

Soil Sample Survey

Columbia Co.

Samples analyzed by CNAL in 1995-2001



With the evolution of farm technology, the soils of Columbia County have been modified to allow for higher productivity (picture courtesy of CCE of Columbia County).

Summary compiled by

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

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1. General Survey Summary

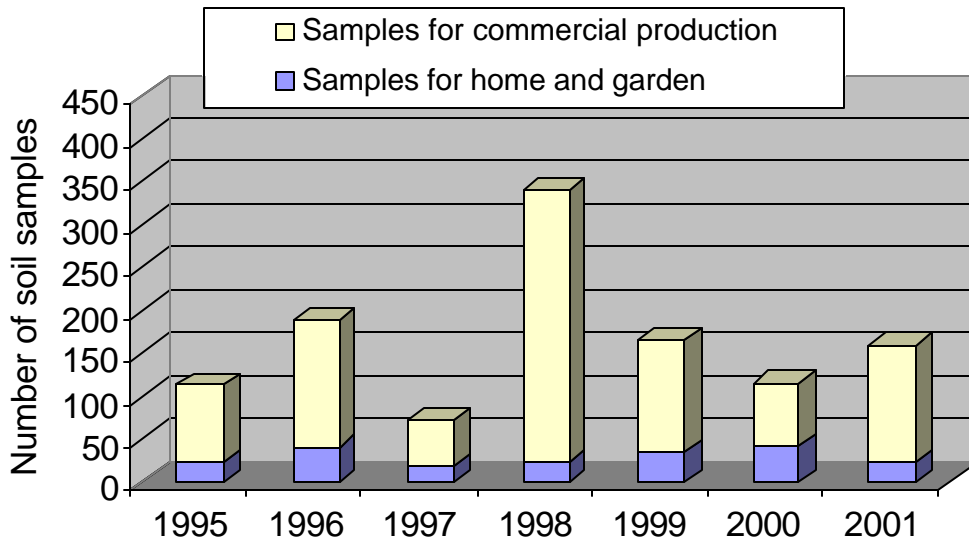
Columbia County is situated between the tidal waters of the Hudson River on the West and the 2,800-foot Taconic range shared with Massachusetts on the East. The county encompasses 643 square miles (411,520 acres). It is composed of two physiographic units. Most of the county is in the Hudson-Mohawk Valley unit. The Hudson-Mohawk valley has two major subsections. One is deep, dissected lacustrine sediments immediately adjacent to the Hudson River. At the eastern margin of this lacustrine plain, a strand of sand and gravel beach ridge is transitional to the glacial till upland. The easternmost portion of the county is in the New England Upland – East of NYS Route 22. The far eastern portion of the county consists of the Harlem Valley with its fertile river outwash soils sandwiched between steep uplands. The central part of the county is underlain by folded shale bedrock. Glacial till deposits are thin on the North-South oriented ridgetops of this region.

The agriculture in Columbia County is quite diverse. Thirty seven percent of the county's agricultural sales come from dairy farming while twelve percent originates from fruits and berries and a significant portion comes from cash crops (i.e., corn, small grains, etc.). There are farms in each town in the county. The dairy farms are mainly concentrated in the two northwestern townships and the two southeastern townships. Soils in sections of these townships lend themselves better to forage production than other types of crops. Most fruit production is located in the western portion of the county where soils and climate are more favorable for this type of production. Apples, cherries, peaches, pears and plums are the most important generator of fruit farm income. Small fruits such as strawberries, brambles, ribes and blueberries are grown for fresh market sales.

Due to the county's close proximity to Albany and New York City, the county is experiencing home development pressure. In response to growing communities, farmers' markets, roadside stands, and specialty horticultural farms are rapidly increasing in number.

This survey summarizes the soil test results from Columbia 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 1149. Of these

1149 samples, 943 (82%) were submitted to obtain fertilizer recommendations for commercial production while 206 samples (18%) were submitted as home and garden samples.



Homeowners		Commercial		Total
1995	23	1995	89	112
1996	41	1996	147	188
1997	17	1997	56	73
1998	24	1998	315	339
1999	35	1999	128	163
2000	43	2000	71	114
<u>2001</u>	<u>23</u>	<u>2001</u>	<u>137</u>	<u>160</u>
Total	206	Total	943	1149

Twenty-eight percent of the home and garden samples were submitted to request fertilizer recommendations for mixed vegetable gardens. Fifteen percent of the samples came from lawns while another 15% were from beds with perennial flowers. Other samples were sent in to request recommendations for azaleas, apricots, blueberries, fairways, flowering annuals, greens, grapes, herbs, perennials, roses, roughs, ornamentals adapted to pH 6.0

to 7.5, sods, spring flowering bulbs, summer flowering bulbs, and tree fruits. People submitting samples for commercial production requested fertilizer recommendations for hay production (21%), alfalfa, alfalfa/grass or alfalfa/trefoil mixtures (18%), corn silage or grain production (15%), while the remainder of the samples was sent to the laboratory to request recommendations for other crops including small grains, vegetables, apples, other tree fruits, small fruits, grapes and pasture land.

