Soil Sample Survey

Livingston County

Samples analyzed by CNAL (2002-2006)

Livingston County (photo credit: Nate Herendeen, North West NY Dairy, Livestock & Field Crops Team).

Summary compiled by

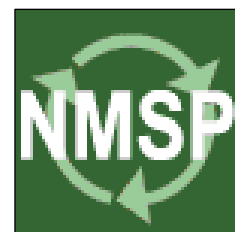**Renuka Rao, Nate Herendeen, Quirine M. Ketterings, and Hettie Krol**

Cornell Nutrient Analysis Laboratory
http://www.css.cornell.edu/soiltest/newindex.asp
&
Nutrient Management Spear Program
http://nmsp.css.cornell.edu/

Soil Sample Survey

Livingston County

Samples analyzed by CNAL (2002-2006)

Summary compiled by

Renuka Rao

Director

Cornell Nutrient Analysis Laboratory

Department of Crop and Soil Sciences

804 Bradfield Hall, Cornell University

Ithaca NY 14853

Nate Herendeen

Field Crops Educator

Cornell Cooperative Extension

North West New York Dairy, Livestock & Field Crops Team

Quirine M. Ketterings and **Hettie Krol**

Nutrient Management Spear Program

Department of Crop and Soil Sciences

November 27, 2007

Correct Citation:

Table of Content

Rao, R., N. Herendeen, Q.M. Ketterings, and H. Krol (2007). Livingston Soil Sample Survey (2002-2006). CSS Extension Bulletin E07-29. 34 pages.

1. County Introduction

Livingston County is located in the western Finger Lakes area of New York, south of Rochester. It contains over 404,000 acres of land area. Roughly 55% of the area is used for farm production.
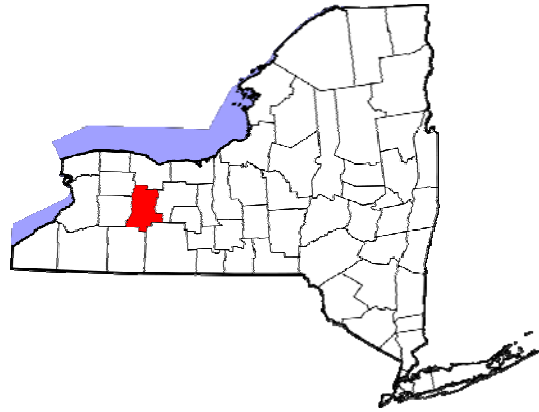
The northern two-thirds of the county lies in the Ontario Lowlands with transition to the Appalachian Uplands in the south. The Ontario Lowlands begin at Lake Ontario, about 25 miles to the north where the elevation is 246 feet above sea level. In Livingston County, the Lowlands are under 600 feet elevation in the north extending to about 1000 in the middle of the county. At the Appalachian interface, the elevation transitions quickly from 1000 to over 1500 feet. The exception is in the Genesee Valley that dissects the county in a north-south transect.

The pre-glacial Genesee Valley flood plain extends from Dansville in the south to the border of Monroe County in the north. The valley floor is about 600 feet above sea level for the entire distance. The narrow post-glacial valley enters the valley floor at Mt. Morris. It extends from there to the southwest as a 600 – 800 foot deep ravine that is the major feature of Letchworth State Park. At Portageville, it rejoins the upper, broad flood plain valley in Allegany County at just over 1000 feet. On the east side of the county, the Conesus and Hemlock Lake watersheds drain northward into the Genesee.

Livingston County soils are extremely diverse. The soils in the northern parts of the county are dominated by high carbonate materials developed from the limestone parent material. This was spread southward by the last glacial action that covered the county. In the south, soils formed from the low carbonate Devonian shale deposits. In the Genesee Valley area, soils formed from recent alluvium.

The agriculture of Livingston County is diverse. Dairy farming is the largest single generator of farm income. Livestock farmers produce and market beef, hogs and sheep from Livingston County. Thousands of acres are devoted to field and forage crops to support the dairy and livestock industry. Processing vegetable crops comprise the next

largest segment of the agricultural economy. Crops grown for processing include peas, snap beans, sweet corn, red beets, kidney beans, cabbage, carrots, onions and potatoes.

Fresh vegetables produced include all the above listed crops plus cucumbers, squash, pumpkins, and cole. 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. Christmas trees are grown on a wide range of soils, especially the acid soils on the hills in the south.

