

Rao, R., J. Walsh, Q.M. Ketterings, and H. Krol (2007). Sullivan Soil Sample Survey (2002-2006). CSS Extension Bulletin E07-47. 30 pages.

# Soil Sample Survey

# Sullivan County

Samples analyzed by CNAL (2002-2006)



Sullivan County (photo credit: Audrey Reith, CCE of Orange County).

**Summary compiled by**

**Renuka Rao, Joe Walsh, 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/>



Rao, R., J. Walsh, Q.M. Ketterings, and H. Krol (2007). Sullivan Soil Sample Survey (2002-2006). CSS Extension Bulletin E07-47. 30 pages.

# Soil Sample Survey

# Sullivan 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

**Joe Walsh**

Agricultural Program Leader

Cornell Cooperative Extension of Sullivan County

**Quirine M. Ketterings and Hettie Krol**

Nutrient Management Spear Program  
Department of Crop and Soil Sciences

**December 17, 2007**

Correct Citation:

Rao, R., J. Walsh, Q.M. Ketterings, and H. Krol (2007). Soil sample survey of Sullivan County. Samples analyzed by the Cornell Nutrient Analysis Laboratory (2002-2006). CSS Extension Bulletin E07-47. 31 pages.

---

## Table of Content

1. County Introduction.....	1
2. General Survey Summary.....	1
3. Cropping Systems.....	6
3.1 Homeowner Samples.....	6
3.2 Commercial Samples.....	7
4. Soil Types.....	8
4.1 Homeowner Samples.....	8
4.2 Commercial Samples.....	9
5. Organic Matter.....	10
5.1 Homeowner Samples.....	10
5.2 Commercial Samples.....	11
6. pH.....	12
6.1 Homeowner Samples.....	12
6.2 Commercial Samples.....	13
7. Phosphorus.....	14
7.1 Homeowner Samples.....	14
7.2 Commercial Samples.....	15
8. Potassium.....	16
8.1 Homeowner Samples.....	16
8.2 Commercial Samples.....	18
9. Magnesium.....	20
9.1 Homeowner Samples.....	20
9.2 Commercial Samples.....	21
10. Iron.....	22
10.1 Homeowner Samples.....	22
10.2 Commercial Samples.....	23
11. Manganese.....	24
11.1 Homeowner Samples.....	24
11.2 Commercial Samples.....	25
12. Zinc.....	26
12.1 Homeowner Samples.....	26
12.2 Commercial Samples.....	27
Appendix: Cornell Crop Codes.....	28



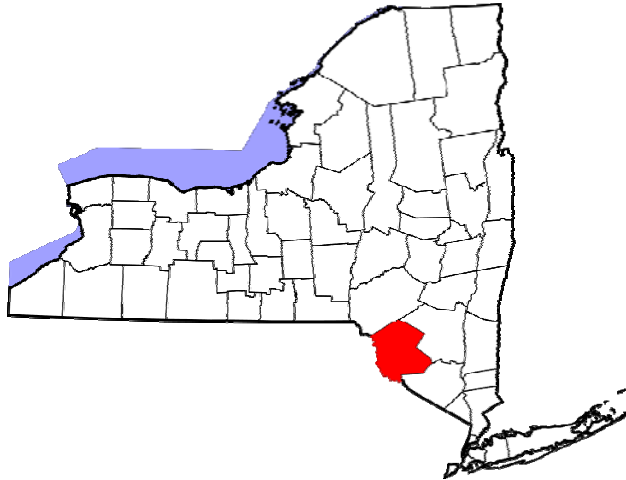
Sullivan County (photo credit: Audrey Reith, CCE of Orange County).





