Wine Trail" has been developed as an agri-tourism feature and is finding wide acceptance. Most of the wine and grape facilities are on or near the Niagara Escarpment with several on the Ontario Lake Plain, near Lake Ontario.

All the above industries rely heavily on soil testing to maintain optimum production while protecting the agricultural environment from nutrient runoff.

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2. General Survey Summary

This survey summarizes the soil test results from grower (identified as “commercial samples”) and homeowner samples from Niagara County submitted to the Cornell Nutrient Analysis Laboratory (CNAL) from 2002 to 2006. The total number of samples analyzed in these years amounted to 649. Of these, 567 samples (87%) were submitted by commercial growers while 82 samples (13%) were submitted by homeowners.



Homeowners		Commercial		Total
2002	19	2002	120	139
2003	20	2003	133	153
2004	15	2004	115	130
2005	9	2005	109	118
<u>2006</u>	<u>19</u>	<u>2006</u>	<u>90</u>	<u>109</u>
Total	82	Total	567	649

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Homeowners submitted soil samples to the Cornell Nutrient Analysis Laboratory during 2002-2006 primarily to request fertilizer recommendations for ornamentals (32%), lawns (18%), home garden vegetable production (19%), athletic fields (12%) and flowering annuals (10%). Commercial growers submitted samples primarily to grow apples (24%), corn silage or grain (16%), soybeans (11%) or grapes (9%).

Soils tested for home and garden in Niagara County were classified as belonging to soil management group 2 (11%), group 3 (16%), group 4 (56%), or group 5 (17%). A description of the different management groups is given below.

Soil Management Groups for New York

1	Fine-textured soils developed from clayey lake sediments and medium- to fine-textured soils developed from lake sediments.
2	Medium- to fine-textured soils developed from calcareous glacial till and medium-textured to moderately fine-textured soils developed from slightly calcareous glacial till mixed with shale and medium-textured soils developed in recent alluvium.
3	Moderately coarse textured soil developed from glacial outwash and recent alluvium and medium-textured acid soil developed on glacial till.
4	Coarse- to medium-textured soils formed from glacial till or glacial outwash.
5	Coarse- to very coarse-textured soils formed from gravelly or sandy glacial outwash or glacial lake beach ridges or deltas.
6	Organic or muck soils with more than 80% organic matter.

Of the samples submitted by commercial growers, the majority (55%) belonged to soil management group 2. Groups 1, 3, 4, and 5 were represented with 1, 25, 16, 2% of all samples. There were two muck soils. Hilton was the most common soil series (13% of all samples), followed by Rhinebeck (91%), Ovid (10%), Howard and Arkport (8% each).

Organic matter levels, as measured by loss-on-ignition, ranged from less than 1% to almost 30%. For homeowner samples, 46% tested between 2 and 4% organic matter, while 39% had more than 4% organic matter. Of the samples submitted by commercial growers, 64% contained between 2 and 4% organic matter.

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Soil pH in water (1:1 soil:water extraction ratio) varied from 4.3 to 8.1 for home and garden samples while 65% tested between 7.0 and 7.9 for pH. For the commercial samples, the highest pH was 8.0 and 73% tested between 6.0 and 7.4.

Extractable nutrients such as phosphorus (P), potassium (K), magnesium (Mg), calcium (Ca), iron (Fe), manganese (Mn), and zinc (Zn) were measured using the Morgan method (Morgan, 1941). This solution contains sodium acetate buffered at pH of 4.8.

Soil test P levels of <1 lb P/acre are classified as very low. Between 1-3 lbs P/acre is low. Medium is between 4-8 lbs P/acre. High testing soils have P levels between 9 and 39 lbs P/acre and anything higher is classified as very high. For homeowners, 12% of the soils tested low for P, 17% tested medium, 30% tested high and 40% tested very high. This meant that 70% tested high or very high in P. For commercial growers, 8% tested very high. In total 21% were low in P, 28% tested medium for P while 43% of the submitted samples were classified as high in soil test P. This means that 51% tested high or very high in P.

