

Rao, R., K. Green, Q.M. Ketterings, and H. Krol (2007). Oswego Soil Sample Survey (2002-2006). CSS Extension Bulletin E07-28. 33 pages.

# Soil Sample Survey

# Oswego County

Samples analyzed by CNAL (2002-2006)



Oswego County (photo credit: Katy Green, CCE of Oswego County).

**Summary compiled by**

**Renuka Rao, Katy Green, Quirine M. Ketterings, and Hettie Krol**



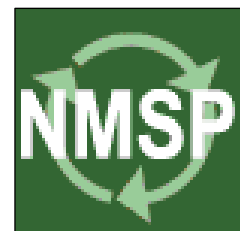
**Cornell Nutrient Analysis Laboratory**

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

**&**

**Nutrient Management Spear Program**

<http://nmssp.css.cornell.edu/>



Rao, R., K. Green, Q.M. Ketterings, and H. Krol (2007). Oswego Soil Sample Survey (2002-2006). CSS Extension Bulletin E07-28. 33 pages.

# Soil Sample Survey

# Oswego 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

**Katy Green**

Lake Neatahwanta Project Coordinator  
Cornell Cooperative Extension of Oswego County

**Quirine M. Ketterings and Hettie Krol**

Nutrient Management Spear Program  
Department of Crop and Soil Sciences

**November 26, 2007**

Correct Citation:

Rao, R., K. Green, Q.M. Ketterings, and H. Krol (2007). Soil sample survey of Oswego County. Samples analyzed by the Cornell Nutrient Analysis Laboratory (2002-2006). CSS Extension Bulletin E07-28. 33 pages.

---

## Table of Content

1. County Introduction.....	1
2. General Survey Summary.....	3
3. Cropping Systems.....	7
3.1 Homeowner Samples.....	7
3.2 Commercial Samples.....	8
4. Soil Types.....	10
4.1 Homeowner Samples.....	10
4.2 Commercial Samples.....	11
5. Organic Matter.....	12
5.1 Homeowner Samples.....	12
5.2 Commercial Samples.....	13
6. pH.....	14
6.1 Homeowner Samples.....	14
6.2 Commercial Samples.....	15
7. Phosphorus.....	16
7.1 Homeowner Samples.....	16
7.2 Commercial Samples.....	17
8. Potassium.....	18
8.1 Homeowner Samples.....	18
8.2 Commercial Samples.....	20
9. Magnesium.....	23
9.1 Homeowner Samples.....	23
9.2 Commercial Samples.....	24
10. Iron.....	25
10.1 Homeowner Samples.....	25
10.2 Commercial Samples.....	26
11. Manganese.....	27
11.1 Homeowner Samples.....	27
11.2 Commercial Samples.....	28
12. Zinc.....	29
12.1 Homeowner Samples.....	29
12.2 Commercial Samples.....	30
Appendix: Cornell Crop Codes.....	31

Rao, R., K. Green, Q.M. Ketterings, and H. Krol (2007). Oswego Soil Sample Survey (2002-2006). CSS Extension Bulletin E07-28. 33 pages.

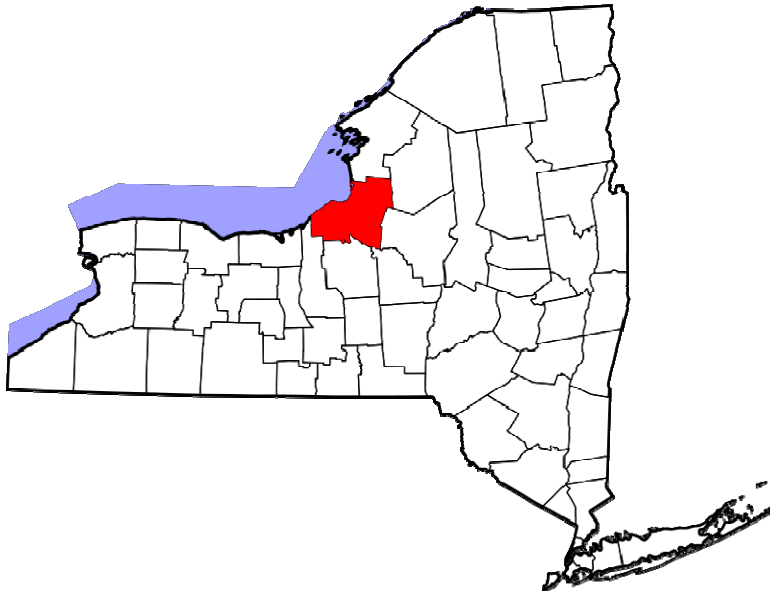


Oswego County (photo credit: Karen Meyers (above) and Katy Green (below), CCE of Oswego County).



