# Soil Sample Survey Orange County

# Samples analyzed by CNAL (2002-2006)



Western Orange County (photo credit: Larry Hulle, CCE of Orange County).

## Summary compiled by

#### Renuka Rao, Larry R. Hulle, Quirine M. Ketterings, and Hettie Krol



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



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Central (above) and Eastern (below) Orange County (photo credit: Larry Hulle, CCE of Orange County).



#### **1. County Introduction**

Orange County is located in the lower Hudson Valley on the West side of the Hudson River in New York State. It is approximately 50 miles north of New York City. It borders both Pennsylvania and New Jersey. Orange County covers 522,240 acres.



Farming in Orange County is quite diverse. Approximately 19% or 101,300 acres of the counties total acreage is in agriculture. Orange County is known for its onion production. The county has several large areas of glacial lake deposits (Black Dirt) which comprise 14,000 acres that are the center of the vegetable industry. The second largest agricultural industry in the county is dairy farming which is mostly made up of mid-sized dairy farms, although there are several large and expanding dairy farms as well.

Orange County is the fastest developing county in New York State. With this rapid increase in population the Horticulture industry has seen an increase in the number of greenhouses, nurseries and landscape/lawn care services. Orange County also has the fourth highest number of horses in the state. The livestock industry includes, beef, hogs, sheep, meat goats, milk goats, chickens, fallow deer and other exotic livestock such as red deer, emus, llamas and ostriches. A large majority of the open space in Orange County is used for forage crops like alfalfa, clover, grass and corn. The bulk of these crops go to feed the dairy, beef and equine industries.

Orange County is home to four priority watersheds:

- Hudson River/Moodna Creek. These habitats have been designated as "irreplaceable" significant coastal fish and wildlife habitats by the New York State Coastal Management Program.
- 2) **Neversink River**. The Neversink River's population of *Alasmidonta heterodon* (dwarf wedge mussel) is considered the largest and healthiest remaining population of this species in the world.
- 3) **Ramapo River**. The Ramapo and its associated aquifer have been declared a "sole source" of drinking water for the community of Mahwah, NJ. Two million people

living and/or working in Rockland County, NY and northern New Jersey rely on the Ramapo aquifer.

4) **Wallkill River**. The Wallkill River drains the heartland of Orange County, including 14,000 acres of highly productive organic soils (Black Dirt).

Both surface reservoirs and groundwater aquifers face the same potential risks of pollution as the priority watersheds, portions of the recharge zones of two sole source aquifers have been identified in Orange County. Nutrient management planning is an essential Best Management Practice (BMP) for all of the agricultural industries. The largest farms have been required to design a management plan to manage the amount, sources, placement, form and timing of the application of nutrients from fertilizer, manure, and other organic sources to assure optimum crop growth. Regulations will soon include mid-sized farms to have similar management plans, to protect water quality.

Larry R. Hulle Dairy, Field Crops & Farm Business Management Cornell Cooperative Extension Orange County



Southern Orange County (photo credit: Larry Hulle, CCE of Orange County).

## 2. General Survey Summary

This survey summarizes the soil test results from grower (identified as "commercial samples") and homeowner samples from Orange County submitted to the Cornell Nutrient Analysis Laboratory (CNAL) from 2002 to 2006. The total number of samples analyzed in these years amounted to 1163. Of these, 783 samples (67%) were submitted by commercial growers while 380 samples (33%) were submitted by homeowners.



Homeowners		Comm	Commercial			
2002 2003 2004 2005 <u>2006</u>	58 57 60 77 <u>128</u>	2002 2003 2004 2005 <u>2006</u>	221 157 83 75 <u>247</u>	279 214 143 152 <u>375</u>		
Total	380	Total	783	1163		

Homeowners submitted soil samples to the Cornell Nutrient Analysis Laboratory during 2002-2006 primarily to request fertilizer recommendations for lawns (32%), athletic fields (19%), home garden vegetable production (17%) and ornamentals (7%). Commercial growers submitted samples to grow corn silage or grain (30%), alfalfa or alfalfa/grass mixes (14%), onions (14%), grass hay production (13%) and apples 97%).