Classifications for K depend on soil management group. The fine textured soils (soil management group 1) have a greater K supplying capacity than the coarse textured sandy soils (soil management group 5). Classification for each of the management groups in the above table represent very low, low, medium, high and very high. So for example for soil management group 5 and 6, <60 lbs K/acre means the soil is very low in K, between 60 and 114 lbs K/acre is medium, 115-164 lbs K/acre is medium, 165-269 lbs K/acre is high and >269 lbs K/acre is classified as very high (see Table below).

Soil Management Group	Potassium Soil Test Value (Morgan extraction in lbs K/acre)				
	Very low	Low	Medium	High	Very High
1	<35	35-64	65-94	95-149	>149
2	<40	40-69	70-99	100-164	>164
3	<45	45-79	80-119	120-199	>199
4	<55	55-99	100-149	150-239	>239
5 and 6	<60	60-114	115-164	165-269	>269

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Potassium classifications for Niagara County soils varied from very low (2% of the homeowner soils and 1% of the commercial growers' soils) to very high (44% of the homeowner soils and 52% of the commercial growers' soils). For homeowners, 9% tested low in K, 20% tested medium, and 26% tested high for potassium. For commercial growers' soils, 4% tested low, 12% tested medium and 31% tested high in K.

Soils test very low for Mg if Morgan extractable Mg is less than 20 lbs Mg/acre. Low testing soils have 20-65 lbs Morgan Mg per acre. Soils with 66-100 lbs Mg/acre test medium for Mg. High testing soils have 101-199 lbs Mg/acre while soils with more than 200 lbs Mg/acre in the Morgan extraction are classified as very high in Mg. Magnesium levels ranged from 14 to more than 3500 lbs Mg/acre. There was only one soil sample that tested very low for Mg (commercial grower sample). Most soils tested high or very high for Mg (97% of the homeowner soils and 96% of the soils of the commercial growers).

Soils with more than 50 lbs Morgan extractable Fe per acre test excessive for Fe. Anything lower than 50 lbs Fe/acre is considered normal. Iron levels ranged from 94-99% in the normal range with only 1% of the homeowner soils and 6% of the commercial grower soils testing excessive for Fe. Similarly, most soils (85-99%) tested normal for manganese. Soils with more than 100 lbs Morgan extractable Mn per acre are classified as excessive in Mn. Anything less than 100 lbs Mn per acre is classified as normal. Soils with less than 0.5 lb Zn per acre in the Morgan extraction are classified as low in Zn. Medium testing soils have between 0.5 and 1 lb of Morgan extractable Zn per acre. If more than 1 lb of Zn/acre is extracted with the Morgan solution, the soil tests high in Zn. For the homeowner soils, 87% tested high for Zn while 11% tested medium and 2% were low in Zn. Of the commercial growers' samples, 4% tested low, 26% tested medium while 70% were high in Zn.

In the following sections, the summary tables for each of the soil fertility indicators described above are given. The appendix contains the crop codes used in section 3.

3. Cropping Systems

3.1 Homeowner Samples

Crops for which recommendations are requested by homeowners:

	2002-2006	%
ATF	10	12
FLA	8	10
GEN	1	1
LAW	15	18
MVG	15	18
OTH	1	1
PER	4	5
ROS	1	1
SAG	26	32
TRF	1	1
Total	82	100

Note: See Appendix for Cornell crop codes.