Home and garden samples in Columbia County were silty (24%), silt loams (22%), sandy loams (38%), or sandy (16%), 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, 43% belonged to soil management group 4. None of the samples belonged to group 6 while 2% was classified group 1, 10% belonged to soil management group 2, 32% were group 3 soils and 9% were classified as management group 5. The remainder was of unknown classification. The five most

common soil series were Hoosic (16%), Stockbridge (11%), Blasdell (9%), Nassau (7%), and Knickerbocker (7%). These soils represent 4% (Hoosic), 10% (Stockbridge), 7% (Blasdell), 23% (Nassau), and 3% (Knickerbocker) of the 411,520 acres in the county.

Organic matter levels, as measured by loss on ignition, ranged from 1% to over 65% (most likely an organic soil or amendment) with median values ranging from 3.6 to 5.1% organic matter for home and garden samples and from 3.4 to 4.1% for samples submitted for commercial production. Fifty-two percent of the home and garden samples had between 2.0 and 4.9% organic matter with 31 samples (15%) testing between 2.0 and 2.9% organic matter, 52 samples (25%) between 3.0 and 3.9% organic matter and 26 samples (13%) between 4.0 and 4.9% organic matter. Forty-one percent of the soils submitted for home and garden tested >4.9% in organic matter while 6% of the samples had less than 2.0% organic matter. Of the samples submitted for commercial production, 37% contained between 3.0 and 3.9% organic matter, 23% tested between 4.0 and 4.9% while 8% had organic matter concentrations of 5.0-5.9%. Twenty-eight percent had less than 3.0% organic matter while 4% of the samples had 6.0% or more organic matter. In total, 33% of the samples had organic matter levels between 4.0 and 6.9%.

Soil pH in water (1:1 extraction ratio) varied from pH 3.8 to pH 8.1 with the median for home and garden samples ranging from pH 6.5 to pH 7.1 and for samples submitted for commercial production ranging from pH 5.7 to pH 6.2. Of the home and garden samples, 66% tested between pH 6.0 and 7.4. For the samples submitted for commercial production, this was 56% while 39% 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, 12% tested low, 17% tested medium, 34% tested high and 37% tested very high. This meant that 71% tested high or very high in P. Of the samples submitted for commercial production, 30% tested low in P. Twenty-five percent were medium in P,