# 1. County Introduction

Oswego County is located in north central New York. The county is bordered by Lake Ontario and Jefferson County to the North, Lewis and Oneida Counties to the east,



Onondaga and Madison Counties to the south, and Cayuga County to the west. It is divided into two physiographic regions, with the eastern part of the county on the Tug Hill Plateau and the western portion of the county on the Erie-Ontario Plain. The county, particularly the Tug Hill region, is subject to vast amounts of

lake effect snowfall each winter, totaling approximately 180 inches annually. The population of the county is approximately 122,000 residents, the majority of which live in and around the Cities of Oswego and Fulton.

Agriculture and related agri-businesses are the largest industries in Oswego County, contributing \$31.5 million annually to the local economy. According to the New York Agricultural Statistics Service, in 2003 there were 103,100 acres in farmland out of the 610,113 acres that make up Oswego County. The primary agricultural products produced in the county are vegetables (37%), followed by dairy products (34%), nursery and greenhouse (9%), fruits and nuts (4%), hay and other crops (4%), other products account for the final 12% of those produced in the county. The primary vegetables produced in the county include onions and potatoes. Fruits grown in Oswego County consist of a mix of apples, pears, cranberries, strawberries, blueberries, and raspberries among others. Oswego County fruit and vegetable production contributes greatly to agriculture in New York State. Oswego County is the number one producer of cranberries in New York State. It also ranks 3<sup>rd</sup> in onion production, 5<sup>th</sup> in pear production, and 12<sup>th</sup> in apple production in the state.

Rao, R., K. Green, Q.M. Ketterings, and H. Krol (2007). Oswego Soil Sample Survey (2002-2006). CSS Extension Bulletin E07-28. 33 pages.

Oswego County contains one of the largest acreages of wetlands in the state, including approximately 46,500 acres of muckland. Oswego County is unique in that it has several small pockets of muck soil in the western portion of the county that have been drained and are under cultivation for agricultural use. This soil is used for growing a large portion of the vegetables produced in the county, particularly onions.

Dairies have historically been a large part of agriculture in Oswego County, but have declined in recent years. According to the 2007 agricultural district review, there has been a loss of approximately 50% of the dairies in the county since 1999, which is countered by a 40% increase in vegetable production in the county. The agricultural trend at this point seems to be towards small farms growing a variety of produce for local consumers.

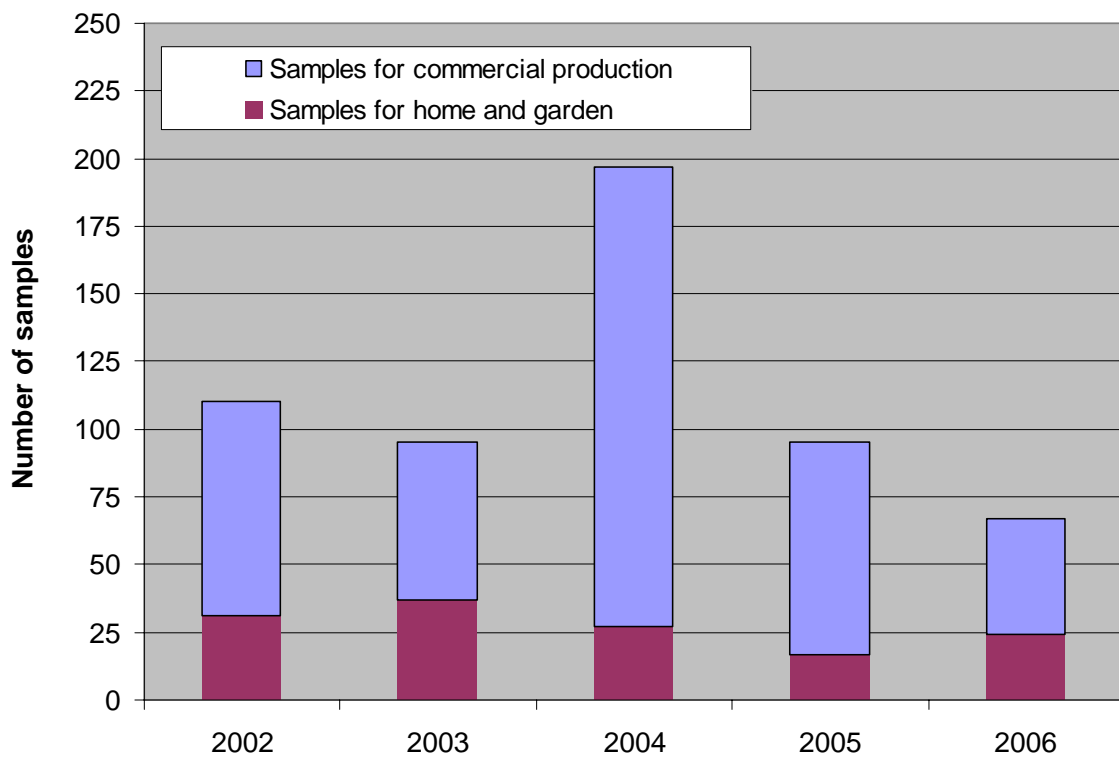
Katy Green  
Lake Neatahwanta Project Coordinator  
Cornell Cooperative Extension of Oswego County