3.2 Commercial Samples

Crops for which recommendations are requested in commercial samples:

Current year crop	2002	2003	2004	2005	2006	Total	%
ABE/ABT	1	1	0	3	2	7	1
ACT	0	1	0	0	1	2	0
AGE/AGT	1	3	0	5	3	12	2
ALE	1	0	0	0	0	1	0
APP	5	57	18	28	26	134	24
BCE/BCT	3	0	0	1	2	6	1
BGE	0	1	0	0	0	1	0
BLB	0	1	0	0	0	1	0
CBP	10	0	2	2	5	19	3
CGE/CGT	0	0	1	1	2	4	1
CHS	0	6	2	0	6	14	2
CHT	0	5	4	0	3	12	2
CLE/CLT	1	0	1	3	0	5	1
COG/COS	29	20	32	8	3	92	16
GPA	4	0	1	3	1	9	2
GPF	0	0	0	2	0	2	0
GPV	5	1	12	17	5	40	7
GRE/GRT	0	0	0	4	2	6	1
IDL	1	2	0	0	0	3	1
MIX	0	0	1	0	2	3	1
OAT	2	2	0	0	0	4	1
PAR	0	2	9	1	2	14	2
PCH	0	7	4	17	6	34	6
PGE/PGT	0	0	0	1	3	4	1
PIE/PIT	0	1	0	0	2	3	1
PLE	0	0	0	0	1	1	0
PLM	0	0	4	0	0	4	1
POT	0	0	0	0	1	1	0
PUM	2	1	0	1	0	4	1
SOY	35	9	12	4	2	62	11
STS	2	3	0	0	0	5	1
SWC	4	0	0	1	0	5	1
TME/TOM	3	2	9	2	5	21	4
TRE/TRT	0	0	0	1	2	3	1
TRP	0	0	0	0	1	1	0
WHS/WHT	1	1	1	1	1	5	1
Unknown	10	7	2	3	1	23	4
Total	120	133	115	109	90	567	100

Note: See Appendix for Cornell crop codes.

4. Soil Types

4.1 Homeowner Samples

Soil types (soil management groups) for homeowner samples:

	2002-2006	%
SMG 1 (clayey)	0	0
SMG 2 (silty)	9	11
SMG 3 (silt loam)	13	16
SMG 4 (sandy loam)	46	56
SMG 5 (sandy)	14	17
SMG 6 (mucky)	0	0
Total	82	100

4.2 Commercial Samples

Soil series for commercial samples:

Name	SMG	2002	2003	2004	2005	2006	Total	%
Altmar	5	0	2	0	1	2	5	1
Appleton	2	5	15	3	3	16	42	7
Arkport	4	0	14	12	7	11	44	8
Canadaigua	3	1	1	0	1	1	4	1
Cayuga	2	0	0	1	2	0	3	1
Churchville	2	6	6	13	1	0	26	5
Claverack	4	1	2	1	1	0	5	1
Collamer	3	5	7	16	3	4	35	6
Colonie	5	0	0	1	0	0	1	0
Cosad	4	1	0	2	3	0	6	1
Dunkirk	3	2	2	0	3	8	15	3
Elnora	5	2	0	0	0	1	3	1
Fonda	2	0	0	0	1	0	1	0
Fredon	4	0	4	4	0	1	9	2
Galen	4	2	2	3	2	0	9	2
Hamlin	2	0	0	0	0	1	1	0
Hilton	2	25	17	11	7	15	75	13
Howard	3	3	16	8	10	7	44	8
Hudson	2	1	1	0	0	0	2	0
Lakemont	1	1	0	0	1	0	2	0
Lamson	4	0	0	0	1	0	1	0
Lockport	2	2	0	2	0	0	4	1
Madalin	1	1	0	0	1	2	4	1
Massena	4	1	0	0	0	0	1	0
Minoa	4	2	0	2	4	1	9	2
Muck	6	2	0	0	0	0	2	0
Niagara	3	3	0	2	0	0	5	1
Odessa	2	4	9	11	1	1	26	5
Ontario	2	9	0	4	4	2	19	3
Otisville	4	6	2	0	0	0	8	1
Ovid	2	7	9	8	19	12	55	10
Phelps	3	3	9	5	16	2	35	6
Raynham	3	0	0	0	5	0	5	1
Rhinebeck	2	24	15	6	12	3	60	11
unknown	-	1	0	0	0	0	1	0
Total	-	120	133	115	109	90	567	100

5. Organic Matter

5.1 Homeowner Samples

Organic matter (loss-on-ignition method) in homeowner samples (number):