Livingston County is headquarters to several of the largest dairy farms in New York plus many smaller dairy farms and a few grass-based dairies. There is a major horse industry based on the gentle slopes adjacent to the old Genesee Valley. There are many farms that have found niche markets for a variety of products from flowers to maple products.

<div align="center">

Nate Herendeen
Field Crops Educator
North West New York Dairy, Livestock & Field Crops Team

</div>

2. General Survey Summary

This survey summarizes the soil test results from grower (identified as "commercial samples") and homeowner samples from Livingston County submitted to the Cornell Nutrient Analysis Laboratory (CNAL) from 2002 to 2006. The total number of samples analyzed in these years amounted to 1156. Of these, 1084 samples (94%) were submitted by commercial growers while 72 samples (6%) were submitted by homeowners.
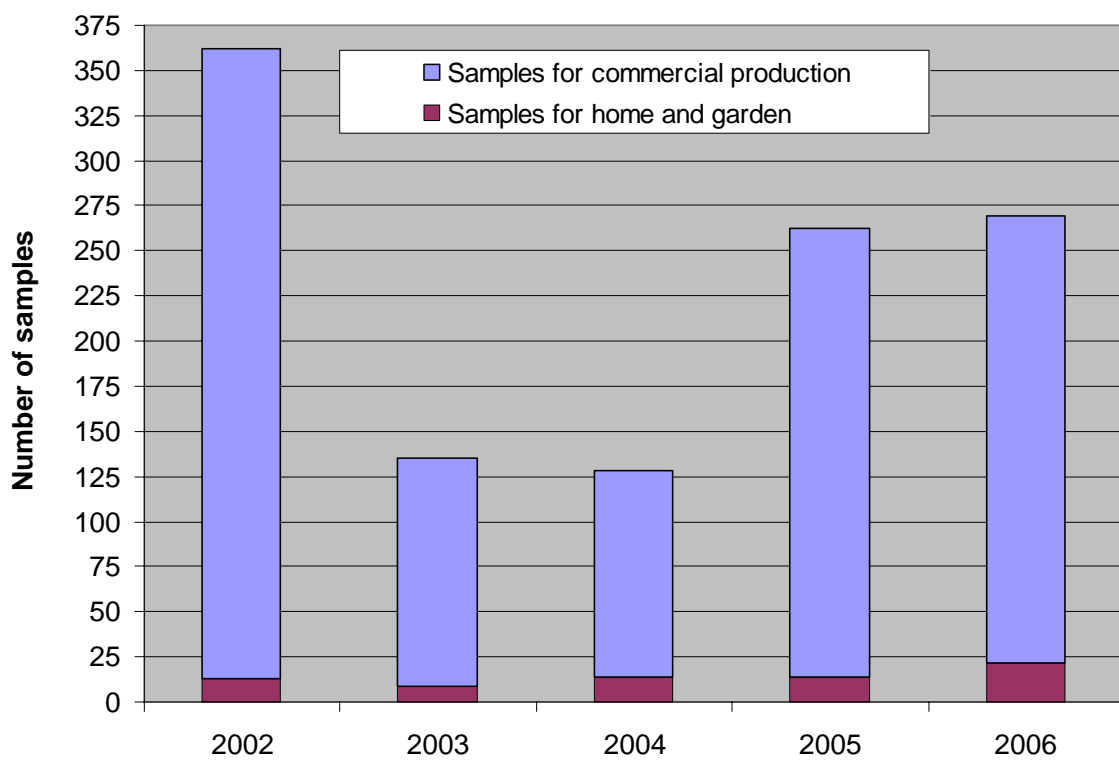
Homeowners			Commercial			Total
2002	13		2002	349		362
2003	9		2003	126		135
2004	14		2004	114		128
2005	14		2005	248		262
2006	22		2006	247		269
Total	72		Total	1084		1156

Homeowners submitted soil samples to the Cornell Nutrient Analysis Laboratory during 2002-2006 primarily to request fertilizer recommendations for ornamentals (33%), vegetable production (26%), and lawns (15%). Commercial growers submitted samples primarily to grow corn silage or grain (33%), alfalfa or alfalfa/grass mixes (19%), and wheat and sweet corn (5% each).

