

Soil Sample Survey

Cattaraugus Co.

Samples analyzed by CNAL in 1995-2001



Farmland in Cattaraugus County

Summary compiled by

Quirine M. Ketterings, Hettie Krol, W. Shaw Reid and D. Sprague



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

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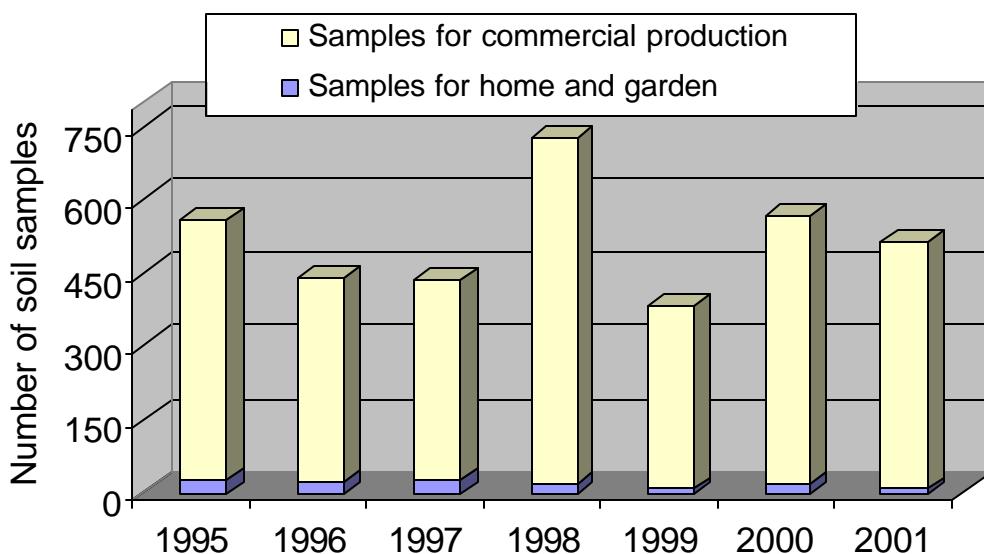
1. General Survey Summary

Cattaraugus County is located in the southwestern part of New York State bordering Pennsylvania to the south, Chautauqua County to the west, Erie and Wyoming County to the north and Allegany County to the east. Cattaraugus County has two cities, Olean and Salamanca. Approximately 204,000 acres (24%) of the county's total 838,400 acres is in farm land. In 1998, Cattaraugus County ranked 5th in the state for number of farms and 11th for land in farms with 1,125 farms averaging 181 acres each. The northwestern most portion of the county is unique in being part of the Great Lakes grape belt without actually bordering one of the lakes.

Cattaraugus County ranks in the top ten counties for New York State in beef, grape, maple, nursery and greenhouse, and oat production. However, dairy is the number one farm product for the county accounting for 69% of the total dollar agriculture sales. In addition to the previously named commodities, the other major agricultural products for the county are hay and silage (3% of total sales), and fruits and berries (2% of total sales). The production of vegetables and specialty horticultural crops, like herbs, bedding plants, and poinsettias, is a growing sector of the industry.

Agriculture is an integral part of the landscape and cultural fabric of Cattaraugus County. It is also a major contributor to the tax base in the county. Farm numbers have declined at a fairly constant rate since record keeping started in the 1930's and the industry continues to restructure to take advantage of economies of scale and technological advances like automated milking systems, biotechnology and integrated pest management. New concentrated animal feeding operation regulations may hasten the restructuring in the dairy sector.

This survey summarizes the soil test results from Cattaraugus 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 3613. Of these 3613 samples, 3487 (97%) were submitted to obtain fertilizer recommendations for commercial production while 126 samples (3%) were submitted as home and garden samples.



Homeowners		Commercial		Total
1995	27	1995	528	555
1996	23	1996	416	439
1997	26	1997	408	434
1998	18	1998	706	724
1999	6	1999	376	382
2000	17	2000	548	565
<u>2001</u>	<u>9</u>	<u>2001</u>	<u>505</u>	<u>514</u>
Total	126	Total	3487	3613

The majority (54%) of the home and garden soil samples during 1995-2001 was submitted to request fertilizer recommendations for home garden vegetable production while 19% of the samples were submitted for lawn recommendations. People submitting samples for commercial production requested fertilizer recommendations for corn silage or grain (43%), alfalfa, alfalfa/grass or alfalfa/trefoil mixtures (26%), while a few producers were planning on growing other crops including hay, clover/grass mixtures, small grains and vegetables.

