

Ketterings, Q.M., H. Krol, W.S. Reid and A. Gabriel (2003). Washington County Soil Sample Survey 1995-2001. CSS Extension Bulletin E03-23. 38 pages.

Soil Sample Survey

Washington Co.

Samples analyzed by CNAL in 1995-2001



Farmland in Washington County.

Summary compiled by

Quirine M. Ketterings, Hettie Krol, W. Shaw Reid and Aaron Gabriel



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

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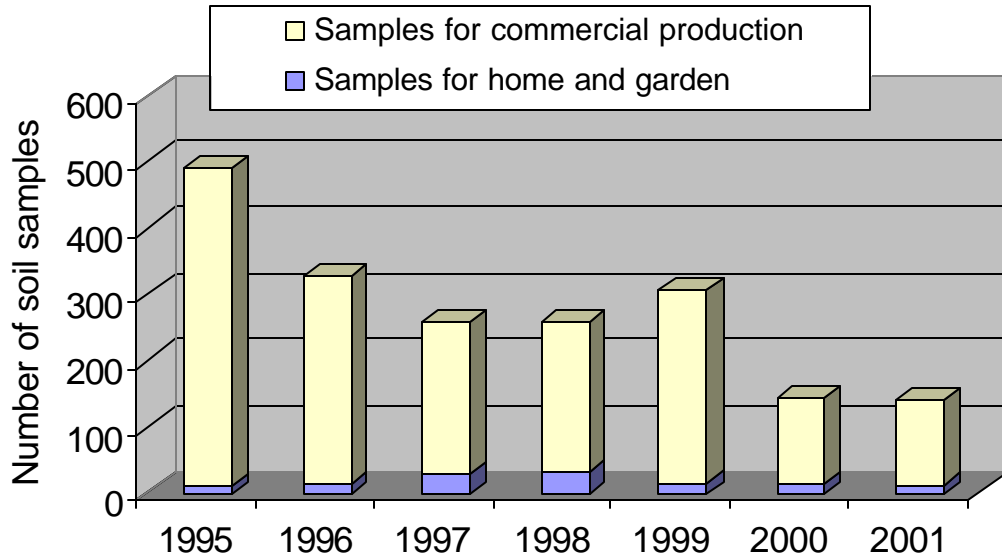
1. General Survey Summary

Washington County is located in eastern New York, north of Rensselaer County and south of Essex County. In the east, it borders Lake Champlain and Vermont. In the west, it borders the Hudson River. Washington County is a rural county with 529,720 acres (883 square miles), of which 218,000 acres are farmland. There are approximately 840 farms and dairy farming is the main agricultural activity. To support over 20,000 milk cows, hay is harvested on about 45,000 acres and corn is planted on about 35,000 acres. However, there is a great diversity of agricultural activity. Several hundred acres are devoted to fresh market vegetable production. Over 300 acres of fruits are grown on about 16 farms. Apples are the main crop followed by strawberries and mostly other small fruits. There are many small beef operations, totaling about 1,300 head. They use the abundant pastureland throughout the county. Ornamental horticulture and the horse industry are also active in the County.

Washington County is made up of three physiographic regions: the Adirondack Mountain area in the northwest; the Taconic Upland in the eastern half; and the Hudson-Champlain Lowland. The soils in the Adirondack Mountain area are shallow, medium textured soils formed by glacial till over bedrock on uplands. The parent material is mostly syenite and granite. Soils in the Taconic Upland were also formed by glacial till on uplands, but they are deeper and have a fragipan. The parent material is mostly shale, slate, and sandstone. The soils in the Hudson-Champlain Lowland were formed from river and lake plain sediments. They are deep soils and range from medium textured soils to fine clays. Several streams and rivers run through Washington County, along which there are productive gravels and alluvial silt loams. The Battenkill River and the Mettawee River are two notable rivers along which lie very productive river bottom soils. There are almost 7,000 acres of muck soils in Washington County, but they have not been developed for agricultural production. Rolling hills, and rivers, and lakes make Washington County very picturesque.

This survey summarizes the soil test results from Washington 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 1922. Of these 1922 samples, 1802 (94%) were submitted to obtain fertilizer recommendations for

commercial production while 121 samples (6%) were submitted as home and garden samples.