Soils tested for home and garden in Livingston County were classified as belonging to soil management group 2 (29%), group 3 (14%), group 4 (21%), or group 5 (36%). 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 (72%) belonged to soil management group 2. Twenty-one percent belonged to group 3 and 6% were group 4 soils. Lima and Ontario were the most common soil series (each 14% of all samples), followed by Conesus (13%), Lansing and Appleton (6% each).

Organic matter levels, as measured by loss-on-ignition, ranged from less than 1% to almost 15%. For homeowners most samples had between 2 and 5% organic matter (68% of all samples) while 36% had more then 5% organic matter. Of the samples submitted by commercial growers, 75% contained between 2 and 4% organic matter.

Soil pH in water (1:1 soil:water extraction ratio) varied from less than 4 to 7.8 for home and garden samples while 61% tested between pH 6.5 and 7.4. For the commercial samples, the highest pH was 8.6 and 80% tested between pH 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, 10% of the soils tested low for P, 7% tested medium, 21% tested high and 62% tested very high. This meant that 83% tested high or very high in P. For commercial growers, 8% tested very high. In total 16% were low in P, 22% tested medium for P while 54% of the submitted samples were classified as high in soil test P. In total, 61% 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 on page 6).

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

Potassium classifications for Livingston County soils varied from very low (1% each for homeowner and commercial growers' soils) to very high (58% of the homeowner soils

and 37% of the commercial growers' soils). For homeowners, 7% tested low in K, 4% tested medium, and 29% tested high for potassium. For commercial growers' soils, 8% tested low, 14% tested medium and 39% 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 34 to just over 2000 lbs Mg/acre. There were no soils that tested very low for Mg. Most soils tested high or very high for Mg (100% of the homeowner soils and 98% 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 96-98% in the normal range with 4% of the homeowner soils and 2% of the commercial grower soils testing excessive for Fe. Similarly, most soils (86-98%) 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, 93% tested high for Zn while 7% tested medium. Of the commercial growers' samples, 5% tested low, 32% tested medium while 63% 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 were requested by homeowners:

	2002-2006	%
BLU	2	3
FLA	3	4
GRA	1	1
IDL	1	1
LAW	11	15
MVG	19	26
OTH	2	3
PER	3	4
ROS	1	1
SAG	24	33
SUB	4	6
TRF	1	1
Total	72	100

Note: See Appendix for Cornell crop codes.

3.2 Commercial Samples

Crops for which recommendations were requested in commercial samples:

Current year crop	2002	2003	2004	2005	2006	Total	%
ABE/ABT	3	0	0	7	4	14	1
AGE/AGT	67	2	5	38	38	150	14
ALE/ALT	12	11	1	21	1	46	4
BCE	0	0	0	0	2	2	0
BDR	10	0	2	0	0	12	1
BET	0	2	20	5	0	27	2
BGE/BGT	1	1	5	1	13	21	2
BLB	1	0	2	0	1	4	0
BND	5	1	10	8	18	42	4
BNS	8	3	2	0	0	13	1
BUK	1	0	0	1	0	2	0
CGE/CGT	2	17	1	1	16	37	3
CHS	0	1	0	0	0	1	0
CLE/CLT	2	4	0	0	6	12	1
COG/COS	135	64	22	82	53	356	33
GIE	0	0	1	2	0	3	0
GPF	0	0	2	0	0	2	0
GRE/GRT	6	2	2	10	5	25	2
IDL	9	0	1	0	1	11	1
MIX	1	0	0	0	1	2	0
MVG	0	0	2	0	0	2	0
OAS	1	0	6	3	3	13	1
OAT	3	0	0	20	3	26	2
OTH	0	0	8	3	3	14	1
PEA	17	2	2	11	11	43	4
PGE/PGT	5	0	1	3	8	17	2
PIE/PIT	2	0	2	5	5	14	1
PLE/PLT	1	1	0	0	14	16	1
PNT	3	0	0	1	1	5	0
POT	3	3	0	0	0	6	1
PUM	0	0	1	0	1	2	0
RYS	0	0	0	0	1	1	0
SOF	0	1	0	0	0	1	0
SOY	6	1	1	11	2	21	2
SSH	2	0	1	0	0	3	0
SWC	7	0	10	6	26	49	5