Home and garden samples in Cattaraugus County were silty (29%), silt loams (20%), sandy loams (45%) or sandy (6%) belonging to soil management groups 2, 3, 4, and 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, 80% belonged to soil management group 3. Three percent was from soil management group 1 while 7% were from management group 2, 6% belonged to soil management group 4 and 1% was classified group 5. The five most common soil series were Chenango (23%), Mardin (15%), Volusia (9%), Valois (5%), and Castile (4%).

Organic matter levels, as measured by loss on ignition, ranged from less than 1% to over 30% with median values ranging from 4.6 to 7.6% organic matter for home and garden samples and from 4.3 to 4.7% organic matter for samples submitted for commercial production. Thirty-nine percent of the home and garden samples had between 2 and 5% organic matter with 6% testing between 2 and 2.9% organic matter, 15% between 3.0 and 3.9% organic matter, and 18% between 4.0 and 4.9% organic matter. Fifty-nine percent of the soils submitted for home and garden tested >4.9% in organic matter while 2% had less than 2% organic matter. Of the samples submitted for commercial production, 19% contained between 3 and 4% organic matter, 38% tested between 4.0 and 4.9% while

23% had organic matter concentrations of 5.0-5.9%. In total, 68% of the samples had organic matter levels between 4.0 and 6.9%.

Soil pH in water (1:1 extraction ratio) varied from pH 4.0 to 7.9 with the median for home and garden samples ranging from pH 5.6 to pH 6.6 and for samples submitted for commercial production ranging from pH 6.1 to pH 6.3. Of the home and garden samples, 58% tested between pH 6.0 and 7.4. For the samples submitted for commercial production, this was 75% while 24% 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, 30% tested low, 15% tested medium, 30% tested high and 25% tested very high. This meant that 55% tested high or very high in P. Phosphorus levels for samples for commercial production in Cattaraugus County were skewed towards low and medium classifications. Three percent of the samples tested very high in P. Twenty-six percent were low in P, 33% tested medium for P while 38% of the submitted samples were classified as high in soil test P. This means that 41% 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, 6% was classified as low in potassium. Nine percent tested medium, 25% high and 60% very high. For samples submitted for commercial production, 1% tested very low in K, 9% tested low, 21% tested medium, 31% tested high and 35% tested very high in potassium while for 3% the soil K classification was unknown. 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 21 to over 6000 lbs Mg/acre (Morgan extraction). There were no samples that tested very low in Mg. Most soils tested high or very high for Mg (96% of the homeowner soils and 98% of the soils of the commercial growers). No more than 5 of the homeowner soils and 2% of the commercial growers' soil tested low or medium in Mg. Thus, magnesium deficiency is not likely to occur in Cattaraugus 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 80-94% in the normal range with 25 of the home and garden samples and 6% of the samples for commercial production testing excessive for Fe. Similarly, most soils (90-98%) for both groups tested normal for manganese. Soils with more than 100 lbs Morgan extractable

