

Rao, R., P. Barney, Q.M. Ketterings, and H. Krol (2007). St. Lawrence Soil Sample Survey (2002-2006). CSS Extension Bulletin E07-2. 35 pages.

Soil Sample Survey

St. Lawrence County

Samples analyzed by CNAL (2002-2006)



St Lawrence County (photo credit: Peter Barney, CCE of St Lawrence County).

Summary compiled by

Renuka Rao, Peter Barney, Quirine M. Ketterings, and Hettie Krol



Cornell Nutrient Analysis Laboratory

<http://www.css.cornell.edu/soiltest/newindex.asp>

&

Nutrient Management Spear Program

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Renuka Rao

Director

Cornell Nutrient Analysis Laboratory
Department of Crop and Soil Sciences
804 Bradfield Hall, Cornell University
Ithaca NY 14853

Peter Barney

Field Crops Educator

St. Lawrence County Cornell Cooperative Extension

Quirine M. Ketterings and Hettie Krol

Nutrient Management Spear Program
Department of Crop and Soil Sciences

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St. Lawrence County (photo credit: Peter Barney, CCE of St Lawrence County).



1. County Introduction

St. Lawrence County is the largest of the six Northern New York Counties. It is also the largest county in New York State and in the top ten for the largest counties east of the Mississippi River. The county is bluntly wedge shaped, bordered on the northwest by the St. Lawrence River, east by Franklin County, west by Jefferson County, southwest by Lewis County, south by Herkimer County, and southeast by Hamilton County. Its land area is 2,041 square miles or 1,306,240 acres.

The county is made up of two belts. The first is a low land belt extending inland from the St. Lawrence River to the foothills of the Adirondacks. The second belt is the Adirondack Mountains. The low land belt's width is about 20 miles relatively flat to gently rolling. This area is underlain by lake-laid clays and glacial-outwash deposits covering limestone or sandstone. This makes up the bedrock. Being a glaciated area, soil types ranging from sand to clay can be found in the county; quite often in the same field.

Drainage in the county varies. All water flows north to the St. Lawrence River. There are seven watersheds that cover the county. The low land belt naturally is poorly drained. In order to farm effectively, ditching, tile drainage or ideally both are needed.

The climate of the county is generally cool and damp. The annual mean temperature for the valley is 44.4°F; for the mountains it is 41.2°F. Our frost-free season ranges from 107 to 152 days.

St. Lawrence County is basically a dairy county. The county has 481 dairy farms and 38,400 milk cows producing an average of 631,000,000 pounds of milk yearly. St. Lawrence County ranks 36th in the top 500 dairy counties in the U.S. The county has a total of 1,585 farms, #1 in the state, with 397,600 acres of farmland and 108,900 acres of woodland. Other than dairy you can find 3,500 head of beef, as well as sheep, goats and other livestock in the county.

Due to the climate St Lawrence County is an excellent forage-producing county. Grasses and legume/grass sods make up much of the farmland with 84,500 acres in hay production. Corn silage comes in at 26,600 acres. Much land is under pasture, both

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rotational and conventional grazing. Other crops grown are small grains, soybeans and various summer annual crops.

St. Lawrence County has a very strong forest product industry as well. This includes hardwood and softwood logs, pulp for paper and pelletizing wood waste for energy. The maple industry is another very strong business with 150 producers, producing 18,580 gallons per year, ranking St Lawrence County third in the state.

“Progressive Farmer” magazine, May 2007 rates St. Lawrence County as number six in the nation as a preferred rural area to live. “Log Cabin” magazine also rates St. Lawrence County in the top ten.