35% tested high while 10% of the samples were very high in P. In total, 46% 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, 12% was classified as very low or low in potassium. Eleven percent tested medium, another 26% were high and 51% were very high in potassium. For samples submitted for commercial production, 3% were very low in K, 13% tested low, 20% tested medium, 25% tested high and 35% 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 12 to 7403 lbs Mg/acre (Morgan extraction). There was only 1 sample in the combined home and garden and commercial agriculture datasets that tested very low in Mg. Most soils tested high or very high for Mg (96% of the homeowner soils and 93% of the soils of the commercial growers). Nine of the home and garden samples and 64 (7%) of the commercial growers' soils tested low or medium in Mg availability. Thus, magnesium deficiency is not likely to occur in Columbia 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. Ninety-four percent of the home and garden samples were classified as normal in Fe while 99% of the commercial samples tested in the normal range for Fe. Similarly, almost all soils (88% of the home and garden samples and 98% 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. Twenty-two commercial samples and 25 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, three samples tested low for zinc while 17 tested medium and 186 (90%) tested high for zinc. Of the samples for commercial production, 5% tested low in zinc, 27% tested medium while 69% 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	2	2	2	0	2	3	1	12	6
APR	0	0	0	0	1	1	0	2	1
BLU	0	0	0	0	1	1	0	2	1
FAR	0	0	0	1	0	0	0	1	0
FLA	0	0	0	5	3	0	1	9	4
GEN	0	3	4	3	0	0	0	10	5
GRA	0	0	0	0	0	0	1	1	0
HRB	0	2	1	0	2	1	0	6	3
LAW	3	12	1	2	3	3	6	30	15
MVG	14	9	2	7	9	13	4	58	28
OTH	0	0	1	1	0	8	1	11	5
PER	2	7	2	1	3	9	7	31	15
PTO	1	0	1	0	0	0	0	2	1
ROS	0	1	1	0	2	0	0	4	2
ROU	0	0	0	0	1	0	0	1	0
SAG	1	3	2	3	7	2	2	20	10
SOD	0	1	0	0	0	0	0	1	0
SPB	0	1	0	0	0	0	0	1	0
SUB	0	0	0	0	1	0	0	1	0
TRF	0	0	0	1	0	2	0	3	1
Total	23	41	17	24	35	43	23	206	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	11	8	1	1	3	5	0	29	3
AGE/AGT	20	25	1	43	10	0	8	107	11
ALE/ALT	4	0	0	18	13	4	0	39	4
ALG	0	0	0	0	1	0	0	1	0
APP	0	19	0	2	4	2	2	29	3
ASP	0	0	1	0	0	0	0	1	0
BCE/BCT	0	0	1	2	0	0	0	3	0
BGE/BGT	3	1	1	1	0	0	0	6	1
BNL	1	0	0	0	0	0	0	1	0
BNS	0	1	0	1	1	0	1	4	0
BRP	1	1	0	0	0	1	0	3	0
BSP	0	2	0	12	0	0	0	14	1
BSS	0	0	0	1	0	0	0	1	0
BUK	0	2	0	0	1	0	0	3	0
BWI	0	0	0	2	0	0	0	2	0
CAR	1	0	0	0	0	0	0	1	0
CGE/CGT	1	2	1	1	5	1	4	15	2
CLE/CLT	0	0	1	0	0	1	0	2	0
COG/COS	10	11	3	74	8	13	19	138	15
CVE	4	0	0	1	0	0	0	5	1
GIE/GIT	0	0	6	3	14	1	2	26	3
GPA	0	1	0	0	0	0	0	1	0
GPF	0	0	0	4	0	0	0	4	0
GPV	0	2	0	0	0	10	1	13	1
GRE/GRT	7	10	3	78	26	2	43	169	18
IDL	2	0	1	2	0	0	1	6	1
LET	1	1	0	2	1	0	0	5	1
MIL	0	1	1	0	0	0	0	2	0
MIX	7	6	5	10	18	10	19	75	8
MML	1	0	0	0	0	0	0	1	0
NUR	0	0	0	1	0	0	0	1	0
OAS	0	6	1	2	1	0	0	10	1
OAT	0	2	1	0	0	0	3	6	1
ONP	1	2	0	0	0	0	0	3	0
OTH	1	0	3	4	0	0	1	9	1

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Current year crop	1995	1996	1997	1998	1999	2000	2001	Total	%
PAR	0	4	0	0	0	0	0	4	0
PCH	0	2	0	0	0	0	1	3	0
PEP	1	0	0	0	0	0	0	1	0
PER	0	0	0	0	0	1	0	1	0
PGE/PGT	2	0	0	6	0	0	1	9	1
PIE/PIT	0	16	7	4	1	2	1	31	3
PLE/PLT	1	4	0	4	0	0	1	10	1
PNE/PNT	0	1	11	2	5	12	15	46	5
POT	1	1	1	1	1	0	0	5	1
PUM	1	1	0	1	0	0	0	3	0
RSS	0	0	0	0	0	0	1	1	0
RYC	1	2	1	1	6	1	0	12	1
RYS	1	0	0	4	0	0	1	6	1
SOF	0	1	0	4	0	0	0	5	1
SOY	0	0	0	3	1	0	6	10	1
SSH	1	1	0	0	6	2	1	11	1
STE	0	0	1	0	0	0	0	1	0
STS	1	2	2	1	1	1	1	9	1
SUD	0	1	0	0	0	0	0	1	0
SWC	0	1	0	2	0	0	0	3	0
TME	1	0	0	0	0	0	0	1	0
TOM	0	1	0	3	0	1	0	5	1
TRE/TRT	0	0	0	1	0	0	0	1	0
WHT	0	5	0	0	0	0	0	5	1
Unknown	2	1	2	13	1	1	4	24	3
Total	89	147	56	315	128	71	137	943	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)	8	13	4	9	6	4	6	50
SMG 3 (silt loam)	2	7	5	11	10	8	3	46
SMG 4 (sandy loam)	12	12	5	2	16	25	6	78
SMG 5 (sandy)	1	9	3	2	3	6	8	32
SMG 6 (mucky)	0	0	0	0	0	0	0	0
Total	23	41	17	24	35	43	23	206

3.2 Samples for Commercial Production

Soil series for samples submitted for commercial production:

Name	SMG	1995	1996	1997	1998	1999	2000	2001	Total
Alden	3	0	1	0	0	0	0	0	1
Bernardston	4	5	7	2	2	9	0	2	27
Blasdell	3	9	21	2	33	8	7	9	89
Castile	4	0	0	0	1	0	0	2	3
Cazenovia	2	0	0	0	0	2	0	0	2
Collamer	3	0	1	1	3	0	0	0	5
Elmridge	5	3	2	1	8	0	0	0	14
Elnora	5	0	0	0	7	0	0	0	7
Farmington	3	0	1	1	2	0	0	0	4
Fredon	4	0	0	0	1	0	0	0	1
Georgia	4	2	12	8	25	5	4	3	59
Hoosic	4	8	7	7	26	22	21	63	154
Hudson	2	1	0	1	18	27	1	2	50
Kingsbury	1	0	0	2	12	2	0	1	17
Knickerbocker	5	4	8	6	34	7	2	3	64
Lanesboro	3	0	0	0	0	1	0	0	1
Limerick	3	0	0	0	2	0	0	4	6
Linlithgo	3	0	5	0	10	1	1	3	20
Livingston	1	0	0	0	0	2	0	0	2
Macomber	4	0	0	1	0	0	2	0	3
Manlius	3	6	3	2	20	1	5	6	43
Massena	4	0	3	0	1	0	2	2	8
Nassau	4	18	15	6	16	4	6	4	69
Niagara	3	0	0	0	4	0	0	0	4
Occum	4	7	4	0	4	4	0	4	23
Palms	6	0	0	0	1	0	0	0	1
Pittstown	4	3	15	3	9	12	5	9	56
Punsit	3	0	5	0	1	2	3	4	15
Raynham	3	2	0	0	2	0	0	0	4
Rhinebeck	2	1	30	4	2	0	6	2	45
Scio	3	0	2	0	4	0	0	0	6
Stockbridge	3	6	4	7	54	17	5	8	101
Sun	4	0	0	1	0	0	0	0	1
Unadilla	3	0	0	0	1	0	0	0	1
Walpole	4	0	0	0	2	0	0	1	3
Unknown	-	14	1	1	10	2	1	5	34
Total	-	89	147	56	315	128	71	137	943

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	4	7	4	2	1	4	23
1996	0	2	5	19	5	6	0	4	41
1997	0	0	3	4	1	1	0	7	17
1998	0	4	1	7	2	3	1	6	24
1999	0	2	4	5	5	9	5	5	35
2000	0	0	8	5	7	5	4	14	43
2001	0	3	6	4	2	2	3	3	23
Total	0	12	31	52	26	28	14	43	206

	1995	1996	1997	1998	1999	2000	2001	
Lowest:	1.3	1.5	2.1	1.0	1.3	2.0	1.1	
Highest:	10.1	10.8	45.2	42.2	11.4	33.2	14.2	
Mean:	4.7	4.1	9.1	8.4	5.1	6.4	4.5	
Median:	3.9	3.6	4.8	4.1	5.0	5.1	3.7	

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	4	17	30	17	9	4	17	100
1996	0	5	12	46	12	15	0	10	100
1997	0	0	18	29	6	6	0	41	100
1998	0	17	4	29	8	13	4	25	100
1999	0	6	11	14	14	26	14	14	100
2000	0	0	19	12	16	12	9	33	100
2001	0	13	26	17	9	9	13	13	100
Total	0	6	15	25	13	14	7	21	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	11	17	32	23	5	0	1	89
1996	0	5	32	55	35	18	1	1	147
1997	0	2	14	22	10	1	1	6	56
1998	2	18	90	127	55	14	4	5	315
1999	0	10	23	49	32	7	3	4	128
2000	0	6	15	26	15	7	2	0	71
2001	1	4	14	41	44	27	5	1	137
Total	3	56	205	352	214	79	16	18	943

	1995	1996	1997	1998	1999	2000	2001	
Lowest:	1.2	1.3	1.2	0.7	1.2	1.2	0.8	
Highest:	13.1	40.2	65.0	27.0	33.0	6.9	8.7	
Mean:	3.5	4.0	5.9	3.5	3.9	3.5	4.1	
Median:	3.4	3.8	3.6	3.3	3.7	3.4	4.1	