Soils tested for home and garden in Orange County were classified as belonging to soil management group 2 (24%), group 3 (27%), group 4 (36%), or group 5 (13%). 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, 3% were group 1 soils, 2% belonged to group2, 64% were group 3 soils, 14% were from group 4, while 16% were muck soils (group 6). Mardin was the most common soil series (34% of all samples), followed by Bath (17%), Carlisle (16%), Pittsfield (6%), Hoosic (4%) and Erie (4%).

Organic matter levels, as measured by loss-on-ignition, ranged from less than 1% to greater than 60% in the muck soils. For homeowners 54% had between 2 and 5% organic matter, 9% testing between 5 and 6% organic matter and 23% were classified as soils with more than 6% organic matter. Of the samples submitted by commercial growers, 48%

contained between 3 and 5% organic matter, 9% had 5 to 6% organic matter and 23% had more than 6% organic matter.

Soil pH in water (1:1 soil:water extraction ratio) varied from less than 3.6 to 8.1 for home and garden samples while 58% tested between pH 5.5 and pH 7 and 27% had a pH between 7 and 8. For the commercial samples, the highest pH was 8.3 and 72% tested between pH 5.5 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, 6% of the soils tested low for P, 18% tested medium, 31% tested high and 44% tested very high. This meant that 83% tested high or very high in P. For commercial growers, 39% tested very high. In total 12% were low or very low in P, 14% tested medium for P while 35% of the submitted samples were classified as high in soil test P. This means that 74% 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 Orange County soils varied from very low (1% of the homeowner soils and 1% of the commercial growers' soils) to very high (66% of the homeowner soils and 62% of the commercial growers' soils). For homeowners, 6% tested low in K, 11% tested medium, and 17% tested high for potassium. For commercial growers' soils, 6% tested low, 11% tested medium and 18% 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 2 3 4 5 and 6	<35 <40 <45 <55 <60	35-64 40-69 45-79 55-99 60-114	65-94 70-99 80-119 100-149 115-164	95-149 100-164 120-199 150-239 165-269	>149 >164 >199 >239 >269			

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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 11 to almost 6700 lbs Mg/acre. There was only one homeowner samples that tested very low for Mg. Most soils tested high or very high for Mg (92% of the homeowner soils and 95% 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 93-95% in the normal range with 7% of the homeowner soils and 5% of the commercial grower soils testing excessive for Fe. Similarly, most soils (87% of homeowner soils and 97% of commercial grower samples) 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 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 7% tested medium and 5% were low in Zn. Of the commercial growers' samples, 4% tested low, 8% tested medium while 88% 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

	2002	2003	2004	2005	2006	Total	%
ALG	4	1	3	1	2	11	3
ATF	14	14	11	7	27	73	19
BLU	0	0	0	0	1	1	0
FLA	0	0	2	3	1	6	2
GRA	0	0	0	1	1	2	1
HRB	0	4	0	0	0	4	1
IDL	0	0	0	0	12	12	3
LAW	13	25	12	24	46	120	32
MVG	7	8	12	13	25	65	17
OTH	2	2	3	3	0	10	3
PER	2	2	5	6	4	19	5
PRK	1	0	1	15	0	17	4
ROD	4	0	1	0	0	5	1
ROU	2	0	1	0	0	3	1
SAG	6	1	6	3	9	25	7
SOD	2	0	0	0	0	2	1
SUB	0	0	1	0	0	1	0
TOM	0	0	1	0	0	1	0
TRF	1	0	1	1	0	3	1
Total	58	57	60	77	128	380	100

Crops for which recommendations are requested by homeowners:

Note: See Appendix for Cornell crop codes.