	<1	1.0-1.9	2.0-2.9	3.0-3.9	4.0-4.9	5.0-5.9	6.0-6.9	>6.9	Total
Number	1	11	21	17	11	7	2	12	82
Percentage	1	13	26	21	13	9	2	15	100

	2002-2006
Lowest:	0.8
Highest:	24.1
Mean:	4.6
Median:	3.7

5.2 Commercial Samples

Organic matter (loss-on-ignition method) in commercial samples (number):

	<1	1.0-1.9	2.0-2.9	3.0-3.9	4.0-4.9	5.0-5.9	6.0-6.9	>6.9	Total
2002	0	16	55	31	11	2	3	2	120
2003	3	37	51	27	8	5	0	2	133
2004	3	26	53	29	3	0	0	1	115
2005	4	30	48	17	6	1	0	3	109
2006	3	27	42	11	3	1	2	1	90
Total	13	136	249	115	31	9	5	9	567

	2002	2003	2004	2005	2006
Lowest:	1.0	0.8	0.8	0.3	0.7
Highest:	29.1	7.6	10.0	20.6	8.5
Mean:	3.4	2.7	2.6	2.7	2.4
Median:	2.8	2.4	2.5	2.3	2.2

Organic matter in commercial samples (% of total number of samples):

	<1	1.0-1.9	2.0-2.9	3.0-3.9	4.0-4.9	5.0-5.9	6.0-6.9	>6.9	Total
2002	0	13	46	26	9	2	3	2	100
2003	2	28	38	20	6	4	0	2	100
2004	3	23	46	25	3	0	0	1	100
2005	4	28	44	16	6	1	0	3	100
2006	3	30	47	12	3	1	2	1	100
Total	2	24	44	20	5	2	1	2	100

6. pH

6.1 Homeowner Samples

pH of homeowner samples (numbers):

	<4.5	4.5-4.9	5.0-5.4	5.5-5.9	6.0-6.4	6.5-6.9	7.0-7.4	7.5-7.9	8.0-8.4	>8.4	Total
Number	0	1	1	5	7	8	24	31	5	0	82
Percentage	0	1	1	6	9	10	29	38	6	0	100

	2002-2006
Lowest:	4.6
Highest:	8.1
Mean:	-
Median:	7.4

6.2 Commercial Samples

pH of commercial samples (number):

	<4.5	4.5-4.9	5.0-5.4	5.5-5.9	6.0-6.4	6.5-6.9	7.0-7.4	7.5-7.9	8.0-8.4	>8.4	?	Total
2002	0	5	8	12	27	43	17	8	0	0	0	120
2003	1	3	11	13	35	47	17	3	0	0	3	133
2004	0	3	5	19	42	33	11	2	0	0	0	115
2005	3	2	9	19	21	34	17	4	0	0	0	109
2006	0	0	3	11	18	33	19	5	1	0	0	90
Total	4	13	36	74	143	190	81	22	1	0	3	567

	2002	2003	2004	2005	2006
Lowest:	4.5	4.3	4.5	4.3	5.1
Highest:	7.9	7.5	7.7	7.7	8.0
Mean:	-	-	-	-	-
Median:	6.5	6.5	6.3	6.5	6.6

pH of commercial samples (% of total number of samples):

	<4.5	4.5-4.9	5.0-5.4	5.5-5.9	6.0-6.4	6.5-6.9	7.0-7.4	7.5-7.9	8.0-8.4	>8.4	?	Total
2002	0	4	7	10	23	36	14	7	0	0	0	100
2003	1	2	8	10	26	35	13	2	0	0	2	100
2004	0	3	4	17	37	29	10	2	0	0	0	100
2005	3	2	8	17	19	31	16	4	0	0	0	100
2006	0	0	3	12	20	37	21	6	1	0	0	100
Total	1	2	6	13	25	34	14	4	0	0	1	100

7. Phosphorus

7.1 Homeowner Samples

Phosphorus (lbs/acre Morgan P) in homeowner samples (numbers):

	<1	1-3	4-8	9-39	40-60	61-80	81-100	101-150	151-200	>200	Total
	VL	L	M	H	VH	VH	VH	VH	VH	VH	
Number	0	10	14	25	9	4	3	4	2	11	82
Percentage	0	12	17	30	11	5	4	5	2	13	100

VL = very low, L = low, M = medium, H = high, VH = very high.