# 1. County Introduction

Sullivan County is located in the southern portion of New York State, nearly halfway between Binghamton and New York City. It is bordered by Delaware County to the north and northwest, Ulster County to the east and northeast, Orange County to the south, and



the Delaware River and Pennsylvania to the west and southwest. The county is nestled firmly within the southern portion of the Catskill Mountains with its northeastern corner within the boundaries of the Catskill Park. The county has a total area of nearly 1,000 square miles. The generally topography of the county is hilly with many moderately steep slopes, to extreme in the northern part of the county. Most of

the agriculture in the county is in the middle elevations between 1000 and 2000 feet of elevation on gentle to moderately steep hills. The highest point in the county is a 3,118-foot peak unofficially known as Beech Mountain in the Town of Rockland. The lowest point, at approximately 475 feet, is along the Delaware River in the Town of Lumberland.

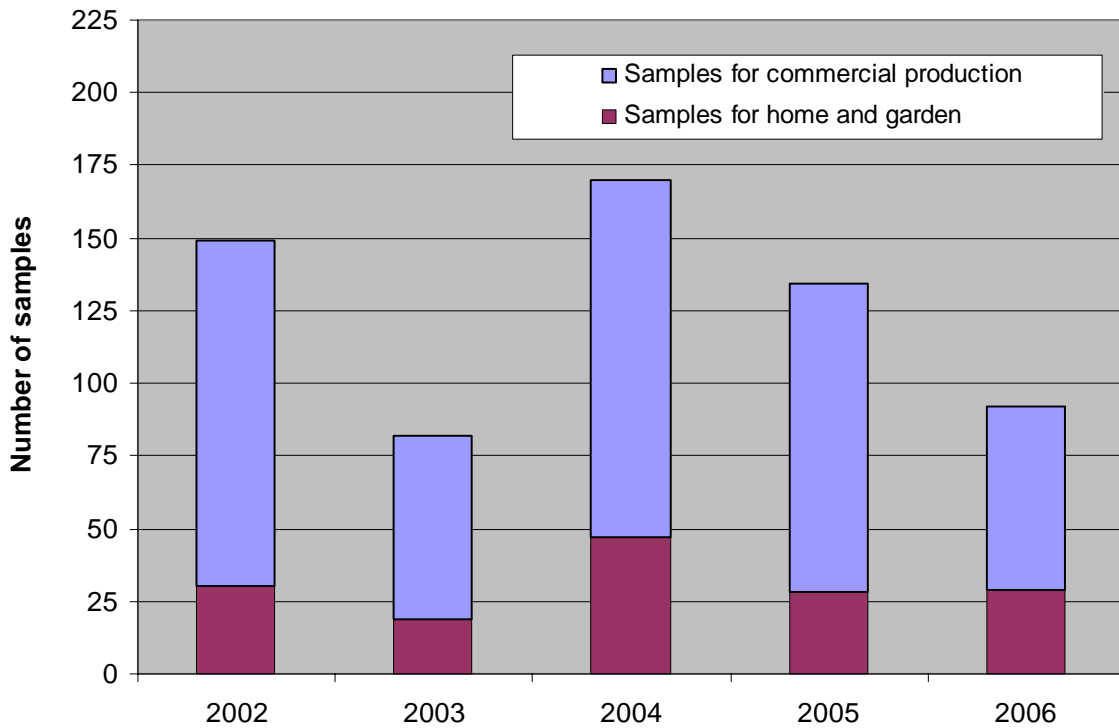
In 2003, there were 63,500 acres in farms, 10 percent of the county's total 620,618 acres. That year, there were 380 farms in the county averaging 167 acres per farm. In 2006, acreage in farm land was 62,300, a relatively small reduction in acreage. The number of farms was 360 versus 380 in 2003. The acreage in farming has stayed above 60,000 acres since 1992.

The leading products sold are poultry and eggs (62%), dairy products (23%), hay and other crops (3%), horses and ponies (2%), and nursery and greenhouse products (2%) with 8% in other products. The Agricultural Census showed 64% of the farm operators reported farming as their principal occupation.

Joe Walsh  
Agricultural Program Leader  
Cornell Cooperative Extension of Sullivan County

## 2. General Survey Summary

This survey summarizes the soil test results from grower (identified as “commercial samples”) and homeowner samples from Sullivan County submitted to the Cornell Nutrient Analysis Laboratory (CNAL) from 2002 to 2006. The total number of samples analyzed in these years amounted to 627. Of these, 474 samples (76%) were submitted by commercial growers while 153 samples (24%) were submitted by homeowners.



