

Soil Sample Survey

Orleans Co.

Samples analyzed by CNAL in 1995-2001



Onions are an important crop on the organic soils in Orleans County that have been developed for farming for nearly 100 years. Guy Smith of Triple G Farms makes use of soil testing to produce high quality onions and minimize fertilizer costs. Soil testing and nutrient management help to minimize loss of nutrients from farmland to the adjacent wetlands. This soil resource needs careful management to keep it productive for the next 100 years.

Summary compiled by

Quirine M. Ketterings, Hettie Krol, W. Shaw Reid and Nate Herendeen



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

Ketterings, Q.M., H. Krol, W.S. Reid and N. Herendeen (2003). Orleans County Soil Sample Survey 1995-2001. CSS Extension Bulletin E03-30. 39 pages.

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1. General Survey Summary

Orleans County is located adjacent to Lake Ontario between Rochester and Niagara Falls in the northwest area of New York. It contains over 253,000 acres of land area. Roughly 60% of the area is used for farm production.

The county lies entirely in the Ontario and Huron Lake Plains region. The lake plain begins at Lake Ontario, where the elevation is 246 feet above sea level. It extends to the foot of the Niagara escarpment. There the elevation increases erratically to the crest of the escarpment, about 600 feet elevation. The Huron Plain extends from that crest southward into Genesee County. It has a high point of 737 feet near West Barre in the south central part of the county.

The soils in the north are dominated by glacial till that was greatly modified by glacial outwash and/or glacial lake sediments. The soils in the south are derived from high carbonate materials deposited by glacial advance across the Niagara dolomite limestone escarpment. However, glacial outwash materials and/or lacustrine sediments also modified much of this area.

Large areas of wetlands occur in the southern portion of the county, the result of massive outwash during the period of glacial recession from western New York. Large areas of shallow wetlands were drained and have been farmed as organic soils or muckland for many years. Additional large areas of wetlands are protected in the federal Iroquois Wildlife Refuge and the New York State Tonawanda Wildlife Area. These areas are seasonal feeding and resting sites to many migratory waterfowl, especially Canada geese.

The agriculture of Orleans County is diverse. Processing and fresh market vegetable crops comprise the largest segment of the agricultural economy. Crops grown for processing include peas, snap beans, sweet corn, and dry beans. Cabbage is grown for fresh marketing plus storage. There are several thousand acres of onions grown on the Elba mucklands at the south border of the county. Other fresh vegetables produced include potatoes, cucumbers, squash, pumpkins, and tomatoes.

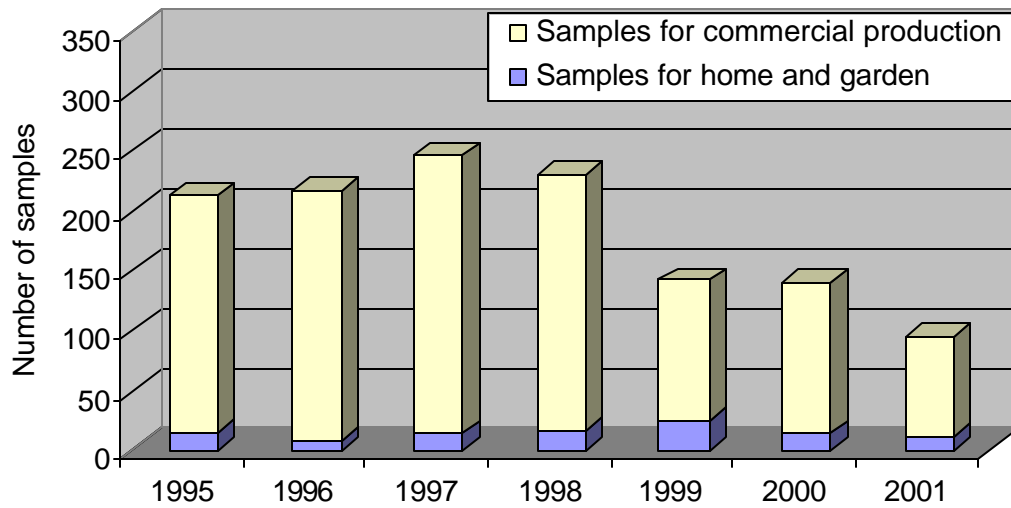
Tree fruit production is next, with large acreages of apples and smaller acreages of cherries, peaches, and pears. There are several commercial storage and marketing facilities for tree fruits in the county. Small fruits such as strawberries and raspberries are grown for fresh markets.

Dairy farming and associated feed crops use large acreages in the county. Additionally, large acreages are devoted to grain corn, winter wheat, hay and soybean crops that are sold out of the county. In the last few years, there has been a proliferation of farms producing less common livestock such as llamas and alpacas. Livestock producers market beef, hogs and sheep from Orleans County.