Current year crop	2002	2003	2004	2005	2006	Total	%
TOM	0	0	0	1	0	1	0
TRE	1	0	0	0	0	1	0
TRT	2	2	0	0	2	6	1
WHS	1	0	0	1	0	2	0
WHT	32	7	3	5	8	55	5
Unknown	0	1	1	2	0	4	0
Total	349	126	114	248	247	1084	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)	21	29
SMG 3 (silt loam)	10	14
SMG 4 (sandy loam)	15	21
SMG 5 (sandy)	26	36
SMG 6 (mucky)	0	0
Total	72	100

4.2 Commercial Samples

Soil series for commercial samples:

Name	SMG	2002	2003	2004	2005	2006	Total	%
Alden	3	0	0	0	0	1	1	0
Angola	2	6	0	1	4	7	18	2
Appleton	2	33	2	0	17	13	65	6
Arkport	4	3	0	3	1	1	8	1
Arnot	3	1	0	0	0	0	1	0
Aurora	2	1	0	4	1	1	7	1
Bath	3	2	0	1	4	3	10	1
Benson	4	0	0	0	0	3	3	0
Berrien	5	0	0	0	2	0	2	0
Braceville	4	9	0	0	0	0	9	1
Burdett	2	2	0	3	0	0	5	0
Castile	4	4	0	0	0	0	4	0
Chenango	3	7	0	0	0	1	8	1
Collamer	3	1	0	0	1	3	5	0
Colonie	5	1	0	0	0	0	1	0
Conesus	2	39	11	1	71	20	142	13
Danley	2	1	0	0	0	0	1	0
Darien	2	0	1	3	0	0	4	0
Dunkirk	3	1	2	0	0	0	3	0
Elmridge	5	3	0	0	0	0	3	0
Erie	3	15	3	6	0	16	40	4
Fonda	2	2	0	0	0	0	2	0
Fredon	4	4	15	0	0	3	22	2
Galen	4	0	3	3	0	5	11	1
Genesee	2	0	0	0	0	2	2	0
Halsey	4	1	0	0	0	0	1	0
Hamlin	2	3	8	0	0	0	11	1
Hilton	2	0	1	0	45	12	58	5
Honeoye	2	4	16	8	5	4	37	3
Howard	3	4	3	1	0	0	8	1
Hudson	2	1	0	0	0	0	1	0
Ilion	2	0	0	3	0	0	3	0
Kendaia	2	9	0	2	6	1	18	2
Lamson	4	1	0	0	0	0	1	0
Langford	3	5	1	3	6	11	26	2
Lansing	2	14	2	8	18	25	67	6

Rao, R., N. Herendeen, Q.M. Ketterings, and H. Krol (2007). Livingston Soil Sample Survey (2002-2006). CSS Extension Bulletin E07-29. 34 pages.

Name	SMG	2002	2003	2004	2005	2006	Total	%
Lima	2	47	5	31	29	39	151	14
Lordstown	3	0	0	0	0	1	1	0
Lyons	2	1	0	0	0	1	2	0
Mardin	3	2	3	2	0	4	11	1
Middlebury	3	3	0	3	0	0	6	1
Niagara	3	4	0	0	1	2	7	1
Odessa	2	2	1	6	2	2	13	1
Ontario	2	76	26	11	13	22	148	14
Ovid	2	4	0	1	1	1	7	1
Palmyra	3	4	19	2	5	14	44	4
Rhinebeck	2	0	0	0	1	0	1	0
Schoharie	1	2	2	0	0	1	5	0
Stockbridge	3	1	0	0	0	2	3	0
Teel	2	4	0	1	0	5	10	1
Tioga	3	2	0	1	0	0	3	0
Valois	3	3	0	0	6	12	21	2
Volusia	3	0	0	3	7	8	18	2
Wampsville	3	0	0	0	2	0	2	0
Wassaic	4	0	0	0	0	1	1	0
Wayland	2	4	0	3	0	0	7	1
Woostern	3	11	0	0	0	0	11	1
Unknown	-	2	2	0	0	0	4	0
Total	-	349	126	114	248	247	1084	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	3	12	14	16	8	6	12	72
Percentage	1	4	17	19	22	11	8	17	100

	2002-2006
Lowest:	0.8
Highest:	14.6
Mean:	4.9
Median:	4.3

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	70	175	74	20	6	0	4	349
2003	11	40	47	24	3	0	1	0	126
2004	0	20	56	30	6	1	0	1	114
2005	0	22	165	46	12	2	0	1	248
2006	0	36	138	49	17	7	0	0	247
Total	11	188	581	223	58	16	1	6	1084