Oswego County (photo credit: Katy Green, CCE of Oswego County).

## 2. General Survey Summary

This survey summarizes the soil test results from grower (identified as “commercial samples”) and homeowner samples from Oswego County submitted to the Cornell Nutrient Analysis Laboratory (CNAL) from 2002 to 2006. The total number of samples analyzed in these years amounted to 564. Of these, 428 samples (76%) were submitted by commercial growers while 43 samples (24%) were submitted by homeowners.



Homeowners		Commercial		Total
2002	31	2002	79	110
2003	37	2003	58	95
2004	27	2004	170	197
2005	17	2005	78	95
<u>2006</u>	<u>24</u>	<u>2006</u>	<u>43</u>	<u>67</u>
Total	136	Total	428	564

Homeowner submitted soil samples to the Cornell Nutrient Analysis Laboratory during 2002-2006 primarily to request fertilizer recommendations for home garden vegetable production (33%), athletic fields (21%) and lawns (18%). Commercial growers submitted samples primarily to grow corn silage or grain (27%), birdsfoot trefoil mixes (16%), alfalfa or alfalfa/grass mixes (12%), onions (11%), and grass hay production (6%).

Soils tested for home and garden in Oswego County were classified as belonging to soil management group 2 (19%), group 3 (12%), group 4 (38%), or group 5 (32%). 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, 50% belonged to soil management group 4. Group 1 soils were represented by less than 1% of the samples. Groups 2, 3, 5, and 6 comprised 3, 5, 29 and 11% of all samples submitted by commercial growers. Worth was the most common soil series (19% of all samples), followed by Alton (14%), the muck soil Carlisle (11%), Williamson (9%) and Winsor (8%).

Organic matter levels, as measured by loss-on-ignition, ranged from less than 1% to almost 60% (muck soil). For homeowner samples, 52% had between 3 and 5% organic matter, 22% tested between 2 and 3% organic matter and 21% had more than 5% organic



matter. Of the samples submitted by commercial growers, 47% contained between 3 and 5% organic matter and 28% had more than 5% organic matter..

Soil pH in water (1:1 soil:water extraction ratio) varied from 4.8 to 8.2 for home and garden samples with 59% testing between pH 6.0 and 7.4 and 26% between pH 5.0 and 5.9. For the commercial samples, the highest pH was 7.5 and 75% tested between 5.5 and 7.0.

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, 20% of the soils tested low for P, 21% tested medium, 35% tested high and 24% tested very high. This meant that 59% tested high or very high in P. For commercial growers, 16% tested very high. In total 32% were low in P, 22% tested medium for P while 30% of the submitted samples were classified as high in soil test P. This means that 46% 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 5).