The number of farms that have found niche markets for fresh produce, flowers, maple products and evergreen (Christmas) trees and is increasing. There are a few farms with recreational horse boarding and training facilities in the county.

All the above industries rely heavily on soil testing to maintain optimum production while protecting the agricultural environment from nutrient runoff. This survey summarizes the soil test results from Orleans 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 1284. Of these 1284 samples, 1179 (92%) were submitted to obtain fertilizer recommendations for commercial production while 105 samples (8%) were submitted as home and garden samples.

Fifty-six percent of the home and garden soil samples were submitted to request fertilizer recommendations for home garden vegetable production while 23% of the samples came from lawns. People submitting samples for commercial production requested fertilizer recommendations for apple production (47%), corn silage or grain (16%), and alfalfa, alfalfa/grass or alfalfa/trefoil mixtures (10%), while a few producers were planning on growing other crops including clover/grass mixtures, small grains and vegetables.



Homeowners		Commercial		Total
1995	15	1995	198	213
1996	8	1996	209	217
1997	14	1997	232	246
1998	17	1998	213	230
1999	25	1999	117	142
2000	14	2000	127	141
<u>2001</u>	<u>12</u>	<u>2001</u>	<u>83</u>	<u>95</u>
Total	105	Total	1179	1284

Home and garden samples in Orleans County were silty (25 samples), silt loams (31 samples), sandy loam (24%), or sandy (25%), belonging to soil management groups 2, 3, 4, and 5, respectively. Of the samples submitted for commercial production, 55% belonged to soil management group 2. One percent was from soil management group 1. Group 3 was represented with 13% of the samples while 24% was classified group 4 and 5% belonged to soil management group 5. The five most common soil series were Hilton (34%), Galen (10%), Appleton (8%), Collamer (6%) and Bonbay (5%). These soils represent 18% (Hilton), 3% (Galen), 9% (Appleton), 5% (Collamer), and 3% (Bombay) of the total 253,439 acres in the county. The table on page 7 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.

Organic matter levels, as measured by loss on ignition, ranged from less than 1% to 24% with median values ranging from 2.8 to 3.8% organic matter for home and garden samples and values ranging from 2.1 to 2.8 for samples submitted for commercial production. Seventy-four percent of the home and garden samples had between 2.0 and 4.9% organic matter with 25% testing between 2.0 and 2.9% organic matter, 30% between 3.0 and 3.9% organic matter and 19% between 4.0 and 4.9% organic matter. Seventeen percent of the soils submitted for home and garden tested >4.9% in organic matter while 9% has less than 2.0% organic matter. Of the samples submitted for commercial production, 53% contained between 2.0 and 2.9% organic matter while 21% contained between 3.0 and 3.9% organic matter and 21% tested lower than 2.0% organic matter. In total, 95% of the samples had organic matter levels below 4.0%.

Soil pH in water (1:1 extraction ratio) varied from pH 3.7 to 8.6 with the median for home and garden samples ranging from pH 6.6 to pH 7.1 and for samples submitted for commercial production ranging from pH 6.3 to pH 6.7. Of the home and garden samples, 68% tested between pH 6.0 and 7.4. For the samples submitted for commercial production, this was 77% while 13% 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, 10% tested low, 13% tested medium, 28% tested high and 49% tested very high. This meant that 77% tested high or very high in P. Phosphorus levels for samples for commercial production in Orleans County were similar to the state average (~50% tests high or very high in P). Six percent of the samples tested very high in P. Thirteen percent were low in P, 28% tested medium for P while 53% of the submitted samples were classified as high in soil test P. This means that 58% tested high or very high in P. 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 or low in K. Nine percent tested medium, 22% high and 61% very high. For samples submitted for commercial production, 2% tested very low in K, 7% tested low, 10% tested medium, 22% tested high and 56% tested very high in potassium with the remainder being of unknown K classification. As with phosphorus, there were no trends over the 7 years.

