

Ketterings, Q.M., H. Krol, W.S. Reid and J. Degni (2004). Tioga County Soil Sample Survey 1995-2001. CSS Extension Bulletin E04-18. 37 pages.

Soil Sample Survey

Tioga Co.

Samples analyzed by CNAL in 1995-2001



Summary compiled by

Quirine M. Ketterings, Hettie Krol, W. Shaw Reid and Janice Degni



Nutrient Management Spear Program: <http://nmsp.css.cornell.edu/>

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Quirine Ketterings and Hettie Krol

Nutrient Management Spear Program
Department of Crop and Soil Sciences
817 Bradfield Hall, Cornell University
Ithaca NY 14853

W. Shaw Reid

Professor Emeritus
Department of Crop and Soil Sciences

Janice Degni

Area Field Crops Specialist and Team Leader
South Central NY (TCT - Tompkins, Cortland, Tioga) Dairy and Field Crops Program

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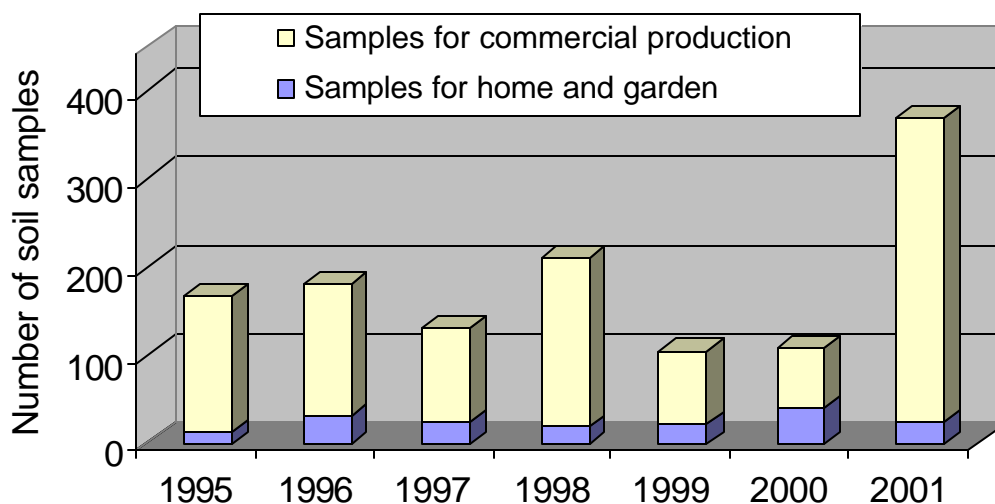
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1. General Survey Summary

This survey summarizes the soil test results from Tioga County soil samples submitted for analyses to the Cornell Nutrient Analysis Laboratory (CNAL) during 1995-2001. The total number of samples analyzed in these years amounted to 1264. Of these 1264 samples, 1093 (86%) were submitted to obtain fertilizer recommendations for commercial production while 171 samples (14%) were submitted as home and garden samples.



Homeowners		Commercial		Total
1995	13	1995	154	167
1996	32	1996	148	180
1997	23	1997	105	128
1998	19	1998	192	211
1999	21	1999	82	103
2000	40	2000	68	108
<u>2001</u>	<u>23</u>	<u>2001</u>	<u>344</u>	<u>367</u>
Total	171	Total	1093	1264

Fifty-six percent of the home and garden samples were submitted to request fertilizer recommendations for mixed vegetable gardens while 15% of the samples came from athletic fields, and 6% came from mixed vegetable gardens. Other samples were sent in to request recommendations for azaleas, blueberries, flowering annuals, grapes, herbs, perennials, roses, ornamentals adapted to pH 6.0 to 7.5, squash, strawberries, sweet corn, tomatoes, tree fruits, and water melon. People submitting samples for commercial production requested fertilizer recommendations for corn silage or grain production (22%), alfalfa, alfalfa/grass or alfalfa/trefoil mixtures (20%), pasture (17%), hay production (11%), and clover grass mixes (6%), while the remainder of the samples was sent to the laboratory to request recommendations for other crops including small grains, potatoes, and sweet corn.

Home and garden samples in Tioga County were silty (22%), silt loams (35%), sandy loams (38%), or sandy (6%), belonging to soil management groups 2, 3, 4, and 5, respectively. The table below gives descriptions of each of the soil management groups.

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 for commercial production, 92% belonged to soil management group 3 while 5% was classified group 2 and the remainder was of unknown classification. The four most common soil series were Volusia (25%), Mardin (20%), Howard (15%), and Lordstown (14%). These soils represent 27% (Volusia), 7% (Mardin), 4% (Howard), and 28% (Lordstown) of the 334,800 acres in the county.

Organic matter levels, as measured by loss on ignition, ranged from 1% to over 50% (most likely an organic soil or amendment) with median values ranging from 4.3 to 5.4% organic matter for home and garden samples and from 4.4 to 4.7% for samples submitted for commercial production. Fifty-one percent of the home and garden samples had between 2.0 and 4.9% organic matter with 8% testing between 2.0 and 2.9% organic matter, 15% between 3.0 and 3.9% organic matter and almost 28% between 4.0 and 4.9% organic matter. Forty-seven percent of the soils submitted for home and garden tested >4.9% in organic matter while 2% of the samples had less than 2.0% organic matter. Of the samples submitted for commercial production, 17% contained between 3.0 and 3.9% organic matter, 42% tested between 4.0 and 4.9% while 24% had organic matter concentrations of 5.0-5.9%. Eight percent had less than 3.0% organic matter while 9% of the samples had 6.0% or more organic matter. In total, 83% of the samples had organic matter levels between 3.0 and 5.9%.

