

Rao, R., Chuck Kyle, Q.M. Ketterings, and H. Krol (2007). Onondaga Soil Sample Survey (2002-2006). CSS Extension Bulletin E07-37. 35 pages.

Soil Sample Survey

Onondaga County

Samples analyzed by CNAL (2002-2006)



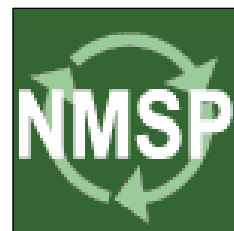
Onondaga County (photo credit: Chuck Kyle, CCE of Onondaga County).

Summary compiled by

Renuka Rao, Chuck Kyle, Quirine M. Ketterings, and Hettie Krol



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



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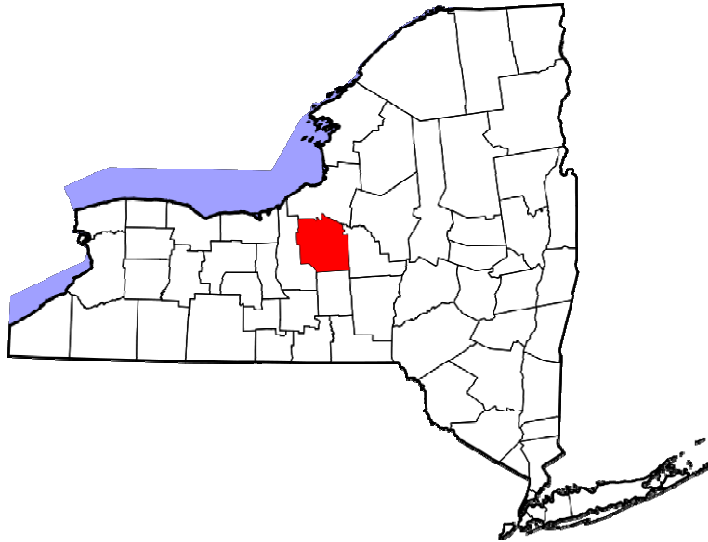


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1. County Introduction

Onondaga County is located in the center of New York State, and covers 507,840 acres or 793.5 square miles. There are two physiographic regions in Onondaga County the Erie-



Onondaga Plain in the north, and the Allegheny Plateau in the south. The majority of all drainage in the county goes towards the north into Lake Ontario.

Agriculture accounts for 156,284 acres of land in the county, or approximately 32 percent of land use. Of the agricultural land 98,000 acres is cropped with the

remaining land being forest and support land Dairy farming contributes over 50% of the gross farm receipts with much of the acreage in production used to support the dairy industry. Corn and hay crops comprise a significant share of all agricultural acreage in the county. However, productive soils in the north are also conducive to vegetable farming. Apple farming is a noteworthy component of Onondaga County agriculture, and the southern part of the county is home to well-known apple farms.

Skaneateles Lake, located partially in the county is known as the Eastern Gateway to the Finger Lakes, and supplies the City of Syracuse with municipal drinking water. Since Skaneateles Lake water is not filtered by Syracuse, a watershed protection program is in place. A voluntary Whole Farm Planning program, the Skaneateles Watershed Agricultural Program, helps develop environmental plans for participating farmers. Comprehensive Nutrient Management Plans (CNMPs) are a key component in all Whole Farm Plans, and soil test analysis is a foundation on which CNMPs are constructed.