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 16 to over 3000 lbs Mg/acre (Morgan extraction). There were only three samples that tested very low in Mg. Most soils tested high or very high for Mg (95% of the homeowner soils and 95% of the soils of the commercial growers). No more than 5 of the homeowner soils and 5% of the commercial growers' soil tested low or medium in Mg. Thus, magnesium deficiency is not likely to occur in Orleans 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 98% in the normal range for both sample sets with only 2 of the home and garden samples and 22 of the samples for commercial production testing excessive for Fe. Similarly, most soils (97-almost 100%) 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 lb Zn/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, 87% tested high for zinc while 12% tested medium and only one sample tested low. Of the samples for commercial production, 4% tested low, 24% tested medium while 72% 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	1	0	0	0	0	0	0	1	1
APR	0	0	0	1	0	0	0	1	1
BLU	0	0	0	0	0	0	1	1	1
FLA	2	0	0	0	0	0	0	2	2
LAW	2	3	3	3	5	5	3	24	23
MVG	7	2	11	8	17	9	6	60	57
OTH	0	0	0	0	1	0	0	1	1
PER	1	2	0	0	1	0	1	5	5
RSP	0	1	0	0	0	0	0	1	1
SAG	0	0	0	4	1	0	0	5	5
STR	1	0	0	1	0	0	0	2	2
Unknown	1	0	0	0	0	0	1	2	2
Total	15	8	14	17	25	14	12	105	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	2	4	0	0	1	2	0	9	1
AGE/AGT	16	21	8	8	2	7	1	63	5
ALE/ALT	10	17	12	5	0	3	2	49	4
APP	61	118	134	72	47	67	52	551	47
ASP	0	0	0	1	0	0	0	1	0
BGE/BGT	1	0	0	0	0	0	0	1	0
BLB	1	1	1	1	0	0	0	4	0
BNS	2	2	2	1	8	0	0	15	1
BTE	0	0	0	0	0	0	1	1	0
CBP	0	4	0	5	2	7	0	18	2
CBS	0	0	0	7	0	0	0	7	1
CGE/CGT	0	0	0	0	3	0	1	4	0
CHC	2	0	0	3	0	0	0	5	0
CHT	0	4	4	0	1	0	1	10	1
CKS	1	1	1	0	1	1	0	5	0
CLE/CLT	1	1	1	0	0	2	2	7	1
COG/COS	56	10	31	57	22	12	3	191	16
CSE/CST	0	0	0	0	1	0	0	1	0
GPA	0	0	2	0	0	0	0	2	0
GRE/GRT	3	0	2	4	0	0	4	13	1
HRB	0	1	0	0	0	0	0	1	0
MIX/MVG	2	1	1	1	1	0	1	7	1
MML	1	0	1	0	0	0	0	2	0
OAS	0	0	0	0	0	1	0	1	0
OAT	0	0	1	5	4	1	0	11	1
OTH	2	1	1	0	3	0	1	8	1
PCH	5	0	3	0	0	3	2	13	1
PEA	1	2	0	2	1	0	0	6	1
PEP	1	2	1	1	0	0	0	5	0
PGE/PGT	0	2	0	1	0	1	0	4	0
PIE/PIT	0	0	1	0	0	0	0	1	0
PLE/PLT	0	1	0	0	1	0	0	2	0
PNE/PNT	3	0	0	0	0	0	0	3	0
PUM	1	0	0	3	3	0	0	7	1
RAD	0	0	0	1	0	0	0	1	0

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Current year crop	1995	1996	1997	1998	1999	2000	2001	Total	%
RSS	0	0	0	2	1	0	0	3	0
RYC	1	0	0	0	0	0	0	1	0
SOY	8	6	8	14	6	6	9	57	5
SQS	0	0	0	0	1	0	0	1	0
SQW	0	0	0	1	2	0	0	3	0
SSH	0	0	0	1	1	0	0	2	0
STS	2	1	0	1	0	0	0	4	0
SWC	5	2	4	6	0	2	0	19	2
TOM	2	0	0	2	0	0	0	4	0
TRE	0	0	0	1	0	0	0	1	0
WHS	0	1	0	0	0	0	0	1	0
WHT	5	6	9	6	4	5	1	36	3
Unknown	3	0	3	2	1	7	2	18	2
Total	198	209	232	213	117	127	83	1179	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)	3	1	4	1	10	3	3	25
SMG 3 (silt loam)	6	3	1	4	9	4	4	31
SMG 4 (sandy loam)	2	1	3	10	2	4	2	24
SMG 5 (sandy)	4	3	6	2	4	3	3	25
SMG 6 (mucky)	0	0	0	0	0	0	0	0
Total	15	8	14	17	25	14	12	105

3.2 Samples for Commercial Production

Soil series for samples submitted for commercial production:

Name	SMG	1995	1996	1997	1998	1999	2000	2001	Total
Alton	5	4	4	6	10	0	4	1	29
Appleton	2	11	11	20	19	12	11	11	96
Arkport	4	4	15	19	5	3	2	2	50
Barre	1	1	0	0	0	0	0	0	1
Bombay	4	5	11	16	9	3	9	8	61
Brockport	1	0	4	0	0	3	0	0	7
Canandaigua	3	0	0	0	1	1	0	0	2
Cazenovia	2	6	7	4	4	16	3	1	41
Churchville	2	2	1	1	3	1	1	0	9
Claverack	4	0	0	2	3	0	2	1	8
Collamer	3	10	17	5	4	5	21	11	73
Colonie	5	0	1	0	1	2	0	1	5
Cosad	4	0	1	0	0	2	0	0	3
Elnora	5	6	6	1	3	2	1	1	20
Fredon	4	0	0	0	0	1	0	0	1
Galen	4	15	22	31	14	20	8	10	120
Hilton	2	88	58	88	79	20	38	32	403
Howard	3	1	1	4	5	3	4	0	17
Kendaia	2	0	0	0	2	0	0	0	2
Lairdsville	2	0	0	1	0	0	0	0	1
Lakemont	1	1	0	0	0	1	0	0	2
Lockport	2	1	1	1	8	1	1	0	13
Lyons	2	0	0	0	1	0	0	0	1
Madalin	1	0	0	1	0	1	0	0	2
Madrid	4	3	2	2	6	1	2	0	16
Massena	4	0	0	1	0	0	0	0	1
Minoa	4	0	0	0	0	1	0	0	1
Niagara	3	4	8	5	11	6	5	1	40
Odessa	2	1	1	2	1	1	2	0	8
Ontario	2	4	6	4	9	2	1	1	27
Ovid	2	5	2	4	5	5	3	1	25
Phelps	3	3	5	2	3	1	3	0	17
Rhinebeck	2	3	7	6	1	0	2	0	19
Sun	4	0	4	0	0	0	1	0	5
Teel	2	0	1	0	0	0	0	0	1
Wampsville	3	1	0	0	2	0	0	0	3

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Name	SMG	1995	1996	1997	1998	1999	2000	2001	Total
Wassaic	4	4	2	5	1	0	1	0	13
Unknown	-	15	11	1	3	3	2	1	36
Total	-	198	209	232	213	117	127	83	1179

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	3	5	6	0	1	0	0	15
1996	0	0	2	3	1	2	0	0	8
1997	0	3	3	3	4	1	0	0	14
1998	0	1	3	5	5	3	0	0	17
1999	0	1	7	8	4	3	0	2	25
2000	1	0	4	3	4	1	1	0	14
2001	0	1	2	3	2	1	2	1	12
Total	1	9	26	31	20	12	3	3	105

	1995	1996	1997	1998	1999	2000	2001	
Lowest:	1.0	2.0	1.0	1.5	1.7	0.8	1.3	
Highest:	5.2	5.9	5.1	5.4	11.5	6.7	10.2	
Mean:	2.9	3.7	3.2	3.9	4.0	3.7	4.3	
Median:	2.8	3.6	3.2	3.9	3.5	3.6	3.8	

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	20	33	40	0	7	0	0	100
1996	0	0	25	38	13	25	0	0	100
1997	0	21	21	21	29	7	0	0	100
1998	0	6	18	29	29	18	0	0	100
1999	0	4	28	32	16	12	0	8	100
2000	7	0	29	21	29	7	7	0	100
2001	0	8	17	25	17	8	17	8	100
Total	1	9	25	30	19	11	3	3	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	2	21	96	64	9	3	0	3	198
1996	0	43	111	45	7	1	0	2	209
1997	2	51	123	49	5	2	0	0	232
1998	1	26	127	47	11	1	0	0	213
1999	0	30	60	19	6	2	0	0	117
2000	1	29	76	18	2	1	0	0	127
2001	2	32	37	9	2	1	0	0	83
Total	8	232	630	251	42	11	0	5	1179

	1995	1996	1997	1998	1999	2000	2001	
Lowest:	0.5	1.1	0.8	0.9	1.1	0.9	0.9	
Highest:	23.4	24.1	5.7	5.7	5.6	5.5	5.0	
Mean:	3.0	2.7	2.5	2.7	2.5	2.4	2.3	
Median:	2.8	2.5	2.4	2.6	2.4	2.3	2.1	

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	1	11	48	32	5	2	0	2	100
1996	0	21	53	22	3	0	0	1	100
1997	1	22	53	21	2	1	0	0	100
1998	0	12	60	22	5	0	0	0	100
1999	0	26	51	16	5	2	0	0	100
2000	1	23	60	14	2	1	0	0	100
2001	2	39	45	11	2	1	0	0	100
Total	1	20	53	21	4	1	0	0	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	2	1	2	2	6	1	0	1	15
1996	0	0	0	2	3	1	1	1	0	0	8
1997	0	0	2	2	2	4	2	2	0	0	14
1998	0	0	0	4	2	4	5	2	0	0	17
1999	0	0	2	1	4	4	11	3	0	0	25
2000	0	0	0	1	3	2	6	2	0	0	14
2001	0	0	0	0	2	5	1	4	0	0	12
Total	0	0	6	11	18	22	32	15	0	1	105