Soil pH in water (1:1 extraction ratio) varied from pH 3.3 to pH 11.5 (most likely an amendment) with the median for home and garden samples ranging from pH 6.2 to pH 7.1 and for samples submitted for commercial production ranging from pH 5.8 to pH 6.4. Of the home and garden samples, 62% tested between pH 6.0 and 7.4. For the samples submitted for commercial production, this was 67% while 29% tested between pH 5.0 and pH 5.9.

Extractable nutrients such as phosphorus (P), potassium (K), magnesium (Mg), calcium (Ca), iron (Fe), manganese (Mn), and zinc (Zn) were measured using the Morgan solution and extraction method (Morgan, 1941). This solution contains sodium acetate buffered at a 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 soils with >39 lbs P/acre are classified as very high. Of the home and garden samples, 6% tested low, almost 14% tested medium, 42% tested high and 38% tested very high. This meant that 80% tested high or very high in P. Of the samples submitted for commercial production, 28% tested low in P. Twenty-seven percent were medium in P, 34% tested high while 11% of the samples were very high in P. In total, 45% of the samples tested high or very high in P. There were no clear trends over the 7 years.

Classifications for potassium depend on soil management group. The fine-textured soils of 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 low, 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 the table below).

Potassium classifications depend on soil test K levels and soil management group.

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

Of the home and garden samples, 2% was classified as very low, 4% were low in potassium, 6% tested medium, another 20% were high and 68% were very high in potassium. For samples submitted for commercial production, 8% tested very low or low, 16% tested medium, 29% tested high and 44% tested very high in potassium while the remainder was of unknown K classification. As with phosphorus, there were no trends over the 7 years of soil sampling.

Soils test very low for magnesium 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 magnesium. 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 33 to 15,579 lbs Mg/acre (Morgan extraction). There were only 10 samples in the home and garden datasets that tested low in Mg and none of the samples was very low in Mg. Most soils tested high or very high for Mg (98% of the homeowner soils and also 98% of the soils of the commercial growers). One percent of each group of samples tested medium in Mg. Thus, Mg deficiency is not likely to occur in Tioga County given optimum pH is maintained.

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. Ninety-eight percent of the home and garden samples were classified as normal in Fe while 95% of the commercial samples tested in the normal range for Fe. Similarly, almost all soils (91% of the home and garden samples and 97% of the commercial samples) tested normal for manganese. Anything less than 100 lbs Mn per acre is classified as normal. Soils with more than 100 lbs Morgan extractable Mn per acre are classified as excessive in Mn. Three percent of the commercial samples and 9% of the home and garden samples were excessive in Mn. Soils with less than 0.5 lb zinc 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 home and garden samples, 1% tested low for zinc while 16% tested medium and almost 83% tested high for zinc. Of the samples for commercial production, 5% tested low in zinc, 33% tested medium while 62% of the samples were high in zinc.

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 2.

Reference

- Morgan, M.F. 1941. Chemical soil diagnosis by the universal soil testing system. Connecticut Agricultural Experimental Station. Bulletin 450.

2. Cropping Systems

2.1 Samples for Home and Garden

Crops for which recommendations are requested by homeowners:

	1995	1996	1997	1998	1999	2000	2001	Total	%
ALG	0	2	0	0	0	2	0	4	2
ATF	5	1	0	0	0	8	11	25	15
BLU	0	0	1	0	0	0	0	1	1
FLA	0	0	1	1	0	0	1	3	2
GRA	0	0	0	0	0	0	3	3	2
HRB	0	0	3	2	0	1	0	6	4
LAW	2	0	2	2	0	3	1	10	6
MVG	4	21	11	12	21	22	4	95	56
OTH	0	0	0	0	0	0	1	1	1
PER	2	0	0	0	0	0	1	3	2
ROS	0	0	0	0	0	0	1	1	1
SAG	0	0	4	2	0	0	0	5	4
SQS	0	1	0	0	0	0	0	1	1
SQW	0	1	0	0	0	0	0	1	1
STR	0	0	1	0	0	0	0	1	1
SWC	0	4	0	0	0	1	0	5	3
TOM	0	1	0	0	0	0	0	1	1
TRF	0	0	0	0	0	3	0	3	2
WAT	0	1	0	0	0	0	0	1	1
Total	13	32	23	19	21	40	23	171	100

Notes:

See Appendix for Cornell crop codes.