Current year crop	2002	2003	2004	2005	2006	Total	%
ABE	1	0	0	0	0	1	0
AGE/AGT	60	25	0	2	8	95	12
ALE/ALT	7	1	1	1	9	19	2
APP	0	0	2	28	23	53	7
BET	0	0	1	0	0	1	0
BRS	0	0	0	2	0	2	0
BSP	0	0	0	1	1	2	0
BUK	0	0	1	0	0	1	0
CBP	0	0	1	4	0	5	1
CGE/CGT	5	4	3	0	5	17	2
CHC	0	0	0	0	2	2	0
СКР	0	0	1	0	0	1	0
CKS	0	0	0	1	0	1	0
CLE	1	0	0	0	0	1	0
COG/COS	66	37	11	3	119	236	30
CSE	0	0	3	0	0	3	0
GIE	0	1	0	0	0	1	0
GPF	1	0	0	2	0	3	0
GPV	0	1	0	0	0	1	0
GRE/GRT	34	11	7	16	32	100	13
HRB	0	0	1	0	0	1	0
IDL	0	3	0	0	3	6	1
LAW	1	0	0	0	0	1	0
LET	0	6	6	0	0	12	2
MIX	1	6	3	2	9	21	3
MML	0	0	2	0	0	2	0
OAT	1	0	0	0	0	1	0
ONP	0	2	0	0	3	5	1
ONS	33	40	23	6	0	102	13
OTH	1	2	5	2	3	13	2
PEP	0	0	1	0	0	1	0
PGE/PGT	0	2	0	0	8	10	1
PIE/PIT	0	0	5	2	5	12	2
PLE/PLT	3	5	0	0	0	8	1
PNT	0	1	0	0	8	9	1
РОТ	0	1	1	0	1	3	0

Crops for which recommendations are requested in commercial samples:

Current year crop	2002	2003	2004	2005	2006	Total	%
PUM	1	3	2	0	0	6	1
RAD	0	0	0	1	0	1	0
RYC	0	0	0	0	1	1	0
RYS	0	0	1	0	0	1	0
SOY	1	1	0	0	0	2	0
SSH	0	2	0	0	0	2	0
SWC	0	1	0	0	0	1	0
ТОМ	0	0	1	0	0	1	0
TRT	0	0	1	0	0	2	0
TUR	0	1	0	0	0	1	0
Unknown	4	1	0	1	7	13	2
Total	221	157	83	75	247	783	100

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Note: See Appendix for Cornell crop codes.



Town of Warwick – Allen Baird – Sixth generation farm since 1789. (photo credit: Larry Hulle, CCE of Orange County)

## 4. Soil Types

#### 4.1 Homeowner Samples

	2002	2003	2004	2005	2006	Total	%
SMG 1 (clayey)	0	0	0	0	0	0	0
SMG 2 (silty)	16	19	13	14	30	92	24
SMG 3 (silt loam)	17	16	20	17	34	104	27
SMG 4 (sandy loam)	21	17	21	33	44	136	36
SMG 5 (sandy)	4	5	6	13	20	48	13
SMG 6 (mucky)	0	0	0	0	0	0	0
Total	58	57	60	77	128	380	100

Soil types (soil management groups) for homeowner samples:



Town of Montgomery – Bill Hoekstra Farm – Purchase of Development Rights (PDR) Farm. (photo credit: Larry Hulle, CCE of Orange County)