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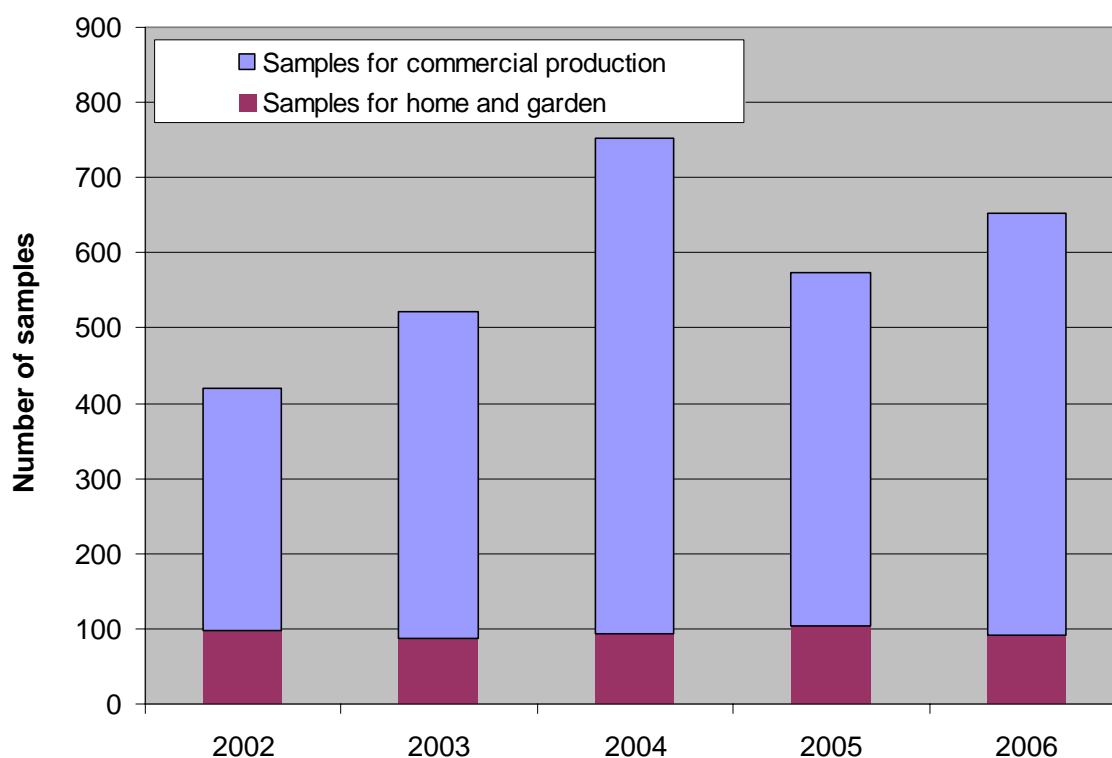
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2. General Survey Summary

This survey summarizes the soil test results from grower (identified as “commercial samples”) and homeowner samples from Onondaga County submitted to the Cornell Nutrient Analysis Laboratory (CNAL) from 2002 to 2006. The total number of samples analyzed in these years amounted to 2919. Of these, 2447 samples (84%) were submitted by commercial growers while 472 samples (16%) were submitted by homeowners.



Homeowners		Commercial		Total
2002	97	2002	323	420
2003	87	2003	434	521
2004	93	2004	659	752
2005	104	2005	469	573
<u>2006</u>	<u>91</u>	<u>2006</u>	<u>562</u>	<u>653</u>
Total	472	Total	2447	2919

Homeowners submitted soil samples to the Cornell Nutrient Analysis Laboratory during 2002-2006 primarily to request fertilizer recommendations for lawns (29%), for home garden vegetable production (25%), and ornamentals (12%). Commercial growers submitted samples primarily to grow corn silage or grain (34%), alfalfa or alfalfa/grass mixes (19%), and soybeans (6%).

Soils tested for home and garden in Onondaga County were classified as belonging to soil management group 2 (36%), group 3 (29%), group 4 (26%), or group 5 (8%). 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 (70%) belonged to soil management group 2. Groups 1 and 6 were represented with less than 1% of all samples. Thirteen percent belonged to group 3, 10% to group 4, and 6% were group 5 soils. Honeoye was the most common soil series (70% of all samples), followed by Lansing (8%), and Arkport and Ontario (7% each).

Organic matter levels, as measured by loss-on-ignition, ranged from less than 1% to almost 50% (more likely a potting medium than a homeowner soil). For homeowners 45% of the samples had between 3 and 5% organic matter, 14% testing between 5 and 6% organic matter, and 23% were classified as soils with more than 6.9% organic matter. Of

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the samples submitted by commercial growers, 69% contained between 2 and 4% organic matter, 15% had 4 to 5 % organic matter and 6% tested greater than 5% in organic matter.