2.2 Samples for Commercial Production

Crops for which recommendations are requested for commercial production:

Current year crop	1995	1996	1997	1998	1999	2000	2001	Total	%
ABE/ABT	5	5	2	0	0	1	0	13	1
AGE/AGT	39	20	4	23	10	3	48	147	13
ALE/ALT	21	10	15	8	0	6	10	70	6
APP	0	1	0	1	0	0	0	2	0
ASP	0	0	0	1	0	0	1	2	0
BCE/BCT	1	2	0	1	0	1	1	6	1
BGE/BGT	5	1	0	2	4	0	0	12	1
BLB	1	1	5	2	0	2	6	17	2
BRP	0	2	0	0	0	0	0	2	0
BSP	0	0	1	0	0	0	0	1	0
BSS	0	3	1	0	0	0	2	6	1
BTE	0	2	0	0	0	0	0	2	0
BUK	0	0	0	0	0	0	1	1	0
CAR	0	0	0	1	0	0	0	1	0
CBP	1	0	0	0	0	0	0	1	0
CGE/CGT	5	4	3	7	5	3	35	62	6
CHC	0	0	0	1	0	0	0	1	0
CKS	0	0	0	0	0	1	0	1	0
CLE/CLT	1	1	0	0	0	1	0	3	0
COG/COS	23	21	28	40	14	18	93	237	22
CSE/CST	0	0	0	0	0	1	0	1	0
GIE/GIT	2	0	0	1	6	0	1	10	1
GRE/GRT	11	5	12	12	7	6	52	105	10
HRB	1	0	0	0	1	0	0	2	0
LET	0	0	0	3	0	0	0	3	0
MIL	1	0	0	0	0	0	0	1	0
MIX	2	16	3	4	4	2	6	37	3
OAS	7	6	0	1	0	0	2	16	1
OAT	0	0	1	0	0	0	0	1	0
OTH	0	0	0	1	2	0	0	3	0
PEP	0	1	0	1	0	0	0	2	0
PGE/PGT	0	1	0	2	3	2	0	8	1
PIE/PIT	11	31	23	22	8	0	29	124	11
PLE/PLT	4	0	0	17	2	6	1	30	3
PNE/PNT	1	0	0	6	4	1	5	17	2

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Current year crop	1995	1996	1997	1998	1999	2000	2001	Total	%
POT	2	5	0	1	5	0	0	13	1
PSL	0	0	0	1	0	0	0	1	0
PUM	1	0	0	0	0	1	0	2	0
RAD	0	0	0	1	0	0	0	1	0
RSS	1	0	0	0	0	0	0	1	0
RYC	0	0	0	1	0	1	0	2	0
RYS	1	0	0	1	0	0	0	2	0
SOG	1	0	0	0	0	0	0	1	0
SPS	0	0	0	1	0	0	0	1	0
SQS	0	0	0	0	1	1	0	2	0
SQW	0	0	0	0	0	1	0	1	0
SSH	0	0	0	0	0	0	4	4	0
STE	0	0	0	1	0	0	0	1	0
STS	2	0	4	1	0	0	2	9	1
SWC	4	5	3	24	5	0	0	41	4
TME	0	0	0	1	0	2	0	3	0
TOM	0	3	0	0	1	1	0	5	0
TUR	0	0	0	0	0	3	0	3	0
Unknown	0	2	0	2	0	4	45	53	5
Total	154	148	105	192	82	68	344	1093	100

Notes:

See Appendix for Cornell crop codes.

3. Soil Types

3.1 Samples for Home and Garden

Soil types (soil management groups) for home and garden samples:

	1995	1996	1997	1998	1999	2000	2001	Total	%
SMG 1 (clayey)	0	0	0	0	0	0	0	0	0
SMG 2 (silty)	2	10	7	4	2	11	1	37	22
SMG 3 (silt loam)	5	13	6	5	2	14	14	59	35
SMG 4 (sandy loam)	5	1	10	10	17	14	8	65	38
SMG 5 (sandy)	1	8	0	0	0	1	0	10	6
SMG 6 (mucky)	0	0	0	0	0	0	0	0	0
Total	13	32	23	19	21	40	23	171	100

3.2 Samples for Commercial Production

Soil series for samples submitted for commercial production:

Name	SMG	1995	1996	1997	1998	1999	2000	2001	Total	%
Chenango	3	6	7	11	11	2	6	7	50	5
Chippewa	3	0	0	0	1	0	0	0	1	0
Fremont	2	1	0	0	0	0	0	8	9	1
Hamlin	2	1	1	0	0	0	0	45	47	4
Howard	3	24	24	23	29	12	11	41	164	15
Hudson	2	0	0	0	0	0	0	1	1	0
Lordstown	3	28	19	7	19	22	19	40	154	14
Madrid	4	0	0	0	0	0	0	1	1	0
Mardin	3	33	29	11	48	28	16	57	222	20
Middlebrook	3	0	1	0	0	0	0	0	1	0
Middlebury	3	0	18	7	10	2	3	10	50	5
Phelps	3	0	0	0	0	0	3	2	5	0
Pope	4	0	0	0	0	0	0	1	1	0
Teel	2	0	0	0	0	0	0	2	2	0
Tioga	3	7	5	5	12	3	0	14	46	4
Unadilla	3	5	12	0	2	0	1	6	26	2
Valois	3	0	2	0	7	0	0	2	11	1
Volusia	3	47	26	40	51	13	9	85	271	25
Wallington	3	0	3	0	0	0	0	4	7	1
Williamson	4	0	1	0	0	0	0	0	1	0
Unknown	-	2	0	1	2	0	0	18	23	2
Total	-	154	148	105	192	82	68	344	1093	100

4. Organic Matter

4.1 Samples for Home and Garden

Number of home and garden samples within each % organic matter range:

	<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
1995	0	1	1	1	6	2	0	2	13
1996	0	1	5	1	7	9	3	6	32
1997	1	1	3	8	1	5	0	4	23
1998	0	0	2	2	4	2	3	6	19
1999	0	0	0	0	9	8	2	2	21
2000	0	0	2	6	15	3	1	13	40
2001	0	0	1	8	5	4	3	2	23
Total	1	3	14	26	47	33	12	35	171