Homeowners		Commercial		Total
2002	30	2002	119	149
2003	19	2003	63	82
2004	47	2004	123	170
2005	28	2005	106	134
<u>2006</u>	<u>29</u>	<u>2006</u>	<u>63</u>	<u>92</u>
Total	153	Total	474	627

Homeowners submitted soil samples to the Cornell Nutrient Analysis Laboratory during 2002-2006 primarily to request fertilizer recommendations for home garden vegetable production (31%) or lawns (29%). Commercial growers submitted samples to grow grass (38%), clover mixes (13%), and pasture (12%).

Soils tested for home and garden in Sullivan County were classified as belonging to soil management group 2 (21%), group 3 (37%), group 4 (28%), or group 5 (14%). 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 (79%) belonged to soil management group 3. There were no group 1, 2, 5 or 6 samples. Nineteen percent belonged to group 4. Wellsboro was the most common soil series (27% of all samples), followed by Lackawanna (10%), Oquaga (9%), Wurtsboro and Arnot (7% each).

Organic matter levels, as measured by loss-on-ignition, ranged from less than 1% to 22%. For homeowner samples 56% had organic matter levels between 2 and 5%. Of the samples submitted by commercial growers, 58% contained between 3 and 5% organic matter.

Rao, R., J. Walsh, Q.M. Ketterings, and H. Krol (2007). Sullivan Soil Sample Survey (2002-2006). CSS Extension Bulletin E07-47. 30 pages.

Soil pH in water (1:1 soil:water extraction ratio) varied from 4.1 to 8.3 for home and garden samples. Thirty-six percent tested between pH 5 and 6, 34% between pH 6 and 7, and 17% had a pH of 7 or higher. For the commercial samples, the highest pH was 7.8 and 46% tested between pH 5 and 6 whereas 33% had a pH between 6 and 7.

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, 22% tested medium, 30% tested high and 33% tested very high. This meant that 63% tested high or very high in P. For commercial growers, 21% tested very high. In total 27% were low in P, 19% tested medium for P while 33% of the submitted samples were classified as high in soil test P. This means that 54% 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 below).

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



Rao, R., J. Walsh, Q.M. Ketterings, and H. Krol (2007). Sullivan Soil Sample Survey (2002-2006). CSS Extension Bulletin E07-47. 30 pages.