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	12	19	36	26	6	0	1	100
1996	0	3	22	37	24	12	1	1	100
1997	0	4	25	39	18	2	2	11	100
1998	1	6	29	40	17	4	1	2	100
1999	0	8	18	38	25	5	2	3	100
2000	0	8	21	37	21	10	3	0	100
2001	1	3	10	30	32	20	4	1	100
Total	0	6	22	37	23	8	2	2	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	1	1	2	4	6	8	1	0	0	23
1996	0	1	1	8	8	9	10	3	1	0	41
1997	0	5	1	2	0	3	5	1	0	0	17
1998	0	1	1	2	2	11	6	1	0	0	24
1999	0	0	1	5	4	9	14	2	0	0	35
2000	0	0	4	7	7	3	12	10	0	0	43
2001	0	2	0	1	2	5	7	5	1	0	23
Total	0	10	9	27	27	46	62	23	2	0	206

	1995	1996	1997	1998	1999	2000	2001	
Lowest:	4.6	4.7	4.5	4.8	5.4	5.1	4.6	
Highest:	7.7	8.1	7.5	7.7	7.5	7.8	8.1	
Mean:	-	-	-	-	-	-	-	
Median:	6.7	6.5	6.5	6.8	6.9	7.0	7.1	

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	4	4	9	17	26	35	4	0	0	100
1996	0	2	2	20	20	22	24	7	2	0	100
1997	0	29	6	12	0	18	29	6	0	0	100
1998	0	4	4	8	8	46	25	4	0	0	100
1999	0	0	3	14	11	26	40	6	0	0	100
2000	0	0	9	16	16	7	28	23	0	0	100
2001	0	9	0	4	9	22	30	22	4	0	100
Total	0	4	13	13	13	22	30	11	1	0	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	1	6	17	35	23	5	2	0	0	89
1996	0	3	17	33	48	36	10	0	0	0	147
1997	4	0	4	16	14	12	5	1	0	0	56
1998*	7	19	76	105	66	34	3	0	0	0	310
1999	0	0	8	24	42	31	20	3	0	0	128
2000	1	2	3	13	24	20	4	3	1	0	71
2001	0	1	14	29	53	30	8	2	0	0	137
Total	12	26	128	237	282	186	55	11	1	0	938

* Five samples were not analyzed for pH in 1998.

	1995	1996	1997	1998	1999	2000	2001	
Lowest:	4.9	4.6	3.8	4.2	5.1	4.1	4.7	
Highest:	7.6	7.4	7.5	7.2	7.8	8.0	7.6	
Mean:	-	-	-	-	-	-	-	
Median:	6.2	6.2	6.1	5.7	6.4	6.4	6.2	

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	1	7	19	39	26	6	2	0	0	100
1996	0	2	12	22	33	24	7	0	0	0	100
1997	7	0	7	29	25	21	9	2	0	0	100
1998	2	6	25	34	21	11	1	0	0	0	100
1999	0	0	6	19	33	24	16	2	0	0	100
2000	1	3	4	18	34	28	6	4	1	0	100
2001	0	1	10	21	39	22	6	1	0	0	100
Total	1	3	14	25	30	20	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	4	5	0	4	2	2	1	4	23
1996	0	9	5	12	3	1	2	4	0	5	41
1997	0	2	4	5	3	0	0	1	1	1	17
1998	0	2	2	9	0	0	1	0	1	9	24
1999	0	2	5	14	4	1	1	4	1	3	35
2000	0	9	6	15	1	3	0	2	3	4	43
2001	0	0	8	11	1	0	0	1	1	1	23
Total	0	25	34	71	12	9	6	14	8	27	206

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

	1995	1996	1997	1998	1999	2000	2001	
Lowest:	1	2	3	1	1	1	4	
Highest:	387	549	4052	1119	234	814	539	
Mean:	102	76	270	170	58	71	49	
Median:	67	31	20	31	30	20	11	

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	4	17	22	0	17	9	9	4	17	100
1996	0	22	12	29	7	2	5	10	0	12	100
1997	0	12	24	29	18	0	0	6	6	6	100
1998	0	8	8	38	0	0	4	0	4	38	100
1999	0	6	14	40	11	3	3	11	3	9	100
2000	0	21	14	35	2	7	0	5	7	9	100
2001	0	0	35	48	4	0	0	4	4	4	100
Total	0	12	17	34	6	4	3	7	4	13	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	41	20	23	3	0	1	0	0	1	89
1996	0	52	41	48	3	1	0	2	0	0	147
1997	0	15	12	18	3	3	0	2	1	2	56
1998	0	72	82	119	31	5	1	2	1	2	315
1999	0	42	25	40	5	0	1	1	0	14	128
2000	0	21	15	30	2	1	0	1	0	1	71
2001	0	37	37	54	4	2	0	3	0	0	137
Total	0	280	232	332	51	12	3	11	2	20	943