	1995	1996	1997	1998	1999	2000	2001	
Lowest:	1.6	1.9	0.6	2.5	4.2	2.8	2.6	
Highest:	8.7	9.5	35.5	9.1	24.7	45.9	24.4	
Mean:	4.9	5.2	6.4	5.8	6.6	8.1	5.4	
Median:	4.7	5.6	3.7	5.4	5.0	4.8	4.3	

Percent of home and garden samples within each % organic matter range:

	<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
1995	0	8	8	8	46	15	0	15	100
1996	0	3	16	3	22	28	9	19	100
1997	4	4	13	35	4	22	0	17	100
1998	0	0	11	11	21	11	16	32	100
1999	0	0	0	0	43	38	10	10	100
2000	0	0	5	15	38	8	3	33	100
2001	0	0	4	35	22	17	13	9	100
Total	1	2	8	15	27	19	7	20	100

4.2 Samples for Commercial Production

Number of samples for commercial production within each % organic matter range:

	<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
1995	0	2	12	25	55	44	14	2	154
1996	1	1	7	33	60	30	9	7	148
1997	0	1	10	21	42	21	8	2	105
1998	0	4	19	24	76	53	8	8	192
1999	1	0	1	9	45	19	2	5	82
2000	0	0	1	10	34	13	6	4	68
2001	0	4	21	67	152	78	18	4	344
Total	2	12	71	189	464	258	65	32	1093

	1995	1996	1997	1998	1999	2000	2001	
Lowest:	1.7	0.2	1.8	1.5	0.5	2.9	1.6	
Highest:	11.9	52.0	8.7	13.6	8.7	26.7	8.1	
Mean:	4.6	5.2	4.5	4.6	4.8	5.2	4.5	
Median:	4.7	4.5	4.4	4.6	4.6	4.6	4.5	

Percent of samples for commercial production within each % organic matter range:

	<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
1995	0	1	8	16	36	29	9	1	100
1996	1	1	5	22	41	20	6	5	100
1997	0	1	10	20	40	20	8	2	100
1998	0	2	10	13	40	28	4	4	100
1999	1	0	1	11	55	23	2	6	100
2000	0	0	1	15	50	19	9	6	100
2001	0	1	6	19	44	23	5	1	100
Total	0	1	6	17	42	24	6	3	100

5. pH

5.1 Samples for Home and Garden

Number of home and garden samples within each pH range:

	<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
1995	0	0	1	4	1	3	3	1	0	0	13
1996	0	1	2	11	3	1	11	3	0	0	32
1997	0	0	3	5	5	5	3	2	0	0	23
1998	0	0	1	2	2	1	11	2	0	0	19
1999	0	0	1	3	3	5	4	5	0	0	21
2000	0	0	2	2	7	10	11	5	2	1	40
2001	0	1	2	2	2	10	5	1	0	0	23
Total	0	2	12	29	23	35	48	19	2	1	171

	1995	1996	1997	1998	1999	2000	2001	
Lowest:	5.4	4.9	5.0	5.3	5.2	5.2	4.9	
Highest:	7.7	7.5	7.9	7.5	7.7	8.6	7.6	
Mean:	-	-	-	-	-	-	-	
Median:	6.5	6.2	6.3	7.1	6.7	6.9	6.7	

Percent of home and garden samples within each pH range:

	<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
1995	0	0	8	31	8	23	23	8	0	0	100
1996	0	3	6	34	9	3	34	9	0	0	100
1997	0	0	13	22	22	22	13	9	0	0	100
1998	0	0	5	11	11	5	58	11	0	0	100
1999	0	0	5	14	14	24	19	24	0	0	100
2000	0	0	5	5	18	25	28	13	5	3	100
2001	0	4	9	9	9	43	22	4	0	0	100
Total	0	1	7	17	13	20	28	11	1	1	100

5.2 Samples for Commercial Production

Number of samples for commercial production within each pH range:

	<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
1995	0	4	14	35	65	32	4	0	0	0	154
1996	1	0	13	33	42	40	11	5	3	0	148
1997*	4	1	15	42	21	13	5	0	0	0	101
1998	0	2	14	51	75	38	8	3	0	1	192
1999	0	3	4	19	25	26	4	1	0	0	82
2000	0	2	5	9	21	23	6	2	0	0	68
2001	4	2	10	54	116	127	29	2	0	0	344
Total	9	14	75	243	365	299	67	13	3	1	1089

* Four samples were not analyzed for pH in 1997.