Potassium classifications for Oswego County soils varied from very low (7% of the homeowner soils and 9% of the commercial growers' soils) to very high (29% of the homeowner soils and 28% of the commercial growers' soils). For homeowners, 19% tested low in K, 18% tested medium, and 27% tested high for potassium. For commercial growers' soils, 22% tested low, 19% tested medium and 19% 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 6 to more than 3500 lbs Mg/acre. Only 1% of the homeowner and commercial grower soils tested very low for Mg. Most soils tested high or very high for Mg (87% of the homeowner soils and 76% 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 88-94% in the normal range with 6% of the homeowner soils and 12% of the commercial grower soils testing excessive for Fe. Similarly, most soils (94-97%) 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, 84% tested high for Zn while 13% tested medium and the remainder were low in Zn. Of the commercial growers' samples, 5% tested low, 18% tested medium while 77% 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	2003	2004	2005	2006	Total	%
ATF	9	13	4	2	0	28	21
BLU	0	0	0	0	2	2	1
FLA	1	0	0	0	0	1	1
GRA	0	0	2	0	0	2	1
LAW	8	6	6	0	5	25	18
MVG	6	8	9	11	11	45	33
OTH	3	1	0	0	1	5	4
PER	1	0	1	1	1	4	3
PTO	0	0	1	0	1	2	1
ROS	0	0	2	0	0	2	1
ROU	0	2	0	0	0	2	1
RSP	0	1	0	0	0	1	1
SAG	1	0	1	1	3	6	4
STR	0	4	1	0	0	5	4
SUB	2	0	0	0	0	2	1
TRF	0	1	0	2	0	3	2
Unknown	0	1	0	0	0	1	1
Total	31	37	27	17	24	136	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	0	0	1	2	0	3	1
AGE/AGT	8	6	21	8	1	44	10
ALE/ALT	0	0	4	1	0	5	1
APP	0	2	0	2	0	4	1
BCE/BCT	1	0	0	2	0	3	1
BGT	0	0	50	0	0	50	12
BLB	1	0	0	9	3	13	3
BRP	0	0	0	1	0	1	0
BUK	2	0	0	0	0	2	0
BWI	1	0	0	0	0	1	0
CBS	0	0	0	0	2	2	0
CGE	3	1	1	0	0	5	1
CLE	1	7	2	0	0	10	2
COG/COS	22	8	43	28	14	115	27
CUR	0	2	0	0	0	2	0
GIE/GIT	1	1	0	0	0	2	0
GPF	0	0	12	0	0	12	3
GPV	0	0	0	1	0	1	0
GRE/GRT	1	1	4	10	9	25	6
LET	0	0	0	1	0	1	0
MIX	0	3	0	1	0	4	1
OAS	3	0	0	0	1	4	1
OAT	0	3	0	3	4	10	2
ONP	0	0	0	1	0	1	0
ONS	14	13	18	0	0	45	11
OTH	2	1	2	0	0	5	1
PGE	0	1	1	0	0	2	0
PIT	0	0	2	0	0	2	0
PLT	0	0	1	0	0	1	0
PNT	2	0	1	1	0	4	1
POT	0	0	1	0	0	1	0
PUM	1	3	0	1	0	5	1
RSF	0	1	0	0	0	1	0
RSS	0	2	0	1	0	3	1
RYC	3	1	0	0	0	4	1
RYS	1	0	0	0	0	1	0

Rao, R., K. Green, Q.M. Ketterings, and H. Krol (2007). Oswego Soil Sample Survey (2002-2006). CSS Extension Bulletin E07-28. 33 pages.

Current year crop	2002	2003	2004	2005	2006	Total	%
SOY	6	0	0	0	0	6	1
SSH	0	0	0	1	0	1	0
STS	0	0	0	3	0	3	1
SUN	0	0	0	0	1	1	0
SWC	1	1	1	0	7	10	2
TOM	0	0	0	1	0	1	0
TRE	0	0	2	0	1	3	1
TRT	5	0	1	0	0	6	1
WHT	0	1	0	0	0	1	0
Unknown	0	0	2	0	0	2	0
Total	79	58	170	78	43	428	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	2	7	6	7	26	19
SMG 3 (silt loam)	7	2	2	2	3	16	12
SMG 4 (sandy loam)	12	23	6	4	6	51	38
SMG 5 (sandy)	8	10	12	5	8	43	32
SMG 6 (mucky)	0	0	0	0	0	0	0
Total	31	37	27	17	24	136	100

## 4.2 Commercial Samples

Soil series for commercial samples:

Name	SMG	2002	2003	2004	2005	2006	Total	%
Adams	5	1	3	0	0	0	4	1
Alton	5	4	1	14	31	11	61	14
Amboy	4	0	1	12	0	0	13	3
Aurora	2	0	0	0	1	0	1	0
Brockport	1	0	0	0	0	1	1	0
Canadaigua	3	1	0	2	0	0	3	1
Carlisle	6	14	13	18	0	0	45	11
Colonie	5	0	0	0	0	1	1	0
Colton	5	3	2	3	0	1	9	2
Deerfield	5	0	2	0	0	0	2	0
Empeyville	4	1	3	0	0	3	7	2
Fredon	4	2	0	0	1	0	3	1
Hinckley	5	0	3	0	2	1	6	1
Ira	4	8	2	13	6	2	31	7
Madalin	1	0	0	1	0	0	1	0
Middlebury	3	0	0	1	0	0	1	0
Minoa	4	2	0	0	0	2	4	1
Naumburg	5	0	1	1	0	1	3	1
Oakville	5	0	2	2	1	1	6	1
Ontario	2	1	0	1	0	0	2	0
Raynham	3	7	3	5	2	0	17	4
Rhinebeck	2	3	5	2	1	0	11	3
Scriba	4	3	1	7	5	2	18	4
Sodus	4	3	0	9	1	0	13	3
Swanton	4	0	0	0	0	2	2	0
Venango	3	1	0	0	0	0	1	0
Westbury	4	0	0	2	0	0	2	0
Williamson	4	16	2	14	7	1	40	9
Windsor	5	3	9	2	16	4	34	8
Worth	4	6	1	59	4	10	80	19
Unknown	-	0	4	2	0	0	6	1
Total	-	79	58	170	78	43	428	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	1	0	5	8	11	2	2	2	31
2003	0	3	14	10	7	1	2	0	37
2004	0	0	5	8	7	2	2	3	27
2005	0	2	2	4	5	1	1	2	17
2006	0	1	4	8	3	3	2	3	24
Total	1	6	30	38	33	9	9	10	136

	2002	2003	2004	2005	2006
Lowest:	0.4	1.0	2.0	1.7	1.6
Highest:	11.0	6.2	13.0	7.7	9.8
Mean:	4.2	3.3	4.5	4.2	4.3
Median:	4.0	3.3	4.0	4.0	3.9

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	0	16	26	35	6	6	6	100
2003	0	8	38	27	19	3	5	0	100
2004	0	0	19	30	26	7	7	11	100
2005	0	12	12	24	29	6	6	12	100
2006	0	4	17	33	13	13	8	13	100
Total	1	4	22	28	24	7	7	7	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	8	23	22	8	3	0	15	79
2003	0	3	13	13	7	1	3	18	58
2004	0	5	22	57	38	15	7	26	170
2005	7	4	12	9	22	21	3	0	78
2006	0	2	9	13	11	6	1	1	43
Total	7	22	79	114	86	46	14	60	428

	2002	2003	2004	2005	2006
Lowest:	1.3	1.4	2.3	0.1	1.7
Highest:	58.7	55.1	58.1	6.6	7.6
Mean:	12.1	13.6	9.2	3.9	3.8
Median:	3.2	4.0	4.0	4.3	3.6

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	10	29	28	10	4	0	19	100
2003	0	5	22	22	12	2	5	31	100
2004	0	3	13	34	22	9	4	15	100
2005	9	5	15	12	28	27	4	0	100
2006	0	5	21	30	26	14	2	2	100
Total	2	5	18	27	20	11	3	14	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	4	4	5	10	4	4	0	31
2003	0	1	6	9	5	1	8	7	0	0	37
2004	0	0	4	5	6	3	7	2	0	0	27
2005	0	0	0	4	0	7	6	0	0	0	17
2006	0	0	1	3	4	12	3	1	0	0	24
Total	0	1	11	25	19	28	34	14	4	0	136

	2002	2003	2004	2005	2006
Lowest:	5.7	4.8	5.1	5.6	5.3
Highest:	8.2	7.9	7.8	7.4	7.5
Mean:	-	-	-	-	-
Median:	7.2	6.2	6.4	6.9	6.6

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	13	13	16	32	13	13	0	100
2003	0	3	16	24	14	3	22	19	0	0	100
2004	0	0	15	19	22	11	26	7	0	0	100
2005	0	0	0	24	0	41	35	0	0	0	100
2006	0	0	4	13	17	50	13	4	0	0	100
Total	0	1	8	18	14	21	25	10	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	3	20	23	21	10	2	0	0	0	79
2003	1	3	12	16	13	7	5	1	0	0	58
2004	0	3	31	45	61	26	4	0	0	0	170
2005	0	1	10	21	26	17	2	1	0	0	78
2006	0	2	4	14	12	10	1	0	0	0	43
Total	1	12	77	119	133	70	14	2	0	0	428

