Rao, R., B. Aldrich, Q.M. Ketterings, and H. Krol (2007). Cayuga Soil Sample Survey (2002-2006). CSS Extension Bulletin E07-34. 34 pages.

Soil Sample Survey

Cayuga County

Samples analyzed by CNAL (2002-2006)

Cayuga County (photo credit: Brian Aldrich, CCE of Cayuga County).

Summary compiled by

Renuka Rao, Brian Aldrich, 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

Cayuga County

Samples analyzed by CNAL (2002-2006)

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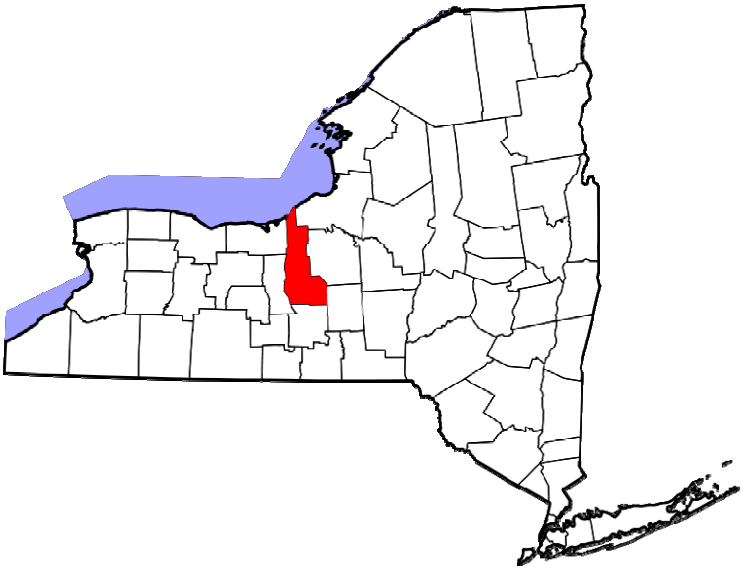
Cayuga County (photo credit: Brian Aldrich, CCE of Cayuga County).

1. County Introduction

Located in the heart of central New York in the Finger Lakes region, Cayuga County stretches 55 miles from the southern tier to the shores of Lake Ontario. Cayuga Lake



forms the southwestern border of the county, and the southern half of Skaneateles Lake forms part of the eastern border. Owasco Lake lies entirely within the county, and the city of Auburn (the county seat) lies at the north end of the lake. The county is 22 miles wide at the southern end but narrows to only 6 miles wide at the northern end. Cayuga County covers a total of 699 square miles, or 447,360 acres. Virtually all of the water in the county makes its way to Lake Ontario, most of it through the Seneca River.

According to the Soil Survey (Hutton, 1971):

> Most of the soils formed in glacial deposits containing various amounts of sandstone, shale, and limestone. For the most part, these soils are deep, gently to moderately sloping, and medium textured. They are mainly well drained and are medium to high in content of lime. They are well suited to the type of farming common in the county.

The richest farmland is found in the southern half of the county, between the border with Tompkins County and Route 20. It is here that the largest dairies are found, but the soils also support profitable crop farming. Honeoye soils predominate and Honeoye is the most extensive series in the county. The agriculture is more mixed north of Route 20, where there are organic soils used for vegetable production; however, some vegetables are also grown in the southern half of the county.

According to the USDA Census of Agriculture there were 881 farms in the county in 2002 and 178,497 acres of cropland. Corn was by far the largest crop, covering 59,876 acres. Alfalfa and grass hay combined covered 62,036 acres. Soybean acreage has been increasing, and soybeans were grown on 23,064 acres in 2002. There were 7,124 acres of wheat, 3,265 acres of oats, 5,175 acres of vegetables and 314 acres in orchards. There are two wineries on the shore of Cayuga Lake.

For animal agriculture, the 2002 Census reports 173 dairy farms with a total of 28,939 milkers, and 169 beef farms with a total of 2,049 beef cows. The entire cattle/calves inventory was 58,765 head. For poultry, there were 43 egg farms with a total of 102,674 layers, and 7 broiler operations with 6,020 birds. Hog farms numbered 25, with 7,924 animals sold.