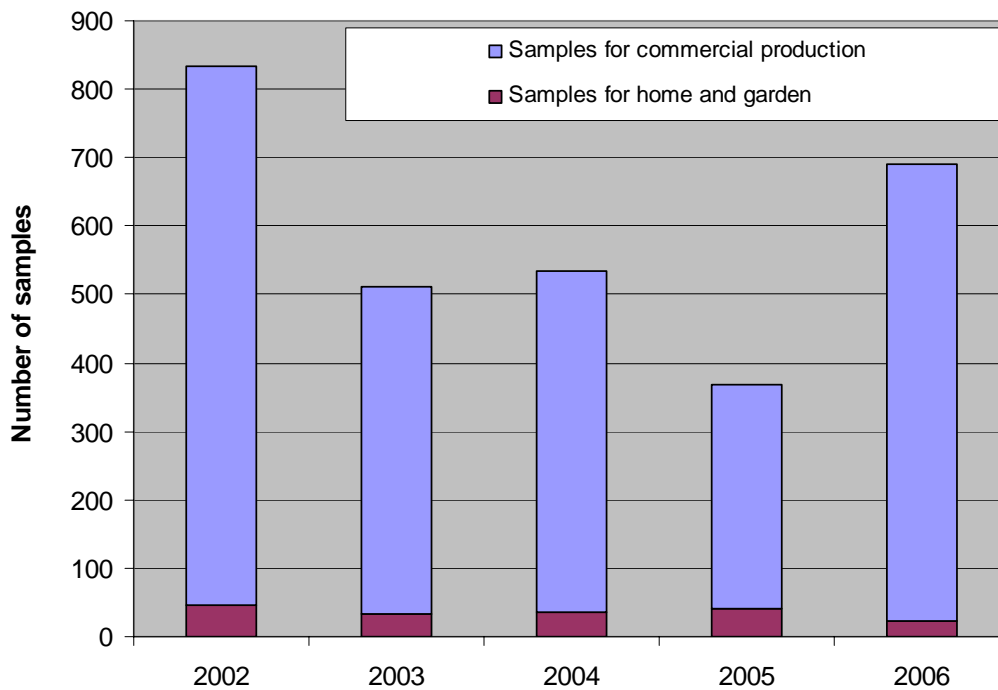
Peter Barney
Field Crop Extension Educator
St Lawrence County Cornell Cooperative Extension



St. Lawrence County (photo credit: Peter Barney, CCE of St Lawrence County).

2. General Survey Summary

This survey summarizes the soil test results from grower (identified as “commercial samples”) and homeowner samples from Lewis County submitted to the Cornell Nutrient Analysis Laboratory (CNAL) from 2002 to 2006. The total number of samples analyzed in these years amounted to 2938. Of these 2763 samples (94%) were submitted by commercial growers while 175 samples (6%) were submitted by homeowners. The number of samples fluctuated over the years.



Homeowners		Commercial		Total
2002	45	2002	789	834
2003	31	2003	479	510
2004	36	2004	499	535
2005	40	2005	328	368
<u>2006</u>	<u>23</u>	<u>2006</u>	<u>668</u>	<u>691</u>
Total	175	Total	2763	2938

The majority (74%) of the homeowners that submitted soil samples to the Cornell Nutrient Analysis Laboratory during 1995-2001 requested fertilizer recommendations for home garden vegetable production (39%) or lawns (27%). Commercial growers submitted samples to grow corn silage or grain (34%), grass hay production (28%), and alfalfa or alfalfa/grass mixes (22%), and while a few growers were planning to grow clover, oats and other crops.

Soils tested for home and garden in St Lawrence County were classified as soil management group 5 soils (57%), group 4 soil (21%), group 3 soils (19%), or group 2 soils (4%). 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, 10% belonged to soil management group 1, 3% were group 2 soils, 24% were group 3 soils, 54% were group 4 soils, 8% belonged to group 5 and less than 1% were organic soils. Muskellunge was the most common soil series (16% of all samples), followed by Hogansburg (14%), Swanton (8%), and Pittsfield (5%).

Organic matter levels, as measured by loss-on-ignition, ranged from less than 1% to greater than 40%. For homeowners 66% had between 2 and 5% organic matter while 51% had between 3 and 6% organic matter. Six percent had more than 6.9% organic matter. Of the samples submitted by commercial growers, 75% contained between 3 and 6% organic matter.

Soil pH in water (1:1 extraction ratio) varied from 4.8 to 8.4 for home and garden samples while 64% tested between 6.0 and 7.4 for pH. For the commercial samples, the highest pH was 7.9 and 80% 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 a pH of 4.8.

Soil test P levels of <1 lbs 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 40 lbs P/acre or greater is classified as very high. For homeowners, 25% tested low for phosphorus, 21% tested medium, 33% tested high and 21% tested very high. This meant that 54% tested high or very high in P. For commercial growers, only 3% tested very high. In total 38% was low in P, 29% tested medium for P while 28% were high in soil test P. This means that 31% tested high or very high in P. There were no clear trends in P levels over the 6 years.

Classifications for potassium 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 on page 8). Potassium classifications for St Lawrence County soils varied from very low (10% of the homeowner soils and 9% of the commercial growers' soils) to very high (27% of the homeowner soils and 14% of the commercial growers' soils). For homeowners, 22% tested low in K, 21% tested medium, and 20% tested high for potassium. For commercial growers' soils, 28% tested low, 25% tested medium and 21% tested high in potassium.