Homeowners		Commercial		Total
1995	9	1995	482	491
1996	14	1996	313	327
1997	28	1997	232	260
1998	30	1998	227	257
1999	15	1999	292	307
2000	14	2000	128	142
<u>2001</u>	<u>11</u>	<u>2001</u>	<u>127</u>	<u>138</u>
Total	121	Total	1801	1922

Twenty-seven percent of the home and garden soil samples were submitted to request fertilizer recommendations for home garden vegetable production while 25% of the samples were for submitted for recommendations for lawn care. People submitting samples for commercial production requested fertilizer recommendations for corn silage or grain production (38%), alfalfa or alfalfa/grass mixtures (27%), and hay production (13%), while a few producers were planning on growing other crops including apples, clover/grass mixtures, grass for pasture, and vegetables.

Home and garden samples in Washington County were mostly sandy loam soils belonging to soil management group 4 (59%). Eleven percent belonged to soil management group 2. Group 3 was represented by 26% of all samples and 25% was classified as sandy (soil management group 5). 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, 59% belonged to soil management group 4. Eighteen percent were from soil management group 1, 8% were from soil management group 2, 7% belonged to group 3 and 8% were from group 4. None of the samples belonged to group 6. The five most common soil series were Bernardston (33%), Vergennes (10%), Hoosic (8%), Nassau (8%), and Kingsbury (8%). These soils represent 16% (Bernardston), 6% (Vergennes), 4% (Hoosic), 25% (Nassau), and 4% (Kingsbury) of the total 529,720 acres in the county.

Organic matter levels, as measured by loss on ignition, ranged from less than 1% to slightly over 20% with median values ranging from 3.0 to 4.7% organic matter for home

and garden samples and values ranging from 3.6 to 3.9% for samples submitted for commercial production. Sixty-five percent of the home and garden samples had between 2 and 5% organic matter with 17% testing between 2 and 2.9% organic matter, 23% between 3.0 and 3.9% organic matter and 25% between 4.0 and 4.9% organic matter. Twenty-eight percent of the soils submitted for home and garden tested >4.9% in organic matter while slightly less than 7% had less than 2% organic matter. Of the samples submitted for commercial production, 38% contained between 3 and 4% organic matter, 27% tested between 4.0 and 4.9% while 9% had organic matter concentrations of 5.0-5.9%. In total, 40% of the samples had organic matter levels between 4.0 and 6.9% while 56% contained less than 4% organic matter.

Soil pH in water (1:1 extraction ratio) varied from pH 3.3 to 9.7 with the median for home and garden samples ranging from pH 6.3 to pH 7.0 and for samples submitted for commercial production ranging from pH 6.3 to pH 6.6. Of the home and garden samples, 55% tested between pH 6.0 and 7.4. For the samples submitted for commercial production, this was 76% while 17% tested between pH 5.0 and 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 lbs 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, 20% tested low, 22% tested medium, 32% tested high and 26% tested very high. This meant that 58% tested high or very high in P.

Phosphorus levels for samples for commercial production in Washington County were similar to the state average (50% tests high or very high in P). Fourteen percent of the samples tested very high in P. Twenty-two percent were low in P, 26% tested medium for P while 38% of the submitted samples were classified as high in soil test P. This means that 48% tested high or very high in P and. There were no clear trends in P levels over the 6 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, 8% were classified as very low in potassium. Twenty percent were low, 17% tested medium, 15% high and 40% were very high in potassium. For samples submitted for commercial production, 2% tested very low in K, 10% tested low, 17% tested medium, 24% tested high and 46% tested very high in potassium. As with phosphorus, there were no trends over the 6 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 less than 10 to almost 3000 lbs Mg/acre (Morgan extraction). There were only 6 samples that tested very low in Mg. Most soils tested high or very high for Mg (97% of the homeowner soils and 92% of the soils of the commercial growers). No more than 4 of the homeowner soils and 8% of the commercial growers'

soil tested low or medium in Mg. Thus, magnesium deficiency is not likely to occur in Washington County provided the soil pH is maintained in the desirable range.