Cayuga County is also home to the Musgrave Research Farm in Aurora, where field crop research has been conducted for over 50 years by scientists from Cornell University. The results of that research, and of field trials conducted at other locations across the state, form the basis for Cornell's crop and soil nutrient recommendations. Crop nutrient recommendations based on locally-calibrated soil tests are the foundation for profitable agriculture. Soil tests show where nutrients are needed to achieve maximum economic yield. On fields where soil nutrient levels exceed crop requirements, soil tests show farmers where money can be saved by withholding unnecessary applications of fertilizer, which in turn protects water quality by preventing excessive buildup of soil nutrients.

The Cornell Nutrient Analysis Laboratory provides fertility recommendations for three years for each soil sample it receives, and copies of the soil test report are mailed to the county agent as well. This enables the county agent to answer questions the farmer or homeowner may have about the recommendations. The result is a powerful tool for maintaining profitable agriculture as well as protecting the environment, without which we would be blind.

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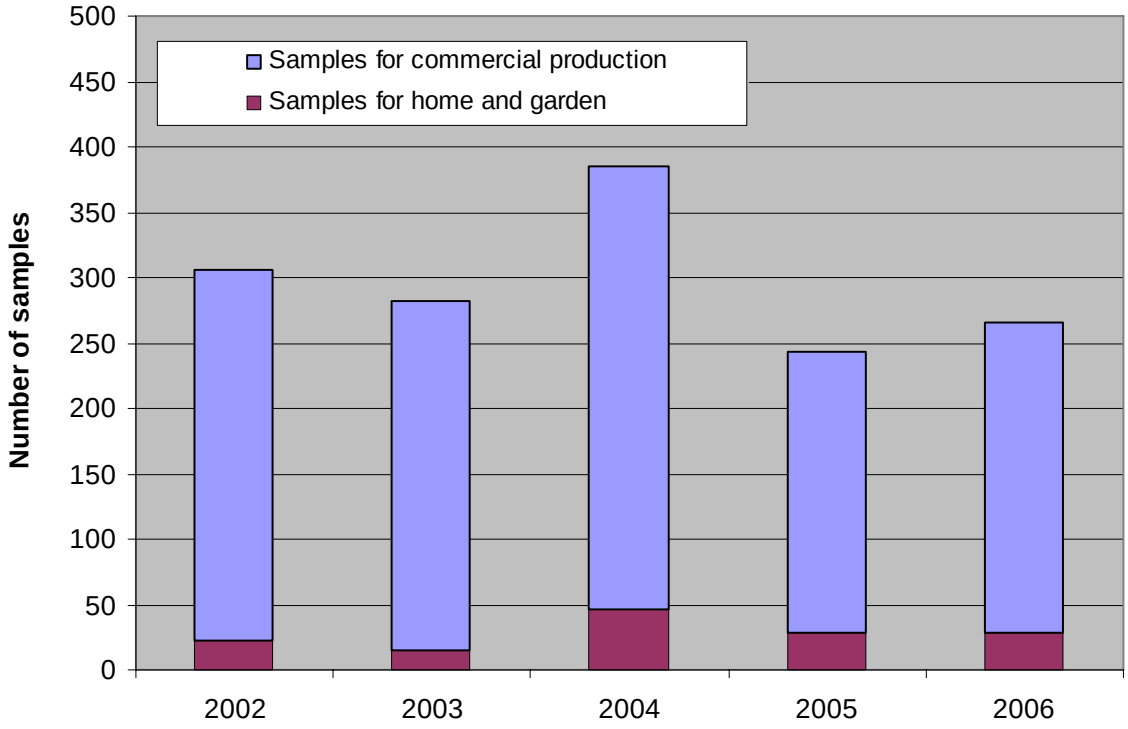
2. General Survey Summary

This survey summarizes the soil test results from grower (identified as "commercial samples") and homeowner samples from Cayuga County submitted to the Cornell Nutrient Analysis Laboratory (CNAL) from 2002 to 2006. The total number of samples analyzed in these years amounted to 1482. Of these, 1341 samples (90%) were submitted by commercial growers while 141 samples (10%) were submitted by homeowners.