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

Soils test very low for magnesium 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 magnesium. High testing soils have 101-199 lbs Mg/acre while soils with more than 200 lbs Mg/acre are classified as very high in Mg. Magnesium levels ranged from 5 to 4570 lbs Mg/acre. There were no soils that tested very low for Mg among the homeowner samples and only 8 samples for commercial production were very low in Mg. Most soils were very high or very high in Mg (95% of the homeowner soils and 97% of the soils of the commercial growers). In total, 5% of the homeowner soils and 3% of the commercial growers' soil tested low or medium in Mg. Thus, Mg deficiency is not likely to occur in St Lawrence County provided the soil pH is maintained in a desirable range.

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 fell for 93-94% in the normal range with only 7% of the homeowner soils and 6% of the commercial grower soils testing excessive for Fe. Similarly, most soils (97-100%) 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/acre Zn are classified as low in Zn. Medium testing soils have between 0.5 and 1 lb/acre Zn. If more than 1 lb of Zn/acre is extracted, the soil tests high in Zn. For the homeowner soils, 92% tested high while 6% tested medium for Zn. Of the commercial growers' samples, 19% tested medium while 80% was 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 2.

3. Cropping Systems

3.1 Homeowner Samples

Crops for which recommendations are requested by homeowners:

	2002	2003	2004	2005	2006	Total	%
ALG	0	0	0	1	0	1	1
ATF	1	1	7	1	1	11	6
BLU	3	2	2	0	1	8	5
CEM	1	0	0	0	0	1	1
FAR	4	0	0	0	0	4	2
FLA	1	0	1	0	0	2	1
GEN	3	0	0	0	0	3	2
GRA	0	0	0	1	0	1	1
LAW	11	10	14	5	8	48	27
MIX	0	0	0	0	1	1	1
MVG	16	13	7	24	8	68	39
OTH	0	0	0	2	0	2	1
PER	0	1	0	3	0	4	2
PTO	0	0	0	1	0	1	1
RSP	0	0	3	0	3	6	3
SAG	1	4	0	2	1	8	5
STR	1	0	0	0	0	1	1
TRF	3	0	1	0	0	4	2
Unknown	0	0	1	0	0	1	1
Total	45	31	36	40	23	175	100

Notes: 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	2	2	1	0	2	7	0
AGE/AGT	181	71	109	42	115	518	19
ALE/ALT	3	20	32	9	29	93	3
ALG	0	0	0	1	0	1	0
APP	0	1	0	0	0	1	0
BCE	3	0	0	1	0	4	0
BDR	0	0	0	0	1	1	0
BKB	0	0	0	0	1	1	0
BRS	0	0	0	0	1	1	0
BSS	0	0	0	1	0	1	0
BUK	0	6	3	2	0	11	0
CBP	0	0	0	0	1	1	0
CGE/CGT	54	18	20	7	42	141	5
CLE/CLT	14	5	2	3	12	36	1
COG/COS	237	181	178	106	231	933	34
CSE	2	0	0	0	2	4	0
CVE	0	1	0	0	0	1	0
GIE/GIT	115	14	15	2	4	150	5
GRE/GRT	117	98	97	141	178	631	23
IDL	9	0	1	0	2	12	0
LET	0	0	0	0	1	1	0
MIX	3	1	0	0	6	10	0
OAS	12	8	4	0	2	26	1
OAT	1	5	1	4	10	21	1
OTH	3	13	15	3	5	39	1
PEP	1	0	0	0	0	1	0
PGE/PGT	1	2	0	0	0	3	0
PIE/PIT	1	1	0	0	0	2	0
PLE/PLT	0	0	2	0	0	2	0
PNE/PNT	6	0	3	0	3	12	0
POT	0	0	0	0	1	1	0
PUM	3	0	2	0	2	7	0
RSS	1	0	0	1	0	2	0
SOF	0	1	2	0	0	3	0
SOY	2	2	2	1	5	12	0
SSH	6	2	1	2	0	11	0
STS	2	1	0	0	0	3	0

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Current year crop	2002	2003	2004	2005	2006	Total	%
SWC	5	0	4	1	2	12	0
TRE/TRT	1	0	1	0	1	3	0
TUR	1	0	0	0	0	1	0
WHT	0	0	0	0	1	1	0
Unknown	3	26	4	1	8	42	2
Total	789	479	499	328	668	2763	100

Notes: See Appendix for Cornell crop codes.