Name	SMG	2002	2003	2004	2005	2006	Total	%
Alden	3	1	1	0	0	4	6	1
Allard	3	2	0	0	0	2	4	1
Arnot	3	0	0	3	0	0	3	0
Barbour	3	3	0	0	0	0	3	0
Bath	3	22	15	4	27	64	132	17
Canadaigua	3	0	0	0	0	7	7	1
Carlisle	6	34	47	32	8	1	122	16
Castile	4	3	0	0	0	0	3	0
Chenango	3	1	0	1	1	4	7	1
Chippewa	3	0	1	0	0	0	1	0
Erie	3	13	8	0	0	12	33	4
Farmington	3	0	0	0	1	0	1	0
Fredon	4	1	0	0	0	0	1	0
Hoosic	4	14	8	0	1	11	34	4
Madalin	1	8	2	9	1	7	27	3
Mardin	3	73	51	14	24	105	267	34
Middlebury	3	6	0	0	0	1	7	1
Morris	3	1	0	0	0	0	1	0
Muck	6	0	4	0	0	0	4	1
Nassau	4	8	1	1	0	5	15	2
Palms	6	0	1	0	0	0	1	0
Pittsfield	4	10	7	8	6	13	44	6
Raynham	3	2	0	0	0	5	7	1
Rhinebeck	2	3	2	0	1	1	7	1
Riverhead	4	3	0	0	0	0	3	0
Scio	3	5	2	0	1	3	11	1
Swartswood	4	0	1	2	0	1	4	1
Teel	2	5	1	0	0	0	6	1
Tunkhannock	3	1	0	0	0	0	1	0
Volusia	3	0	1	1	3	0	5	1
Wayland	2	1	2	0	0	1	4	1
Wellsboro	3	0	1	0	0	0	1	0
Unknown	_	1	1	8	1	0	11	1
Total	-	221	157	83	75	247	783	100

Soil series for commercial samples:

## 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	4	6	11	12	2	6	14	58
2003	3	1	11	15	9	4	7	7	57
2004	4	4	9	11	8	8	6	10	60
2005	2	13	14	13	8	11	3	13	77
2006	5	10	23	23	25	11	12	19	128
Total	17	32	63	73	62	36	34	63	380

	2002	2003	2004	2005	2006
Lowest:	0.4	0.1	0.3	0.1	0.4
Highest:	55.2	13.7	23.5	31.0	53.6
Mean:	8.0	4.5	4.9	4.9	5.2
Median:	4.5	3.7	4.3	3.8	4.2

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	5	7	10	19	21	3	10	24	100
2003	5	2	19	26	16	7	12	12	100
2004	7	7	15	18	13	13	10	17	100
2005	3	17	18	17	10	14	4	17	100
2006	4	8	18	18	20	9	9	15	100
Total	4	8	19	19	16	9	9	17	100

	<1	1.0- 1.9	2.0- 2.9	3.0- 3.9	4.0- 4.9	5.0- 5.9	6.0- 6.9	>6.9	Total
2002	0	5	30	60	48	26	5	47	221
2003	0	1	10	31	38	16	4	57	157
2004	0	1	11	20	12	4	0	35	83
2005	4	1	23	20	7	3	1	16	75
2006	0	4	67	85	53	20	8	10	247
Total	4	12	141	216	158	69	18	165	783

Organic matter (loss-on-ignition method) in commercial samples (number):

	2002	2003	2004	2005	2006
Lowest:	1.3	1.8	1.8	0.1	1.4
Highest:	57.2	61.9	60.5	62.3	36.8
Mean:	11.9	21.8	23.9	12.5	4.0
Median:	4.2	4.9	4.6	3.2	3.5

Organic matter in commercial samples (% of total number of samples):

	<1	1.0- 1.9	2.0- 2.9	3.0- 3.9	4.0- 4.9	5.0- 5.9	6.0- 6.9	>6.9	Total
2002	0	2	14	27	22	12	2	21	100
2003	0	1	6	20	24	10	3	36	100
2004	0	1	13	24	14	5	0	42	100
2005	5	1	31	27	9	4	1	21	100
2006	0	2	27	34	21	8	3	4	100
Total	1	2	18	28	20	9	2	21	100

## 6. pH

## 6.1 Homeowner 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	6	8	9	7	15	8	1	0	58
2003	3	6	5	14	9	12	6	2	0	0	57
2004	1	2	2	12	10	11	20	2	0	0	60
2005	2	3	6	18	15	18	14	1	0	0	77
2006	3	2	7	17	28	32	34	4	1	0	128
Total	9	17	26	69	71	80	89	17	2	0	380

pH of homeowner samples (numbers):

	2002	2003	2004	2005	2006
Lowest:	4.6	4.0	4.4	3.8	3.6
Highest:	8.1	7.6	7.5	7.5	8.0
Mean:	-	-	-	-	-
Median:	6.7	6.0	6.6	6.3	6.5