Homeowners			Commercial			Total
2002	22		2002	284		306
2003	15		2003	267		282
2004	47		2004	338		385
2005	29		2005	215		244
2006	28		2006	237		265
Total	141		Total	1341		1482

Homeowners submitted soil samples to the Cornell Nutrient Analysis Laboratory during 2002-2006 primarily to request fertilizer recommendations for lawns (39%) or for home garden vegetable production (20%). Commercial growers submitted samples primarily to grow corn silage or grain (43%), alfalfa or alfalfa/grass mixes (15%), soybeans (12%) and wheat (5%).

Soils tested for home and garden in Cayuga County were classified as belonging to soil management group 2 (37%), group 3 (32%), group 4 (21%), or group 5 (11%). 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, 68% belonged to soil management group 2. Groups 1, 3, 4, 5 and 6 were represented with 1, 27, 2, less than 1% and 1% of all samples, respectively. Honeoye was the most common soil series (24% of all samples), followed by Langford (19%), Lima (11%), and Lansing (10%).

Organic matter levels, as measured by loss-on-ignition, ranged from less than 1% to 55% (muck soil). For homeowner samples, 63% had between 2 and 5% organic matter, 12% showed 5-6% organic matter while 13% had more than 6% organic matter. Of the samples submitted by commercial growers, 90% contained between 2 and 5% organic matter.

Soil pH in water (1:1 soil:water extraction ratio) varied from 5.0 to 8.2 for home and garden samples with 79% testing between pH 7.0 and 8.0. For the commercial samples, the highest pH was 8.2 and 75% 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, 15% of the soils tested low for P, 15% tested medium, 35% tested high and 35% tested very high. This meant that 70% tested high or very high in P. For commercial growers, 6% tested very high. In total 28% were low in P, 25% tested medium for P while 41% of the submitted samples were classified as high in soil test P. This means that 47% 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).

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 Cayuga County soils varied from very low (3% of the homeowner soils and 1% of the commercial growers' soils) to very high (50% of the homeowner soils and 38% of the commercial growers' soils). For homeowners, 7% tested low in K, 18% tested medium, and 22% tested high for potassium. For commercial growers' soils, 5% tested low, 19% tested medium and 36% 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 21 to more than 10,000 lbs Mg/acre (muck soil). There were no soils that tested very low for Mg. Most soils tested high or very high for Mg (98% of the homeowner soils and 97% 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 (96-99%) 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, 82% tested high for Zn while 13% were medium in Zn and 5% tested low in Zn. Of the commercial growers' samples, 11% tested low, 36% tested medium while 53% 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	2003	2004	2005	2006	Total	%
ALG	0	0	1	1	0	2	1
ATF	2	1	2	0	0	5	4
BLU	0	0	1	0	1	2	1
CEM	0	0	0	0	4	4	3
COS	0	0	0	0	2	2	1
FLA	0	0	1	1	0	2	1
GRA	0	0	3	6	0	9	6
HRB	0	1	0	0	0	1	1
LAW	4	6	17	16	12	55	39
MVG	10	6	4	4	4	28	20
OTH	0	0	3	0	1	4	3
PER	0	0	1	1	0	2	1
PTO	0	0	1	0	1	2	1
ROS	1	0	0	0	0	1	1
SAG	4	0	11	0	3	18	13
TRF	1	0	2	0	0	3	2
Unknown	0	1	0	0	0	1	1
Total	22	15	47	29	28	141	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	1	0	0	0	4	5	0
AGE/AGT	41	11	37	42	42	173	13
ALE/ALT	11	1	7	4	9	32	2
APP	2	3	3	1	0	9	1
BCT	0	4	0	0	0	4	0
BDR	0	0	1	0	0	1	0
BET	0	0	0	1	0	1	0
BGE	0	6	0	0	0	6	0
BLB	4	0	5	2	2	13	1
BLU	0	0	0	0	3	3	0
BNS	0	3	1	1	0	5	0
BSP	10	6	3	4	6	29	2
BUK	0	9	2	0	2	13	1
CAR	0	0	0	2	0	2	0
CBP	0	6	0	0	0	6	0
CGE/CGT	7	0	0	0	0	7	1
CHS	2	0	2	0	0	4	0
CKP	6	0	0	0	0	6	0
CLE/CLT	1	6	2	0	3	12	1
COG/COS	124	102	179	81	93	579	43
CUR	0	0	1	0	1	2	0
ELD	0	0	0	0	1	1	0
GIE/GIT	0	1	1	0	2	4	0
GPF	0	0	2	0	0	2	0
GPV	0	0	0	1	9	10	1
GRE/GRT	4	5	1	4	2	16	1
IDL	2	8	0	1	0	11	1
LET	0	0	0	2	0	2	0
MIX	6	2	1	2	0	11	1
OAS	7	0	2	7	5	21	2
OAT	6	3	0	4	1	14	1
ONP	0	1	0	1	0	2	0
ONS	0	1	0	0	0	1	0
OTH	0	7	2	2	1	12	1
PCH	1	0	0	0	0	1	0
PGT	2	3	0	0	0	5	0