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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 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, 90% tested high for zinc while 9% tested medium and 1% was low. Of the samples for commercial production, 3% tested low in zinc, 29% tested medium while 68% 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	%
ATF	1	0	0	2	0	0	0	3	2
FLA	0	1	0	0	0	1	1	3	2
HRB	0	0	2	0	0	0	0	2	2
LAW	3	10	4	3	1	2	1	24	19
MVG	17	10	10	12	3	11	5	68	54
OTH	1	0	1	0	1	0	0	3	2
ONP	0	0	0	0	0	1	0	1	1
PER	0	0	1	0	0	0	1	2	2
SAG	4	0	4	0	0	1	1	10	8
STR	1	2	3	1	0	1	0	8	6
SUB	0	0	0	0	1	0	0	1	1
TRF	0	0	1	0	0	0	0	1	1
Total	27	23	26	18	6	17	9	126	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	44	20	9	5	1	14	0	93	3
AGE/AGT	124	87	87	139	66	172	89	764	22
ALE/ALT	8	8	4	6	2	2	4	34	1
APP	0	0	0	0	2	0	0	2	0
ASP	0	0	1	0	0	0	0	1	0
BCE/BCT	11	0	3	2	4	2	1	23	1
BGE/BGT	10	7	1	1	1	5	1	26	1
BLB	0	0	0	0	1	0	1	2	0
BNS	6	0	0	0	0	0	3	9	0
BSP	1	0	0	0	0	0	0	1	0
BSS	0	6	0	0	0	0	0	6	0
BTE/BTT	2	0	0	0	0	0	0	2	0
BUK	4	0	1	0	0	0	2	7	0
CGE/CGT	32	23	33	52	21	15	9	185	5
CLE/CLT	0	0	1	1	5	2	6	15	0
COG/COS	184	185	182	288	188	242	214	1483	43
GIE/GIT	10	4	12	70	15	56	112	279	8
GPA	0	0	0	3	0	1	0	4	0
GPF	0	0	0	1	0	0	0	1	0
GRE/GRT	22	33	22	61	25	16	19	198	6
IDL	0	0	0	7	0	1	0	8	0
MIL	0	0	0	0	1	0	0	1	0
MIX	1	1	4	2	0	1	5	14	0
OAS	31	24	16	27	11	9	8	126	4
OAT	5	6	1	0	3	1	0	16	0
OTH	0	0	1	1	1	0	7	10	0
PEA	0	0	0	0	0	1	0	1	0
PGE/PGT	8	3	4	4	9	1	4	33	1
PIE/PIT	0	1	8	20	13	1	5	48	1
PLE/PLT	1	0	2	0	0	1	7	11	0
PNE/PNT	0	0	1	6	0	2	0	9	0
PUM	1	0	1	0	0	0	0	2	0
RSF	0	0	0	0	1	0	1	2	0
RYC	1	2	0	0	0	0	0	3	0
RYS	5	1	0	0	0	0	0	6	0

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Current year crop	1995	1996	1997	1998	1999	2000	2001	Total	%
SOF	1	0	0	0	0	0	0	4	0
SOY	0	0	3	1	0	0	0	4	0
SSH	0	0	0	1	0	0	0	1	0
STS	0	0	0	1	1	0	1	3	0
SWC	0	0	4	1	0	0	3	8	0
TOM	0	0	0	0	0	1	0	1	0
TRE/TRT	14	3	4	5	2	0	1	29	1
TRP	0	0	0	0	2	0	0	2	0
WHT	0	1	2	0	0	0	0	3	0
Unknown	2	1	1	1	1	2	2	10	0
Total	528	416	408	706	376	548	505	3487	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)	11	6	8	2	1	9	0	37
SMG 3 (silt loam)	2	1	7	6	2	5	2	25
SMG 4 (sandy loam)	13	13	9	10	3	3	6	57
SMG 5 (sandy)	1	3	2	0	0	0	1	7
SMG 6 (mucky)	0	0	0	0	0	0	0	0
Total	27	23	26	18	6	17	9	126

3.2 Samples for Commercial Production

Soil series for samples submitted for commercial production:

Name	SMG	1995	1996	1997	1998	1999	2000	2001	Total
Allard	3	0	0	2	5	6	8	7	28
Almond	3	0	0	0	0	0	4	6	10
Busti	3	1	0	0	2	21	4	0	28
Canadice	2	0	1	1	5	0	7	0	14
Canandaigua	3	73	4	1	0	3	9	3	93
Canaseraga	3	0	0	0	0	0	0	16	16
Carlisle	6	3	0	0	0	0	0	0	3
Castile	4	4	12	40	16	8	26	25	131
Chautauqua	3	0	1	0	11	9	10	0	31
Chenango	3	94	58	108	196	97	134	121	808
Chippewa	3	0	2	2	1	0	3	1	9
Churchville	2	0	0	0	1	0	0	3	4
Collamer	3	5	11	12	7	1	13	0	49
Colonie	5	2	0	0	0	0	0	3	5
Dalton	3	0	0	0	0	0	1	6	7
Darien	2	0	0	0	0	1	0	0	1
Dunkirk	3	0	2	4	0	0	0	2	8
Elnora	5	1	8	0	1	4	0	8	22
Erie	3	6	10	10	19	11	8	8	72
Fremont	2	10	5	0	19	2	1	6	43
Getzville	3	2	2	2	5	0	2	3	16
Gretor	3	0	0	0	0	0	4	2	6
Hamlin	2	1	8	4	0	0	3	0	16
Holderton	3	0	0	0	0	0	0	3	3
Hornell	2	2	1	0	5	1	1	4	14
Hudson	2	6	1	3	1	4	0	0	15
Ischua	3	0	0	0	0	0	1	5	6
Ivory	2	0	18	0	0	0	0	0	18
Lamson	4	1	5	0	0	1	2	0	9
Langford	3	22	12	4	19	6	23	12	98
Mardin	3	69	63	46	144	45	86	65	518
Middlebury	3	2	25	14	8	17	20	21	107
Minoa	4	0	0	0	0	0	0	10	10
Mongaup	3	7	0	2	1	2	3	1	16
Napoli	3	0	0	0	0	0	1	6	7
Niagara	3	7	21	11	3	1	5	10	58