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 fell for 88-98% in the normal range with 12% of the home and garden samples and 2% of the samples for commercial production testing excessive for Fe. Similarly, most soils (97-99%) for both groups 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 lbs Zinc per acre in the Morgan extraction are classified as low in Zn. Medium testing soils have between 0.5 and 1 lbs of Morgan extractable Zn per acre. If more than 1 lbs of Zn/acre is extracted with the Morgan solution, the soil tests high in Zn. For the home and garden samples, 83% tested high for zinc while 16% tested medium and 1% was low in zinc. Of the samples for commercial production, 7% tested low in zinc, 33% tested medium while 60% was 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	%
ATF	1	0	2	0	0	1	0	4	3
CEM	0	0	2	0	0	0	0	2	2
FAR	0	0	4	9	0	0	0	13	11
FLA	0	1	1	0	2	0	0	4	3
GEN	4	0	4	0	0	0	0	8	7
GRA	0	0	0	0	1	0	0	1	1
LAW	1	0	6	11	5	5	2	30	25
MVG	1	7	7	4	5	6	3	33	27
PER	1	4	2	1	1	0	0	9	7
ROS	0	0	0	0	1	0	0	1	1
SAG	1	2	0	4	0	2	1	10	8
TRF	0	0	0	0	0	0	5	5	4
Unknown	0	0	0	1	0	0	0	1	1
Total	9	14	28	30	15	14	11	121	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	1	0	3	0	0	0	1	5	0
AGE/AGT	189	106	46	37	56	15	9	458	25
ALE/ALT	7	6	7	2	5	4	5	36	2
APP	8	0	1	14	3	5	0	31	2
BCE/BCT	2	1	1	1	0	0	0	5	0
BGE/BGT	1	2	0	1	0	1	0	5	0
BKB	0	0	0	1	0	0	0	1	0
BLB	4	1	0	2	2	0	0	9	0
CGE/CGT	17	11	4	9	11	2	1	55	3
CHT	0	0	0	2	0	0	0	2	0
CLE/CLT	10	3	0	0	2	0	1	16	1
COG/COS	177	128	93	111	94	12	74	689	38
GIE/GIT	1	4	15	6	1	0	0	27	1
GRE/GRT	17	13	34	7	75	59	3	208	12
IDL	2	0	0	0	0	0	2	4	0
LET	0	0	2	0	0	0	0	2	0
MIX	6	2	3	0	9	3	4	27	1
MML	0	2	0	0	2	4	0	8	0
OTH	3	1	0	0	1	0	1	6	0
PEA	0	0	1	0	0	0	0	1	0
PER	0	0	0	0	0	1	0	1	0
PGE/PGT	5	1	3	0	3	2	3	17	1
PIE/PIT	10	0	9	1	5	0	1	26	1
PLE/PLT	1	0	0	1	0	0	0	2	0
PNE/PNT	0	4	2	2	1	2	0	11	1
POP	0	0	0	1	0	0	0	1	0
POT	0	0	0	1	2	0	0	3	0
PUM	0	0	0	1	2	0	0	3	0
RSF	2	0	2	0	1	0	0	5	0
RSS	1	0	0	1	0	0	0	3	0
RYC	0	0	0	1	0	0	0	1	0
RYS	0	1	0	2	0	1	0	4	0
SOY	3	2	0	0	0	0	0	5	0
SPS	1	0	0	0	2	0	0	3	0
SQS	0	0	0	1	0	0	2	3	0

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Current year crop	1995	1996	1997	1998	1999	2000	2001	Total	%
SQW	0	0	1	0	0	0	0	1	0
SSH	0	1	1	0	0	0	0	2	0
STE	0	0	0	1	0	0	0	1	0
STS	4	0	0	2	3	0	0	9	0
SWC	0	3	1	3	1	0	14	22	1
TME	0	0	0	0	0	1	0	1	0
TOM	1	0	1	0	2	1	0	5	0
TRE/TRT	2	13	0	14	2	13	0	44	2
TUR	0	0	1	0	0	0	0	1	0
WHT	6	2	0	0	2	2	0	12	1
WPE	0	0	0	0	1	0	0	1	0
Unknown	1	6	1	1	4	0	6	19	1
Total	482	313	232	227	292	128	127	1801	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
SMG 2 (silty)	2	1	1	3	2	2	0	11
SMG 3 (silt loam)	3	3	0	9	2	3	6	26
SMG 4 (sandy loam)	3	8	19	15	6	5	3	59
SMG 5 (sandy)	1	2	8	3	5	4	2	25
SMG 6 (mucky)	0	0	0	0	0	0	0	0
Total	9	14	28	30	15	14	11	121

3.2 Samples for Commercial Production

Soil series for samples submitted for commercial production:

Name	SMG	1995	1996	1997	1998	1999	2000	2001	Total
Belgrade	3	4	4	1	5	4	2	3	23
Bernards	4	227	111	78	87	52	30	12	597
Charlton	4	0	0	0	0	3	0	0	3
Claverack	4	2	1	3	1	2	3	0	12
Colton	5	1	0	0	0	0	0	0	1
Cosad	4	1	0	3	2	3	0	0	9
Covington	1	4	0	1	0	5	0	0	10
Farmington	3	2	11	0	0	0	0	0	13
Fredon	4	3	0	0	0	1	0	0	4
Halsey	4	0	0	0	2	0	1	0	3
Hamlin	2	5	0	6	2	0	0	2	15
Hartland	4	0	0	0	2	7	0	2	11
Herkimer	3	0	1	0	1	0	0	1	3
Hoosic	4	42	40	11	14	17	9	14	147
Hudson	2	5	26	2	4	9	3	1	50
Kingsbury	1	31	29	11	13	39	8	6	137
Limerick	3	3	1	2	7	12	0	5	30
Madalin	4	0	4	2	0	0	0	1	7
Nassau	5	51	13	20	23	12	6	13	138
Oakville	4	24	10	3	14	23	8	6	88
Otisville	4	15	3	24	6	0	52	23	123
Palatine	2	0	2	0	0	0	0	0	2
Pittstown	4	0	0	6	0	4	1	9	20
Rhinebeck	2	5	21	0	1	2	0	0	29
Saco	3	0	0	0	0	2	0	0	2
Scriba	4	4	2	0	2	1	3	1	13
Stissing	4	5	5	8	0	1	0	1	20
Sun	4	0	1	0	0	0	0	0	1
Teel	2	12	7	9	9	8	1	5	51
Venango	3	0	0	0	0	9	0	0	9
Vergennes	1	34	18	40	18	65	1	4	180
Wallington	3	1	1	1	13	9	0	17	42
Unknown	-	1	2	1	1	2	0	1	8
Total	-	482	313	232	227	292	128	127	1801

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	0	1	1	6	1	0	0	9
1996	0	1	2	4	4	3	0	0	14
1997	0	0	3	10	4	9	1	1	28
1998	0	1	5	5	8	4	2	5	30
1999	0	1	4	1	5	2	0	2	15
2000	0	0	5	4	1	2	1	1	14
2001	4	1	0	3	2	1	0	0	11
Total	4	4	20	28	30	22	4	9	121

	1995	1996	1997	1998	1999	2000	2001	
Lowest:	2.6	1.0	2.5	1.7	1.7	2.2	0.1	
Highest:	5.1	5.1	7.1	10.8	9.0	14.1	5.1	
Mean:	4.3	3.8	4.4	5.1	4.2	4.5	2.4	
Median:	4.3	4.0	4.1	4.7	4.1	3.6	3.0	

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	0	11	11	67	11	0	0	100
1996	0	7	14	29	29	21	0	0	100
1997	0	0	11	36	14	32	4	4	100
1998	0	3	17	17	27	13	7	17	100
1999	0	7	27	7	33	13	0	13	100
2000	0	0	36	29	7	14	7	7	100
2001	36	9	0	27	18	9	0	0	100
Total	3	3	17	23	25	18	3	7	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	3	16	55	174	151	51	18	14	482
1996	1	7	38	133	87	28	12	7	313
1997	0	11	30	78	69	25	12	7	232
1998	0	10	33	105	52	19	3	5	227
1999	5	16	39	93	62	26	16	35	292
2000	2	7	14	50	36	11	4	4	128
2001	0	13	16	51	34	9	1	3	127
Total	11	80	225	684	491	169	66	75	1801

	1995	1996	1997	1998	1999	2000	2001	
Lowest:	0.2	0.7	1.0	1.1	0.4	0.4	1.3	
Highest:	14.4	8.4	9.1	9.1	18.5	8.7	20.7	
Mean:	4.0	3.9	4.0	3.7	4.3	3.9	3.9	
Median:	3.9	3.8	3.9	3.6	3.8	3.8	3.7	

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	1	3	11	36	31	11	4	3	100
1996	0	2	12	42	28	9	4	2	100
1997	0	5	13	34	30	11	5	3	100
1998	0	4	15	46	23	8	1	2	100
1999	2	5	13	32	21	9	5	12	100
2000	2	5	11	39	28	9	3	3	100
2001	0	10	13	40	27	7	1	2	100
Total	1	4	12	38	27	9	4	4	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	1	2	2	2	1	0	0	9
1996	0	0	3	1	4	2	3	1	0	0	14
1997	0	0	7	4	2	8	3	3	1	0	28
1998	0	1	2	2	3	11	3	5	3	0	30
1999	0	0	1	0	4	6	2	2	0	0	15
2000	0	0	2	2	0	2	5	2	1	0	14
2001	0	1	2	0	1	2	0	1	2	2	11
Total	0	2	18	10	16	33	18	15	7	2	121