Current year crop	2002	2003	2004	2005	2006	Total	%
PIE/PIT	2	6	14	0	6	28	2
PLE/PLT	1	0	1	0	0	2	0
PNT	0	0	0	0	4	4	0
POT	0	4	1	1	0	6	0
PSN	0	0	0	1	0	1	0
PUM	1	1	1	0	0	3	0
RSS	1	1	4	0	0	6	0
RYC	0	1	0	0	0	1	0
RYS	1	0	0	0	0	1	0
SOG	0	1	0	0	0	1	0
SOY	16	35	51	35	25	162	12
SQW	2	0	0	0	0	2	0
STS	4	0	7	0	0	11	1
SWC	1	2	0	1	2	6	0
TOM	1	0	0	2	2	5	0
TRE	0	1	0	0	0	1	0
TRP	0	0	1	0	0	1	0
TRT	0	2	0	0	0	2	0
WAT	0	0	1	0	0	1	0
WHT	17	20	3	12	12	64	5
Unknown	0	5	2	1	0	8	1
Total	284	267	338	215	237	1341	100

Note: 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	6	24	10	8	52	37
SMG 3 (silt loam)	10	4	12	9	10	45	32
SMG 4 (sandy loam)	7	2	8	7	5	29	21
SMG 5 (sandy)	1	3	3	3	5	15	11
SMG 6 (mucky)	0	0	0	0	0	0	0
Total	22	15	47	29	28	141	100

4.2 Commercial Samples

Soil series for commercial samples:

Name	SMG	2002	2003	2004	2005	2006	Total	%
Alden	3	0	1	6	0	0	7	1
Alton	5	2	0	2	0	0	4	0
Angola	2	2	1	1	0	2	6	0
Appleton	2	0	0	0	1	5	6	0
Arkport	4	6	0	0	2	0	8	1
Aurora	2	9	6	5	7	7	34	3
Cazenovia	2	14	6	2	2	2	26	2
Chippewa	3	2	0	1	0	0	3	0
Collamer	3	1	2	1	2	2	8	1
Colonie	5	1	0	0	0	0	1	0
Conesus	2	15	28	27	14	18	102	8
Dunkirk	3	4	3	3	2	0	12	1
Erie	3	6	6	5	12	6	35	3
Farmington	3	2	0	0	0	0	2	0
Fonda	2	0	1	0	0	0	1	0
Galen	4	0	0	0	0	4	4	0
Hilton	2	2	0	5	0	0	7	1
Honeoye	2	53	52	58	58	97	318	24
Ira	4	1	0	1	0	0	2	0
Kendaia	2	4	3	1	6	3	17	1
Lamson	4	2	0	0	0	0	2	0
Langford	3	61	45	82	32	31	251	19
Lansing	2	23	44	36	15	11	129	10
Lima	2	30	21	52	32	19	154	11
Lordstown	3	4	0	0	0	0	4	0
Madalin	1	1	1	0	1	0	3	0
Minoa	4	0	0	0	0	2	2	0
Muck	6	0	8	0	0	0	8	1
Napoli	3	0	2	0	0	0	2	0
Niagara	3	0	3	1	1	1	6	0
Odessa	2	3	5	0	0	0	8	1
Ontario	2	22	6	29	7	20	84	6
Ovid	2	9	3	3	2	2	19	1
Palmyra	3	2	3	2	3	3	13	1
Phelps	3	0	0	3	1	2	6	0
Riga	2	0	0	2	0	0	2	0