	1995	1996	1997	1998	1999	2000	2001	
Lowest:	4.6	4.4	3.3	4.6	4.7	4.6	3.7	
Highest:	7.1	8.2	7.2	11.5	7.9	7.7	7.7	
Mean:	-	-	-	-	-	-	-	
Median:	6.1	6.2	5.8	6.2	6.2	6.4	6.4	

Percent of samples for commercial production within each pH range:

	<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
1995	0	3	9	23	42	42	3	0	0	0	100
1996	1	0	9	22	28	28	7	3	2	0	100
1997	4	1	15	42	21	21	5	0	0	0	100
1998	0	1	7	27	39	39	4	2	0	1	100
1999	0	4	5	23	30	30	5	1	0	0	100
2000	0	3	7	13	31	31	9	3	0	0	100
2001	1	1	3	16	34	34	8	1	0	0	100
Total	1	1	7	22	34	34	6	1	0	0	100

6. Phosphorus

6.1 Samples for Home and Garden

Number of home and garden samples within each range Morgan extractable P range (lbs/acre Morgan P):

	<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	
1995	0	1	1	7	2	0	0	0	0	2	13
1996	0	1	5	9	1	2	2	3	1	8	32
1997	0	5	2	10	1	0	0	0	0	5	23
1998	0	0	2	10	0	2	0	1	0	4	19
1999	0	1	2	13	1	2	0	0	0	2	21
2000	0	3	7	11	4	3	1	1	2	8	40
2001	0	0	4	12	1	0	2	0	0	4	23
Total	0	11	23	72	10	9	5	5	3	33	171

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

	1995	1996	1997	1998	1999	2000	2001	
Lowest:	2	1	1	7	2	1	5	
Highest:	396	642	1176	612	1952	1524	868	
Mean:	75	160	178	122	167	184	104	
Median:	27	58	24	21	19	27	23	

Percent of home and garden samples within each Morgan extractable phosphorus range:

	<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	
1995	0	8	8	54	15	0	0	0	0	15	100
1996	0	3	16	28	3	6	6	9	3	25	100
1997	0	22	9	43	4	0	0	0	0	22	100
1998	0	0	11	53	0	11	0	5	0	21	100
1999	0	5	10	62	5	10	0	0	0	10	100
2000	0	8	18	28	10	8	3	3	5	20	100
2001	0	0	17	52	4	0	9	0	0	17	100
Total	0	6	13	42	6	5	3	3	2	19	100

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

6.2 Samples for Commercial Production

Number of samples submitted for commercial production within each Morgan extractable phosphorus (lbs P/acre) range:

	<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	
1995	0	49	43	48	7	4	1	0	1	1	154
1996	0	37	30	53	10	2	1	3	3	9	148
1997	0	29	27	34	11	1	1	2	0	0	105
1998	0	50	55	65	11	3	2	0	1	5	192
1999	0	23	24	31	4	0	0	0	0	0	82
2000	0	23	16	20	1	1	1	1	1	4	68
2001	0	93	104	121	16	6	4	0	0	0	344
Total	0	304	299	372	60	17	10	6	6	19	1093

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

	1995	1996	1997	1998	1999	2000	2001	
Lowest:	1	1	1	1	1	1	1	
Highest:	212	931	110	716	51	705	89	
Mean:	15	45	16	30	11	40	13	
Median:	6	12	7	7	7	7	7	

Percent of samples submitted for commercial production within each Morgan P range :

	<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	
1995	0	32	28	31	5	3	1	0	1	1	100
1996	0	25	20	36	7	1	1	2	2	6	100
1997	0	28	26	32	10	1	1	2	0	0	100
1998	0	26	29	34	6	2	1	0	1	3	100
1999	0	28	29	38	5	0	0	0	0	0	100
2000	0	34	24	29	1	1	1	1	1	6	100
2001	0	27	30	35	5	2	1	0	0	0	100
Total	0	28	27	34	5	2	1	1	1	2	100

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

7. Potassium

7.1 Samples for Home and Garden

Number of home and garden samples within each K range (lbs K/acre Morgan extraction):

Soil Management Group 1						
	<35	35-64	65-94	95-149	>149	Total
	Very Low	Low	Medium	High	Very High	
1995	0	0	0	0	0	0
1996	0	0	0	0	0	0
1997	0	0	0	0	0	0
1998	0	0	0	0	0	0
1999	0	0	0	0	0	0
2000	0	0	0	0	0	0
2001	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	
1995	0	0	1	0	1	2
1996	0	0	0	0	10	10
1997	0	2	1	1	3	7
1998	0	0	0	1	3	4
1999	0	0	0	0	2	2
2000	0	1	0	1	9	11
2001	0	0	0	0	1	1
Total (#)	0	3	2	3	29	37
Total (%)	0	8	5	8	78	100
Soil Management Group 3						
	<45	45-79	80-119	120-199	>199	Total
	Very Low	Low	Medium	High	Very High	
1995	0	0	0	2	3	5
1996	3	3	1	4	2	13
1997	0	0	1	2	3	6
1998	0	0	1	2	2	5
1999	0	0	0	0	2	2
2000	0	0	1	3	10	14
2001	0	0	0	0	14	14
Total (#)	3	3	4	13	36	59
Total (%)	5	5	7	22	61	100

Soil Management Group 4						
	<55	55-99	100-149	150-239	>239	Total
	Very Low	Low	Medium	High	Very High	
1995	0	0	0	0	5	5
1996	0	0	0	0	1	1
1997	0	0	2	0	8	10
1998	0	0	0	4	6	10
1999	0	0	2	4	11	17
2000	0	1	1	3	9	14
2001	0	0	0	5	3	8
Total (#)	0	1	5	16	43	65
Total (%)	0	2	8	25	66	100
Soil Management Group 5						
	<60	60-114	115-164	165-269	>269	Total
	Very Low	Low	Medium	High	Very High	
1995	0	0	0	1	0	1
1996	0	0	0	0	8	8
1997	0	0	0	0	0	0
1998	0	0	0	0	0	0
1999	0	0	0	0	0	0
2000	0	0	0	1	0	1
2001	0	0	0	0	0	0
Total (#)	0	0	0	2	8	10
Total (%)	0	0	0	20	80	100
Soil Management Group 6						
	<60	60-114	115-164	165-269	>269	Total
	Very Low	Low	Medium	High	Very High	
1995	0	0	0	0	0	0
1996	0	0	0	0	0	0
1997	0	0	0	0	0	0
1998	0	0	0	0	0	0
1999	0	0	0	0	0	0
2000	0	0	0	0	0	0
2001	0	0	0	0	0	0
Total (#)	0	0	0	0	0	0
Total (%)	-	-	-	-	-	-