	2002-2006
Lowest:	1
Highest:	742
Mean:	87
Median:	25

7.2 Commercial Samples

Phosphorus (lbs P/acre Morgan extraction) for commercial samples (number):

	<1	1-3	4-8	9-39	40-60	61-80	81-100	101-150	151-200	>200	Total
	VL	L	M	H	VH	VH	VH	VH	VH	VH	
2002	0	29	39	46	5	0	1	0	0	0	120
2003	0	17	34	64	12	3	1	0	0	2	133
2004	0	30	36	44	4	1	0	0	0	0	115
2005	0	30	32	45	1	1	0	0	0	0	109
2006	0	15	16	43	9	4	0	1	0	2	90
Total	0	121	157	242	31	9	2	1	0	4	567

VL = very low, L = low, M = medium, H = high, VH = very high.

	2002	2003	2004	2005	2006
Lowest:	1	1	1	1	1
Highest:	98	358	67	71	340
Mean:	12	23	12	11	26
Median:	7	13	7	7	14

Phosphorus in commercial samples (% of total number of samples):

	<1	1-3	4-8	9-39	40-60	61-80	81-100	101-150	151-200	>200	Total
	VL	L	M	H	VH	VH	VH	VH	VH	VH	
2002	0	24	33	38	4	0	1	0	0	0	100
2003	0	13	26	48	9	2	1	0	0	2	100
2004	0	26	31	38	3	1	0	0	0	0	100
2005	0	28	29	41	1	1	0	0	0	0	100
2006	0	17	18	48	10	4	0	1	0	2	100
Total	0	21	28	43	5	2	0	0	0	1	100

VL = very low, L = low, M = medium, H = high, VH = very high.

8. Potassium

8.1 Homeowner Samples

Potassium (lbs K/acre Morgan extraction) in homeowner samples (number):

Soil Management Group 1						
	<35	35-64	65-94	95-149	>149	Total
	Very Low	Low	Medium	High	Very High	
Total (#)	0	0	0	0	0	0
Total (%)	-	-	-	-	-	-
Soil Management Group 2						
	<40	40-69	70-99	100-164	>164	Total
	Very Low	Low	Medium	High	Very High	
Total (#)	0	0	4	4	1	9
Total (%)	0	0	44	44	11	100
Soil Management Group 3						
	<45	45-79	80-119	120-199	>199	Total
	Very Low	Low	Medium	High	Very High	
Total (#)	1	2	0	2	8	13
Total (%)	8	15	0	15	62	100
Soil Management Group 4						
	<55	55-99	100-149	150-239	>239	Total
	Very Low	Low	Medium	High	Very High	
Total (#)	0	1	11	11	23	46
Total (%)	0	2	24	24	50	100
Soil Management Group 5						
	<60	60-114	115-164	165-269	>269	Total
	Very Low	Low	Medium	High	Very High	
Total (#)	1	4	1	4	4	14
Total (%)	7	29	7	29	29	100
Soil Management Group 6						
	<60	60-114	115-164	165-269	>269	Total
	Very Low	Low	Medium	High	Very High	
Total (#)	0	0	0	0	0	0
Total (%)	-	-	-	-	-	-

Rao, R., N. Herendeen, Q.M. Ketterings, and H. Krol (2007). Niagara Soil Sample Survey (2002-2006). CSS Extension Bulletin E07-36. 32 pages.