Name	SMG	2002	2003	2004	2005	2006	Total	%
Schoharie	1	0	3	1	1	0	5	0
Sloan	3	0	0	3	0	0	3	0
Sodus	4	1	0	0	0	0	1	0
Tuller	3	0	1	3	2	0	6	0
Volusia	3	0	1	0	0	0	1	0
Wampsville	3	0	0	3	0	0	3	0
Williamson	4	0	10	0	0	0	10	1
Unknown	-	2	2	0	12	0	16	1
Total	-	284	267	338	215	237	1341	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
2002	0	1	3	5	4	4	2	3	22
2003	1	2	5	1	2	3	1	0	15
2004	2	0	9	13	11	6	3	3	47
2005	1	6	5	10	5	0	1	1	29
2006	4	0	5	9	2	4	2	2	28
Total	8	9	27	38	24	17	9	9	141

	2002	2003	2004	2005	2006
Lowest:	1.9	0.9	0.9	0.9	0.3
Highest:	7.4	6.9	9.8	12.0	9.2
Mean:	4.6	3.6	4.2	3.3	3.8
Median:	4.1	2.9	3.9	3.3	3.6

Organic matter in 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	0	5	14	23	18	18	9	14	100
2003	7	13	33	7	13	20	7	0	100
2004	4	0	19	28	23	13	6	6	100
2005	3	21	17	34	17	0	3	3	100
2006	14	0	18	32	7	14	7	7	100
Total	6	6	19	27	17	12	6	6	100

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	7	69	142	48	10	7	1	284
2003	0	6	76	115	40	16	3	11	267
2004	0	6	132	118	60	17	3	2	338
2005	0	5	40	102	42	22	1	3	215
2006	0	6	94	97	35	2	3	0	237
Total	0	30	411	574	225	67	17	17	1341

	2002	2003	2004	2005	2006
Lowest:	1.3	1.7	1.2	1.2	1.3
Highest:	7.6	55.0	9.4	17.6	6.7
Mean:	3.5	4.4	3.3	3.7	3.2
Median:	3.3	3.2	3.1	3.5	3.1

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	2	24	50	17	4	2	0	100
2003	0	2	28	43	15	6	1	4	100
2004	0	2	39	35	18	5	1	1	100
2005	0	2	19	47	20	10	0	1	100
2006	0	3	40	41	15	1	1	0	100
Total	0	2	31	43	17	5	1	1	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	0	1	1	1	4	12	3	0	22
2003	0	0	0	1	0	2	6	5	1	0	15
2004	0	0	3	2	1	4	20	17	0	0	47
2005	0	0	0	2	0	2	10	15	0	0	29
2006	0	0	0	0	1	3	11	12	1	0	28
Total	0	0	3	6	3	12	51	61	5	0	141

	2002	2003	2004	2005	2006
Lowest:	5.5	5.5	5.0	5.7	6.0
Highest:	8.2	8.0	7.9	7.9	8.0
Mean:	-	-	-	-	-
Median:	7.5	7.4	7.4	7.5	7.4

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	0	5	5	5	18	55	14	0	100
2003	0	0	0	7	0	13	40	33	7	0	100
2004	0	0	6	4	2	9	43	36	0	0	100
2005	0	0	0	7	0	7	34	52	0	0	100
2006	0	0	0	0	4	11	39	43	4	0	100
Total	0	0	2	4	2	9	36	43	4	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	3	1	5	21	72	67	61	50	4	0	0	284
2003	1	11	18	26	87	76	27	19	1	0	1	267
2004	3	3	3	25	71	78	105	45	5	0	0	338
2005	0	3	2	10	50	76	53	21	0	0	0	215
2006	0	3	7	23	56	53	72	23	0	0	0	237
Total	7	21	35	105	336	350	318	158	10	0	1	1341