4. Soil Types

4.1 Homeowner Samples

Soil types (soil management groups) for homeowner samples:

	2002	2003	2004	2005	2006	Total	%
SMG 1 (clayey)	0	0	0	0	0	0	0
SMG 2 (silty)	4	1	1	1	0	7	4
SMG 3 (silt loam)	9	5	11	3	4	33	19
SMG 4 (sandy loam)	14	8	5	4	6	37	21
SMG 5 (sandy)	18	17	19	32	13	99	57
SMG 6 (mucky)	0	0	0	0	0	0	0
Total	45	31	36	40	23	175	100

4.2 Commercial Samples

Soil series for commercial samples:

Name	SMG	2002	2003	2004	2005	2006	Total	%
Adams	5	12	4	16	2	21	55	2
Adjidaumo	1	22	1	7	15	8	53	2
Berkshire	5	8	0	0	0	0	8	0
Brayton	4	10	0	0	0	0	10	0
Canandaigua	3	0	0	0	0	3	3	0
Carbondale	6	1	0	0	0	0	1	0
Chaumont	1	13	2	0	19	13	47	2
Cheektowaga	5	0	0	0	1	0	1	0
Collamer	3	1	2	0	3	1	7	0
Colton	5	3	0	0	0	1	4	0
Cornish	3	8	0	0	0	0	8	0
Coveytown	4	3	0	0	2	1	6	0
Covington	1	3	0	5	0	0	8	0
Crary	4	5	0	3	0	2	10	0
Croghan	5	15	6	8	5	25	59	2
Deford	4	1	1	7	0	2	11	0
Depeyster	3	9	21	5	9	4	48	2
Dixmont	5	7	4	10	4	2	27	1
Dorval	6	4	0	0	0	0	4	0
Dunkirk	3	0	1	0	1	2	4	0
Eelweir	4	0	0	1	0	0	1	0
Elmwood	4	14	15	13	5	49	96	3
Empeyville	4	4	0	0	0	0	4	0
Fahey	5	5	0	0	2	0	7	0
Flackville	4	18	9	5	3	15	50	2
Georgia	4	1	1	3	0	5	10	0
Grenville	4	22	22	15	1	39	99	4
Guff	1	0	0	0	0	2	2	0
Guffin	1	0	0	0	7	0	7	0
Hailsboro	3	15	13	11	19	20	78	3
Hannawa	4	1	0	0	0	1	2	0
Hermon	4	0	0	0	1	0	1	0
Heuvelton	2	14	9	2	5	10	40	1
Hogansburg	4	85	106	99	4	87	381	14
Hollis	4	0	0	5	0	3	8	0
Hoosic	4	1	0	0	0	0	1	0
Hudson	2	4	1	0	1	1	7	0

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Name	SMG	2002	2003	2004	2005	2006	Total	%
Insula	4	0	3	0	1	2	6	0
Kalurah	4	38	16	19	18	6	97	4
Kars	4	0	0	2	0	0	2	0
Kingsbury	1	8	0	1	0	1	10	0
Lovewell	2	7	0	0	0	0	7	0
Lyme	5	0	0	1	0	0	1	0
Madalin	1	2	1	0	61	1	65	2
Madrid	4	1	0	0	0	0	1	0
Malone	4	65	22	18	9	7	121	4
Massena	4	1	0	14	1	4	20	1
Matoon	1	16	16	3	1	1	37	1
Melrose	4	0	3	3	0	1	7	0
Mino	4	3	1	0	0	0	4	0
Monarda	4	1	0	0	0	0	1	0
Munuscong	4	2	1	1	1	0	5	0
Muskellunge	3	188	52	67	49	91	447	16
Naumburg	5	2	0	1	2	36	41	1
Nehasne	4	11	2	1	1	1	16	1
Niagara	3	0	1	1	2	41	45	2
Nicholville	4	8	0	13	0	0	21	1
Ogdensburg	4	6	2	2	2	0	12	0
Pittsfield	4	0	34	48	30	39	151	5
Potsdam	4	0	0	3	0	1	4	0
Pyrities	4	20	14	5	5	6	50	2
Raquette	4	2	7	8	0	0	17	1
Rhinebeck	2	1	0	18	1	3	23	1
Roundabout	3	0	0	4	0	0	4	0
Salmon	4	2	0	1	0	0	3	0
Stockholm	5	10	5	6	2	2	25	1
Summerville	4	5	1	0	6	3	15	1
Sun	4	0	0	0	4	0	4	0
Sunapee	4	0	1	3	0	0	4	0
Swanton	4	31	45	33	11	93	213	8
Trout River	5	0	0	0	2	0	2	0
Vergennes	1	17	1	2	9	2	31	1
Waddington	4	10	0	3	1	3	17	1
Wallington	3	2	0	0	0	0	2	0
Wegatchie	3	4	1	0	0	2	7	0
Wilpoint	1	2	0	0	0	0	2	0
Unknown	-	15	32	3	0	5	55	2
Total	-	789	479	499	328	668	2763	100