Number of home and garden samples within each potassium classification:

Summary (#)	Very Low	Low	Medium	High	Very High	Total
1995	0	0	1	3	9	13
1996	3	3	1	4	21	32
1997	0	2	4	3	14	23
1998	0	0	1	7	11	19
1999	0	0	2	4	15	21
2000	0	2	2	8	28	40
2001	0	0	0	5	18	23
Total #	3	7	11	34	116	171

	1995	1996	1997	1998	1999	2000	2001	
Lowest:	93	34	67	110	104	53	151	
Highest:	918	1705	3123	1698	5286	19624	1910	
Mean:	385	448	655	511	720	1672	471	
Median:	398	360	306	254	355	364	417	

Percent of samples submitted for home and garden within each potassium classification.

Summary (%)	Very Low	Low	Medium	High	Very High	Total
1995	0	0	8	23	69	100
1996	9	9	3	13	66	100
1997	0	9	17	13	61	100
1998	0	0	5	37	58	100
1999	0	0	10	19	71	100
2000	0	5	5	20	70	100
2001	0	0	0	22	78	100
Grand Total	2	4	6	20	68	100

7.2 Samples for Commercial Production

Number of samples submitted for commercial production within each potassium (lbs K/acre Morgan extraction) range:

Soil Management Group 1						
	<35	35-64	65-94	95-149	>149	Total
	Very Low	Low	Medium	High	Very High	
1995	0	0	0	0	0	0
1996	0	0	0	0	0	0
1997	0	0	0	0	0	0
1998	0	0	0	0	0	0
1999	0	0	0	0	0	0
2000	0	0	0	0	0	0
2001	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	
1995	0	0	0	2	0	2
1996	0	0	0	1	0	1
1997	0	0	0	0	0	0
1998	0	0	0	0	0	0
1999	0	0	0	0	0	0
2000	0	0	0	0	0	0
2001	0	4	6	8	38	56
Total (#)	0	4	6	11	38	59
Total (%)	0	7	10	19	64	100
Soil Management Group 3						
	<45	45-79	80-119	120-199	>199	Total
	Very Low	Low	Medium	High	Very High	
1995	0	7	26	46	71	150
1996	2	7	14	43	81	147
1997	1	8	18	38	39	104
1998	0	15	38	53	84	190
1999	1	3	15	25	38	82
2000	4	9	8	19	28	68
2001	7	27	54	81	99	268
Total (#)	15	76	173	305	440	1009
Total (%)	1	8	17	30	44	100

Soil Management Group 4						
	<55	55-99	100-149	150-239	>239	Total
	Very Low	Low	Medium	High	Very High	
1995	0	0	0	0	0	0
1996	0	0	0	0	1	1
1997	0	0	0	0	0	0
1998	0	0	0	0	0	0
1999	0	0	0	0	0	0
2000	0	0	0	0	0	0
2001	0	0	0	0	2	2
Total (#)	0	0	0	0	3	3
Total (%)	0	0	0	0	100	100
Soil Management Group 5						
	<60	60-114	115-164	165-269	>269	Total
	Very Low	Low	Medium	High	Very High	
1995	0	0	0	0	0	0
1996	0	0	0	0	0	0
1997	0	0	0	0	0	0
1998	0	0	0	0	0	0
1999	0	0	0	0	0	0
2000	0	0	0	0	0	0
2001	0	0	0	0	0	0
Total (#)	0	0	0	0	0	0
Total (%)	-	-	-	-	-	-
Soil Management Group 6						
	<60	60-114	115-164	165-269	>269	Total
	Very Low	Low	Medium	High	Very High	
1995	0	0	0	0	0	0
1996	0	0	0	0	0	0
1997	0	0	0	0	0	0
1998	0	0	0	0	0	0
1999	0	0	0	0	0	0
2000	0	0	0	0	0	0
2001	0	0	0	0	0	0
Total (#)	0	0	0	0	0	0
Total (%)	-	-	-	-	-	-

Number of samples submitted for commercial production within each potassium classification.

Summary (#)	Very Low	Low	Medium	High	Very High	Un-known	Total
1995	0	7	26	48	71	2	154
1996	2	7	14	44	81	0	148
1997	1	8	18	38	39	1	105
1998	0	15	38	53	84	2	192
1999	1	3	15	25	38	0	82
2000	4	9	8	19	28	0	68
2001	7	31	60	89	139	18	344
Grand Total	15	80	179	316	480	23	1093

	1995	1996	1997	1998	1999	2000	2001	
Lowest:	45	26	32	46	2	36	33	
Highest:	828	20318	813	4513	1174	1152	899	
Mean:	217	574	210	287	252	233	222	
Median:	187	219	169	175	184	172	176	

Percent of samples submitted for commercial production within each potassium classification.