	1995	1996	1997	1998	1999	2000	2001	
Lowest:	5.3	5.1	5.2	4.6	5.3	5.1	4.6	
Highest:	7.6	7.6	8.1	8.4	7.6	8.0	9.1	
Mean:	-	-	-	-	-	-	-	
Median:	6.9	6.3	6.5	6.7	6.7	7.0	6.9	

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	11	11	22	22	22	11	0	0	100
1996	0	0	21	7	29	14	21	7	0	0	100
1997	0	0	25	14	7	29	11	11	4	0	100
1998	0	3	7	7	10	37	10	17	10	0	100
1999	0	0	7	0	27	40	13	13	0	0	100
2000	0	0	14	14	0	14	36	14	7	0	100
2001	0	9	18	0	9	18	0	9	18	18	100
Total	0	2	15	8	13	27	15	12	6	2	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	3	4	26	86	152	149	56	6	0	0	482
1996	2	3	14	74	87	98	34	1	0	0	313
1997*	0	3	18	35	75	56	26	15	3	0	231
1998	0	11	10	40	61	89	16	0	0	0	227
1999	0	0	4	38	74	91	78	6	0	1	292
2000	0	2	2	10	27	57	25	3	2	0	128
2001	0	0	3	17	29	45	32	1	0	0	127
Total	5	23	77	300	505	585	267	32	5	1	1800

* One sample was not analyzed for pH in 1997.

	1995	1996	1997	1998	1999	2000	2001	
Lowest:	3.3	4.0	4.9	4.6	5.1	4.8	5.0	
Highest:	7.7	7.6	8.3	7.4	9.7	8.4	7.7	
Mean:	-	-	-	-	-	-	-	
Median:	6.4	6.3	6.4	6.4	6.6	6.6	6.6	

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	1	1	5	18	32	31	12	1	0	0	100
1996	1	1	4	24	28	31	11	0	0	0	100
1997	0	1	8	15	32	24	11	6	1	0	100
1998	0	5	4	18	27	39	7	0	0	0	100
1999	0	0	1	13	25	31	27	2	0	0	100
2000	0	2	2	8	21	45	20	2	2	0	100
2001	0	0	2	13	23	35	25	1	0	0	100
Total	0	1	4	17	28	33	15	2	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	4	2	1	2	0	0	0	0	0	9
1996	0	3	5	4	0	1	0	0	0	1	14
1997	0	10	4	10	1	0	1	0	1	1	28
1998	0	2	7	10	5	1	0	0	0	5	30
1999	0	1	3	6	2	0	0	3	0	0	15
2000	0	2	2	5	0	1	1	2	1	0	14
2001	0	2	4	3	1	0	0	0	0	1	11
Total	0	24	27	39	11	3	2	5	2	8	121

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

	1995	1996	1997	1998	1999	2000	2001	
Lowest:	1	1	1	1	2	1	3	
Highest:	58	299	261	521	150	165	417	
Mean:	14	34	28	70	43	51	48	
Median:	4	8	8	21	23	26	7	

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	44	22	11	22	0	0	0	0	0	100
1996	0	21	36	29	0	7	0	0	0	7	100
1997	0	36	14	36	4	0	4	0	4	4	100
1998	0	7	23	33	17	3	0	0	0	17	100
1999	0	7	20	40	13	0	0	20	0	0	100
2000	0	14	14	36	0	7	7	14	7	0	100
2001	0	18	36	27	9	0	0	0	0	9	100
Total	0	20	22	32	9	2	2	4	2	7	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	124	117	181	25	12	4	11	3	5	482
1996	0	70	98	105	17	8	6	6	2	1	313
1997	0	39	63	93	22	6	2	6	0	1	232
1998	0	67	50	85	9	6	6	2	1	1	227
1999	0	47	77	120	21	13	2	5	2	5	292
2000	0	32	30	49	8	3	3	2	1	0	128
2001	0	14	26	60	10	3	5	5	0	4	127
Total	0	393	461	693	112	51	28	37	9	17	1801

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:	550	244	910	237	519	174	906	
Mean:	21	19	25	18	27	19	46	
Median:	9	8	12	8	12	9	14	