5. Organic Matter

5.1 Homeowner Samples

Organic matter (loss-on-ignition method) of 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
2002	2	6	17	9	5	5	0	1	45
2003	0	4	5	9	5	4	1	3	31
2004	1	3	7	10	6	4	1	4	36
2005	0	3	10	10	10	3	4	0	40
2006	3	2	5	4	4	1	1	3	23
Total	6	18	44	42	30	17	7	11	175

	2002	2003	2004	2005	2006
Lowest:	0.1	1.5	0.9	1.6	0.1
Highest:	28.3	36.3	16.4	6.6	8.9
Mean:	3.5	4.9	4.3	3.7	3.6
Median:	2.6	3.8	3.9	3.5	3.5

Organic matter of homeowner 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	4	13	38	20	11	11	0	2	100
2003	0	13	16	29	16	13	3	10	100
2004	3	8	19	28	17	11	3	11	100
2005	0	8	25	25	25	8	10	0	100
2006	13	9	22	17	17	4	4	13	100
Total	3	10	25	24	17	10	4	6	100

5.2 Commercial Samples

Organic matter (loss-on-ignition method) of 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	27	132	299	201	84	23	23	789
2003	0	13	89	224	124	22	5	2	479
2004	0	14	107	225	119	24	4	6	499
2005	0	7	56	124	72	40	16	13	328
2006	0	13	144	304	141	44	14	8	668
Total	0	74	528	1176	657	214	62	52	2763

	2002	2003	2004	2005	2006
Lowest:	1.0	1.1	1.2	1.1	1.2
Highest:	29.7	44.1	19.0	32.7	9.9
Mean:	4.0	3.7	3.6	4.2	3.7
Median:	3.7	3.6	3.5	3.8	3.5

Organic matter of 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	3	17	38	25	11	3	3	100
2003	0	3	19	47	26	5	1	0	100
2004	0	3	21	45	24	5	1	1	100
2005	0	2	17	38	22	12	5	4	100
2006	0	2	22	46	21	7	2	1	100
Total	0	3	19	43	24	8	2	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
2002	0	0	2	6	11	4	10	11	1	0	45
2003	0	1	0	6	1	4	15	4	0	0	31
2004	0	1	2	6	8	8	7	3	1	0	36
2005	0	1	0	4	5	7	17	6	0	0	40
2006	0	0	0	2	3	4	9	3	2	0	23
Total	0	3	4	24	28	27	58	27	4	0	175

	2002	2003	2004	2005	2006
Lowest:	5.2	4.8	4.9	4.8	5.7
Highest:	8.4	7.7	8.3	7.8	8.2
Mean:	-	-	-	-	-
Median:	6.8	7.1	6.5	7.0	7.1

pH of homeowner of 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	0	4	13	24	9	22	24	2	0	100
2003	0	3	0	19	3	13	48	13	0	0	100
2004	0	3	6	17	22	22	19	8	3	0	100
2005	0	3	0	10	13	18	43	15	0	0	100
2006	0	0	0	9	13	17	39	13	9	0	100
Total	0	2	2	14	16	15	33	15	2	0	100

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	1	6	25	85	204	278	129	61	0	0	789
2003	0	0	9	53	121	156	105	35	0	0	479
2004	2	1	8	42	142	188	98	18	0	0	499
2005	0	1	10	70	113	108	24	2	0	0	328
2006	4	1	6	69	166	230	132	60	0	0	668
Total	7	9	58	319	746	960	488	176	0	0	2763

	2002	2003	2004	2005	2006
Lowest:	4.1	5.0	4.0	4.8	4.1
Highest:	7.9	7.8	7.8	7.5	7.9
Mean:	-	-	-	-	-
Median:	6.6	6.6	6.6	6.3	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	1	3	11	26	35	16	8	0	0	100
2003	0	0	2	11	25	33	22	7	0	0	100
2004	0	0	2	8	28	38	20	4	0	0	100
2005	0	0	3	21	34	33	7	1	0	0	100
2006	1	0	1	10	25	34	20	9	0	0	100
Total	0	0	2	12	27	35	18	6	0	0	100

7. Phosphorus

7.1 Homeowner Samples

Phosphorus (lbs/acre Morgan P) of 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	
2002	0	16	5	18	1	0	1	1	2	1	45
2003	0	3	7	14	2	1	2	1	0	1	31
2004	0	10	9	10	1	2	1	3	0	0	36
2005	0	10	9	10	1	3	1	2	1	3	40
2006	0	5	7	5	0	0	1	1	2	2	23
Total	0	44	37	57	5	6	6	8	5	7	175