	2002	2003	2004	2005	2006
Lowest:	4.8	4.4	4.9	4.8	4.7
Highest:	7.3	7.5	7.3	7.5	7.3
Mean:	-	-	-	-	-
Median:	5.9	5.9	6.0	6.1	6.0

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

	<4.5	4.5-4.9	5.0-5.4	5.5-5.9	6.0-6.4	6.5-6.9	7.0-7.4	7.5-7.9	8.0-8.4	>8.4	Total
2002	0	4	25	29	27	13	3	0	0	0	100
2003	2	5	21	28	22	12	9	2	0	0	100
2004	0	2	18	26	36	15	2	0	0	0	100
2005	0	1	13	27	33	22	3	1	0	0	100
2006	0	5	9	33	28	23	2	0	0	0	100
Total	0	3	18	28	31	16	3	00	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	6	10	7	4	1	0	0	1	2	31
2003	0	11	6	15	2	2	1	0	0	0	37
2004	0	4	7	8	3	0	1	1	3	0	27
2005	0	3	3	6	0	2	1	1	1	0	17
2006	0	3	3	12	2	1	0	0	0	3	24
Total	0	27	29	48	11	6	3	2	5	5	136

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

	2002	2003	2004	2005	2006
Lowest:	1	1	1	3	1
Highest:	420	84	192	198	475
Mean:	46	20	42	41	57
Median:	8	16	13	16	21

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	19	32	23	13	3	0	0	3	6	100
2003	0	30	16	41	5	5	3	0	0	0	100
2004	0	15	26	30	11	0	4	4	11	0	100
2005	0	18	18	35	0	12	6	6	6	0	100
2006	0	13	13	50	8	4	0	0	0	13	100
Total	0	20	21	35	8	4	2	1	4	4	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	41	11	12	1	1	4	9	0	0	79
2003	0	16	14	11	3	1	0	12	1	0	58
2004	0	51	41	53	7	0	1	11	5	1	170
2005	0	16	19	33	3	1	3	3	0	0	78
2006	0	13	8	19	2	0	1	0	0	0	43
Total	0	137	93	128	16	3	9	35	6	1	428

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

	2002	2003	2004	2005	2006
Lowest:	1	1	1	1	1
Highest:	144	162	223	146	99
Mean:	23	37	24	20	14
Median:	2	8	7	9	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	52	14	15	1	1	5	11	0	0	100
2003	0	28	24	19	5	2	0	21	2	0	100
2004	0	30	24	31	4	0	1	6	3	1	100
2005	0	21	24	42	4	1	4	4	0	0	100
2006	0	30	19	44	5	0	2	0	0	0	100
Total	0	32	22	30	4	1	2	8	1	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						
	Very Low	Low	Medium	High	Very High	
	<40	40-69	70-99	100-164	>164	Total
2002	0	1	0	1	2	4
2003	0	1	0	1	0	2
2004	0	0	1	2	4	7
2005	0	0	0	1	5	6
2006	1	0	1	2	3	7
Total (#)	1	2	2	7	14	26
Total (%)	4	8	8	27	54	100
Soil Management Group 3						
	<45	45-79	80-119	120-199	>199	Total
2002	0	0	2	4	1	7
2003	0	0	1	1	0	2
2004	0	0	1	0	1	2
2005	0	1	1	0	0	2
2006	0	0	0	2	1	3
Total (#)	0	1	5	7	3	16
Total (%)	0	6	31	44	19	100
Soil Management Group 4						
	<55	55-99	100-149	150-239	>239	Total
2002	1	4	1	4	2	12
2003	2	6	4	6	5	23
2004	0	0	1	2	3	6
2005	0	1	1	2	0	4
2006	0	1	2	0	3	6
Total (#)	3	12	9	14	13	51
Total (%)	6	24	18	27	25	100
Soil Management Group 5						
	<60	60-114	115-164	165-269	>269	Total
2002	0	2	2	1	3	8
2003	2	4	1	3	0	10
2004	3	0	1	4	4	12
2005	0	3	0	1	1	5
2006	0	2	4	0	2	8
Total (#)	5	11	8	9	10	43
Total (%)	12	26	19	21	23	100