	2002	2003	2004	2005	2006
Lowest:	1.3	0.1	1.1	1.3	1.2
Highest:	12.8	6.4	7.6	13.7	5.5
Mean:	2.7	2.2	2.7	2.7	2.7
Median:	2.4	2.2	2.6	2.5	2.6

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	20	50	21	6	2	0	1	100
2003	9	32	37	19	2	0	1	0	100
2004	0	18	49	26	5	1	0	1	100
2005	0	9	67	19	5	1	0	0	100
2006	0	15	56	20	7	3	0	0	100
Total	1	17	54	21	5	1	0	1	100

Rao, R., N. Herendeen, Q.M. Ketterings, and H. Krol (2007). Livingston Soil Sample Survey (2002-2006). CSS Extension Bulletin E07-29. 34 pages.

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	1	1	4	5	3	18	26	14	0	0	72
Percentage	1	1	6	7	4	25	36	19	0	0	100

	2002-2006
Lowest:	3.1
Highest:	7.8
Mean:	-
Median:	7.1

Rao, R., N. Herendeen, Q.M. Ketterings, and H. Krol (2007). Livingston Soil Sample Survey (2002-2006). CSS Extension Bulletin E07-29. 34 pages.

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	0	10	29	64	125	86	28	6	0	0	349
2003	0	1	2	6	13	34	45	14	4	7	0	126
2004	0	0	0	8	23	48	18	5	0	0	12	114
2005	0	0	1	22	59	105	52	9	0	0	0	248
2006	0	0	14	38	77	80	33	5	0	0	0	247
Total	1	1	27	103	236	392	234	61	10	7	12	1084

	2002	2003	2004	2005	2006
Lowest:	5.0	4.7	5.6	5.1	5.1
Highest:	8.2	8.6	7.7	7.7	7.9
Mean:	-	-	-	-	-
Median:	6.8	7.0	6.6	6.6	6.4

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	0	3	8	18	36	25	8	2	0	0	100
2003	0	1	2	5	10	27	36	11	3	6	0	100
2004	0	0	0	7	20	42	16	4	0	0	11	100
2005	0	0	0	9	24	42	21	4	0	0	0	100
2006	0	0	6	15	31	32	13	2	0	0	0	100
Total	0	0	2	10	22	36	22	6	1	1	1	100

Rao, R., N. Herendeen, Q.M. Ketterings, and H. Krol (2007). Livingston Soil Sample Survey (2002-2006). CSS Extension Bulletin E07-29. 34 pages.

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	7	5	15	5	1	2	5	4	28	72
Percentage	0	10	7	21	7	1	3	7	6	39	100

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

	2002-2006
Lowest:	1
Highest:	672
Mean:	177
Median:	112

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	45	76	195	19	2	2	4	1	5	349
2003	0	20	32	58	13	0	2	1	0	0	126
2004	0	21	16	71	4	1	0	0	0	1	114
2005	0	38	57	131	13	2	4	1	1	1	248
2006	0	52	62	128	3	1	0	0	1	0	247
Total	0	176	243	583	52	6	8	6	3	7	1084

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

	2002	2003	2004	2005	2006
Lowest:	1	1	1	1	1
Highest:	636	124	210	530	176
Mean:	23	19	16	19	12
Median:	14	13	12	12	9

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	13	22	56	5	1	1	1	0	1	100
2003	0	16	25	46	10	0	2	1	0	0	100
2004	0	18	14	62	4	1	0	0	0	1	100
2005	0	15	23	53	5	1	2	0	0	0	100
2006	0	21	25	52	1	0	0	0	0	0	100
Total	0	16	22	54	5	1	1	1	0	1	100

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

Rao, R., N. Herendeen, Q.M. Ketterings, and H. Krol (2007). Livingston Soil Sample Survey (2002-2006). CSS Extension Bulletin E07-29. 34 pages.