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

	2002	2003	2004	2005	2006
Lowest:	1	2	1	1	3
Highest:	383	271	149	317	502
Mean:	32	34	26	46	67
Median:	9	15	8	10	8

Phosphorus of homeowner 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	36	11	40	2	0	2	2	4	2	100
2003	0	10	23	45	6	3	6	3	0	3	100
2004	0	28	25	28	3	6	3	8	0	0	100
2005	0	25	23	25	3	8	3	5	3	8	100
2006	0	22	30	22	0	0	4	4	9	9	100
Total	0	25	21	33	3	3	3	5	3	4	100

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

7.2 Commercial Samples

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

	<1	1-3	4-8	9-39	40-60	61-80	81-100	101-150	151-200	>200	Un-known	Total
	VL	L	M	H	VH	VH	VH	VH	VH	VH	-	
2002	0	392	171	199	16	3	3	4	0	1	0	789
2003	0	160	150	150	14	3	1	0	1	0	0	479
2004	0	159	175	149	15	0	1	0	0	0	0	499
2005	0	131	90	99	5	1	1	1	0	0	0	328
2006	0	220	201	179	12	3	3	3	0	1	46	668
Total	0	1062	787	776	62	10	9	8	1	2	46	2763

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

	2002	2003	2004	2005	2006
Lowest:	1	1	1	1	1
Highest:	244	162	88	130	229
Mean:	9	10	9	9	9
Median:	4	6	5	5	4

Phosphorus of 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	Un-known	Total
	VL	L	M	H	VH	VH	VH	VH	VH	VH	-	
2002	0	50	22	25	2	0	0	1	0	0	0	100
2003	0	33	31	31	3	1	0	0	0	0	0	100
2004	0	32	35	30	3	0	0	0	0	0	0	100
2005	0	40	27	30	2	0	0	0	0	0	0	100
2006	0	33	30	27	2	0	0	0	0	0	7	100
Total	0	38	28	28	2	0	0	0	0	0	2	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) of homeowner 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	0	0
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	0	0
Total (%)	-	-	-	-	-	-
Soil Management Group 2						
	<40	40-69	70-99	100-164	>164	Total
	Very Low	Low	Medium	High	Very High	
2002	0	0	1	2	1	4
2003	0	0	0	0	1	1
2004	0	1	0	0	0	1
2005	0	0	0	1	0	1
2006	0	0	0	0	0	0
Total (#)	0	1	1	3	2	7
Total (%)	0	14	14	43	29	100
Soil Management Group 3						
	<45	45-79	80-119	120-199	>199	Total
	Very Low	Low	Medium	High	Very High	
2002	0	1	2	2	4	9
2003	0	0	0	0	5	5
2004	1	1	3	3	3	11
2005	0	0	0	2	1	3
2006	0	0	1	2	1	4
Total (#)	1	2	6	9	14	32
Total (%)	3	6	19	28	44	100

Soil Management Group 4						
	<55	55-99	100-149	150-239	>239	Total
	Very Low	Low	Medium	High	Very High	
2002	2	1	6	2	3	14
2003	0	5	0	3	0	8
2004	1	0	1	1	2	5
2005	0	1	0	0	3	4
2006	0	0	1	1	4	6
Total (#)	3	7	8	7	12	37
Total (%)	8	19	22	19	32	100
Soil Management Group 5						
	<60	60-114	115-164	165-269	>269	Total
	Very Low	Low	Medium	High	Very High	
2002	4	6	4	1	3	18
2003	2	6	2	2	5	17
2004	0	8	2	5	4	19
2005	3	6	9	6	8	32
2006	4	2	5	2	0	13
Total (#)	13	28	22	16	20	99
Total (%)	13	28	22	16	20	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	0	0
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	0	0
Total (%)	-	-	-	-	-	-

Rao, R., P. Barney, Q.M. Ketterings, and H. Krol (2007). St. Lawrence Soil Sample Survey (2002-2006). CSS Extension Bulletin E07-2. 35 pages.

Potassium classification summary for homeowner samples:

Summary (#)	Very Low	Low	Medium	High	Very High	Total
2002	6	8	13	7	11	45
2003	2	11	2	5	11	31
2004	2	10	6	9	9	36
2005	3	7	9	9	12	40
2006	4	2	7	5	5	23
Grand Total	17	38	37	35	48	175

Summary (%)	Very Low	Low	Medium	High	Very High	Total
2002	13	18	29	16	24	100
2003	6	35	6	16	35	100
2004	6	28	17	25	25	100
2005	8	18	23	23	30	100
2006	17	9	30	22	22	100
Grand Total	10	22	21	20	27	100

	2002	2003	2004	2005	2006
Lowest:	18	31	31	29	51
Highest:	778	705	1029	1262	631
Mean:	174	221	207	226	192
Median:	134	161	129	147	137