% summary	Very Low	Low	Medium	High	Very High	Un-known	Total
1995	0	5	17	31	46	1	100
1996	1	5	9	30	55	0	100
1997	1	8	17	36	37	1	100
1998	0	8	20	28	44	1	100
1999	1	4	18	30	46	0	100
2000	6	13	12	28	41	0	100
2001	2	9	17	26	40	5	100
Grand Total	1	7	16	29	44	2	100

8. Magnesium

8.1 Samples for Home and Garden

Number of home and garden samples within each Mg range (lbs Morgan Mg/acre):

	<20	20-65	66-100	101-199	>199	Total
	Very Low	Low	Medium	High	Very High	
1995	0	0	0	1	12	13
1996	0	0	1	8	23	32
1997	0	0	1	1	21	23
1998	0	0	0	1	18	19
1999	0	0	0	0	21	21
2000	0	1	0	2	37	40
2001	0	0	0	3	20	23
Total	0	1	2	16	152	171

	1995	1996	1997	1998	1999	2000	2001	
Lowest:	154	98	95	168	229	48	101	
Highest:	901	1256	3010	1388	6220	15579	1882	
Mean:	447	553	748	587	795	1513	472	
Median:	458	479	499	470	326	350	413	

Percent of home and garden samples within each Mg range (lbs Morgan Mg/acre):

	<20	20-65	66-100	101-199	>199	Total
	Very Low	Low	Medium	High	Very High	
1995	0	0	0	8	92	100
1996	0	0	3	25	72	100
1997	0	0	4	4	91	100
1998	0	0	0	5	95	100
1999	0	0	0	0	100	100
2000	0	3	0	5	93	100
2001	0	0	0	13	87	100
Total	0	1	1	9	89	100

8.2 Samples for Commercial Production

Number of samples submitted for commercial production within each Mg range (lbs Mg/acre Morgan extraction):

	<20	20-65	66-100	101-199	>199	Total
	Very Low	Low	Medium	High	Very High	
1995	0	3	2	12	137	154
1996	0	0	0	5	143	148
1997	0	2	2	10	91	105
1998	0	0	3	10	179	192
1999	0	4	0	0	78	82
2000	0	0	0	7	61	68
2001	0	0	2	5	337	344
Total	0	9	9	49	1026	1093

	1995	1996	1997	1998	1999	2000	2001	
Lowest:	51	102	33	83	47	101	76	
Highest:	1112	8689	807	3160	1101	1598	963	
Mean:	428	570	409	486	485	573	501	
Median:	428	450	426	466	484	572	501	

Percent of samples submitted for commercial production within each magnesium range (lbs Mg/acre Morgan extraction):

	<20	20-65	66-100	101-199	>199	Total
	Very Low	Low	Medium	High	Very High	
1995	0	2	1	8	89	100
1996	0	0	0	3	97	100
1997	0	2	2	10	87	100
1998	0	0	2	5	93	100
1999	0	5	0	0	95	100
2000	0	0	0	10	90	100
2001	0	0	1	1	98	100
Total	0	1	1	4	94	100

9. Iron

9.1 Samples for Home and Garden

Iron (lbs Fe/acre Morgan extraction) in samples for home and garden:

Total number of samples:

	0-49	>49	Total
	Normal	Excessive	
1995	13	0	13
1996	31	1	32
1997	23	0	23
1998	19	0	19
1999	21	0	21
2000	38	2	40
2001	23	0	23
Total	168	3	171

Percentages:

	0-49	>49	Total
	Normal	Excessive	
	100	0	100
	97	3	100
	100	0	100
	100	0	100
	100	0	100
	95	5	100
	100	0	100
	98	2	100

	1995	1996	1997	1998	1999	2000	2001	
Lowest:	1	2	2	4	3	1	3	
Highest:	13	158	35	21	31	118	42	
Mean:	6	14	10	9	11	15	10	
Median:	5	7	8	8	10	7	7	

9.2 Samples for Commercial Production

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

Total number of samples:

	0-49	>49	Total
	Normal	Excessive	
1995	142	12	154
1996	142	6	148
1997	94	11	105
1998	186	6	192
1999	75	7	82
2000	64	4	68
2001	333	11	344
Total	1036	57	1093

Percentages:

	0-49	>49	Total
	Normal	Excessive	
	92	8	100
	96	4	100
	90	10	100
	97	3	100
	91	9	100
	94	6	100
	97	3	100
	95	5	100

	1995	1996	1997	1998	1999	2000	2001	
Lowest:	1	1	2	2	1	2	1	
Highest:	249	97	162	90	91	286	216	
Mean:	16	13	21	15	16	19	11	
Median:	8	7	12	10	9	9	6	

10. Manganese

10.1 Samples for Home and Garden

Manganese (lbs Mn/acre Morgan extraction) in samples for home and garden:

Total number of samples:

	0-99	>99	Total
	Normal	Excessive	
1995	12	1	13
1996	31	1	32
1997	21	2	23
1998	17	2	19
1999	18	3	21
2000	34	6	40
2001	23	0	23
Total	156	15	171

Percentages:

0-99	>99	Total
Normal	Excessive	
92	8	100
97	3	100
91	9	100
89	11	100
86	14	100
85	15	100
100	0	100
91	9	100