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	1	0	8	12	21
Total (%)	0	5	0	38	57	100

Soil Management Group 3					
	<45	45-79	80-119	120-199	>199	Total
	Very Low	Low	Medium	High	Very High	
Total (#)	0	0	0	2	8	10
Total (%)	0	0	0	20	80	100

Soil Management Group 4					
	<55	55-99	100-149	150-239	>239	Total
	Very Low	Low	Medium	High	Very High	
Total (#)	1	1	1	3	9	15
Total (%)	7	7	7	20	60	100

Soil Management Group 5					
	<60	60-114	115-164	165-269	>269	Total
	Very Low	Low	Medium	High	Very High	
Total (#)	0	3	2	8	13	26
Total (%)	0	12	8	31	50	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). Livingston Soil Sample Survey (2002-2006). CSS Extension Bulletin E07-29. 34 pages.

Potassium classification summary for homeowners:

Summary	Very Low	Low	Medium	High	Very High	Total
Number	1	5	3	21	42	72
Percentage	1	7	4	29	58	100

	2002-2006
Lowest:	48
Highest:	2165
Mean:	351
Median:	247

Rao, R., N. Herendeen, Q.M. Ketterings, and H. Krol (2007). Livingston Soil Sample Survey (2002-2006). CSS Extension Bulletin E07-29. 34 pages.

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	2	0	2
2003	0	0	0	1	1	2
2004	0	0	0	0	0	0
2005	0	0	0	0	0	0
2006	0	0	0	1	0	1
Total (#)	0	0	0	4	1	5
Total (%)	0	0	0	80	20	100

Soil Management Group 2					
	<40	40-69	70-99	100-164	>164	Total
	Very Low	Low	Medium	High	Very High	
2002	0	9	40	90	114	253
2003	11	7	5	25	25	73
2004	0	3	14	47	22	86
2005	0	17	21	62	113	213
2006	0	18	18	72	47	155
Total (#)	11	54	98	301	321	780
Total (%)	1	7	13	38	41	100

Soil Management Group 3					
	<45	45-79	80-119	120-199	>199	Total
	Very Low	Low	Medium	High	Very High	
2002	2	8	15	23	18	66
2003	0	3	6	11	11	31
2004	0	0	2	12	8	22
2005	0	10	4	15	3	32
2006	0	5	10	34	29	78
Total (#)	2	26	37	95	69	229
Total (%)	1	11	16	41	30	100

Rao, R., N. Herendeen, Q.M. Ketterings, and H. Krol (2007). Livingston Soil Sample Survey (2002-2006). CSS Extension Bulletin E07-29. 34 pages.

Soil Management Group 4					
	<55	55-99	100-149	150-239	>239	Total
	Very Low	Low	Medium	High	Very High	
2002	0	2	6	8	6	22
2003	0	1	7	8	2	18
2004	0	0	4	2	0	6
2005	0	0	1	0	0	1
2006	0	1	2	8	2	13
Total (#)	0	4	20	26	10	60
Total (%)	0	7	33	43	17	100

Soil Management Group 5					
	<60	60-114	115-164	165-269	>269	Total
	Very Low	Low	Medium	High	Very High	
2002	0	2	1	1	0	4
2003	0	0	0	0	0	0
2004	0	0	0	0	0	0
2005	0	1	1	0	0	2
2006	0	0	0	0	0	0
Total (#)	0	3	2	1	0	6
Total (%)	0	50	33	17	0	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., N. Herendeen, Q.M. Ketterings, and H. Krol (2007). Livingston Soil Sample Survey (2002-2006). CSS Extension Bulletin E07-29. 34 pages.

Potassium classification summary for commercial samples.

Summary (#)	Very Low	Low	Medium	High	Very High	Un-known	Total
2002	2	21	62	124	138	2	349
2003	11	11	18	45	39	2	126
2004	0	3	20	61	30	0	114
2005	0	28	27	77	116	0	248
2006	0	24	30	115	78	0	247
Grand Total	13	87	157	422	401	4	1084

Summary (%)	Very Low	Low	Medium	High	Very High	Un-known	Total
2002	1	6	18	36	40	1	100
2003	9	9	14	36	31	2	100
2004	0	3	18	54	26	0	100
2005	0	11	11	31	47	0	100
2006	0	10	12	47	32	0	100
Grand Total	1	8	14	39	37	0	100

	2002	2003	2004	2005	2006
Lowest:	38	20	54	43	44
Highest:	1256	441	388	1156	422
Mean:	190	162	151	183	161
Median:	157	149	137	161	150

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	0	0	4	68	72
Percentage	0	0	0	6	94	100

	2002-2006
Lowest:	128
Highest:	2003
Mean:	593
Median:	457

Rao, R., N. Herendeen, Q.M. Ketterings, and H. Krol (2007). Livingston Soil Sample Survey (2002-2006). CSS Extension Bulletin E07-29. 34 pages.