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	7	10	14	16	12	26	14	2	0	100
2003	5	11	9	25	16	21	11	4	0	0	100
2004	2	3	3	20	17	18	33	3	0	0	100
2005	3	4	8	23	19	23	18	1	0	0	100
2006	2	2	5	13	22	25	27	3	1	0	100
Total	2	4	7	18	19	21	23	4	1	0	100

	<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	5	21	57	50	50	34	4	0	0	221
2003	0	2	24	61	38	21	8	3	0	0	157
2004	2	2	7	42	18	6	6	0	0	0	83
2005	0	5	5	16	9	8	20	8	4	0	75
2006	0	6	33	61	69	64	13	1	0	0	247
Total	2	20	90	237	184	149	81	16	4	0	783

pH of commercial samples (number):

	2002	2003	2004	2005	2006
Lowest:	4.6	4.6	4.0	4.7	4.7
Highest:	7.8	7.6	7.4	8.3	7.5
Mean:	-	-	-	-	-
Median:	6.3	5.8	5.7	6.7	6.1

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	2	10	26	23	23	15	2	0	0	100
2003	0	1	15	39	24	13	5	2	0	0	100
2004	2	2	8	51	22	7	7	0	0	0	100
2005	0	7	7	21	12	11	27	11	5	0	100
2006	0	2	13	25	28	26	5	0	0	0	100
Total	0	3	11	30	23	19	10	2	1	0	100

## 7. Phosphorus

## 7.1 Homeowner Samples

	<1	1-3	4-8	9-39	40-60	61-80	81- 100	101- 150	151- 200	>200	Total
	VL	L	М	Н	VH	VH	VH	VH	VH	VH	
2002	0	4	8	16	8	3	3	9	3	4	58
2003	0	4	17	17	6	6	2	1	3	1	57
2004	0	3	8	19	9	2	4	1	2	12	60
2005	0	9	18	21	3	2	5	2	3	14	77
2006	0	4	19	46	12	12	8	4	3	20	128
Total	0	24	70	119	38	25	22	17	14	51	380

Phosphorus (lbs/acre Morgan P) in homeowner samples (numbers):

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

	2002	2003	2004	2005	2006
Lowest:	1	3	2	1	1
Highest:	1111	232	772	822	947
Mean:	85	39	102	95	105
Median:	40	15	39	19	33

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	Μ	Н	VH	VH	VH	VH	VH	VH	
2002	0	7	14	28	14	5	5	16	5	7	100
2003	0	7	30	30	11	11	4	2	5	2	100
2004	0	5	13	32	15	3	7	2	3	20	100
2005	0	12	23	27	4	3	6	3	4	18	100
2006	0	3	15	36	9	9	6	3	2	16	100
Total	0	6	18	31	10	7	6	4	4	13	100

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

	<1	1-3	4-8	9-39	40-60	61-80	81- 100	101- 150	151- 200	>200	Total
	VL	L	Μ	Н	VH	VH	VH	VH	VH	VH	
2002	0	33	22	93	16	9	10	19	14	5	221
2003	0	11	8	56	7	20	8	23	14	10	157
2004	0	15	17	10	3	5	4	16	8	5	83
2005	0	8	15	28	7	2	3	4	6	2	75
2006	0	29	44	87	34	15	12	14	6	6	247
Total	0	96	106	274	67	51	37	76	48	28	783

Phosphorus (lbs P/acre Morgan extraction) for commercial samples (number):

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

	2002	2003	2004	2005	2006
Lowest:	1	1	1	1	1
Highest:	232	223	313	211	899
Mean:	47	69	68	44	45
Median:	23	50	36	16	21

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	Μ	Н	VH	VH	VH	VH	VH	VH	
2002	0	15	10	42	7	4	5	9	6	2	100
2003	0	7	5	36	4	13	5	15	9	6	100
2004	0	18	20	12	4	6	5	19	10	6	100
2005	0	11	20	37	9	3	4	5	8	3	100
2006	0	12	18	35	14	6	5	6	2	2	100
Total	0	12	14	35	9	7	5	10	6	4	100