Potassium classification summary for homeowners:

Summary (#)	Very Low	Low	Medium	High	Very High	Total
Number	2	7	16	21	36	82
Percentage	2	9	20	26	44	100

	2002-2006
Lowest:	29
Highest:	4802
Mean:	383
Median:	211

8.2 Commercial Samples

Potassium (lbs K/acre Morgan extraction) in commercial samples (number):

Soil Management Group 1						
	<35	35-64	65-94	95-149	>149	Total
	Very Low	Low	Medium	High	Very High	
2002	0	0	0	0	2	2
2003	0	0	0	0	0	0
2004	0	0	0	0	0	0
2005	0	0	0	1	1	2
2006	0	0	0	0	2	2
Total (#)	0	0	0	1	5	6
Total (%)	0	0	0	17	83	100
Soil Management Group 2						
	<40	40-69	70-99	100-164	>164	Total
	Very Low	Low	Medium	High	Very High	
2002	0	0	6	38	39	83
2003	0	1	5	31	35	72
2004	0	4	11	27	17	59
2005	0	3	9	18	20	50
2006	0	1	7	12	30	50
Total (#)	0	9	38	126	141	314
Total (%)	0	3	12	40	45	100
Soil Management Group 3						
	<45	45-79	80-119	120-199	>199	Total
	Very Low	Low	Medium	High	Very High	
2002	0	2	7	5	3	17
2003	0	0	4	2	29	35
2004	0	1	6	8	16	31
2005	0	2	4	6	26	38
2006	0	1	2	1	18	22
Total (#)	0	6	23	22	92	143
Total (%)	0	4	16	15	64	100

Soil Management Group 4						
	<55	55-99	100-149	150-239	>239	Total
	Very Low	Low	Medium	High	Very High	
2002	3	2	1	2	5	13
2003	0	0	1	7	16	24
2004	0	0	4	9	11	24
2005	2	0	1	5	10	18
2006	0	1	1	1	10	13
Total (#)	5	3	8	24	52	92
Total (%)	5	3	9	26	57	100

Soil Management Group 5						
	<60	60-114	115-164	165-269	>269	Total
	Very Low	Low	Medium	High	Very High	
2002	0	1	0	1	0	2
2003	0	0	0	1	1	2
2004	0	0	0	0	1	1
2005	0	0	0	1	0	1
2006	0	1	0	2	0	3
Total (#)	0	2	0	5	2	9
Total (%)	0	22	0	56	22	100

Soil Management Group 6						
	<60	60-114	115-164	165-269	>269	Total
	Very Low	Low	Medium	High	Very High	
2002	0	0	0	0	2	2
2003	0	0	0	0	0	0
2004	0	0	0	0	0	0
2005	0	0	0	0	0	0
2006	0	0	0	0	0	0
Total (#)	0	0	0	0	2	2
Total (%)	0	0	0	0	100	100

Potassium classification summary for commercial samples.

Summary (#)	Very Low	Low	Medium	High	Very High	Un-known	Total
2002	3	5	14	46	51	1	120
2003	0	1	10	41	81	0	133
2004	0	5	21	44	45	0	115
2005	2	5	14	31	57	0	109
2006	0	4	10	16	60	0	90
Grand Total	5	20	69	178	294	1	567

Summary (%)	Very Low	Low	Medium	High	Very High	Un-known	Total
2002	3	4	12	38	43	1	100
2003	0	1	8	31	61	0	100
2004	0	4	18	38	39	0	100
2005	2	5	13	28	52	0	100
2006	0	4	11	18	67	0	100
Grand Total	1	4	12	31	52	0	100

	2002	2003	2004	2005	2006
Lowest:	37	61	40	16	64
Highest:	573	934	531	714	1254
Mean:	187	291	195	223	291
Median:	158	249	163	199	255

9. Magnesium

9.1 Homeowner Samples

Magnesium (lbs Mg/acre Morgan extraction) in homeowner samples (numbers):

	<20	20-65	66-100	101-199	>199	Total
	Very Low	Low	Medium	High	Very High	
Number	0	2	1	6	73	82
Percentage	0	2	1	7	89	100