Potassium classifications for Sullivan County soils varied from very low (4% of the homeowner soils and 5% of the commercial growers' soils) to very high (32% of the homeowner soils and 21% of the commercial growers' soils). For homeowners, 22% tested low in K, 21% tested medium, and 22% tested high for potassium. For commercial growers' soils, 22% tested low, 24% tested medium and 25% 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 1 to more than 2500 lbs Mg/acre. There were only three soils that tested very low for Mg within the homeowner samples while 1% of the samples for commercial production tested very low in Mg. Most soils tested high or very high for Mg (71% of the homeowner soils and 77% 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 68-77% in the normal range with 23% of the homeowner soils and 32% of the commercial grower soils testing excessive for Fe. Similarly, most soils (88-89%) 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, 90% tested high for Zn while 7% tested medium and 4% were low in Zn. Of the commercial growers' samples, 5% tested low, 10% tested medium while 85% 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	%
ALG	0	0	2	0	0	2	1
APP	0	0	1	0	0	1	1
APR	0	0	0	1	0	1	1
ATF	0	1	4	0	0	5	3
BLU	0	0	1	1	0	2	1
FLA	1	0	0	0	1	2	1
GEN	0	0	0	0	3	3	2
HRB	0	0	2	0	1	3	2
LAW	9	7	7	10	12	45	29
MVG	7	7	17	10	6	47	31
OTH	5	1	2	1	1	10	7
PER	1	3	5	3	2	14	9
PTO	0	0	0	1	0	1	1
ROS	0	0	1	0	0	1	1
SAG	2	0	4	1	3	10	7
TOM	0	0	1	0	0	1	1
TRF	3	0	0	0	0	3	2
Unknown	7	1	2	1	1	12	8
Total	30	19	47	28	29	153	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	3	0	2	0	0	5	1
AGE/AGT	1	0	0	1	3	5	1
ALE/ALT	1	0	0	0	1	2	0
APP	3	1	1	1	2	8	2
BCE/BCT	2	4	7	8	11	32	7
BGE	4	10	0	1	0	15	3
BLB	0	0	0	0	1	1	0
BTE	0	0	0	0	1	1	0
BWS	0	0	2	0	0	2	0
CGE/CGT	3	2	4	9	6	24	5
CLE/CLT	4	6	5	20	4	39	8
COG/COS	16	1	1	2	2	22	5
CVE	0	0	0	0	1	1	0
GIE/GIT	9	0	0	2	0	11	2
GPF	0	0	1	0	0	1	0
GPV	0	0	6	0	2	8	2
GRE/GRT	50	6	63	34	19	172	36
IDL	3	1	0	1	0	5	1
MIX	11	2	3	1	1	18	4
OTH	0	9	0	5	3	17	4
PGE/PGT	0	4	1	0	2	7	1
PIE/PIT	5	3	14	1	0	23	5
PLE/PLT	0	2	0	3	0	5	1
PNT	2	0	9	15	0	26	5
POT	1	0	0	0	0	1	0
PUM	0	0	0	0	1	1	0
RYC	0	0	0	1	0	1	0
SOY	0	0	0	0	2	2	0
SQW	0	0	0	0	1	1	0
SSH	0	1	0	0	0	1	0
SWC	0	0	1	0	0	1	0
TRE	0	1	0	0	0	1	0
TRT	0	2	0	0	0	2	0
WHT	0	0	3	0	0	3	1
Unknown	1	8	0	1	0	10	2
Total	119	53	133	106	63	474	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)	3	6	14	5	4	32	21
SMG 3 (silt loam)	23	2	9	9	13	56	37
SMG 4 (sandy loam)	2	8	17	10	6	43	28
SMG 5 (sandy)	2	3	7	4	6	22	14
SMG 6 (mucky)	0	0	0	0	0	0	0
Total	30	19	47	28	29	153	100

## 4.2 Commercial Samples

Soil series for commercial samples:

Name	SMG	2002	2003	2004	2005	2006	Total	%
Arnot	3	8	1	6	8	8	31	7
Barbour	3	5	1	0	1	3	10	2
Bash	3	0	0	2	2	0	4	1
Chenango	3	0	0	9	0	2	11	2
Cheshire	4	0	0	8	11	0	19	4
Chippewa	3	3	0	0	0	0	3	1
Hawksnest	3	0	5	1	5	0	11	2
Lackawanna	3	13	6	13	11	6	49	10
Lewbeach	3	2	1	1	4	1	9	2
Lordstown	3	0	0	0	0	2	2	0
Mardin	3	2	0	0	0	0	2	0
Middlebury	3	1	0	0	0	0	1	0
Mongaup	3	3	0	1	18	0	22	5
Morris	3	1	1	3	1	0	6	1
Norwich	3	0	1	0	0	0	1	0
Onteora	3	0	0	0	1	0	1	0
Oquaga	3	19	6	9	5	3	42	9
Otisville	4	0	0	3	0	0	3	1
Pope	4	7	5	0	0	0	12	3
Riverhead	4	2	1	1	2	0	6	1
Scriba	4	0	0	1	1	0	2	0
Swartswood	4	6	0	5	1	1	13	3
Tuller	3	0	0	0	0	1	1	0
Tunkhannock	3	0	0	3	0	3	6	1
Unadilla	3	0	0	1	0	0	1	0
Valois	3	0	0	0	1	0	1	0
Volusia	3	1	0	0	0	0	1	0
Wellsboro	3	37	10	40	14	29	130	27
Willowemoc	3	1	7	3	18	1	30	6
Wurtsboro	4	8	11	12	0	2	33	7
Unknown	-	0	7	1	2	1	11	2
Total	-	119	63	123	106	63	474	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	2	1	10	5	8	2	1	1	30
2003	2	2	2	5	3	1	2	2	19
2004	2	6	4	7	10	4	6	8	47
2005	2	4	9	3	3	2	0	5	28
2006	7	2	5	7	4	2	1	1	29
Total	15	15	30	27	28	11	10	17	153