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

## 8. Potassium

#### 8.1 Homeowner Samples

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	0	1	2	1	12	16				
2003	0	0	2	5	12	19				
2004	0	0	0	2	11	13				
2005	0	2	2	3	7	14				
2006	0	0	2	8	20	30				
Total (#)	0	3	8	19	62	92				
Total (%)	0	3	9	21	67	100				
		Soil I	Management	Group 3						
	<45	45-79	80-119	120-199	>199	Total				
	Very Low	Low	Medium	High	Very High					
2002	0	0	0	4	13	17				
2003	0	1	3	4	8	16				
2004	0	1	1	1	17	20				
2005	0	0	0	2	15	17				
2006	0	1	1	3	29	34				
Total (#)	0	3	5	14	82	104				
Total (%)	0	3	5	13	79	100				

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

Soil Management Group 4										
	<55	55-99	100-149	150-239	>239	Total				
	Very Low	Low	Medium	High	Very High					
2002	0	1	1	2	17	21				
2003	0	2	2	3	10	17				
2004	0	0	1	4	16	21				
2005	0	0	11	9	13	33				
2006	0	1	3	8	32	44				
Total (#)	0	4	18	26	88	136				
Total (%)	0	3	13	19	65	100				
Soil Management Group 5										
	<60	60-114	115-164	165-269	>269	Total				
	Very Low	Low	Medium	High	Very High					
2002	1	2	1	0	0	4				
2003	1	1	0	2	1	5				
2004	0	3	2	0	1	6				
2005	0	3	3	1	6	13				
2006	1	2	3	3	11	20				
Total (#)	3	11	9	6	19	48				
Total (%)	6	23	19	13	40	100				
		Soil M	anagement G	iroup 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 (%)	-	-	-	-	-	-				

Summary (#)	Very Low	Low	Medium	High	Very High	Total
2002	1	4	4	7	42	58
2003	1	4	7	14	31	57
2004	0	4	4	7	45	60
2005	0	5	16	15	41	77
2006	1	4	9	22	92	128
Grand Total	3	21	40	65	251	380

Potassium	classification	summary	for	homeowners:
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Summary (%)	Very Low	Low	Medium	High	Very High	Total
2002	2	7	7	12	72	100
2003	2	7	12	25	54	100
2004	0	7	7	12	75	100
2005	0	6	21	19	53	100
2006	1	3	7	17	72	100
Grand Total	1	6	11	17	66	100

	2002	2003	2004	2005	2006
Lowest:	41	41	63	58	35
Highest:	10551	670	29154	6287	8341
Mean:	529	242	851	384	449
Median:	292	182	302	179	256

	Soil Management Group 1									
	<35	35-64	65-940	95-149	>149	Total				
	Very Low	Low	Medium	High	Very High					
2002	0	0	1	3	4	8				
2003	0	0	0	2	0	2				
2004	0	2	5	0	2	9				
2005	0	0	0	0	1	1				
2006	0	0	0	0	7	7				
Total (#)	0	2	6	5	14	27				
Total (%)	0	7	22	19	52	100				
Soil Management Group 2										
	<40	40-69	70-99	100-164	>164	Total				
	Very Low	Low	Medium	High	Very High					
2002	0	0	0	4	5	9				
2003	0	0	1	1	3	5				
2004	0	0	0	0	0	0				
2005	0	0	0	1	0	1				
2006	0	0	0	0	2	2				
Total (#)	0	0	1	6	10	17				
Total (%)	0	0	6	36	59	100				
		Soil I	Management	Group 3						
	<45	45-79	80-119	120-199	>199	Total				
	Very Low	Low	Medium	High	Very High					
2002	2	9	15	29	75	130				
2003	0	4	12	19	45	80				
2004	2	8	2	3	8	23				
2005	0	8	8	4	37	57				
2006	0	11	24	50	122	207				
Total (#)	4	40	61	105	287	497				
Total (%)	1	8	12	21	58	100				