	2002-2006
Lowest:	33
Highest:	2131
Mean:	704
Median:	561

9.2 Commercial Samples

Magnesium (lbs Mg/acre Morgan extraction) in commercial samples (number):

	<20	20-65	66-100	101-199	>199	Total
	Very Low	Low	Medium	High	Very High	
2002	1	1	2	15	101	120
2003	0	0	3	27	103	133
2004	0	1	6	18	90	115
2005	0	3	5	22	79	109
2006	0	1	0	18	71	90
Total	1	6	16	100	444	567

	2002	2003	2004	2005	2006
Lowest:	14	68	59	41	34
Highest:	1991	1457	1067	3534	1279
Mean:	459	391	388	487	338
Median:	392	331	385	328	298

Magnesium in commercial samples (% of total number of samples):

	<20	20-65	66-100	101-199	>199	Total
	Very Low	Low	Medium	High	Very High	
2002	1	1	2	13	84	100
2003	0	0	2	20	77	100
2004	0	1	5	16	78	100
2005	0	3	5	20	72	100
2006	0	1	0	20	79	100
Total	0	1	3	18	78	100

10. Iron

10.1 Homeowner Samples

Iron (lbs Fe/acre Morgan extraction) in homeowner samples:

Total number of samples:

	0-49	>49	Total
	Normal	Excessive	
Total	81	1	82

Percentages:

0-49	>49	Total
Normal	Excessive	
99	1	100

	2002-2006
Lowest:	2
Highest:	72
Mean:	12
Median:	8

10.2 Commercial Samples

Iron (lbs Fe/acre Morgan extraction) in commercial samples:

Total number of samples:

	0-49	>49	Total
	Normal	Excessive	
2002	113	7	120
2003	123	10	133
2004	108	7	115
2005	100	9	109
2006	87	3	90
Total	531	36	567

Percentages:

	0-49	>49	Total
	Normal	Excessive	
	94	6	100
	92	8	100
	94	6	100
	92	8	100
	97	3	100
	94	6	100

	2002	2003	2004	2005	2006
Lowest:	1	1	3	1	1
Highest:	69	146	111	246	91
Mean:	12	15	17	20	11
Median:	6	6	11	7	7

11. Manganese

11.1 Homeowner Samples

Manganese (lbs Mn/acre Morgan extraction) in homeowner samples:

Total number of samples:

	0-99	>99	Total
	Normal	Excessive	
Total	70	12	82

Percentages:

0-99	>99	Total
Normal	Excessive	
85	15	100

	2002-2006
Lowest:	7
Highest:	209
Mean:	63
Median:	52

11.2 Commercial Samples

Manganese (lbs Mn/acre Morgan extraction) in commercial samples:

Total number of samples:

	0-99	>99	Total
	Normal	Excessive	
2002	120	0	120
2003	132	1	133
2004	113	2	115
2005	105	4	109
2006	90	0	90
Total	560	7	567

Percentages:

	0-99	>99	Total
	Normal	Excessive	
	100	0	100
	99	1	100
	98	2	100
	96	4	100
	100	0	100
	99	1	100

	2002	2003	2004	2005	2006
Lowest:	7	4	8	9	6
Highest:	89	135	302	291	96
Mean:	28	27	31	33	23
Median:	24	21	28	23	20

12. Zinc

12.1 Homeowner Samples

Zinc (lbs Zn/acre Morgan extraction) in homeowner samples:

Total number of samples:

	<0.5	0.5-1.0	>1	Total
	Low	Medium	High	
Total	2	9	71	82

Percentages:

<0.5	0.5-1.0	>1	Total
Low	Medium	High	
2	11	87	100

	2002-2006
Lowest:	0.3
Highest:	110.8
Mean:	8.2
Median:	4.1

12.2 Commercial Samples

Zinc (lbs Zn/acre Morgan extraction) in commercial samples:

Total number of samples:

	<0.5	0.5-1.0	>1	Total
	Low	Medium	High	
2002	4	40	76	120
2003	1	10	122	133
2004	5	43	67	115
2005	4	31	74	109
2006	9	21	60	90
Total	23	145	399	567

Percentages:

<0.5	0.5-1.0	>1	Total
Low	Medium	High	
3	33	63	100
1	8	92	100
4	37	58	100
4	28	68	100
10	23	67	100
4	26	70	100

	2002	2003	2004	2005	2006
Lowest:	0.2	0.4	0.1	0.1	0.1
Highest:	108.7	126.1	28.0	10.9	153.6
Mean:	3.4	6.2	2.8	2.3	5.4
Median:	1.4	3.2	1.3	1.9	1.9

Appendix: Cornell Crop Codes

Crop codes used in the Cornell Nutrient Analysis Laboratory.

Crop Code	Crop Description
Alfalfa	
ABE	Alfalfa trefoil grass, Establishment
ABT	Alfalfa trefoil grass, Established
AGE	Alfalfa grass, Establishment
AGT	Alfalfa grass, Established
ALE	Alfalfa, Establishment
ALT	Alfalfa, Established
Birdsfoot	
BCE	Birdsfoot trefoil clover, Establishment
BCT	Birdsfoot trefoil clover, Established
BGE	Birdsfoot trefoil grass, Establishment
BGT	Birdsfoot trefoil grass, Established
BSE	Birdsfoot trefoil seed, Establishment
BST	Birdsfoot trefoil seed, Established
BTE	Birdsfoot trefoil, Establishment
BTT	Birdsfoot trefoil, Established
Barley	
BSP	Spring barley
BSS	Spring barley with legumes
BUK	Buckwheat
BWI	Winter barley
BWS	Winter barley with legumes
Clover	
CGE	Clover grass, Establishment
CGT	Clover grass, Established
CLE	Clover, Establishment
CLT	Clover, Established
CSE	Clover seed production, Establishment
CST	Clover seed production, Established

Crop Code	Crop Description
	Corn
COG	Corn grain
COS	Corn silage
	Grasses, pastures, covercrops
CVE	Crownvetch, Establishment
CVT	Crownvetch, Established
GIE	Grasses intensively managed, Establishment
GIT	Grasses intensively managed, Established
GRE	Grasses, Establishment
GRT	Grasses, Established
PGE	Pasture, Establishment
PGT	Pasture improved grasses, Established
PIE	Pasture intensively grazed, Establishment
PIT	Pasture intensively grazed, Established
PLE	Pasture with legumes, Establishment
PLT	Pasture with legumes, Established
PNT	Pasture native grasses
RYC	Rye cover crop
RYS	Rye seed production
TRP	Triticale peas
	Small grains
MIL	Millet
OAS	Oats seeded with legume
OAT	Oats
SOF	Sorghum forage
SOG	Sorghum grain
SOY	Soybeans
SSH	Sorghum sudan hybrid
SUD	Sudangrass
WHS	Wheat with legume
WHT	Wheat
	Others
ALG	Azalea
APP	Apples
ATF	Athletic field

Crop Code	Crop Description
BDR/DND	Beans-dry
BLU	Blueberries
CEM	Cemetery
FAR	Fairway
FLA	Flowering annuals
GRA	Grapes
GEN	Green
HRB	Herbs
IDL	Idle land
LAW	Lawn
MIX/MVG	Mixed vegetables
PER	Perennials
PRK	Park
POT/PTO	Potatoes
PUM	Pumpkins
ROD	Roadside
ROS	Roses
RSF	Raspberries, Fall
RSP	Raspberries (homeowners)
RSS	Raspberries, Summer
SAG	Ornamentals adapted to pH 6.0 to 7.5
SQW	Squash, Winter
STE	Strawberries, Ever
STR	Strawberries (homeowners)
STS	Strawberries, Spring
SUN	Sunflowers
SWC	Sweet corn
TOM	Tomatoes
TRE	Christmas trees, Establishment
TRF	Turf
TRT	Christmas trees, Topdressing