Soil pH in water (1:1 soil:water extraction ratio) varied from less than 4.8 to 9.0 for home and garden samples with 57% testing between pH 6.0 and 7.4 for pH and 33% with a pH of 7.5 or greater. For the commercial samples, the highest pH was 8.1 and 82% tested between 6.0 and 7.4 while 6% were pH 7.5 or greater.

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, 13% of the soils tested low for P, 15% tested medium, a little over 31% tested high while slightly more than 40% tested very high. This meant that 72% tested high or very high in P. For commercial growers, 14% tested very high. In total 23% were low in P, 26% tested medium for P while 37% of the submitted samples were classified as high in soil test P. This means that 51% tested high or very high in P.

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

Potassium classifications for Onondaga County soils varied from very low (1% of the homeowner soils and 1% of the commercial growers' soils) to very high (52% of the homeowner soils and 42% of the commercial growers' soils). For homeowners, 8% tested low in K, 12% tested medium, and 27% tested high for potassium. For commercial growers' soils, 7% tested low, 17% tested medium and 33% tested high in K.

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 Mg if Morgan extractable Mg is less than 20 lbs Mg/acre. Low testing soils have 20-65 lbs Morgan Mg per acre. Soils with 66-100 lbs Mg/acre test medium for Mg. High testing soils have 101-199 lbs Mg/acre while soils with more than 200 lbs Mg/acre in the Morgan extraction are classified as very high in Mg. Magnesium levels ranged from 14 to almost 6000 lbs Mg/acre. There were only three commercial grower soils that tested very low for Mg. Most soils tested high or very high for Mg (98% of the homeowner soils and 94% 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 98-99% in the normal range with only 2% of the homeowner soils and 1% of the commercial grower soils testing excessive for Fe. Similarly, most soils (97-99%) 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, 88% tested high for Zn while 10% tested medium and 3% were low in Zn. Of the commercial growers' samples, 9% tested low, 29% 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 are requested by homeowners:

	2002	2003	2004	2005	2006	Total	%
ALG	1	2	2	2	1	8	2
APR	0	0	0	0	2	2	0
ATF	2	8	15	1	2	28	6
BLU	0	0	6	1	5	12	3
FAR	0	0	0	1	0	1	0
FLA	3	0	1	0	0	4	1
GEN	0	1	0	0	0	1	0
GRA	0	0	0	2	0	2	0
HRB	4	0	0	0	0	4	1
IDL	1	0	3	0	0	4	1
LAW	42	24	19	29	23	137	29
MIX	1	1	0	2	0	4	1
MVG	25	18	18	21	34	116	25
OTH	1	12	2	7	3	25	5
PER	6	1	9	7	7	30	6
PRK	0	1	0	0	0	1	0
PTO	0	1	1	0	0	2	0
ROS	2	1	0	5	3	11	2
RSP	1	1	2	1	0	5	1
SAG	7	7	12	21	8	55	12
SOD	0	0	2	0	0	2	0
SPB	0	0	0	1	0	1	0
STR	0	0	0	0	1	1	0
TRF	0	0	1	3	1	5	1
Unknown	1	9	0	0	1	11	2
Total	97	87	93	104	91	472	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	%
AGE/AGT	27	77	94	78	28	344	14
ALE/ALT	30	26	35	29	9	129	5
APP	1	0	0	0	1	2	0
ASP	0	1	0	0	0	1	0
BCE	0	0	0	0	1	1	0
BGE/BGT	0	1	28	0	0	29	1
BKB	1	0	0	0	0	1	0
BLB	0	0	0	0	20	20	1
BNS	0	2	0	1	0	3	0
BRS	0	0	0	1	0	1	0
BSP	1	0	1	0	0	2	0
BSS	0	1	0	2	0	3	0
BUK	0	0	1	0	0	1	0
CBP	0	2	0	0	0	2	0
CGE/CGT	0	1	2	1	2	6	0
CHT	0	1	0	0	0	1	0
CKP	0	5	0	0	0	5	0
CLE/CLT	1	0	1	2	69	73	3
COG/COS	136	164	237	191	109	837	34
GIE/GIT	0	3	1	0	9	13	1
GPF	0	0	0	7	0	7	0
GPV	2	0	0	3	0	5	0
GRE/GRT	13	7	4	18	6	48	2
IDL	0	11	2	0	0	13	1
MIX	6	0	13	8	45	72	3
OAS	2	1	0	6	12	21	1
OAT	10	4	33	22	16	85	3
ONP	0	0	1	0	0	1	0
OTH	1	4	39	9	2	55	2
PEA	0	0	0	1	0	1	0
PGE/PGT	3	4	2	6	4	19	1
PIE/PIT	10	14	9	1	12	46	2
PLE/PLT	1	0	7	0	2	10	0
PLM	0	1	0	0	0	1	0
PNT	7	11	16	9	7	50	2
POP	0	0	0	1	0	1	0