	1995	1996	1997	1998	1999	2000	2001	
Lowest:	5.0	5.7	5.2	5.5	5.1	5.6	6.3	
Highest:	8.6	7.5	7.7	7.7	7.7	7.6	7.5	
Mean:	-	-	-	-	-	-	-	
Median:	7.1	7.1	6.6	6.8	7.1	6.6	6.8	

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	13	7	13	13	40	7	0	1	100
1996	0	0	0	25	38	13	13	13	0	0	100
1997	0	0	14	14	14	29	14	14	0	0	100
1998	0	0	0	24	12	24	29	12	0	0	100
1999	0	0	8	4	16	16	44	12	0	0	100
2000	0	0	0	7	21	14	43	14	0	0	100
2001	0	0	0	0	17	42	8	33	0	0	100
Total	0	0	6	10	17	21	30	14	0	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	1	6	20	43	70	52	5	1	0	198
1996	1	4	17	33	44	80	28	2	0	0	209
1997*	2	5	16	41	81	62	21	0	0	0	228
1998*	3	4	8	26	49	77	35	4	3	0	209
1999	0	2	6	17	29	40	18	5	0	0	117
2000	0	0	4	12	21	56	27	7	0	0	127
2001	0	0	5	9	18	26	24	1	0	0	83
Total	6	16	62	158	285	411	205	24	4	0	1171

* Four samples were not analyzed for pH in 1997 and in 1998, respectively.

	1995	1996	1997	1998	1999	2000	2001	
Lowest:	4.6	4.4	4.2	3.7	4.7	5.0	5.1	
Highest:	8.0	7.6	7.4	8.1	7.7	7.8	7.9	
Mean:	-	-	-	-	-	-	-	
Median:	6.6	6.5	6.3	6.5	6.5	6.7	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	0	1	3	10	22	35	26	3	1	0	100
1996	0	2	8	16	21	38	13	1	0	0	100
1997	1	2	7	18	36	27	9	0	0	0	100
1998	1	2	4	12	23	37	17	2	1	0	100
1999	0	2	5	15	25	34	15	4	0	0	100
2000	0	0	3	9	17	44	21	6	0	0	100
2001	0	0	6	11	22	31	29	1	0	0	100
Total	1	1	5	13	24	35	18	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	3	0	4	1	1	0	2	2	2	15
1996	0	0	0	4	1	1	0	1	0	0	8
1997	0	1	5	5	1	0	0	2	0	0	14
1998	0	2	2	3	3	0	2	2	0	3	17
1999	0	1	3	6	3	0	0	2	2	8	25
2000	0	1	3	3	4	1	1	1	0	0	14
2001	0	3	0	4	0	0	1	3	0	1	12
Total	0	11	14	29	13	3	4	13	4	14	105

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

	1995	1996	1997	1998	1999	2000	2001	
Lowest:	1	1	3	2	3	3	1	
Highest:	313	121	127	250	766	150	245	
Mean:	90	40	31	77	185	42	67	
Median:	52	26	14	48	57	37	22	

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	20	0	27	7	7	0	13	13	13	100
1996	0	0	13	50	13	13	0	13	0	0	100
1997	0	7	36	36	7	0	0	14	0	0	100
1998	0	12	12	18	18	0	12	12	0	18	100
1999	0	4	12	24	12	0	0	8	8	32	100
2000	0	7	21	21	29	7	7	7	0	0	100
2001	0	25	0	33	0	0	8	25	0	8	100
Total	0	10	13	28	12	3	4	12	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	43	46	99	5	3	0	0	0	2	198
1996	0	27	72	99	7	0	1	2	0	1	209
1997	0	23	68	129	7	1	1	2	0	1	232
1998	0	17	50	133	6	3	1	1	1	1	213
1999	0	14	34	62	6	1	0	0	0	0	117
2000	0	25	44	54	2	2	0	0	0	0	127
2001	0	10	18	47	3	2	2	1	0	0	83
Total	0	159	332	623	36	12	5	6	1	5	1179

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:	1114	278	268	369	68	67	106	
Mean:	22	15	16	19	15	12	20	
Median:	10	9	11	12	13	7	15	