	2002	2003	2004	2005	2006
Lowest:	4.1	4.2	4.2	4.8	4.8
Highest:	8.1	8.2	8.1	7.9	7.9
Mean:	-	-	-	-	-
Median:	6.8	6.4	6.8	6.7	6.7

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	1	0	2	7	25	24	21	18	1	0	0	100
2003	0	4	7	10	33	28	10	7	0	0	0	100
2004	1	1	1	7	21	23	31	13	1	0	0	100
2005	0	1	1	5	23	35	25	10	0	0	0	100
2006	0	1	3	10	24	22	30	10	0	0	0	100
Total	1	2	3	8	25	26	24	12	1	0	0	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	
2002	0	1	3	3	3	1	1	4	1	5	22
2003	0	3	0	1	4	0	1	1	0	5	15
2004	0	10	10	18	3	1	1	3	0	1	47
2005	0	5	4	15	1	1	0	2	0	1	29
2006	0	2	4	12	4	2	0	2	0	2	28
Total	0	21	21	49	15	5	3	12	1	14	141

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

	2002	2003	2004	2005	2006
Lowest:	1	1	1	1	2
Highest:	501	314	203	653	602
Mean:	120	118	29	47	61
Median:	76	57	13	15	18

Phosphorus in 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	5	14	14	14	5	5	18	5	23	100
2003	0	20	0	7	27	0	7	7	0	33	100
2004	0	21	21	38	6	2	2	6	0	2	100
2005	0	17	14	52	3	3	0	7	0	3	100
2006	0	7	14	43	14	7	0	7	0	7	100
Total	0	15	15	35	11	4	2	9	1	10	100

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

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	83	60	118	15	3	1	2	2	0	0	284
2003	0	80	85	86	4	3	2	5	1	1	0	267
2004	0	37	64	216	17	1	0	2	0	1	0	338
2005	0	79	59	68	6	1	0	0	0	2	0	215
2006	0	99	63	60	7	0	1	0	1	2	4	237
Total	0	378	331	548	49	8	4	9	4	6	4	1341

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

	2002	2003	2004	2005	2006
Lowest:	1	1	1	1	1
Highest:	195	1528	261	1077	402
Mean:	15	18	17	17	12
Median:	8	7	12	5	4

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	29	21	42	5	1	0	1	1	0	0	100
2003	0	30	32	32	1	1	1	2	0	0	0	100
2004	0	11	19	64	5	0	0	1	0	0	0	100
2005	0	37	27	32	3	0	0	0	0	1	0	100
2006	0	42	27	25	3	0	0	0	0	1	2	100
Total	0	28	25	41	4	1	0	1	0	0	0	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 2						
	<40	40-69	70-99	100-164	>164	Total
	Very Low	Low	Medium	High	Very High	
2002	0	0	0	2	2	4
2003	0	2	0	1	3	6
2004	0	1	2	8	13	24
2005	0	0	0	0	7	7
2006	0	0	0	1	7	8
Total (#)	0	3	2	12	32	49
Total (%)	0	6	4	24	65	100
Soil Management Group 3						
	<45	45-79	80-119	120-199	>199	Total
2002	0	0	0	2	8	10
2003	0	0	0	2	2	4
2004	0	2	4	1	5	12
2005	1	1	4	2	1	9
2006	0	0	3	4	3	10
Total (#)	1	3	11	11	19	45
Total (%)	2	7	24	24	42	100
Soil Management Group 4						
	<55	55-99	100-149	150-239	>239	Total
2002	0	0	2	1	4	7
2003	0	0	0	1	1	2
2004	0	0	1	0	7	8
2005	0	0	1	1	5	7
2006	0	0	2	2	1	5
Total (#)	0	0	6	5	18	29
Total (%)	0	0	21	17	62	100
Soil Management Group 5						
	<60	60-114	115-164	165-269	>269	Total
2002	0	0	0	0	1	1
2003	0	2	1	0	0	3
2004	0	1	1	0	1	3
2005	0	0	2	1	0	3
2006	3	1	1	0	0	5
Total (#)	3	4	5	1	2	15
Total (%)	20	27	33	7	13	100