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Current year crop	2002	2003	2004	2005	2006	Total	%
POT	3	1	2	2	2	10	0
PUM	2	6	1	1	0	10	0
RSF	1	1	0	0	0	2	0
RSS	2	0	0	0	0	2	0
RYC	5	1	1	1	1	9	0
RYS	1	6	9	2	6	24	1
SOY	7	28	43	43	38	159	6
SQS	0	4	0	0	0	4	0
SQW	0	0	0	1	0	1	0
SSH	0	3	0	0	0	3	0
STS	0	4	0	0	2	6	0
SUN	0	0	0	1	0	1	0
SWC	26	17	14	13	10	80	3
TME	2	0	5	0	0	7	0
TOM	2	1	1	0	0	4	0
TRE	14	0	0	0	1	15	1
TRP	0	0	0	0	3	3	0
TRT	4	2	6	0	3	15	1
WHT	2	12	19	8	11	52	2
Unknown	0	7	32	1	91	131	5
Total	323	434	659	469	562	2447	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
SMG2 (silty)	41	27	42	35	26	171	36
SMG 3 (silt loam)	20	30	19	44	26	139	29
SMG 4 (sandy loam)	27	20	22	21	33	123	26
SMG 5 (sandy)	9	10	10	4	6	39	8
SMG 6 (mucky)	0	0	0	0	0	0	0
Total	97	87	93	104	91	472	100

4.2 Commercial Samples

Soil series for commercial samples:

Name	SMG	2002	2003	2004	2005	2006	Total	%
Alton	5	20	22	8	20	29	99	4
Amboy	4	0	0	0	0	20	20	1
Angola	2	5	1	13	0	5	24	1
Appleton	2	3	0	8	3	0	14	1
Arkport	4	3	8	7	5	7	30	1
Aurora	2	10	21	104	15	19	169	7
Benson	4	3	2	1	0	0	6	0
Bombay	4	1	3	2	7	0	13	1
Camillus	3	16	1	0	8	2	27	1
Canandaigua	3	1	0	1	0	0	2	0
Cazenovia	2	4	6	17	9	6	42	2
Chagrin	3	0	0	0	1	0	1	0
Collamer	3	12	4	7	7	17	47	2
Colonie	5	3	6	8	3	7	27	1
Conesus	2	4	5	41	15	12	77	3
Croghan	5	0	0	4	0	0	4	0
Dunkirk	3	0	0	1	0	6	7	0
Fredon	4	1	2	1	2	1	7	0
Galen	4	1	4	3	3	2	13	1
Hamlin	2	0	0	3	0	0	3	0
Herkimer	3	0	0	0	0	1	1	0
Hilton	2	8	9	10	12	12	51	2
Homer	2	1	0	0	0	1	2	0
Honeoye	2	79	76	145	141	168	609	25
Howard	3	9	4	10	22	14	59	2
Kendaia	2	2	17	7	4	5	35	1
Lairdsville	2	0	0	5	0	1	6	0
Lakemont	1	0	1	0	0	0	1	0
Lamson	4	1	1	2	1	1	6	0
Lansing	2	19	52	51	36	38	196	8
Lima	2	10	43	35	16	28	132	5
Lordstown	3	0	0	0	5	0	5	0
Lyons	2	0	2	1	0	0	3	0
Madrid	4	14	19	25	7	21	86	4
Manheim	2	0	6	1	2	6	15	1
Manlius	3	0	1	1	1	2	5	0