	1995	1996	1997	1998	1999	2000	2001	
Lowest:	11	17	8	25	10	15	20	
Highest:	113	132	282	106	106	413	86	
Mean:	48	41	57	50	38	65	50	
Median:	38	40	33	46	27	32	53	

10.2 Samples for Commercial Production

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

Total number of samples:

	0-99	>99	Total
	Normal	Excessive	
1995	151	3	154
1996	143	5	148
1997	100	5	105
1998	187	5	192
1999	80	2	82
2000	65	3	68
2001	329	15	344
Total	1055	38	1093

Percentages:

	0-99	>99	Total
	Normal	Excessive	
	98	2	100
	97	3	100
	95	5	100
	97	3	100
	98	2	100
	96	4	100
	96	4	100
	97	3	100

	1995	1996	1997	1998	1999	2000	2001	
Lowest:	11	10	9	8	12	9	7	
Highest:	417	336	129	219	161	451	145	
Mean:	39	41	44	37	39	41	39	
Median:	32	32	35	29	31	28	33	

11. Zinc

11.1 Samples for Home and Garden

Zinc (lbs Zn/acre Morgan extraction) in samples for home and garden:

Total number of samples:					Percentages:				
	<0.5	0.5-1.0	>1	Total	<0.5	0.5-1.0	>1	Total	
	Low	Medium	High		Low	Medium	High		
1995	0	3	10	13	0	23	77	100	
1996	0	1	31	32	0	3	97	100	
1997	0	8	15	23	0	35	65	100	
1998	0	2	17	19	0	11	89	100	
1999	2	5	14	21	10	24	67	100	
2000	0	9	31	40	0	23	78	100	
2001	0	0	23	23	0	0	100	100	
Total	2	28	141	171	1	16	82	100	

	1995	1996	1997	1998	1999	2000	2001	
Lowest:	0.5	0.9	0.5	0.6	0.3	0.5	1.2	
Highest:	19.7	48.7	182.1	29.1	130.0	115.8	22.3	
Mean:	3.6	11.5	19.4	7.1	9.3	12.8	5.6	
Median:	1.3	3.4	3.1	1.8	2.1	2.2	2.7	

11.2 Samples for Commercial Production

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

Total number of samples:

	<0.5	0.5-1.0	>1	Total
	Low	Medium	High	
1995	5	38	111	154
1996	3	40	105	148
1997	1	34	70	105
1998	23	68	101	192
1999	4	26	52	82
2000	7	17	44	68
2001	10	143	191	344
Total	53	366	674	1093

Percentages:

<0.5	0.5-1.0	>1	Total
Low	Medium	High	
3	25	72	100
2	27	71	100
1	32	67	100
12	35	53	100
5	32	63	100
10	25	65	100
3	42	56	100
5	33	62	100

	1995	1996	1997	1998	1999	2000	2001	
Lowest:	0.3	0.2	0.2	0.1	0.1	0.1	0.1	
Highest:	18.6	41.8	213.8	24.6	54.2	136.8	117.1	
Mean:	1.9	2.7	4.3	1.8	2.4	4.6	3.1	
Median:	1.4	1.3	1.4	1.1	1.3	1.7	1.1	

Appendix: Cornell Crop Codes

Crop codes are used in the Cornell Nutrient Analyses Laboratory.

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

Crop Code	Crop Description
	Corn
COG	Corn grain
COS	Corn silage
	Grasses, pastures, covercrops
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
PNE	Pasture native grasses, Established
RYC	Rye cover crop
RYS	Rye seed production
TRP	Triticale peas
	Small grains
MIL	Millet
OAS	Oats 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
APR	Apricots

Crop Code	Crop Description
ASP	Asparagus
ATF	Athletic Field
BDR/BND	Beans-dry
BLU/BLB	Blueberries
BRP	Broccoli, Transplanted
BSP	Beans, Transplanted
CAR	Carrots
CBP	Cabbage, Transplanted
CEM	Cemetery
CHC	Chinese cabbage
EGG	Eggplants
END	Endives
FAR	Fairway
FLA	Flowering Annuals
GPA	Grapes, American
GPF	Grapes, French-American
GPV	Grapes, Vinifera
GEN	Green
GRA	Grapes
HRB	Herbs
IDL	Idle land
LAW	Lawn
LET	Lettuce
MIX/MVG	Mixed vegetables
MML	Muskmelon
NUR	Nursery
ONS	Onion-seeded
OTH	Other
PAR	Pears
PCH	Peaches
PEA	Peas
PEP	Peppers
PER	Perennials
POP	Popcorn
PRK	Park
POT/PTO	Potatoes
PSL	Parsley
PUM	Pumpkins
RAD	Radish

Crop Code	Crop Description
ROD	Roadside
ROS	Roses
ROU	Rough
RSF	Raspberries, Fall
RSP	Raspberries (homeowners)
RSS	Raspberries, Summer
SAG	Ornamentals adapted to pH 6.0 to 7.5
SPS	Spinach, Spring
SQS	Squash, Summer
SQW	Squash, Winter
STE	Strawberries, Ever
STR	Strawberries (homeowners)
STS	Strawberries, Spring
SUN	Sunflowers
SWC	Sweet corn
TME	Tomatoes, Early
TOM	Tomatoes
TRE	Christmas trees, Established
TRF	Turf
TUR	Turnips
WAT	Watermelons