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Name	SMG	1995	1996	1997	1998	1999	2000	2001	Total
Olean	2	0	0	0	0	1	0	4	5
Orpark	2	0	0	0	0	0	1	0	1
Pawling	4	2	0	0	0	0	0	0	2
Raynham	3	0	0	0	0	0	0	2	2
Red Hook	4	2	5	15	6	2	14	9	53
Rhinebeck	2	15	1	7	7	1	2	2	35
Rushford	3	0	0	0	0	0	0	1	1
Salamanca	3	0	0	0	0	0	2	1	3
Schuyler	3	0	2	0	0	0	0	5	7
Scio	3	1	4	1	5	0	5	9	25
Swormville	1	9	6	17	8	13	22	16	91
Teel	2	6	23	12	8	1	11	7	68
Tioga	3	41	20	13	14	13	15	10	126
Towerville	3	0	0	0	1	5	0	0	6
Unadilla	3	11	4	19	22	8	19	17	100
Valois	3	21	8	19	68	22	19	22	179
Varysburg	2	0	0	1	0	0	3	0	4
Volusia	3	68	54	21	78	37	42	24	324
Wakeville	3	0	3	0	2	0	0	1	6
Wallington	3	0	2	1	0	0	0	5	8
Wayland	2	5	1	2	4	1	1	1	15
Wharton	2	4	0	0	1	0	0	0	5
Willdin	3	0	0	0	0	0	1	0	1
Unknown	-	25	13	14	13	32	12	12	121
total	-	528	416	408	706	376	548	505	3487

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	0	2	6	9	5	5	27
1996	0	1	3	3	7	2	3	4	23
1997	0	0	1	6	4	5	3	7	26
1998	0	0	2	5	4	4	2	1	18
1999	0	0	0	2	0	2	0	2	6
2000	0	0	1	1	2	4	4	5	17
2001	0	1	0	0	0	0	1	7	9
Total	0	2	7	19	23	26	18	31	126

	1995	1996	1997	1998	1999	2000	2001	
Lowest:	3.4	1.7	2.7	2.2	3.1	2.2	1.7	
Highest:	34.8	19.7	9.9	7.4	11.7	10.7	13.5	
Mean:	7.4	5.5	5.5	4.6	6.3	6.0	8.2	
Median:	5.5	4.6	5.2	4.7	5.3	6.0	7.6	

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	0	7	22	33	19	19	100
1996	0	4	13	13	30	9	13	17	100
1997	0	0	4	23	15	19	12	27	100
1998	0	0	11	28	22	22	11	6	100
1999	0	0	0	33	0	33	0	33	100
2000	0	0	6	6	12	24	24	29	100
2001	0	11	0	0	0	0	11	78	100
Total	0	2	6	15	18	21	14	25	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	27	84	198	122	64	22	528
1996	0	7	33	82	165	105	19	5	416
1997	0	8	28	87	157	90	28	10	408
1998	0	14	45	120	268	184	58	17	706
1999	0	4	35	91	138	73	21	14	376
2000	0	19	54	102	222	117	28	6	548
2001	1	14	48	110	168	121	32	11	505
Total	1	77	270	676	1316	812	250	85	3487

	1995	1996	1997	1998	1999	2000	2001	
Lowest:	1.1	1.3	1.3	1.1	1.6	1.1	0.9	
Highest:	33.2	8.1	8.2	10.6	12.5	11.5	10.2	
Mean:	4.9	4.4	4.5	4.6	4.4	4.3	4.4	
Median:	4.7	4.5	4.6	4.7	4.3	4.4	4.4	

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	2	5	16	38	23	12	4	100
1996	0	2	8	20	40	25	5	1	100
1997	0	2	7	21	38	22	7	2	100
1998	0	2	6	17	38	26	8	2	100
1999	0	1	9	24	37	19	6	4	100
2000	0	3	10	19	41	21	5	1	100
2001	0	3	10	22	33	24	6	2	100
Total	0	2	8	19	38	23	7	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	0	3	7	11	4	2	0	0	0	27
1996	0	0	1	6	3	7	5	1	0	0	23
1997	1	3	4	11	3	3	1	0	0	0	26
1998	0	0	2	3	4	0	8	1	0	0	18
1999	0	1	1	0	1	1	2	0	0	0	6
2000	0	1	2	3	1	5	5	0	0	0	17
2001	0	0	1	1	2	3	2	0	0	0	19
Total	1	5	14	31	25	23	25	2	0	0	126