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:	327	135	3299	306	521	267	146	
Mean:	13	11	85	18	61	18	15	
Median:	4	6	9	9	8	8	8	

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	46	22	26	3	0	1	0	0	1	100
1996	0	35	28	33	2	1	0	1	0	0	100
1997	0	27	21	32	5	5	0	4	2	4	100
1998	0	23	26	38	10	2	0	1	0	1	100
1999	0	33	20	31	4	0	1	1	0	11	100
2000	0	30	21	42	3	1	0	1	0	1	100
2001	0	27	27	39	3	1	0	2	0	0	100
Total	0	30	25	35	5	1	0	1	0	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	0	3	5	8
1996	0	1	1	1	10	13
1997	0	0	0	1	3	4
1998	0	0	1	1	7	9
1999	0	0	0	4	2	6
2000	0	0	0	2	2	4
2001	1	0	1	2	2	6
Total (#)	1	1	3	14	31	50
Total (%)	2	2	6	28	62	100
Soil Management Group 3						
	<45	45-79	80-119	120-199	>199	Total
	Very Low	Low	Medium	High	Very High	
1995	0	0	1	0	1	2
1996	0	0	1	3	3	7
1997	0	0	0	3	2	5
1998	0	1	2	5	3	11
1999	0	1	1	2	6	10
2000	0	0	1	1	6	8
2001	0	0	0	1	2	3
Total (#)	0	2	6	15	23	46
Total (%)	0	4	13	33	50	100

Soil Management Group 4						
	<55	55-99	100-149	150-239	>239	Total
	Very Low	Low	Medium	High	Very High	
1995	0	1	0	4	7	12
1996	0	5	4	0	3	12
1997	0	0	0	5	0	5
1998	0	0	0	0	2	2
1999	0	0	2	1	13	16
2000	2	0	3	3	17	25
2001	0	1	0	2	3	6
Total (#)	2	7	9	15	45	78
Total (%)	3	9	12	19	58	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	1	1
1996	1	3	2	2	1	9
1997	0	0	0	0	3	3
1998	0	1	0	0	1	2
1999	0	0	1	1	1	3
2000	1	1	1	3	0	6
2001	0	4	0	4	0	8
Total (#)	2	9	4	10	7	32
Total (%)	6	28	13	31	22	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	1	1	7	14	23
1996	1	9	8	6	17	41
1997	0	0	0	9	8	17
1998	0	2	3	6	13	24
1999	0	1	4	8	22	35
2000	3	1	5	9	25	43
2001	1	5	1	9	7	23
Total #	5	19	22	54	106	206

	1995	1996	1997	1998	1999	2000	2001	
Lowest:	57	45	143	50	77	27	28	
Highest:	1879	2843	20809	8404	1112	3707	7774	
Mean:	512	306	1518	708	375	422	554	
Median:	343	162	237	180	326	256	173	

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

Summary (%)	Very Low	Low	Medium	High	Very High	Total
1995	0	4	4	30	61	100
1996	2	22	20	15	41	100
1997	0	0	0	53	47	100
1998	0	8	13	25	54	100
1999	0	3	11	23	63	100
2000	7	2	12	21	58	100
2001	4	22	4	39	30	100
Grand Total	2	9	11	26	51	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	1	1	0	2
1998	0	0	0	4	8	12
1999	0	0	0	2	2	4
2000	0	0	0	0	0	0
2001	0	0	0	1	0	1
Total (#)	0	0	1	8	10	19
Total (%)	0	0	5	42	53	100
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	1	0	0	6	23	30
1997	0	0	0	1	4	5
1998	0	0	2	7	11	20
1999	1	3	8	10	7	29
2000	0	0	0	4	3	7
2001	0	0	0	1	3	4
Total (#)	2	3	11	29	52	97
Total (%)	2	3	11	30	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	4	10	8	23
1996	1	4	11	12	15	43
1997	0	0	2	6	5	13
1998	2	11	28	49	46	136
1999	1	3	3	2	21	30
2000	0	2	2	8	9	21
2001	1	8	6	11	8	34
Total (#)	5	29	56	98	112	300
Total (%)	2	10	19	33	37	100