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	26	24	38	5	2	1	2	1	1	100
1996	0	22	31	34	5	3	2	2	1	0	100
1997	0	17	27	40	9	3	1	3	0	0	100
1998	0	30	22	37	4	3	3	1	0	0	100
1999	0	16	26	41	7	4	1	2	1	2	100
2000	0	25	23	38	6	2	2	2	1	0	100
2001	0	11	20	47	8	2	4	4	0	3	100
Total	0	22	26	38	6	3	2	2	0	1	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	1	0	2
1996	0	0	0	1	0	1
1997	0	0	1	0	0	1
1998	0	0	1	0	2	3
1999	0	0	0	0	2	2
2000	0	1	0	0	1	2
2001	0	0	0	0	0	0
Total (#)	0	1	3	2	5	11
Total (%)	0	9	27	18	45	100
Soil Management Group 3						
	<45	45-79	80-119	120-199	>199	Total
	Very Low	Low	Medium	High	Very High	
1995	0	1	1	0	1	3
1996	0	1	0	0	2	3
1997	0	0	0	0	0	0
1998	0	1	0	1	7	9
1999	0	0	1	0	1	2
2000	0	0	1	1	1	3
2001	4	0	0	0	2	6
Total (#)	4	3	3	2	14	26
Total (%)	15	12	12	8	54	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	1	2	3
1996	0	2	1	3	2	8
1997	0	5	5	3	6	19
1998	0	1	6	3	5	15
1999	0	1	0	0	5	6
2000	0	2	0	1	2	5
2001	1	0	0	0	2	3
Total (#)	1	11	12	11	24	59
Total (%)	2	19	20	19	41	100
Soil Management Group 5						
	<60	60-114	115-164	165-269	>269	Total
	Very Low	Low	Medium	High	Very High	
1995	1	0	0	0	0	1
1996	1	0	0	0	1	2
1997	1	2	3	0	2	8
1998	0	1	0	1	1	3
1999	2	1	0	1	1	5
2000	0	3	0	1	0	4
2001	0	2	0	0	0	2
Total (#)	5	9	3	3	5	25
Total (%)	20	36	12	12	20	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	1	1	2	2	3	9
1996	1	3	1	4	5	14
1997	1	7	9	3	8	28
1998	0	3	7	5	15	30
1999	2	2	1	1	9	15
2000	0	6	1	3	4	14
2001	5	2	0	0	4	11
Total #	10	24	21	18	48	121

	1995	1996	1997	1998	1999	2000	2001	
Lowest:	41	9	57	85	21	66	9	
Highest:	461	343	940	979	648	2081	880	
Mean:	199	187	206	350	279	416	198	
Median:	116	189	137	238	304	132	87	

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

Summary (%)	Very Low	Low	Medium	High	Very High	Total
1995	11	11	22	22	33	100
1996	7	21	7	29	36	100
1997	4	25	32	11	29	100
1998	0	10	23	17	50	100
1999	13	13	7	7	60	100
2000	0	43	7	21	29	100
2001	45	18	0	0	36	100
Grand Total	8	20	17	15	40	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	4	5	16	44	69
1996	0	2	7	8	34	51
1997	0	3	4	15	32	54
1998	0	2	3	13	13	31
1999	1	1	5	18	84	109
2000	0	0	0	0	9	9
2001	0	0	2	5	4	11
Total (#)	1	12	26	75	220	334
Total (%)	0	4	8	22	66	100
Soil Management Group 2						
	<40	40-69	70-99	100-164	>164	Total
	Very Low	Low	Medium	High	Very High	
1995	0	3	6	6	12	27
1996	0	1	4	16	36	57
1997	0	2	5	4	6	17
1998	0	2	2	4	8	16
1999	0	1	2	2	14	19
2000	0	0	2	0	2	4
2001	0	1	5	0	2	8
Total (#)	0	10	26	32	80	148
Total (%)	0	7	18	22	54	100
Soil Management Group 3						
	<45	45-79	80-119	120-199	>199	Total
	Very Low	Low	Medium	High	Very High	
1995	0	1	2	5	2	10
1996	0	0	3	10	5	18
1997	0	0	2	1	1	4
1998	0	4	8	7	7	26
1999	3	0	3	14	16	36
2000	0	0	1	0	1	2
2001	0	2	6	9	9	26
Total (#)	3	7	25	46	41	122
Total (%)	2	6	20	38	34	100