Potassium classification summary for homeowners:

Summary (#)	Very Low	Low	Medium	High	Very High	Total
2002	0	0	2	5	15	22
2003	0	4	1	4	6	15
2004	0	4	8	9	26	47
2005	1	1	8	6	13	28
2006	3	1	6	7	11	28
Grand Total	4	10	25	31	71	141

Summary (%)	Very Low	Low	Medium	High	Very High	Total
2002	0	0	9	23	68	100
2003	0	27	7	27	40	100
2004	0	9	17	19	55	100
2005	3	3	28	21	45	100
2006	11	4	21	25	39	100
Grand Total	3	7	18	22	50	100

	2002	2003	2004	2005	2006
Lowest:	101	42	54	33	37
Highest:	1102	1275	1529	1155	1207
Mean:	407	311	255	227	259
Median:	323	147	207	179	183

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	1	1
2003	0	0	0	2	2	4
2004	0	0	0	0	1	1
2005	0	0	0	0	2	2
2006	0	0	0	0	0	0
Total (#)	0	0	0	2	6	8
Total (%)	0	0	0	25	75	100
Soil Management Group 2						
	<40	40-69	70-99	100-164	>164	Total
	Very Low	Low	Medium	High	Very High	
2002	1	9	35	71	70	186
2003	0	7	30	70	69	176
2004	0	6	24	77	114	221
2005	2	9	28	57	48	144
2006	0	8	54	70	54	186
Total (#)	3	39	171	345	355	913
Total (%)	0	4	19	38	39	100
Soil Management Group 3						
	<45	45-79	80-119	120-199	>199	Total
	Very Low	Low	Medium	High	Very High	
2002	0	2	20	21	39	82
2003	1	7	12	20	27	67
2004	0	6	17	51	39	113
2005	0	3	16	30	6	55
2006	0	0	13	12	20	45
Total (#)	1	18	78	134	131	362
Total (%)	0	5	22	37	36	100

Soil Management Group 4						
	<55	55-99	100-149	150-239	>239	Total
	Very Low	Low	Medium	High	Very High	
2002	2	5	2	1	0	10
2003	0	0	1	2	7	10
2004	0	0	0	0	1	1
2005	0	0	1	1	0	2
2006	1	3	1	0	1	6
Total (#)	3	8	5	4	9	29
Total (%)	10	28	17	14	31	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	1	3
2003	0	0	0	0	0	0
2004	0	0	0	2	0	2
2005	0	0	0	0	0	0
2006	0	0	0	0	0	0
Total (#)	0	1	0	3	1	5
Total (%)	0	20	0	60	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	8	8
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	8	8
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	17	57	94	111	2	284
2003	1	14	43	94	113	2	267
2004	0	12	41	130	155	0	338
2005	2	12	45	88	56	12	215
2006	1	11	68	82	75	0	237
Grand Total	7	66	254	488	510	16	1341

Summary (%)	Very Low	Low	Medium	High	Very High	Un-known	Total
2002	1	6	20	33	39	1	100
2003	0	5	16	35	42	1	100
2004	0	4	12	38	46	0	100
2005	1	6	21	41	26	6	100
2006	0	5	29	35	32	0	100
Grand Total	1	5	19	36	38	1	100

	2002	2003	2004	2005	2006
Lowest:	32	44	43	30	40
Highest:	1878	26902	1167	1114	608
Mean:	194	291	187	158	155
Median:	149	156	168	131	123

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	0	0	1	21	22
2003	0	0	0	0	15	15
2004	0	2	0	0	45	47
2005	0	0	0	1	28	29
2006	0	0	1	1	26	28
Total	0	2	1	3	135	141

	2002	2003	2004	2005	2006
Lowest:	132	218	41	182	84
Highest:	1401	1167	1211	2356	1096
Mean:	725	580	616	681	501
Median:	631	572	594	616	484

Magnesium in 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	0	0	5	95	100
2003	0	0	0	0	100	100
2004	0	4	0	0	96	100
2005	0	0	0	3	97	100
2006	0	0	4	4	93	100
Total	0	1	1	2	96	100