Soil Management Group 4						
	<55	55-99	100-149	150-239	>239	Total
	Very Low	Low	Medium	High	Very High	
1995	0	8	12	15	8	43
1996	2	15	17	11	18	63
1997	2	2	12	3	9	28
1998	2	14	26	19	26	87
1999	3	13	14	9	17	56
2000	3	7	8	5	17	40
2001	3	14	17	24	32	90
Total (#)	15	73	106	86	127	407
Total (%)	4	18	26	21	31	100
Soil Management Group 5						
	<60	60-114	115-164	165-269	>269	Total
	Very Low	Low	Medium	High	Very High	
1995	0	2	1	3	1	7
1996	0	2	4	2	2	10
1997	1	0	0	1	5	7
1998	0	11	9	10	19	49
1999	1	0	2	2	2	7
2000	0	0	0	1	1	2
2001	1	0	2	0	0	3
Total (#)	3	15	18	19	30	85
Total (%)	4	18	21	22	35	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	1	1
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	1	1
Total (%)	0	0	0	0	100	100

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

Summary (#)	Very Low	Low	Medium	High	Very High	Un-known	Total
1995	0	11	18	28	18	14	89
1996	4	21	32	31	58	1	147
1997	3	2	15	12	23	1	56
1998	4	36	65	89	111	10	315
1999	6	19	27	25	49	2	128
2000	3	9	10	18	30	1	71
2001	5	22	25	37	43	5	137
Grand Total	25	120	192	240	332	34	943

	1995	1996	1997	1998	1999	2000	2001	
Lowest:	52	18	44	34	28	31	36	
Highest:	2837	1116	19737	1724	818	1133	812	
Mean:	206	235	597	227	222	238	219	
Median:	150	168	176	158	148	188	160	

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

% summary	Very Low	Low	Medium	High	Very High	Un-known	Total
1995	0	12	20	31	20	16	100
1996	3	14	22	21	39	1	100
1997	5	4	27	21	41	2	100
1998	1	11	21	28	35	3	100
1999	5	15	21	20	38	2	100
2000	4	13	14	25	42	1	100
2001	4	16	18	27	31	4	100
Grand Total	3	13	20	25	35	4	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	1	5	17	23
1996	0	0	1	11	29	41
1997	0	2	1	5	9	17
1998	0	0	2	2	20	24
1999	0	0	0	7	28	35
2000	0	1	1	5	36	43
2001	0	0	0	4	19	23
Total	0	3	6	39	158	206

	1995	1996	1997	1998	1999	2000	2001	
Lowest:	92	77	33	73	113	46	137	
Highest:	1350	1591	6839	7259	794	7403	3128	
Mean:	474	371	730	978	427	757	446	
Median:	406	265	251	392	443	384	306	

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	4	22	74	100
1996	0	0	2	27	71	100
1997	0	12	6	29	53	100
1998	0	0	8	8	83	100
1999	0	0	0	20	80	100
2000	0	2	2	12	84	100
2001	0	0	0	17	83	100
Total	0	1	3	19	77	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	8	22	56	89
1996	0	5	7	29	106	147
1997	0	1	1	9	45	56
1998	0	5	20	93	197	315
1999	0	1	3	12	112	128
2000	1	0	2	8	60	71
2001	0	4	4	23	106	137
Total	1	19	45	196	682	943

	1995	1996	1997	1998	1999	2000	2001	
Lowest:	43	39	60	51	56	12	30	
Highest:	4095	2547	6316	1138	4303	1099	1032	
Mean:	312	337	436	298	412	378	339	
Median:	243	307	306	236	361	328	315	

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	3	9	25	63	100
1996	0	3	5	20	72	100
1997	0	2	2	16	80	100
1998	0	2	6	30	63	100
1999	0	1	2	9	88	100
2000	1	0	3	11	85	100
2001	0	3	3	17	77	100
Total	0	2	5	21	72	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	22	1	23
1996	40	1	41
1997	11	6	17
1998	24	0	24
1999	34	1	35
2000	41	2	43
2001	22	1	23
Total	194	12	206

Percentages:

	0-49	>49	Total
	Normal	Excessive	
	96	4	100
	98	2	100
	65	35	100
	100	0	100
	97	3	100
	95	5	100
	96	4	100
	94	6	100

	1995	1996	1997	1998	1999	2000	2001	
Lowest:	2	1	1	2	1	1	1	
Highest:	57	100	138	38	67	70	57	
Mean:	7	10	39	10	7	10	9	
Median:	4	6	17	5	4	5	3	

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	89	0	89
1996	147	0	147
1997	51	5	56
1998	314	1	315
1999	126	2	128
2000	71	0	71
2001	136	1	137
Total	934	9	943

Percentages:

	0-49	>49	Total
	Normal	Excessive	
	100	0	100
	100	0	100
	91	9	100
	100	0	100
	98	2	100
	100	0	100
	99	1	100
	99	1	100