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Name	SMG	2002	2003	2004	2005	2006	Total	%
Mardin	3	0	0	3	1	0	4	0
Martisco	6	0	0	0	1	0	1	0
Minoa	4	3	2	5	3	4	17	1
Mohawk	2	41	24	10	15	14	104	4
Niagara	3	4	3	3	5	7	22	1
Odessa	2	0	2	4	0	0	6	0
Ontario	2	9	40	37	32	51	169	7
Otisville	4	4	0	0	3	0	7	0
Ovid	2	4	3	10	7	0	24	1
Palatine	2	1	0	1	3	0	5	0
Palmyra	3	19	29	17	13	28	106	4
Phelps	3	1	2	9	3	4	19	1
Rhinebeck	2	0	2	7	1	1	11	0
Romulus	2	0	0	0	0	2	2	0
Schoharie	1	0	0	0	1	6	7	0
Teel	2	0	1	12	1	1	15	1
Venango	3	0	0	0	0	1	1	0
Volusia	3	0	0	0	1	0	1	0
Wampsville	3	2	2	2	3	3	12	0
Wareham	5	1	1	1	3	1	7	0
Wassaic	4	2	1	0	9	3	15	1
Wayland	2	1	0	4	3	2	10	0
Weaver	3	0	0	0	7	0	7	0
Williamson	4	1	2	10	9	2	24	1
Worth	4	0	0	2	0	0	2	0
Unknown	-	0	4	0	0	1	5	0
Total	-	323	434	659	469	562	2447	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	3	3	11	26	22	15	6	11	97
2003	1	3	9	21	26	7	5	15	87
2004	1	2	8	16	21	16	10	19	93
2005	1	8	22	26	15	11	5	16	104
2006	1	4	14	21	14	15	6	16	91
Total	1	20	64	110	98	64	32	72	472

	2002	2003	2004	2005	2006
Lowest:	0.1	0.4	0.9	0.8	0.8
Highest:	23.5	17.8	46.2	38.4	18.7
Mean:	4.7	5.0	5.8	5.0	5.4
Median:	4.2	4.2	4.9	3.9	4.4

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	3	3	11	27	23	15	6	11	100
2003	1	3	10	24	30	8	6	17	100
2004	1	2	9	17	23	17	11	20	100
2005	1	8	21	25	14	11	5	15	100
2006	1	4	15	23	15	16	7	18	100
Total	1	4	14	23	21	14	7	16	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	4	33	105	128	41	7	4	1	323
2003	13	47	131	138	81	13	6	5	434
2004	6	30	193	285	102	31	6	6	659
2005	3	32	138	174	79	32	7	4	469
2006	11	71	199	203	56	20	2	0	562
Total	37	213	766	928	359	103	25	16	2447

	2002	2003	2004	2005	2006
Lowest:	0.6	0.6	0.6	0.8	0.4
Highest:	15.0	9.5	11.3	10.1	6.4
Mean:	3.1	3.2	3.3	3.3	3.0
Median:	3.1	3.2	3.3	3.4	3.0

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	1	10	33	40	13	2	1	1	100
2003	3	11	30	32	19	3	1	1	100
2004	1	5	29	43	15	5	1	1	100
2005	1	7	29	37	17	7	1	1	100
2006	2	13	35	36	10	4	0	0	100
Total	2	9	31	38	15	4	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	1	1	6	5	6	19	50	8	1	97
2003	0	2	4	4	8	9	40	16	3	1	87
2004	2	0	2	7	9	20	33	18	2	0	93
2005	0	0	0	6	6	12	37	40	3	0	104
2006	0	0	5	7	11	12	42	14	0	0	91
Total	2	2	12	30	39	59	171	138	16	2	472

	2002	2003	2004	2005	2006
Lowest:	4.8	4.8	4.8	5.5	5.1
Highest:	8.5	9.0	8.2	8.3	7.9
Mean:	-	-	-	-	-
Median:	7.6	7.1	7.1	7.3	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	1	1	6	5	6	20	52	8	1	100
2003	0	2	5	5	9	10	46	18	3	1	100
2004	2	0	2	8	10	22	35	19	2	0	100
2005	0	0	0	6	6	12	36	38	3	0	100
2006	0	0	5	8	12	13	46	15	0	0	100
Total	0	1	3	6	8	13	36	29	3	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	0	1	9	27	46	92	103	39	6	0	323
2003	0	2	5	42	120	156	87	22	0	0	434
2004	0	1	16	76	192	229	106	37	2	0	689
2005	0	4	5	41	141	153	109	13	3	0	469
2006	0	1	17	59	115	198	156	16	0	0	562
Total	0	9	52	245	614	828	561	127	11	0	2447