	2002	2003	2004	2005	2006
Lowest:	0.8	0.6	0.5	0.3	0.5
Highest:	9.2	10.1	22.0	14.6	9.6
Mean:	3.6	3.9	5.1	4.1	3.0
Median:	3.3	3.6	4.4	2.9	3.0

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	7	3	33	17	27	7	3	3	100
2003	11	11	11	26	16	5	11	11	100
2004	4	13	9	15	21	9	13	17	100
2005	7	14	32	11	11	7	0	18	100
2006	24	7	17	24	14	7	3	3	100
Total	10	10	20	18	18	7	7	11	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	11	8	22	46	26	3	3	119
2003	1	3	9	21	19	6	2	2	63
2004	1	1	17	39	35	19	4	7	123
2005	0	2	6	24	36	20	11	7	106
2006	0	6	6	16	16	13	6	0	63
Total	2	23	46	122	152	84	26	19	474

	2002	2003	2004	2005	2006
Lowest:	1.1	0.4	0.8	1.5	1.0
Highest:	8.4	18.8	11.4	10.3	6.5
Mean:	4.2	4.1	4.2	4.7	4.1
Median:	4.4	3.8	4.0	4.5	4.1

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	9	7	18	39	22	3	3	100
2003	2	5	14	33	30	10	3	3	100
2004	1	1	14	32	28	15	3	6	100
2005	0	2	6	23	34	19	10	7	100
2006	0	10	10	25	25	21	10	0	100
Total	0	5	10	26	32	18	5	4	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	1	3	4	10	6	4	2	0	0	0	30
2003	0	4	4	1	2	3	4	1	0	0	19
2004	0	4	5	11	9	11	6	1	0	0	47
2005	0	3	4	6	6	4	4	1	0	0	28
2006	1	0	3	9	4	4	4	1	3	0	29
Total	2	14	20	37	27	26	20	4	3	0	153

	2002	2003	2004	2005	2006
Lowest:	4.1	4.6	4.5	4.5	4.4
Highest:	7.3	7.5	7.5	7.5	8.3
Mean:	-	-	-	-	-
Median:	5.8	6.3	6.1	6.1	6.2

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	3	10	13	33	20	13	7	0	0	0	100
2003	0	21	21	5	11	16	21	5	0	0	100
2004	0	9	11	23	19	23	13	2	0	0	100
2005	0	11	14	21	21	14	14	4	0	0	100
2006	3	0	10	31	14	14	14	3	10	0	100
Total	1	9	13	24	18	17	13	3	2	0	100

## 6.2 Commercial Samples

pH of commercial samples (number):

	<4.5	4.5-4.9	5.0-5.4	5.5-5.9	6.0-6.4	6.5-6.9	7.0-7.4	7.5-7.9	8.0-8.4	>8.4	Total
2002	1	7	24	38	17	16	12	4	0	0	119
2003	8	9	12	4	12	5	12	1	0	0	63
2004	2	6	23	42	26	18	6	0	0	0	123
2005	3	7	30	18	25	12	11	0	0	0	106
2006	1	4	15	12	17	10	4	0	0	0	63
Total	15	33	104	114	97	61	45	5	0	0	474

	2002	2003	2004	2005	2006
Lowest:	4.1	3.2	4.2	3.9	4.2
Highest:	7.8	7.5	7.4	7.4	7.3
Mean:	-	-	-	-	-
Median:	5.8	5.6	5.8	5.7	5.9