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

	Soil Management Group 4									
	<55	55-99	100-149	150-239	>239	Total				
	Very Low	Low	Medium	High	Very High					
2002	2	4	8	8	17	39				
2003	0	1	2	1	13	17				
2004	0	2	1	0	8	11				
2005	0	0	3	1	3	7				
2006	0	1	4	12	13	30				
Total (#)	2	8	18	22	54	104				
Total (%)	2	8	17	21	52	100				
Soil Management Group 5										
	<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 (%)	-	-	-	-	-	-				
		Soil I	Management	Group 6						
	<60	60-114	115-164	165-269	>269	Total				
	Very Low	Low	Medium	High	Very High					
2002	0	0	0	2	32	34				
2003	0	0	0	1	51	52				
2004	0	0	0	0	32	32				
2005	0	0	0	1	7	8				
2006	0	0	0	0	1	1				
Total (#)	0	0	0	4	123	127				
Total (%)	0	0	0	3	97	100				

Summary (#)	Very Low	Low	Medium	High	Very High	Un- known	Total
2002	4	13	24	46	133	1	221
2003	0	5	15	24	112	1	157
2004	2	12	8	3	50	8	83
2005	0	8	11	7	48	1	75
2006	0	12	28	62	145	0	247
Grand Total	6	50	86	142	488	11	783

	Potassium cla	assification	summary f	for commerc	ial samples.
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Summary (%)	Very Low	Low	Medium	High	Very High	Un- known	Total
2002	2	6	11	21	60	0	100
2003	0	3	10	15	71	1	100
2004	2	14	10	4	60	10	100
2005	0	11	15	9	64	1	100
2006	0	5	11	25	59	0	100
Grand Total	1	6	11	18	62	1	100

	2002	2003	2004	2005	2006
Lowest:	40	55	43	52	56
Highest:	1385	2329	1672	1208	5819
Mean:	349	423	390	380	343
Median:	242	387	337	295	242

## 9. Magnesium

#### 9.1 Homeowner Samples

	<20	20-65	66-100	101-199	>199	Total
	Very Low	Low	Medium	High	Very High	
2002	0	3	1	10	44	58
2003	0	1	5	14	37	57
2004	0	1	2	8	49	60
2005	0	2	6	20	49	77
2006	1	0	8	24	95	128
Total	1	7	22	76	274	380

Magnesium (lbs Mg/acre Morgan extraction) in homeowner samples (numbers):

	2002	2003	2004	2005	2006
Lowest:	30	59	62	41	11
Highest:	3993	942	6684	6461	3038
Mean:	573	296	484	480	445
Median:	337	263	342	303	308

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	5	2	17	76	100
2003	0	2	9	25	65	100
2004	0	2	3	13	82	100
2005	0	3	8	26	64	100
2006	1	0	6	19	74	100
Total	0	2	6	20	72	100

	<20	20-65	66-100	101-199	>199	Total
	Very Low	Low	Medium	High	Very High	
2002	0	0	4	43	174	221
2003	0	0	1	22	134	157
2004	0	3	2	10	68	83
2005	0	1	0	17	57	75
2006	0	13	14	56	164	247
Total	0	17	21	148	597	783

Magnesium (lbs Mg/acre Morgan extraction) in commercial samples (number):

	2002	2003	2004	2005	2006
Lowest:	71	86	25	26	38
Highest:	2588	3843	3619	2855	4597
Mean:	582	1019	1227	637	331
Median:	332	425	413	445	279

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Magnesuum	in commercial	camples i	% OF TOTAL	numner	or campleel.
widencolum	in commercial	Samples	10 OI $101a$	number	or samples.