	2002	2003	2004	2005	2006
Lowest:	4.9	4.6	4.8	4.8	4.6
Highest:	8.1	7.8	8.0	8.1	7.9
Mean:	-	-	-	-	-
Median:	6.9	6.6	6.6	6.6	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	0	0	3	8	14	28	32	12	2	0	100
2003	0	0	1	10	28	36	26	5	0	0	100
2004	0	0	2	12	29	35	16	6	0	0	100
2005	0	1	1	9	30	33	23	3	1	0	100
2006	0	0	3	10	20	35	28	3	0	0	100
Total	0	0	2	10	25	34	23	5	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	10	18	33	10	6	2	4	5	9	97
2003	0	16	12	24	13	5	1	2	3	11	87
2004	0	11	12	31	12	5	3	6	2	11	93
2005	0	14	17	32	5	10	3	5	4	14	104
2006	0	11	13	28	2	8	3	6	11	9	91
Total	0	62	72	148	42	34	12	23	25	54	472

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

	2002	2003	2004	2005	2006
Lowest:	2	1	1	1	1
Highest:	858	705	1637	718	678
Mean:	70	83	87	90	82
Median:	22	34	28	23	29

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	10	19	34	10	6	2	4	5	9	100
2003	0	18	14	38	15	6	1	2	3	13	100
2004	0	12	13	33	13	5	3	6	2	12	100
2005	0	13	16	31	5	10	3	5	4	13	100
2006	0	12	14	31	2	9	3	7	12	10	100
Total	0	13	15	31	9	7	3	5	5	11	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	90	101	120	4	2	1	2	0	3	323
2003	0	109	94	143	22	18	12	20	4	12	434
2004	0	135	170	272	18	16	15	22	8	3	659
2005	0	104	145	166	12	9	9	17	2	5	469
2006	0	135	115	199	36	24	14	16	9	14	562
Total	0	573	625	900	92	69	51	77	23	37	2447

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

	2002	2003	2004	2005	2006
Lowest:	1	1	1	1	1
Highest:	431	479	249	537	375
Mean:	14	32	21	21	30
Median:	7	9	9	8	11

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	28	31	37	1	1	0	1	0	1	100
2003	0	25	22	33	5	4	3	5	1	3	100
2004	0	20	26	41	3	2	2	3	1	0	100
2005	0	22	31	35	3	2	2	4	0	1	100
2006	0	24	20	35	6	4	2	3	2	2	100
Total	0	23	26	37	4	3	2	3	1	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) in 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	1	0	6	14	20	41
2003	0	1	2	6	18	27
2004	0	1	3	11	27	42
2005	0	2	3	8	22	35
2006	0	1	0	8	17	26
Total (#)	1	5	14	47	104	171
Total (%)	1	3	8	27	61	100
Soil Management Group 3						
	<45	45-79	80-119	120-199	>199	Total
	Very Low	Low	Medium	High	Very High	
2002	0	1	1	6	12	20
2003	0	4	4	6	16	30
2004	0	0	1	4	14	19
2005	0	0	11	14	19	44
2006	0	2	3	9	12	26
Total (#)	0	7	20	39	73	139
Total (%)	0	5	14	28	53	100

Soil Management Group 4						
	<55	55-99	100-149	150-239	>239	Total
	Very Low	Low	Medium	High	Very High	
2002	0	1	2	9	15	27
2003	0	5	3	3	9	20
2004	0	0	3	7	12	22
2005	0	3	3	4	11	21
2006	0	3	5	10	15	33
Total (#)	0	12	16	33	62	123
Total (%)	0	10	13	27	50	100
Soil Management Group 5						
	<60	60-114	115-164	165-269	>269	Total
	Very Low	Low	Medium	High	Very High	
2002	1	1	1	4	2	9
2003	2	7	0	1	0	10
2004	0	1	3	2	4	10
2005	0	2	1	1	0	4
2006	0	2	1	1	2	6
Total (#)	3	13	6	9	8	39
Total (%)	8	33	15	23	21	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 (%)	-	-	-	-	-	-