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	6	20	32	14	13	10	3	0	0	100
2003	13	14	19	6	19	8	19	2	0	0	100
2004	2	5	19	34	21	15	5	0	0	0	100
2005	3	7	28	17	24	11	10	0	0	0	100
2006	2	6	24	19	27	16	6	0	0	0	100
Total	3	7	22	24	20	13	9	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	7	6	11	1	0	0	1	1	3	30
2003	0	3	2	7	0	1	1	0	1	4	19
2004	0	4	7	13	8	2	1	1	6	5	47
2005	0	1	8	8	3	1	2	1	1	3	28
2006	0	8	10	7	0	0	0	2	0	2	29
Total	0	23	33	46	12	4	4	5	9	17	153

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

	2002	2003	2004	2005	2006
Lowest:	1	1	2	2	1
Highest:	513	602	616	539	469
Mean:	62	118	92	76	39
Median:	14	24	31	25	6

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	23	20	37	3	0	0	3	3	10	100
2003	0	16	11	37	0	5	5	0	5	21	100
2004	0	9	15	28	17	4	2	2	13	11	100
2005	0	4	29	29	11	4	7	4	4	11	100
2006	0	28	34	24	0	0	0	7	0	7	100
Total	0	15	22	30	8	3	3	3	6	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	39	18	30	9	5	3	4	1	10	119
2003	0	30	7	6	10	0	1	4	1	4	63
2004	0	22	37	40	9	3	2	5	3	2	123
2005	0	24	18	50	6	3	0	3	1	1	106
2006	0	11	12	29	3	2	1	1	2	2	63
Total	0	126	92	155	37	13	7	17	8	19	474

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

	2002	2003	2004	2005	2006
Lowest:	1	1	1	1	1
Highest:	625	522	478	237	582
Mean:	61	51	29	21	43
Median:	9	4	9	10	14

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	33	15	25	8	4	3	3	1	8	100
2003	0	48	11	10	16	0	2	6	2	6	100
2004	0	18	30	33	7	2	2	4	2	2	100
2005	0	23	17	47	6	3	0	3	1	1	100
2006	0	17	19	46	5	3	2	2	3	3	100
Total	0	27	19	33	8	3	1	4	2	4	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	1	0	1	1	0	3
2003	0	0	2	1	3	6
2004	1	1	6	1	5	14
2005	0	0	0	1	4	5
2006	0	1	0	1	2	4
Total (#)	2	2	9	5	14	32
Total (%)	6	6	28	16	44	100
Soil Management Group 3						
	<45	45-79	80-119	120-199	>199	Total
2002	1	5	4	6	7	23
2003	0	0	2	0	0	2
2004	0	2	1	1	5	9
2005	1	2	0	3	3	9
2006	1	4	3	3	2	13
Total (#)	3	13	10	13	17	56
Total (%)	5	23	18	23	30	100
Soil Management Group 4						
	<55	55-99	100-149	150-239	>239	Total
2002	0	0	1	1	0	2
2003	0	3	3	0	2	8
2004	0	3	4	3	7	17
2005	0	3	1	0	6	10
2006	0	2	1	1	2	6
Total (#)	0	11	10	5	17	43
Total (%)	0	26	23	12	40	100
Soil Management Group 5						
	<60	60-114	115-164	165-269	>269	Total
2002	0	1	0	1	0	2
2003	0	2	0	0	1	3
2004	1	1	0	5	0	7
2005	0	0	2	2	0	4
2006	0	3	1	2	0	6
Total (#)	1	7	3	10	1	22
Total (%)	5	32	14	45	5	100



Potassium classification summary for homeowners:

Summary (#)	Very Low	Low	Medium	High	Very High	Total
2002	2	6	6	9	7	30
2003	0	5	7	1	6	19
2004	2	7	11	10	17	47
2005	1	5	3	6	13	28
2006	1	10	5	7	6	29
Grand Total	6	33	32	33	49	153