	1995	1996	1997	1998	1999	2000	2001	
Lowest:	1	1	1	1	1	1	1	
Highest:	43	37	428	68	97	45	51	
Mean:	7	8	21	8	8	7	6	
Median:	5	6	7	6	5	4	4	

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	22	1	23
1996	37	4	41
1997	12	5	17
1998	23	1	24
1999	33	2	35
2000	33	10	43
2001	21	2	23
Total	181	25	206

Percentages:

0-99	>99	Total
Normal	Excessive	
96	4	100
90	10	100
71	29	100
96	4	100
94	6	100
97	23	100
91	9	100
88	12	100

	1995	1996	1997	1998	1999	2000	2001	
Lowest:	14	20	12	22	12	7	16	
Highest:	146	165	262	243	134	496	145	
Mean:	43	51	79	60	42	75	46	
Median:	33	42	50	50	36	31	39	

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	86	3	89
1996	144	3	147
1997	52	4	56
1998	311	4	315
1999	126	2	128
2000	69	2	71
2001	133	4	137
Total	921	22	943

Percentages:

	0-99	>99	Total
	Normal	Excessive	
	97	3	100
	98	2	100
	93	7	100
	99	1	100
	98	2	100
	97	3	100
	97	3	100
	98	2	100

	1995	1996	1997	1998	1999	2000	2001	
Lowest:	9	13	19	8	1	10	17	
Highest:	183	124	380	1269	130	160	141	
Mean:	41	42	55	42	46	38	47	
Median:	34	37	37	35	42	31	42	

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	0	23	23	0	0	100	100	
1996	1	7	33	41	2	17	80	100	
1997	0	0	17	17	0	0	100	100	
1998	1	0	23	24	4	0	96	100	
1999	0	3	32	35	0	9	91	100	
2000	1	3	39	43	2	7	91	100	
2001	0	4	19	23	0	17	83	100	
Total	3	17	186	206	1	8	90	100	

	1995	1996	1997	1998	1999	2000	2001	
Lowest:	1.1	0.4	1.2	0.4	0.8	0.4	0.5	
Highest:	23.3	120.0	53.3	64.9	124.2	49.0	24.9	
Mean:	7.7	11.6	15.9	11.7	9.1	7.2	4.3	
Median:	4.6	3.9	5.7	6.3	4.0	4.0	2.1	

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	7	17	65	89
1996	4	49	94	147
1997	1	15	40	56
1998	8	81	226	315
1999	15	31	82	128
2000	3	18	50	71
2001	7	39	91	137
Total	45	250	648	943

Percentages:

<0.5	0.5-1.0	>1	Total
Low	Medium	High	
8	19	73	100
3	33	64	100
2	27	71	100
3	26	72	100
12	24	64	100
4	25	70	100
5	28	66	100
5	27	69	100

	1995	1996	1997	1998	1999	2000	2001	
Lowest:	0.1	0.3	0.4	0.3	0.1	0.1	0.1	
Highest:	20.1	50.2	45.4	15.6	34.1	25.0	38.6	
Mean:	2.1	2.8	3.5	2.0	2.8	2.9	2.2	
Median:	1.6	1.4	1.4	1.5	1.4	1.5	1.5	

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
SOF	Sorghum forage
SSH	Sorghum sudan hybrid
SUD	Sudangrass
Small grains	
BSP	Barley, Spring
MIL	Millet
OAS	Oats with legume
OAT	Oats
SOG	Sorghum grain
SOY	Soybeans
WHS	Wheat with legume
WHT	Wheat
Others	
ALG	Azalea
APP	Apples

Crop Code	Crop Description
APR	Apricots
ASP	Asparagus
ATF	Athletic Field
BDR/BND	Beans-dry
BLU/BLB	Blueberries
BNL	Beans, Lima
BNS	Beans, Snap
BRP	Broccoli, Transplanted
CAR	Carrots
CEM	Cemetery
CVE	Crownvetch
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
ONP	Onions, Transplanted
ONS	Onion, Seeded
OTH	Other
PAR	Pears
PCH	Peaches
PEA	Peas
PEP	Peppers
PER	Perennials
POP	Popcorn
PRK	Park
POT/PTO	Potatoes
PUM	Pumpkins

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
SOD	Sod production
SPB	Spring flowering bulbs
SQS	Squash, Summer
SQW	Squash, Winter
STE	Strawberries, Ever
STR	Strawberries (homeowners)
STS	Strawberries, Spring
SUB	Summer flowering bulbs
SUN	Sunflowers
SWC	Sweet corn
TOM	Tomatoes
TME	Tomatoes, Early
TRE	Christmas trees, Established
TRF	Tree fruits
TRT	Christmas trees, Topdressing