Potassium classification summary for homeowners:

Summary (#)	Very Low	Low	Medium	High	Very High	Total
2002	1	7	5	10	8	31
2003	4	11	6	11	5	37
2004	3	0	4	8	12	27
2005	0	5	2	4	6	17
2006	1	3	7	4	9	24
Grand Total	9	26	24	37	40	136

Summary (%)	Very Low	Low	Medium	High	Very High	Total
2002	3	23	16	32	26	100
2003	11	30	16	30	14	100
2004	11	0	15	30	44	100
2005	0	29	12	24	35	100
2006	4	13	29	17	38	100
Grand Total	7	19	18	27	29	100

	2002	2003	2004	2005	2006
Lowest:	24	33	18	50	36
Highest:	736	337	618	513	4104
Mean:	204	141	247	188	401
Median:	153	116	236	185	158

## 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	0	0	0
2004	0	0	0	0	1	1
2005	0	0	0	0	0	0
2006	0	0	0	0	1	1
Total (#)	0	0	0	0	2	2
Total (%)	0	0	0	0	100	100
Soil Management Group 2						
	<40	40-69	70-99	100-164	>164	Total
	Very Low	Low	Medium	High	Very High	
2002	0	0	1	2	1	4
2003	0	0	0	2	3	5
2004	0	0	0	2	1	3
2005	0	0	0	2	0	2
2006	0	0	0	0	0	0
Total (#)	0	0	1	8	5	14
Total (%)	0	0	7	57	36	100
Soil Management Group 3						
	<45	45-79	80-119	120-199	>199	Total
	Very Low	Low	Medium	High	Very High	
2002	0	0	5	3	1	9
2003	0	0	0	3	0	3
2004	0	0	0	1	5	6
2005	1	1	1	1	0	4
2006	0	0	0	8	0	8
Total (#)	1	1	6	16	6	30
Total (%)	3	3	20	53	20	100



Soil Management Group 4						
	<55	55-99	100-149	150-239	>239	Total
	Very Low	Low	Medium	High	Very High	
2002	10	13	9	4	5	41
2003	0	3	0	4	3	10
2004	19	36	21	28	12	116
2005	0	7	2	6	9	24
2006	0	12	4	4	2	22
Total (#)	29	71	36	46	31	213
Total (%)	14	33	17	22	15	100
Soil Management Group 5						
	<60	60-114	115-164	165-269	>269	Total
	Very Low	Low	Medium	High	Very High	
2002	3	3	0	0	5	11
2003	2	5	11	4	1	23
2004	1	2	7	4	8	22
2005	1	9	14	10	16	50
2006	3	5	7	3	2	20
Total (#)	10	24	39	21	32	126
Total (%)	8	19	31	17	25	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	14	14
2003	0	0	0	0	13	13
2004	0	0	0	0	18	18
2005	0	0	0	0	0	0
2006	0	0	0	0	0	0
Total (#)	0	0	0	0	45	45
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	13	16	15	9	26	0	79
2003	2	8	11	13	20	4	58
2004	21	39	28	35	45	2	170
2005	1	16	17	19	25	0	78
2006	3	17	11	7	5	0	43
Grand Total	40	96	82	83	121	6	428

Summary (%)	Very Low	Low	Medium	High	Very High	Un-known	Total
2002	16	20	19	11	33	0	100
2003	3	14	19	22	34	7	100
2004	12	23	16	21	26	1	100
2005	1	21	22	24	32	0	100
2006	7	40	26	16	12	0	100
Grand Total	9	22	19	19	28	1	100

	2002	2003	2004	2005	2006
Lowest:	10	32	15	32	52
Highest:	3544	864	701	561	535
Mean:	265	258	189	211	154
Median:	118	159	142	185	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	1	0	7	23	31
2003	1	2	7	10	17	37
2004	1	1	2	5	18	27
2005	0	1	0	3	13	17
2006	0	2	0	9	13	24
Total	2	7	9	34	84	136

	2002	2003	2004	2005	2006
Lowest:	56	16	12	46	27
Highest:	1004	673	849	496	1290
Mean:	368	219	303	271	306
Median:	297	197	270	273	217