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	3	6	20	255	284
2003	0	9	10	25	223	267
2004	0	6	1	19	312	338
2005	0	1	0	15	199	215
2006	0	3	3	23	208	237
Total	0	22	20	102	1197	1341

	2002	2003	2004	2005	2006
Lowest:	32	25	21	53	46
Highest:	1465	10123	1129	1610	1569
Mean:	439	420	418	467	449
Median:	430	367	398	468	455

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	2	7	90	100
2003	0	3	4	9	84	100
2004	0	2	0	6	92	100
2005	0	0	0	7	93	100
2006	0	1	1	10	88	100
Total	0	2	1	8	89	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	
2002	22	0	22
2003	15	0	15
2004	43	4	47
2005	28	1	29
2006	28	0	28
Total	136	5	141

Percentages:

0-49	>49	Total
Normal	Excessive	
100	0	100
100	0	100
91	9	100
97	3	100
100	0	100
96	4	100

	2002	2003	2004	2005	2006
Lowest:	1	1	1	1	1
Highest:	18	15	149	106	32
Mean:	4	5	13	11	7
Median:	3	3	7	5	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	280	4	284
2003	255	12	267
2004	332	6	338
2005	210	5	215
2006	232	5	237
Total	1309	32	1341

Percentages:

0-49	>49	Total
Normal	Excessive	
99	1	100
96	4	100
98	2	100
98	2	100
98	2	100
98	2	100

	2002	2003	2004	2005	2006
Lowest:	1	1	1	1	1
Highest:	207	123	121	175	77
Mean:	8	11	7	8	7
Median:	3	5	4	4	3

11. Manganese

11.1 Homeowner Samples

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

Total number of samples: Percentages:

	0-99	>99	Total		0-99	>99	Total
	Normal	Excessive			Normal	Excessive	
2002	22	0	22		100	0	100
2003	14	1	15		93	7	100
2004	44	3	47		94	6	100
2005	27	2	29		93	7	100
2006	28	0	28		100	0	100
Total	135	6	141		96	4	100

	2002	2003	2004	2005	2006
Lowest:	10	11	13	11	8
Highest:	96	102	201	311	93
Mean:	40	44	55	58	45
Median:	38	38	50	46	42

11.2 Commercial Samples

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

Total number of samples: Percentages:

	0-99	>99	Total		0-99	>99	Total
	Normal	Excessive			Normal	Excessive	
2002	282	2	284		99	1	100
2003	260	7	267		97	3	100
2004	336	2	338		99	1	100
2005	215	0	215		100	0	100
2006	237	0	237		100	0	100
Total	1330	11	1341		99	1	100

	2002	2003	2004	2005	2006
Lowest:	5	7	8	12	3
Highest:	144	221	223	85	74
Mean:	33	32	30	29	28
Median:	32	26	27	28	25

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	
2002	0	0	22	22
2003	0	2	13	15
2004	2	7	38	47
2005	3	4	22	29
2006	2	6	20	28
Total	7	19	115	141

Percentages:

<0.5	0.5-1.0	>1	Total
Low	Medium	High	
0	0	100	100
0	13	87	100
4	15	81	100
10	14	76	100
7	21	71	100
5	13	82	100

	2002	2003	2004	2005	2006
Lowest:	1.8	0.7	0.3	0.1	0.1
Highest:	66.8	84.2	63.2	28.9	59.0
Mean:	11.2	14.7	4.9	5.9	8.3
Median:	4.5	7.4	2.4	2.0	2.3

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	5	96	183	284
2003	7	77	183	267
2004	66	141	131	338
2005	28	98	89	215
2006	45	72	120	237
Total	151	484	706	1341

Percentages:

<0.5	0.5-1.0	>1	Total
Low	Medium	High	
2	34	64	100
3	29	69	100
20	42	39	100
13	46	41	100
19	30	51	100
11	36	53	100

	2002	2003	2004	2005	2006
Lowest:	0.1	0.1	0.1	0.1	0.1
Highest:	8.8	44.3	25.1	171.6	45.5
Mean:	1.5	2.5	1.1	1.9	1.9
Median:	1.3	1.4	0.9	0.9	1.1

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