Soil Management Group 4						
	<55	55-99	100-149	150-239	>239	Total
	Very Low	Low	Medium	High	Very High	
1995	8	30	55	82	175	350
1996	3	26	37	41	68	175
1997	4	22	35	31	61	153
1998	3	26	31	27	52	139
1999	2	1	20	25	46	94
2000	16	23	20	26	20	105
2001	1	6	14	21	33	75
Total (#)	37	134	212	253	455	1091
Total (%)	3	12	19	23	42	100
Soil Management Group 5						
	<60	60-114	115-164	165-269	>269	Total
	Very Low	Low	Medium	High	Very High	
1995	2	3	4	9	7	25
1996	0	0	3	1	6	10
1997	0	0	1	1	1	3
1998	0	4	6	3	1	14
1999	0	0	2	8	13	23
2000	2	1	3	0	2	8
2001	0	1	1	2	2	6
Total (#)	4	9	20	24	32	89
Total (%)	4	10	22	27	36	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 samples submitted for commercial production within each potassium classification.

Summary (#)	Very Low	Low	Medium	High	Very High	Un-known	Total
1995	10	41	72	118	240	1	482
1996	3	29	54	76	149	2	313
1997	4	27	47	52	101	1	232
1998	3	38	50	54	81	1	227
1999	6	12	32	67	173	2	292
2000	18	24	26	26	34	0	128
2001	1	10	28	37	50	1	127
Grand Total	45	181	309	430	828	8	1801

	1995	1996	1997	1998	1999	2000	2001	
Lowest:	32	31	50	42	29	26	49	
Highest:	1292	1529	1173	816	2211	993	1191	
Mean:	272	245	242	204	262	177	424	
Median:	215	186	178	155	214	140	187	

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

% summary	Very Low	Low	Medium	High	Very High	Un-known	Total
1995	2	9	15	24	50	0	100
1996	1	9	17	24	48	1	100
1997	2	12	20	22	44	0	100
1998	1	17	22	24	36	0	100
1999	2	4	11	23	59	1	100
2000	14	19	20	20	27	0	100
2001	1	8	22	29	39	1	100
Grand Total	2	10	17	24	46	0	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	8	9
1996	0	1	0	5	8	14
1997	0	0	0	6	22	28
1998	0	1	0	2	27	30
1999	0	0	0	3	12	15
2000	0	1	0	2	11	14
2001	0	1	0	3	7	11
Total	0	4	0	22	95	121

	1995	1996	1997	1998	1999	2000	2001	
Lowest:	196	58	108	39	110	23	26	
Highest:	433	1011	969	1279	1354	1228	665	
Mean:	297	371	424	523	451	427	293	
Median:	269	300	337	398	349	345	287	

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	11	89	100
1996	0	7	0	36	57	100
1997	0	0	0	21	79	100
1998	0	3	0	7	90	100
1999	0	0	0	20	80	100
2000	0	7	0	14	79	100
2001	0	9	0	27	64	100
Total	0	3	0	18	79	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	3	23	33	113	310	482
1996	0	10	10	77	216	313
1997	0	5	9	50	168	232
1998	3	9	9	70	136	227
1999	0	9	5	39	239	292
2000	0	4	7	37	80	128
2001	0	2	7	40	78	127
Total	6	62	80	426	1227	1801

	1995	1996	1997	1998	1999	2000	2001	
Lowest:	8	34	20	9	32	20	39	
Highest:	2130	2981	2171	1748	2060	1664	3527	
Mean:	367	404	416	319	612	299	341	
Median:	257	293	302	225	444	233	225	

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	1	5	7	23	64	100
1996	0	3	3	25	69	100
1997	0	2	4	22	72	100
1998	1	4	4	31	60	100
1999	0	3	2	13	82	100
2000	0	3	5	29	63	100
2001	0	2	6	31	61	100
Total	0	3	4	24	68	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	9	0	9
1996	13	1	14
1997	28	0	28
1998	22	8	30
1999	14	1	15
2000	13	1	14
2001	7	4	11
Total	106	15	212

Percentages:

	0-49	>49	Total
	Normal	Excessive	
	100	0	100
	93	7	100
	100	0	100
	73	27	100
	93	7	100
	93	7	100
	64	36	100
	88	12	100

	1995	1996	1997	1998	1999	2000	2001	
Lowest:	2	3	2	1	1	2	1	
Highest:	44	480	41	881	65	192	92	
Mean:	9	48	14	67	12	24	38	
Median:	4	14	10	11	7	5	26	

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	468	14	482
1996	302	11	313
1997	232	0	232
1998	219	8	227
1999	284	8	292
2000	128	0	128
2001	127	0	127
Total	1760	41	1801