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	3	0	23	74	100
2003	3	5	19	27	46	100
2004	4	4	7	19	67	100
2005	0	6	0	18	76	100
2006	0	8	0	38	54	100
Total	1	5	7	25	62	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	3	9	12	20	35	79
2003	2	7	5	19	25	58
2004	1	16	14	46	93	170
2005	0	10	9	20	39	78
2006	0	6	11	13	13	43
Total	6	48	51	118	205	428

	2002	2003	2004	2005	2006
Lowest:	6	10	17	21	23
Highest:	2181	3685	3450	597	548
Mean:	427	659	448	215	160
Median:	175	171	226	201	131

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	4	11	15	25	44	100
2003	3	12	9	33	43	100
2004	1	9	8	27	55	100
2005	0	13	12	26	50	100
2006	0	14	26	30	30	100
Total	1	11	12	28	48	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	30	1	31
2003	34	3	37
2004	27	0	27
2005	14	3	17
2006	23	1	24
Total	128	8	136

Percentages:

	0-49	>49	Total
	Normal	Excessive	
	97	3	100
	92	8	100
	100	0	100
	82	18	100
	96	4	100
	94	6	100

	2002	2003	2004	2005	2006
Lowest:	2	2	4	2	2
Highest:	98	96	36	132	50
Mean:	11	21	16	23	13
Median:	6	11	13	6	8

## 10.2 Commercial Samples

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

Total number of samples:

	0-49	>49	Total
	Normal	Excessive	
2002	72	7	79
2003	49	9	58
2004	140	30	170
2005	77	1	78
2006	39	4	43
Total	377	51	428

Percentages:

	0-49	>49	Total
	Normal	Excessive	
	91	9	100
	84	16	100
	82	18	100
	99	1	100
	91	9	100
	88	12	100

	2002	2003	2004	2005	2006
Lowest:	2	2	2	1	3
Highest:	174	380	364	121	160
Mean:	21	30	35	14	23
Median:	13	14	16	11	11

## 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	
2002	29	2	31
2003	35	2	37
2004	24	3	27
2005	16	1	17
2006	24	0	24
Total	128	8	136

Percentages:

	0-99	>99	Total
	Normal	Excessive	
	94	6	100
	95	5	100
	89	11	100
	94	6	100
	100	0	100
	94	6	100

	2002	2003	2004	2005	2006
Lowest:	10	13	4	13	6
Highest:	298	148	214	118	79
Mean:	48	50	46	37	29
Median:	34	49	35	31	27

## 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	77	2	79		97	3	100
2003	54	4	58		93	7	100
2004	168	2	170		99	1	100
2005	77	1	78		99	1	100
2006	41	2	43		95	5	100
Total	417	11	428		97	3	100

	2002	2003	2004	2005	2006
Lowest:	5	4	7	5	13
Highest:	329	158	166	136	514
Mean:	37	38	33	36	45
Median:	26	30	30	29	29



## 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	1	5	25	31
2003	0	6	31	37
2004	1	3	23	27
2005	2	1	14	17
2006	1	2	21	24
Total	5	17	114	136

Percentages:

<0.5	0.5-1.0	>1	Total
Low	Medium	High	
3	16	81	100
0	16	84	100
4	11	85	100
12	6	82	100
4	8	88	100
4	13	84	100

	2002	2003	2004	2005	2006
Lowest:	0.3	0.6	0.4	0.4	0.2
Highest:	21.8	78.5	33.2	64.1	60.4
Mean:	5.0	5.9	3.5	3.3	2.7
Median:	2.6	2.3	3.5	3.3	2.7

## 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	18	56	79
2003	4	8	46	58
2004	1	30	139	170
2005	0	10	68	78
2006	13	9	21	43
Total	23	75	330	428

Percentages:

<0.5	0.5-1.0	>1	Total
Low	Medium	High	
6	23	71	100
7	14	79	100
1	18	82	100
0	13	87	100
30	21	49	100
5	18	77	100

	2002	2003	2004	2005	2006
Lowest:	0.2	0.3	0.3	0.6	0.1
Highest:	65.2	21.1	63.9	22.7	26.5
Mean:	6.7	6.3	4.1	3.1	2.5
Median:	1.7	3.1	2.0	1.8	0.9

## Appendix: Cornell Crop Codes

Crop codes used in the Cornell Nutrient Analysis Laboratory.

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

Crop Code	Crop Description
	<b>Corn</b>
COG	Corn grain
COS	Corn silage
	<b>Grasses, pastures, covercrops</b>
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
	<b>Small grains</b>
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
	<b>Others</b>
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