Summary (%)	Very Low	Low	Medium	High	Very High	Total
2002	7	20	20	30	23	100
2003	0	26	37	5	32	100
2004	4	15	23	21	36	100
2005	4	18	11	21	46	100
2006	3	34	17	24	21	100
Grand Total	4	22	21	22	32	100

	2002	2003	2004	2005	2006
Lowest:	34	58	34	11	40
Highest:	484	1585	895	1600	307
Mean:	162	308	216	310	135
Median:	129	120	186	181	125

## 8.2 Commercial Samples

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

Soil Management Group 3						
	<45	45-79	80-119	120-199	>199	Total
	Very Low	Low	Medium	High	Very High	
2002	2	19	22	26	27	96
2003	6	13	6	7	7	39
2004	5	19	30	26	12	92
2005	0	8	22	37	22	89
2006	3	9	20	8	19	59
Total (#)	16	68	100	104	87	375
Total (%)	4	18	27	28	23	100
Soil Management Group 4						
	<55	55-99	100-149	150-239	>239	Total
	Very Low	Low	Medium	High	Very High	
2002	1	6	4	5	7	23
2003	6	3	4	1	3	17
2004	2	16	6	5	1	30
2005	1	8	2	3	1	15
2006	0	1	0	1	1	3
Total (#)	10	34	16	15	13	88
Total (%)	11	39	18	17	15	100

Potassium classification summary for commercial samples.

Summary (#)	Very Low	Low	Medium	High	Very High	Un-known	Total
2002	3	25	26	31	34	0	119
2003	12	16	10	8	10	7	63
2004	7	35	36	31	13	1	123
2005	1	16	24	40	23	2	106
2006	3	10	20	9	20	1	63
Grand Total	26	102	116	119	100	11	474

Summary (%)	Very Low	Low	Medium	High	Very High	Un-known	Total
2002	3	21	22	26	29	0	100
2003	19	25	16	13	16	11	100
2004	6	28	29	25	11	1	100
2005	1	15	23	38	22	2	100
2006	5	16	32	14	32	2	100
Grand Total	5	22	24	25	21	2	100

	2002	2003	2004	2005	2006
Lowest:	29	22	7	40	29
Highest:	1470	332	513	4300	758
Mean:	220	127	124	196	190
Median:	132	92	105	141	118

## 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	1	5	5	11	8	30
2003	0	4	4	4	7	19
2004	0	4	7	15	21	47
2005	1	3	2	7	15	28
2006	1	5	3	10	10	29
Total	3	21	21	47	61	153

	2002	2003	2004	2005	2006
Lowest:	15	44	32	15	12
Highest:	998	928	1256	1059	728
Mean:	179	256	280	277	189
Median:	147	132	172	206	172

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	3	17	17	37	27	100
2003	0	21	21	21	37	100
2004	0	9	15	32	45	100
2005	4	11	7	25	54	100
2006	3	17	10	34	34	100
Total	2	14	14	31	40	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	10	6	34	69	119
2003	1	18	7	18	19	63
2004	0	9	18	41	55	123
2005	0	7	19	38	42	106
2006	5	6	5	21	26	63
Total	6	50	55	152	211	474

	2002	2003	2004	2005	2006
Lowest:	31	19	26	25	1
Highest:	961	739	863	2513	517
Mean:	253	185	212	246	188
Median:	228	135	186	176	147

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	8	5	29	58	100
2003	2	29	11	29	30	100
2004	0	7	15	33	45	100
2005	0	7	18	36	40	100
2006	8	10	8	33	41	100
Total	1	11	12	32	45	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	23	7	30
2003	14	5	19
2004	38	9	47
2005	20	8	28
2006	23	6	29
Total	118	35	153

Percentages:

	0-49	>49	Total
	Normal	Excessive	
	77	23	100
	74	26	100
	81	19	100
	71	29	100
	79	21	100
	77	23	100

	2002	2003	2004	2005	2006
Lowest:	4	1	3	1	2
Highest:	424	307	358	478	184
Mean:	41	59	34	58	42
Median:	11	9	12	13	22