Percentages:

	0-49	>49	Total
	Normal	Excessive	
	97	3	100
	96	4	100
	100	0	100
	96	4	100
	97	3	100
	100	0	100
	100	0	100
	98	2	100

	1995	1996	1997	1998	1999	2000	2001	
Lowest:	1	1	1	1	1	1	1	
Highest:	722	364	48	303	138	35	41	
Mean:	11	12	9	13	11	6	5	
Median:	5	6	6	6	7	3	3	

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	9	0	9
1996	14	0	14
1997	28	0	28
1998	29	1	30
1999	15	0	15
2000	13	1	14
2001	9	2	11
Total	117	4	121

Percentages:

0-99	>99	Total
Normal	Excessive	
100	0	100
100	0	100
100	0	100
97	3	100
100	0	100
93	7	100
82	18	100
97	3	100

	1995	1996	1997	1998	1999	2000	2001	
Lowest:	5	2	6	7	6	8	6	
Highest:	76	66	88	140	52	223	128	
Mean:	25	32	36	43	27	46	58	
Median:	19	32	28	37	25	29	60	

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	477	5	482
1996	310	3	313
1997	226	6	232
1998	227	0	227
1999	289	3	292
2000	125	3	128
2001	124	3	127
Total	1778	23	1801

Percentages:

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

	1995	1996	1997	1998	1999	2000	2001	
Lowest:	5	6	4	4	8	2	8	
Highest:	129	126	286	96	213	186	228	
Mean:	27	33	36	26	31	23	33	
Median:	23	30	28	23	28	17	27	

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:

	<0.5	0.5-1.0	>1	Total
	Low	Medium	High	
1995	0	3	6	9
1996	0	1	13	14
1997	0	1	27	28
1998	0	6	24	30
1999	0	2	13	15
2000	0	2	12	14
2001	1	4	6	11
Total	1	19	101	121

Percentages:

<0.5	0.5-1.0	>1	Total
Low	Medium	High	
0	33	67	100
0	7	93	100
0	4	96	100
0	20	80	100
0	13	87	100
0	14	86	100
9	36	55	100
1	16	83	100

	1995	1996	1997	1998	1999	2000	2001	
Lowest:	0.5	0.8	0.7	0.6	0.6	0.6	0.3	
Highest:	9.0	73.3	175.6	57.1	86.1	11.6	17.6	
Mean:	3.1	10.0	17.4	11.9	12.9	3.8	4.2	
Median:	1.7	2.6	3.2	4.6	3.3	2.7	1.3	

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	49	165	268	482
1996	10	123	180	313
1997	5	69	158	232
1998	18	83	126	227
1999	21	65	206	292
2000	15	48	65	128
2001	4	38	85	127
Total	122	591	1088	1801

Percentages:

<0.5	0.5-1.0	>1	Total
Low	Medium	High	
10	34	56	100
3	39	58	100
2	30	68	100
8	37	56	100
7	22	71	100
12	38	51	100
3	30	67	100
7	33	60	100

	1995	1996	1997	1998	1999	2000	2001	
Lowest:	0.1	0.2	0.3	0.1	0.1	0.1	0.3	
Highest:	175.6	49.4	83.4	37.4	21.2	64.0	25.5	
Mean:	2.0	1.7	3.1	1.8	2.1	2.5	2.5	
Median:	1.2	1.2	1.4	1.1	1.6	1.1	1.4	

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
ATF	Athletic Field

Crop Code	Crop Description
ASP	Asparagus
BDR/BND	Beans-dry
BKB	Blackberries
BLU/BLB	Blueberries
CEM	Cemetery
CHT	Cherries, Tart
END	Endives
FAR	Fairway
FLA	Flowering Annuals
GRA	Grapes
GEN	Green
HRB	Herbs
IDL	Idle land
LAW	Lawn
LET	Lettuce
MIX/MVG	Mixed vegetables
MML	Muskmelon
ONS	Onion-seeded
OTH	Other
PAR	Pears
PEA	Peas
PER	Perennials
POP	Popcorn
PRK	Park
POT/PTO	Potatoes
PUM	Pumpkins
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

Crop Code	Crop Description
SUN	Sunflowers
SWC	Sweet corn
TME	Tomatoes, Early
TOM	Tomatoes
TRE	Christmas trees, Established
TRF	Tree fruits
TRT	Christmas trees, Topdressing
TUR	Turnips
WPE	Waterways, Pond Dikes