	1995	1996	1997	1998	1999	2000	2001	
Lowest:	5.0	5.4	4.4	5.1	4.9	4.8	5.4	
Highest:	7.4	7.7	7.3	7.6	7.1	7.4	7.2	
Mean:	-	-	-	-	-	-	-	
Median:	6.0	6.5	5.6	6.6	6.4	6.6	6.6	

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	26	41	15	7	0	0	0	100
1996	0	0	4	26	13	30	22	4	0	0	100
1997	4	12	15	42	12	12	4	0	0	0	100
1998	0	0	11	17	22	0	44	6	0	0	100
1999	0	17	17	0	17	17	33	0	0	0	100
2000	0	6	12	18	6	29	29	0	0	0	100
2001	0	0	11	11	22	33	22	0	0	0	100
Total	1	4	11	25	20	18	20	2	0	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	16	22	89	221	168	11	1	0	0	528
1996	0	3	29	109	183	85	4	3	0	0	416
1997*	0	4	20	105	201	66	11	0	0	0	407
1998*	5	5	27	156	319	171	21	1	0	0	705
1999	0	4	27	72	131	125	16	1	0	0	376
2000	2	0	11	55	161	264	54	1	0	0	548
2001	2	3	25	81	174	175	40	5	0	0	505
Total	9	35	161	667	1390	1054	157	12	0	0	3485

*One sample was not analyzed for pH in 1997 and in 1998, respectively.

	1995	1996	1997	1998	1999	2000	2001	
Lowest:	4.6	4.7	4.5	4.0	4.8	4.2	4.3	
Highest:	7.5	7.6	7.4	7.5	7.9	7.7	7.8	
Mean:	-	-	-	-	-	-	-	
Median:	6.3	6.2	6.1	6.2	6.3	6.5	6.3	

Percent of samples for commercial production within each pH range:

	<4.5	4.5-4.9	5.0-5.4	5.5-5.9	6.0-6.4	6.5-6.9	7.0-7.4	7.5-7.9	8.0-8.4	>8.4	Total
1995	0	3	4	17	42	32	2	0	0	0	100
1996	0	1	7	26	44	20	1	1	0	0	100
1997	0	1	5	26	49	16	3	0	0	0	100
1998	1	1	4	22	45	24	3	0	0	0	100
1999	0	1	7	19	35	33	4	0	0	0	100
2000	0	0	2	10	29	48	10	0	0	0	100
2001	0	1	5	16	34	35	8	1	0	0	100
Total	0	1	5	19	40	30	5	0	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	12	5	6	2	0	0	1	0	1	27
1996	0	9	1	7	2	1	0	1	0	2	23
1997	0	6	5	11	3	0	0	1	0	0	26
1998	0	3	3	6	3	0	0	1	0	2	18
1999	0	1	2	1	1	0	0	0	0	1	6
2000	0	6	2	5	2	0	0	0	1	1	17
2001	0	1	1	2	0	0	0	0	3	2	9
Total	0	38	19	38	13	1	0	4	4	9	126

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

	1995	1996	1997	1998	1999	2000	2001	
Lowest:	1	1	1	2	3	2	1	
Highest:	465	1006	129	444	241	261	290	
Mean:	31	79	22	70	54	40	122	
Median:	4	12	13	15	10	9	152	

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	19	22	7	0	0	4	0	4	100
1996	0	39	4	30	9	4	0	4	0	9	100
1997	0	23	19	42	12	0	0	4	0	0	100
1998	0	17	17	33	17	0	0	6	0	11	100
1999	0	17	33	17	17	0	0	0	0	17	100
2000	0	35	12	29	12	0	0	0	6	6	100
2001	0	11	11	22	0	0	0	0	33	22	100
Total	0	30	15	30	10	1	0	3	3	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	213	157	149	3	0	3	2	0	1	528
1996	0	114	155	141	5	0	0	0	1	0	416
1997	0	72	131	196	6	0	1	1	1	0	408
1998	0	135	260	284	21	4	1	1	0	0	706
1999	0	121	97	144	9	1	1	0	1	2	376
2000	0	140	177	214	12	2	1	1	1	0	548
2001	0	100	159	212	11	4	18	1	0	0	505
Total	0	895	1136	1340	67	11	25	6	4	3	3487