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	22	23	50	3	2	0	0	0	1	100
1996	0	13	34	47	3	0	0	1	0	0	100
1997	0	10	29	56	3	0	0	1	0	0	100
1998	0	8	23	62	3	1	0	0	0	0	100
1999	0	12	29	53	5	1	0	0	0	0	100
2000	0	20	35	43	2	2	0	0	0	0	100
2001	0	12	22	57	4	2	2	1	0	0	100
Total	0	13	28	53	3	1	0	1	0	0	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	0	3	3
1996	0	0	0	0	1	1
1997	0	1	0	1	2	4
1998	0	0	0	0	1	1
1999	0	0	0	3	7	10
2000	0	0	0	0	3	3
2001	0	1	0	0	2	3
Total (#)	0	2	0	4	19	25
Total (%)	0	8	0	16	76	100
Soil Management Group 3						
	<45	45-79	80-119	120-199	>199	Total
	Very Low	Low	Medium	High	Very High	
1995	1	0	0	0	5	6
1996	0	0	1	0	2	3
1997	0	0	1	0	0	1
1998	0	0	0	1	3	4
1999	0	0	0	2	7	9
2000	0	0	0	3	1	4
2001	1	0	1	0	2	4
Total (#)	2	0	3	6	20	31
Total (%)	6	0	10	19	65	100

Soil Management Group 4						
	<55	55-99	100-149	150-239	>239	Total
	Very Low	Low	Medium	High	Very High	
1995	0	1	1	0	0	2
1996	0	0	0	0	1	1
1997	0	0	0	0	3	3
1998	0	0	3	4	3	10
1999	0	0	0	0	2	2
2000	0	0	0	0	4	4
2001	0	0	1	0	1	2
Total (#)	0	1	5	4	14	24
Total (%)	0	4	21	17	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	1	3	4
1996	0	1	0	0	2	3
1997	0	0	1	4	1	6
1998	0	0	0	1	1	2
1999	0	0	0	3	1	4
2000	0	1	0	0	2	3
2001	1	1	0	0	1	3
Total (#)	1	3	1	9	11	25
Total (%)	4	12	4	36	44	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	1	1	11	15
1996	0	1	1	0	6	8
1997	0	1	2	5	6	14
1998	0	0	3	6	8	17
1999	0	0	0	8	17	25
2000	0	1	0	3	10	14
2001	2	2	2	0	6	12
Total #	3	6	9	23	64	105

	1995	1996	1997	1998	1999	2000	2001	
Lowest:	36	75	69	118	141	61	31	
Highest:	856	605	377	1272	1868	464	591	
Mean:	367	283	235	370	649	272	244	
Median:	411	275	257	241	288	271	181	

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

Summary (%)	Very Low	Low	Medium	High	Very High	Total
1995	7	7	7	7	73	100
1996	0	13	13	0	75	100
1997	0	7	14	36	43	100
1998	0	0	18	35	47	100
1999	0	0	0	32	68	100
2000	0	7	0	21	71	100
2001	17	17	17	0	50	100
Grand Total	3	6	9	22	61	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	1	1	0	0	2
1996	0	0	0	2	2	4
1997	0	0	0	1	0	1
1998	0	0	0	0	0	0
1999	0	0	0	1	4	5
2000	0	0	0	0	0	0
2001	0	0	0	0	0	0
Total (#)	0	1	1	4	6	12
Total (%)	0	8	8	33	50	100
Soil Management Group 2						
	<40	40-69	70-99	100-164	>164	Total
	Very Low	Low	Medium	High	Very High	
1995	0	1	13	30	77	121
1996	1	6	8	14	66	95
1997	2	5	14	33	77	131
1998	2	6	9	38	77	132
1999	1	6	4	8	39	58
2000	3	8	7	11	33	62
2001	1	2	5	6	32	46
Total (#)	10	34	60	140	401	645
Total (%)	2	5	9	22	62	100
Soil Management Group 3						
	<45	45-79	80-119	120-199	>199	Total
	Very Low	Low	Medium	High	Very High	
1995	0	1	3	4	11	19
1996	1	2	4	6	18	31
1997	0	1	0	3	12	16
1998	0	3	3	8	12	26
1999	0	2	3	3	8	16
2000	0	7	2	7	17	33
2001	0	0	1	0	11	12
Total (#)	1	16	16	31	89	153
Total (%)	1	10	10	20	58	100

Ketterings, Q.M., H. Krol, W.S. Reid and N. Herendeen (2003). Orleans County Soil Sample Survey 1995-2001. CSS Extension Bulletin E03-30. 39 pages.