8.2 Commercial Samples

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

Soil Management Group 1						
	<35	35-64	65-94	95-149	>149	Total
	Very Low	Low	Medium	High	Very High	
2002	3	20	27	21	12	83
2003	0	1	1	7	12	21
2004	0	1	3	8	6	18
2005	0	6	23	40	43	112
2006	0	2	5	12	9	28
Total (#)	3	30	59	88	82	262
Total (%)	1	11	23	34	31	100
Soil Management Group 2						
	<40	40-69	70-99	100-164	>164	Total
	Very Low	Low	Medium	High	Very High	
2002	1	3	10	4	8	26
2003	0	0	1	8	1	10
2004	0	0	5	6	9	20
2005	0	0	4	2	1	7
2006	0	0	4	6	4	14
Total (#)	1	3	24	26	23	77
Total (%)	1	4	31	34	30	100
Soil Management Group 3						
	<45	45-79	80-119	120-199	>199	Total
	Very Low	Low	Medium	High	Very High	
2002	7	60	67	53	40	227
2003	0	20	32	29	10	91
2004	0	21	45	17	5	88
2005	0	9	31	26	17	83
2006	1	29	59	63	12	164
Total (#)	8	139	234	188	84	653
Total (%)	1	21	36	29	13	100

Soil Management Group 4						
	<55	55-99	100-149	150-239	>239	Total
	Very Low	Low	Medium	High	Very High	
2002	66	129	55	47	74	371
2003	38	124	69	53	22	306
2004	50	106	79	56	37	328
2005	11	21	25	25	24	106
2006	25	144	113	61	27	370
Total (#)	190	524	341	242	184	1481
Total (%)	13	35	23	16	12	100
Soil Management Group 5						
	<60	60-114	115-164	165-269	>269	Total
	Very Low	Low	Medium	High	Very High	
2002	19	28	3	8	4	62
2003	9	6	2	0	2	19
2004	13	11	11	7	0	42
2005	6	7	4	1	2	20
2006	5	26	16	24	16	87
Total (#)	52	78	36	40	24	230
Total (%)	23	34	16	17	10	100
Soil Management Group 6						
	<60	60-114	115-164	165-269	>269	Total
	Very Low	Low	Medium	High	Very High	
2002	0	3	1	1	0	5
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	3	1	1	0	5
Total (%)	0	60	20	20	0	100

Potassium classification summary of commercial samples.

Summary (#)	Very Low	Low	Medium	High	Very High	Un-known	Total
2002	96	243	163	134	138	15	789
2003	47	151	105	97	47	32	479
2004	63	139	143	94	57	3	499
2005	17	43	87	94	87	0	328
2006	31	201	197	166	68	5	668
Grand Total	254	777	695	585	397	55	2763

Summary (%)	Very Low	Low	Medium	High	Very High	Un-known	Total
2002	12	31	21	17	17	2	100
2003	10	32	22	20	10	7	100
2004	13	28	29	19	11	1	100
2005	5	13	27	29	27	0	100
2006	5	30	29	25	10	1	100
Grand Total	9	28	25	21	14	2	100

	2002	2003	2004	2005	2006
Lowest:	6	25	22	19	30
Highest:	1772	1031	1322	585	1612
Mean:	134	138	128	155	136
Median:	95	107	105	125	112

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	
2002	0	1	0	4	40	45
2003	0	2	0	1	28	31
2004	0	0	3	5	28	36
2005	0	1	0	1	38	40
2006	0	1	0	3	19	23
Total	0	5	3	14	153	175

	2002	2003	2004	2005	2006
Lowest:	64	49	73	55	52
Highest:	1272	1292	1516	1108	1542
Mean:	483	571	437	465	589
Median:	450	595	361	406	507

Magnesium of homeowner samples (% of total number of samples):

	<20	20-65	66-100	101-199	>199	Total
	Very Low	Low	Medium	High	Very High	
2002	0	2	0	9	89	100
2003	0	6	0	3	90	100
2004	0	0	8	14	78	100
2005	0	3	0	3	95	100
2006	0	4	0	13	83	100
Total	0	3	2	8	87	100

9.2 Commercial Samples

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

	<20	20-65	66-100	101-199	>199	Total
	Very Low	Low	Medium	High	Very High	
2002	5	15	12	34	723	789
2003	0	7	4	30	438	479
2004	0	5	11	17	466	499
2005	0	4	7	23	294	328
2006	3	5	8	23	629	668
Total	8	36	42	127	2550	2763