Potassium classification summary for homeowners:

Summary (#)	Very Low	Low	Medium	High	Very High	Total
2002	2	3	10	33	49	97
2003	2	17	9	16	43	87
2004	0	2	10	24	57	93
2005	0	7	18	27	52	104
2006	0	8	9	28	46	91
Grand Total	4	37	56	128	247	472

Summary (%)	Very Low	Low	Medium	High	Very High	Total
2002	2	3	10	34	51	100
2003	2	20	10	18	49	100
2004	0	2	11	26	61	100
2005	0	7	17	26	50	100
2006	0	9	10	31	51	100
Grand Total	1	8	12	27	52	100

	2002	2003	2004	2005	2006
Lowest:	3	37	65	63	60
Highest:	6772	3459	34298	4309	1143
Mean:	408	321	664	318	259
Median:	207	187	214	192	209

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	0	0
2003	0	0	0	1	0	1
2004	0	0	0	0	0	0
2005	0	0	0	0	1	1
2006	0	0	0	2	4	6
Total (#)	0	0	0	3	5	8
Total (%)	0	0	0	38	63	100
Soil Management Group 2						
	<40	40-69	70-99	100-164	>164	Total
	Very Low	Low	Medium	High	Very High	
2002	0	10	41	59	91	201
2003	2	16	65	80	147	310
2004	4	24	64	177	257	526
2005	2	20	67	113	113	315
2006	0	11	61	153	147	372
Total (#)	8	81	298	582	755	1724
Total (%)	0	5	17	34	44	100
Soil Management Group 3						
	<45	45-79	80-119	120-199	>199	Total
	Very Low	Low	Medium	High	Very High	
2002	0	3	10	26	25	64
2003	0	8	9	10	19	46
2004	1	5	13	12	23	54
2005	0	2	8	23	44	77
2006	0	6	10	26	43	85
Total (#)	1	24	50	97	154	326
Total (%)	0	7	15	30	47	100

Soil Management Group 4						
	<55	55-99	100-149	150-239	>239	Total
	Very Low	Low	Medium	High	Very High	
2002	0	5	7	13	9	34
2003	0	1	5	13	25	44
2004	1	13	13	19	12	58
2005	0	5	7	19	18	49
2006	0	1	6	20	34	61
Total (#)	1	25	38	84	98	246
Total (%)	0	10	15	34	40	100
Soil Management Group 5						
	<60	60-114	115-164	165-269	>269	Total
	Very Low	Low	Medium	High	Very High	
2002	0	6	4	11	3	24
2003	1	7	15	3	3	29
2004	2	5	4	7	3	21
2005	0	5	6	10	5	26
2006	1	10	6	11	9	37
Total (#)	4	33	35	42	23	137
Total (%)	3	24	26	321	17	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	1	1
2006	0	0	0	0	0	0
Total (#)	0	0	0	0	1	1
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	0	24	62	109	128	0	323
2003	3	32	94	107	194	4	434
2004	8	47	94	215	295	0	659
2005	2	32	88	165	182	0	469
2006	1	28	83	212	237	1	562
Grand Total	14	163	421	808	1036	5	2447

Summary (%)	Very Low	Low	Medium	High	Very High	Un-known	Total
2002	0	7	19	34	40	0	100
2003	1	7	22	25	45	1	100
2004	1	7	14	33	45	0	100
2005	0	7	19	35	39	0	100
2006	0	5	15	38	42	0	100
Grand Total	1	7	17	33	42	0	100

	2002	2003	2004	2005	2006
Lowest:	45	34	10	32	52
Highest:	1759	1093	1369	1303	980
Mean:	192	205	189	183	191
Median:	161	161	163	154	164