Soil Management Group 4						
	<55	55-99	100-149	150-239	>239	Total
	Very Low	Low	Medium	High	Very High	
1995	0	6	3	4	18	31
1996	1	7	7	14	28	57
1997	2	4	9	12	49	76
1998	3	1	7	9	18	38
1999	1	3	3	7	17	31
2000	1	2	1	10	11	25
2001	1	0	1	2	17	21
Total (#)	9	23	31	58	158	279
Total (%)	3	8	11	21	57	100
Soil Management Group 5						
	<60	60-114	115-164	165-269	>269	Total
	Very Low	Low	Medium	High	Very High	
1995	1	1	3	3	2	10
1996	1	3	3	3	1	11
1997	0	0	3	3	1	7
1998	0	1	1	10	2	14
1999	1	0	2	1	0	4
2000	0	0	1	1	3	5
2001	1	2	0	0	0	3
Total (#)	4	7	13	21	9	54
Total (%)	7	13	24	39	17	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	1	10	23	41	108	15	198
1996	4	18	22	39	115	11	209
1997	4	10	26	52	139	1	232
1998	5	11	20	65	109	3	213
1999	3	11	12	20	68	3	117
2000	4	17	11	29	64	2	127
2001	3	4	7	8	60	1	83
Grand Total	24	81	121	254	663	36	1179

	1995	1996	1997	1998	1999	2000	2001	
Lowest:	43	21	34	21	33	19	23	
Highest:	22272	640	813	1246	609	748	796	
Mean:	446	243	279	243	231	228	288	
Median:	205	216	253	206	219	190	293	

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

% summary	Very Low	Low	Medium	High	Very High	Un-known	Total
1995	1	5	12	21	55	8	100
1996	2	9	11	19	55	5	100
1997	2	4	11	22	60	0	100
1998	2	5	9	31	51	1	100
1999	3	9	10	17	58	3	100
2000	3	13	9	23	50	2	100
2001	4	5	8	10	72	1	100
Grand Total	2	7	10	22	56	3	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	3	11	15
1996	0	1	0	0	7	8
1997	0	0	1	3	10	14
1998	0	0	0	4	13	17
1999	0	0	0	2	23	25
2000	1	0	0	2	11	14
2001	0	0	1	0	11	12
Total	1	1	3	14	86	105

	1995	1996	1997	1998	1999	2000	2001	
Lowest:	68	34	85	147	107	17	92	
Highest:	2061	987	829	976	2045	147	1468	
Mean:	477	404	349	393	634	395	520	
Median:	289	353	357	386	532	388	448	

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	7	20	73	100
1996	0	13	0	0	88	100
1997	0	0	7	21	71	100
1998	0	0	0	24	76	100
1999	0	0	0	8	92	100
2000	7	0	0	14	79	100
2001	0	0	8	0	92	100
Total	1	1	3	13	82	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	4	7	29	158	198
1996	0	7	10	41	151	209
1997	1	3	3	42	183	232
1998	0	5	7	39	162	213
1999	0	0	4	18	95	117
2000	0	3	2	19	103	127
2001	1	4	1	15	62	83
Total	2	26	34	203	914	1179

	1995	1996	1997	1998	1999	2000	2001	
Lowest:	35	44	19	24	74	51	16	
Highest:	3341	3149	1126	1343	1744	1007	1496	
Mean:	406	345	331	354	350	340	337	
Median:	348	299	307	328	295	311	337	

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	4	15	80	100
1996	0	3	5	20	72	100
1997	0	1	1	18	79	100
1998	0	2	3	18	76	100
1999	0	0	3	15	81	100
2000	0	2	2	15	81	100
2001	1	5	1	18	75	100
Total	0	2	3	17	78	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	15	0	15
1996	8	0	8
1997	13	1	14
1998	17	0	17
1999	25	0	25
2000	13	1	14
2001	12	0	12
Total	103	2	105

Percentages:

	0-49	>49	Total
	Normal	Excessive	
	100	0	100
	100	0	100
	93	7	100
	100	0	100
	100	0	100
	93	7	100
	100	0	100
	98	2	100

	1995	1996	1997	1998	1999	2000	2001	
Lowest:	2	5	3	2	1	2	1	
Highest:	36	13	100	27	28	61	15	
Mean:	11	8	16	10	7	11	7	
Median:	6	7	10	7	5	7	6	

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	195	3	198
1996	205	4	209
1997	225	7	232
1998	210	3	213
1999	113	4	117
2000	126	1	127
2001	83	0	83
Total	1157	22	1179

Percentages:

	0-49	>49	Total
	Normal	Excessive	
	98	2	100
	98	2	100
	97	3	100
	99	1	100
	97	3	100
	99	1	100
	100	0	100
	98	2	100

	1995	1996	1997	1998	1999	2000	2001	
Lowest:	1	1	1	1	1	1	1	
Highest:	71	64	114	160	86	100	32	
Mean:	8	11	11	11	12	9	8	
Median:	5	7	6	7	9	5	5	