	2002	2003	2004	2005	2006
Lowest:	5	25	27	31	12
Highest:	2377	2364	1504	2042	4570
Mean:	633	566	564	620	640
Median:	592	527	530	531	567

Magnesium content of 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	2	2	4	92	100
2003	0	1	1	6	91	100
2004	0	1	2	3	93	100
2005	0	1	2	7	90	100
2006	0	1	1	3	94	100
Total	0	1	2	5	92	100

10. Iron

10.1 Homeowner Samples

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

Total number of samples:

	0-49	>49	Total
	Normal	Excessive	
2002	41	4	45
2003	31	1	32
2004	34	2	36
2005	35	5	40
2006	23	0	23
Total	164	12	176

Percentages:

	0-49	>49	Total
	Normal	Excessive	
	91	9	100
	97	3	100
	94	6	100
	88	13	100
	100	0	100
	93	7	100

	2002	2003	2004	2005	2006
Lowest:	1	2	2	1	2
Highest:	134	74	61	204	44
Mean:	17	10	13	16	12
Median:	7	6	8	8	7

10.2 Commercial Samples

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

Total number of samples:

	0-49	>49	Total
	Normal	Excessive	
2002	754	35	789
2003	454	25	479
2004	471	28	499
2005	291	37	328
2006	639	29	668
Total	2609	154	2763

Percentages:

	0-49	>49	Total
	Normal	Excessive	
	96	4	100
	95	5	100
	94	6	100
	89	11	100
	96	4	100
	94	6	100

	2002	2003	2004	2005	2006
Lowest:	1	1	1	2	1
Highest:	635	133	346	294	551
Mean:	15	15	16	25	16
Median:	7	8	9	16	8

11. Manganese

11.1 Homeowner Samples

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

Total number of samples:				Percentages:		
	0-99	>99	Total	0-99	>99	Total
	Normal	Excessive		Normal	Excessive	
2002	44	1	45	98	2	100
2003	31	1	32	97	3	100
2004	34	2	36	94	6	100
2005	40	0	40	100	0	100
2006	22	1	23	96	4	100
Total	171	5	176	97	3	100

	2002	2003	2004	2005	2006
Lowest:	4	4	4	4	7
Highest:	115	686	118	53	102
Mean:	24	46	30	23	24
Median:	20	23	22	21	20

11.2 Commercial Samples

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

Total number of samples:				Percentages:		
	0-99	>99	Total	0-99	>99	Total
	Normal	Excessive		Normal	Excessive	
2002	788	1	789	100	0	100
2003	479	0	479	100	0	100
2004	496	3	499	99	1	100
2005	327	1	328	100	0	100
2006	666	2	668	100	0	100
Total	2756	7	2763	100	0	100

	2002	2003	2004	2005	2006
Lowest:	2	2	2	4	2
Highest:	108	98	223	102	174
Mean:	20	24	23	25	24
Median:	19	22	19	23	22

12. Zinc

12.1 Homeowner Samples

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

Total number of samples:

	<0.5	0.5-1.0	>1	Total
	Low	Medium	High	
2002	0	0	45	45
2003	0	0	31	31
2004	0	1	35	36
2005	0	7	33	40
2006	3	3	17	23
Total	3	11	161	175

Percentages:

<0.5	0.5-1.0	>1	Total
Low	Medium	High	
0	0	100	100
0	0	100	100
0	3	97	100
0	18	83	100
13	13	74	100
2	6	92	100

	2002	2003	2004	2005	2006
Lowest:	1.2	1.2	0.8	0.5	0.4
Highest:	37.4	124.7	92.0	45.1	675.6
Mean:	6.3	15.7	13.0	8.4	35.6
Median:	3.6	5.2	6.7	3.1	3.7

12.2 Commercial Samples

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

Total number of samples:

	<0.5	0.5-1.0	>1	Total
	Low	Medium	High	
2002	7	96	686	789
2003	8	106	365	479
2004	4	134	361	499
2005	5	45	278	328
2006	26	131	511	668
Total	50	512	2201	2763

Percentages:

	<0.5	0.5-1.0	>1	Total
	Low	Medium	High	
1	12	87	100	
2	22	76	100	
1	27	72	100	
2	14	85	100	
4	20	76	100	
2	19	80	100	

	2002	2003	2004	2005	2006
Lowest:	0.3	0.2	0.3	0.1	0.1
Highest:	188.0	500.3	28.7	161.4	196.2
Mean:	3.4	3.5	2.3	4.0	2.6
Median:	1.9	1.7	1.5	1.9	1.5

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
BDR/DND	Beans-dry

Crop Code	Crop Description
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, Established
TRF	Turf
TRT	Christmas trees, Topdressing