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	2	1	93	97
2003	0	1	3	8	75	87
2004	0	0	0	3	90	93
2005	0	0	2	7	95	104
2006	0	0	1	5	85	91
Total	0	2	8	24	438	472

	2002	2003	2004	2005	2006
Lowest:	33	30	104	88	73
Highest:	3591	2812	5753	2314	2270
Mean:	650	614	740	637	594
Median:	574	564	648	570	543

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	1	2	1	96	100
2003	0	1	3	9	86	100
2004	0	0	0	3	97	100
2005	0	0	2	7	91	100
2006	0	0	1	5	93	100
Total	0	0	2	5	93	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	2	14	43	264	323
2003	0	4	19	69	342	434
2004	0	10	18	83	548	659
2005	0	9	17	68	375	469
2006	3	23	25	102	409	562
Total	3	48	93	365	1938	2447

	2002	2003	2004	2005	2006
Lowest:	54	44	20	25	14
Highest:	1885	1373	1726	1102	1089
Mean:	423	353	354	382	342
Median:	425	333	331	401	337

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	4	13	82	100
2003	0	1	4	16	79	100
2004	0	2	3	13	83	100
2005	0	2	4	14	80	100
2006	1	4	4	18	73	100
Total	0	2	4	15	79	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	94	3	97
2003	85	2	87
2004	92	1	93
2005	104	0	104
2006	89	2	91
Total	464	8	472

Percentages:

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

	2002	2003	2004	2005	2006
Lowest:	1	1	1	1	1
Highest:	107	140	301	42	234
Mean:	10	11	13	8	13
Median:	5	5	7	6	7

10.2 Commercial Samples

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

Total number of samples:

	0-49	>49	Total
	Normal	Excessive	
2002	322	1	323
2003	433	1	434
2004	646	13	659
2005	466	3	459
2006	554	8	562
Total	2421	26	2447

Percentages:

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

	2002	2003	2004	2005	2006
Lowest:	1	1	1	1	1
Highest:	158	55	211	158	225
Mean:	5	6	9	6	7
Median:	3	4	5	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	88	9	97	91	9	100
2003	84	3	87	97	3	100
2004	84	9	93	90	10	100
2005	98	6	104	94	6	100
2006	88	3	91	97	3	100
Total	442	30	472	97	3	100

	2002	2003	2004	2005	2006
Lowest:	12	3	15	4	8
Highest:	300	251	160	188	771
Mean:	52	48	52	51	52
Median:	42	40	43	47	39

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	321	2	323	99	1	100
2003	432	2	434	100	0	100
2004	655	4	659	99	1	100
2005	468	1	469	100	0	100
2006	557	5	562	99	1	100
Total	2433	14	2447	99	1	100

	2002	2003	2004	2005	2006
Lowest:	4	5	2	8	3
Highest:	180	294	174	133	157
Mean:	5	6	9	6	7
Median:	3	4	5	4	3

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	2	3	92	97
2003	1	6	80	87
2004	1	16	76	93
2005	5	14	85	104
2006	4	6	81	91
Total	13	45	414	472

Percentages:

	<0.5	0.5-1.0	>1	Total
	Low	Medium	High	
	2	3	95	100
	1	7	92	100
	1	17	82	100
	5	13	82	100
	4	7	89	100
	3	10	88	100

	2002	2003	2004	2005	2006
Lowest:	0.1	0.3	0.1	0.2	0.2
Highest:	149.8	99.9	185.3	45.3	110.7
Mean:	11.2	8.5	10.4	8.1	11.9
Median:	3.9	3.5	3.4	5.1	4.3

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	4	93	226	323
2003	49	93	292	434
2004	87	214	358	659
2005	36	155	278	469
2006	40	146	376	562
Total	216	701	1530	2447

Percentages:

<0.5	0.5-1.0	>1	Total
Low	Medium	High	
1	29	70	100
11	21	67	100
13	32	54	100
8	33	59	100
7	26	67	100
9	29	63	100

	2002	2003	2004	2005	2006
Lowest:	0.2	0.1	0.1	0.1	0.1
Highest:	81.4	53.8	30.7	13.7	11.5
Mean:	2.3	2.9	1.8	1.8	2.0
Median:	1.4	1.3	1.1	1.2	1.4

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