## 10.2 Commercial Samples

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

Total number of samples:

	0-49	>49	Total
	Normal	Excessive	
2002	98	21	119
2003	38	25	63
2004	76	47	123
2005	66	40	106
2006	42	21	63
Total	320	154	474

Percentages:

	0-49	>49	Total
	Normal	Excessive	
	82	18	100
	60	40	100
	62	38	100
	62	38	100
	67	33	100
	68	32	100

	2002	2003	2004	2005	2006
Lowest:	1	2	3	2	2
Highest:	293	969	278	518	213
Mean:	28	111	52	79	44
Median:	16	27	33	34	22

## 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	28	2	30
2003	16	3	19
2004	43	4	47
2005	22	6	28
2006	25	4	29
Total	134	19	153

Percentages:

	0-99	>99	Total
	Normal	Excessive	
	93	7	100
	84	16	100
	91	9	100
	79	21	100
	86	14	100
	88	12	100

	2002	2003	2004	2005	2006
Lowest:	5	14	12	16	8
Highest:	265	147	228	192	145
Mean:	40	60	56	64	47
Median:	26	45	43	52	34

## 11.2 Commercial Samples

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

Total number of samples:

	0-99	>99	Total
	Normal	Excessive	
2002	102	17	119
2003	55	8	63
2004	115	8	123
2005	90	16	106
2006	59	4	63
Total	421	53	474

Percentages:

	0-99	>99	Total
	Normal	Excessive	
	86	14	100
	87	13	100
	93	7	100
	85	15	100
	94	6	100
	89	11	100

	2002	2003	2004	2005	2006
Lowest:	6	5	6	4	3
Highest:	233	833	443	572	272
Mean:	55	60	49	66	48
Median:	44	30	36	50	32

## 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	1	29	30
2003	0	2	17	19
2004	1	5	41	47
2005	2	0	26	28
2006	3	2	24	29
Total	6	10	137	153

Percentages:

<0.5	0.5-1.0	>1	Total
Low	Medium	High	
0	3	97	100
0	11	89	100
2	11	87	100
7	0	93	100
10	7	83	100
4	7	90	100

	2002	2003	2004	2005	2006
Lowest:	0.8	0.6	0.2	0.1	0.3
Highest:	218.0	29.7	358.1	334.6	21.8
Mean:	11.9	8.4	18.9	20.5	4.6
Median:	2.7	5.0	6.2	5.1	3.0

## 12.2 Commercial Samples

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

Total number of samples:

	<0.5	0.5-1.0	>1	Total
	Low	Medium	High	
2002	1	10	108	119
2003	1	6	56	63
2004	4	10	109	123
2005	4	14	88	106
2006	13	8	42	63
Total	23	48	403	474

Percentages:

<0.5	0.5-1.0	>1	Total
Low	Medium	High	
1	8	91	100
2	10	89	100
3	8	89	100
4	13	83	100
21	13	67	100
5	10	85	100

	2002	2003	2004	2005	2006
Lowest:	0.4	0.4	0.1	0.2	0.1
Highest:	33.8	36.8	13.6	125.9	36.1
Mean:	5.1	5.2	2.8	4.6	4.1
Median:	3.1	2.9	2.2	2.5	1.8

## Appendix: Cornell Crop Codes

Crop codes used in the Cornell Nutrient Analysis Laboratory.

Crop Code	Crop Description
<b>Alfalfa</b>	
ABE	Alfalfa trefoil grass, Establishment
ABT	Alfalfa trefoil grass, Established
AGE	Alfalfa grass, Establishment
AGT	Alfalfa grass, Established
ALE	Alfalfa, Establishment
ALT	Alfalfa, Established
<b>Birdsfoot</b>	
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
<b>Barley</b>	
BSP	Spring barley
BSS	Spring barley with legumes
BUK	Buckwheat
BWI	Winter barley
BWS	Winter barley with legumes
<b>Clover</b>	
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