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	0	4	3	31	311	349
2003	0	1	1	8	116	126
2004	0	0	0	5	109	114
2005	0	0	1	18	229	248
2006	0	0	4	29	214	247
Total	0	5	9	91	979	1084

	2002	2003	2004	2005	2006
Lowest:	42	34	121	82	73
Highest:	1880	1028	765	1122	1618
Mean:	388	458	382	362	384
Median:	346	445	374	334	322

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	0	1	1	9	89	100
2003	0	1	1	6	92	100
2004	0	0	0	4	96	100
2005	0	0	0	7	92	100
2006	0	0	2	12	87	100
Total	0	0	1	8	90	100

Rao, R., N. Herendeen, Q.M. Ketterings, and H. Krol (2007). Livingston Soil Sample Survey (2002-2006). CSS Extension Bulletin E07-29. 34 pages.

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	69	3	72

Percentages:

0-49	>49	Total
Normal	Excessive	
96	4	100

	2002-2006
Lowest:	1
Highest:	1118
Mean:	25
Median:	5

10.2 Commercial Samples

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

Total number of samples:

	0-49	>49	Total
	Normal	Excessive	
2002	347	2	349
2003	118	8	126
2004	111	3	114
2005	246	2	248
2006	241	6	247
Total	1063	21	1084

Percentages:

	0-49	>49	Total
	Normal	Excessive	
	99	1	100
	94	6	100
	97	3	100
	99	1	100
	98	2	100
	98	2	100

	2002	2003	2004	2005	2006
Lowest:	1	1	1	1	1
Highest:	1405	77	82	94	134
Mean:	9	10	9	7	11
Median:	3	3	5	4	6

Rao, R., N. Herendeen, Q.M. Ketterings, and H. Krol (2007). Livingston Soil Sample
Survey (2002-2006). CSS Extension Bulletin E07-29. 34 pages.

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	62	10	72

Percentages:

0-99	>99	Total
Normal	Excessive	
86	14	100

	2002-2006
Lowest:	11
Highest:	158
Mean:	57
Median:	49

Rao, R., N. Herendeen, Q.M. Ketterings, and H. Krol (2007). Livingston Soil Sample Survey (2002-2006). CSS Extension Bulletin E07-29. 34 pages.

11.2 Commercial Samples

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

Total number of samples:

	0-99	>99	Total
	Normal	Excessive	
2002	348	1	349
2003	114	12	126
2004	111	3	114
2005	248	0	248
2006	246	1	247
Total	1067	17	1084

Percentages:

	0-99	>99	Total
	Normal	Excessive	
100	0	100
90	10	100
97	3	100
100	0	100
100	0	100
98	2	100

	2002	2003	2004	2005	2006
Lowest:	10	8	12	16	16
Highest:	133	179	162	81	136
Mean:	30	39	34	34	35
Median:	29	29	28	32	33

Rao, R., N. Herendeen, Q.M. Ketterings, and H. Krol (2007). Livingston Soil Sample Survey (2002-2006). CSS Extension Bulletin E07-29. 34 pages.

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	0	5	67	72

Percentages:

	<0.5	0.5-1.0	>1	Total
	Low	Medium	High	
	0	7	93	100

	2002-2006
Lowest:	0.5
Highest:	254.4
Mean:	11.5
Median:	5.5

Rao, R., N. Herendeen, Q.M. Ketterings, and H. Krol (2007). Livingston Soil Sample
Survey (2002-2006). CSS Extension Bulletin E07-29. 34 pages.

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	1	65	283	349
2003	1	34	91	126
2004	4	52	58	114
2005	17	81	150	248
2006	26	115	106	247
Total	49	347	688	1084

Percentages:

	<0.5	0.5-1.0	>1	Total
	Low	Medium	High	
	0	19	81	100
	1	27	72	100
	4	46	51	100
	7	33	60	100
	11	47	43	100
	5	32	63	100

	2002	2003	2004	2005	2006
Lowest:	0.4	0.4	0.2	0.1	0.1
Highest:	41.6	7.2	29.7	17.0	28.0
Mean:	2.2	1.6	1.6	1.5	1.4
Median:	1.6	1.4	1.1	1.2	1.0

31

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