	<20	20-65	66-100	101-199	>199	Total
	Very Low	Low	Medium	High	Very High	
2002	0	0	2	19	79	100
2003	0	0	1	14	85	100
2004	0	4	2	12	82	100
2005	0	2	0	23	76	100
2006	0	5	6	23	66	100
Total	0	2	3	19	76	100

## 10. Iron

#### 10.1 Homeowner Samples

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

	Total numbe	er of samples	Percentages	Percentages:		
	0-49	>49	Total	0-49	>49	Total
	Normal	Excessive		Normal	Excessive	
2002	51	7	58	88	12	100
2003	51	6	57	89	11	100
2004	55	5	60	92	8	100
2005	75	2	77	97	3	100
2006	122	6	128	95	5	100
Total	354	26	380	93	7	100

	2002	2003	2004	2005	2006
Lowest:	1	2	3	1	1
Highest:	137	144	83	69	492
Mean:	17	21	15	12	19
Median:	7	12	10	8	8

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

Total number of samples:					Percentages:		
	0-49	>49	Total		0-49	>49	Total
	Normal	Excessive			Normal	Excessive	
2002	208	13	221		94	6	100
2003	150	7	157		96	4	100
2004	73	10	83		88	12	100
2005	74	1	75		99	1	100
2006	237	10	247		96	4	100
Total	742	41	783		95	5	100

	2002	2003	2004	2005	2006
Lowest:	1	1	1	1	1
Highest:	207	748	409	58	140
Mean:	13	16	25	10	13
Median:	5	5	8	6	7

## 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	54	4	58	93	7	100
2003	42	15	57	74	26	100
2004	53	7	60	88	12	100
2005	69	8	77	90	10	100
2006	111	17	128	87	13	100
Total	329	51	380	87	13	100

	2002	2003	2004	2005	2006
Lowest:	4	10	12	13	13
Highest:	816	304	319	448	240
Mean:	60	75	65	60	58
Median:	39	58	52	44	43

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	215	6	221	97	3	100
2003	153	4	157	97	3	100
2004	80	3	83	96	4	100
2005	67	8	75	89	11	100
2006	243	4	247	98	2	100
Total	758	25	783	97	3	100

	2002	2003	2004	2005	2006
Lowest:	7	8	10	12	10
Highest:	321	149	145	208	166
Mean:	39	38	38	50	36
Median:	32	35	34	35	31

## 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	0	57	58				
2003	2	3	52	57				
2004	0	4	56	60				
2005	3	9	65	77				
2006	11	12	105	128				
Total	17	28	335	380				

Percentages:					
<0.5	0.5-1.0	>1	Total		
Low	Medium	High			
2	0	98	100		
4	5	91	100		
0	7	93	100		
4	12	84	100		
9	9	82	100		
5	7	88	100		

	2002	2003	2004	2005	2006
Lowest:	0.3	0.4	0.6	0.2	0.1
Highest:	108.3	129.0	469.9	175.6	91.4
Mean:	9.1	11.2	24.5	10.8	7.1
Median:	4.2	5.2	5.0	4.1	3.4

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

Total number of samples:					Percentage	es:		
	<0.5	0.5-1.0	>1	Total	<0.5	0.5-1.0	>1	Total
	Low	Medium	High		Low	Medium	High	
2002	1	17	203	221	0	8	92	100
2003	0	10	147	157	0	6	94	100
2004	5	8	70	83	6	10	84	100
2005	7	8	60	75	9	11	80	100
2006	20	16	211	247	8	6	85	100
Total	33	59	691	783	4	8	88	100

	2002	2003	2004	2005	2006
Lowest:	0.2	0.7	0.1	0.1	0.1
Highest:	31.6	45.1	34.8	35.8	67.6
Mean:	5.9	9.7	10.3	4.9	4.6
Median:	2.5	4.1	4.8	2.4	2.3

## **Appendix: Cornell Crop Codes**

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 codes used in the Cornell Nutrient Analysis Laboratory.

Crop Code	Crop Description
	Corn
COG	Corn grain
COS	Corn silage
	Grasses pastures covercrops
CVE	Crownyetch, Establishment
CVT	Crownyetch, 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
	Beans_dry
	Blueherries
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	Turt
TRT	Christmas trees, Topdressing