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:				Percentages:		
	0-99	>99	Total	0-99	>99	Total
	Normal	Excessive		Normal	Excessive	
1995	14	1	15	93	7	100
1996	8	0	8	100	0	100
1997	13	1	14	93	7	100
1998	17	0	17	100	0	100
1999	24	1	25	96	4	100
2000	14	0	14	100	0	100
2001	12	0	12	100	0	100
Total	102	3	105	97	3	100

	1995	1996	1997	1998	1999	2000	2001	
Lowest:	9	3	11	7	12	7	6	
Highest:	184	65	113	61	107	58	83	
Mean:	34	27	42	28	45	29	37	
Median:	24	21	40	27	40	27	31	

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	195	3	198
1996	208	1	209
1997	232	0	232
1998	212	1	213
1999	117	0	117
2000	127	0	127
2001	83	0	83
Total	1174	5	1179

Percentages:

	0-99	>99	Total
	Normal	Excessive	
	98	2	100
	100	0	100
	100	0	100
	100	0	100
	100	0	100
	100	0	100
	100	0	100
	100	0	100
	100	0	100

	1995	1996	1997	1998	1999	2000	2001	
Lowest:	2	4	4	6	3	3	4	
Highest:	312	101	89	133	81	48	48	
Mean:	26	24	26	25	24	19	23	
Median:	20	22	23	22	22	19	23	

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	4	11	15
1996	0	1	7	8
1997	0	1	13	14
1998	0	2	15	17
1999	0	3	22	25
2000	0	1	13	14
2001	1	1	10	12
Total	1	13	91	105

Percentages:

<0.5	0.5-1.0	>1	Total
Low	Medium	High	
0	27	73	100
0	13	88	100
0	7	93	100
0	12	88	100
0	12	88	100
0	7	93	100
8	8	93	100
1	12	87	100

	1995	1996	1997	1998	1999	2000	2001	
Lowest:	0.8	0.5	0.8	0.6	0.6	0.8	0.4	
Highest:	28.9	173.8	73.6	44.2	126.8	114.7	29.0	
Mean:	6.6	43.0	9.3	9.4	19.0	11.9	9.3	
Median:	3.2	3.7	2.0	5.6	7.6	2.5	5.2	

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	9	51	138	198
1996	3	45	161	209
1997	1	38	193	232
1998	19	68	126	213
1999	8	32	77	117
2000	4	38	85	127
2001	1	10	72	83
Total	45	282	852	1179

Percentages:

<0.5	0.5-1.0	>1	Total
Low	Medium	High	
5	26	70	100
1	22	77	100
0	16	83	100
9	32	59	100
7	27	66	100
3	30	67	100
1	12	87	100
4	24	72	100

	1995	1996	1997	1998	1999	2000	2001	
Lowest:	0.2	0.3	0.1	0.1	0.1	0.3	0.4	
Highest:	42.4	30.8	40.7	26.8	9.8	11.3	12.6	
Mean:	3.2	3.4	3.7	2.6	1.9	1.7	2.7	
Median:	1.7	1.8	2.1	1.4	1.4	1.3	2.0	

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
ATF	Athletic Field
ASP	Asparagus
BDR/BND	Beans, Dry
BNS	Beans, Snap
BLU/BLB	Blueberries
CBP	Cabbage, Transplanted
CBS	Cabbage, Seeded
CEM	Cemetery
CHC	Chinese cabbage
CHT	Cherries, Tart
CKS	Cucumber, Seeded
END	Endives
FAR	Fairway
FLA	Flowering Annuals
GPA	Grapes, American
GRA	Grapes (homeowners)
GEN	Green
HRB	Herbs
IDL	Idle land
LAW	Lawn
LET	Lettuce
MIX/MVG	Mixed vegetables
MML	Muskmelon
ONS	Onion-seeded
OTH	Other
PAR	Pears
PCH	Peaches
PEA	Peas
PEP	Peppers
PER	Perennials
PLM	Plums
POP	Popcorn
PRK	Park
POT/PTO	Potatoes
PUM	Pumpkins
RAD	Radish
ROD	Roadside
ROS	Roses
ROU	Rough

Crop Code	Crop Description
RSF	Raspberries, Fall
RSP	Raspberries (homeowners)
RSS	Raspberries, Summer
SAG	Ornamentals adapted to pH 6.0 to 7.5
SQS	Squash, Summer
SQW	Squash, Winter
STE	Strawberries, Ever
STR	Strawberries (homeowners)
STS	Strawberries, Spring
SUN	Sunflowers
SWC	Sweet corn
TOM	Tomatoes
TRE	Christmas trees, Established
TRF	Tree fruits
TRT	Christmas trees, Topdressing