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:	1012	163	162	108	416	166	121	
Mean:	10	9	12	12	13	11	14	
Median:	5	6	9	7	7	7	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	40	30	28	1	0	1	0	0	0	100
1996	0	27	37	34	1	0	0	0	0	0	100
1997	0	18	32	48	1	0	0	0	0	0	100
1998	0	19	37	40	3	1	0	0	0	0	100
1999	0	32	26	38	2	0	0	0	0	1	100
2000	0	26	32	39	1	0	0	0	0	0	100
2001	0	20	31	42	2	1	4	0	0	0	100
Total	0	26	33	38	2	0	1	0	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	1	4	6	11
1996	0	0	1	2	3	6
1997	0	0	1	2	5	8
1998	0	0	0	0	2	2
1999	0	0	0	0	1	1
2000	0	0	0	2	7	9
2001	0	0	0	0	0	0
Total (#)	0	0	3	10	24	37
Total (%)	0	0	8	27	65	100
Soil Management Group 3						
	<45	45-79	80-119	120-199	>199	Total
	Very Low	Low	Medium	High	Very High	
1995	0	0	0	0	2	2
1996	0	0	1	0	0	1
1997	0	1	0	1	5	7
1998	0	0	1	2	3	6
1999	0	0	0	1	1	2
2000	0	0	0	1	4	5
2001	0	0	0	0	2	2
Total (#)	0	1	2	5	17	25
Total (%)	0	4	8	20	68	100

Soil Management Group 4						
	<55	55-99	100-149	150-239	>239	Total
	Very Low	Low	Medium	High	Very High	
1995	0	1	2	3	7	13
1996	0	1	1	2	9	13
1997	0	2	1	3	3	9
1998	0	0	0	3	7	10
1999	0	0	0	1	2	3
2000	0	0	0	2	1	3
2001	0	0	0	1	5	6
Total (#)	0	4	4	15	34	57
Total (%)	0	7	7	26	60	100
Soil Management Group 5						
	<60	60-114	115-164	165-269	>269	Total
	Very Low	Low	Medium	High	Very High	
1995	0	0	0	1	0	1
1996	0	2	1	0	0	3
1997	0	0	1	0	1	2
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	1	0	1
Total (#)	0	2	2	2	1	7
Total (%)	0	29	29	29	14	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	3	8	15	27
1996	0	3	4	4	12	23
1997	0	3	3	6	14	26
1998	0	0	1	5	12	18
1999	0	0	0	2	4	6
2000	0	0	0	5	12	17
2001	0	0	0	2	7	9
Total #	0	7	11	32	76	126

	1995	1996	1997	1998	1999	2000	2001	
Lowest:	72	61	72	102	147	112	190	
Highest:	1252	4750	1283	2211	1358	897	631	
Mean:	344	524	275	385	514	332	457	
Median:	202	235	207	273	296	268	468	

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

Summary (%)	Very Low	Low	Medium	High	Very High	Total
1995	0	4	11	30	56	100
1996	0	13	17	17	52	100
1997	0	12	12	23	54	100
1998	0	0	6	28	67	100
1999	0	0	0	33	67	100
2000	0	0	0	29	71	100
2001	0	0	0	22	78	100
Grand Total	0	6	9	25	60	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	5	4	9
1996	0	0	2	3	1	6
1997	0	3	4	5	5	17
1998	0	0	0	1	7	8
1999	0	0	1	8	4	13
2000	0	0	6	9	7	22
2001	0	0	7	6	3	16
Total (#)	0	3	20	37	31	91
Total (%)	0	3	22	41	34	100
Soil Management Group 2						
	<40	40-69	70-99	100-164	>164	Total
	Very Low	Low	Medium	High	Very High	
1995	0	1	5	16	27	49
1996	0	0	6	15	38	59
1997	0	4	2	7	17	30
1998	0	7	12	21	11	51
1999	0	0	0	6	6	12
2000	0	3	8	10	9	30
2001	0	1	5	9	12	27
Total (#)	0	16	38	84	120	258
Total (%)	0	6	15	33	47	100
Soil Management Group 3						
	<45	45-79	80-119	120-199	>199	Total
	Very Low	Low	Medium	High	Very High	
1995	1	32	89	141	167	430
1996	2	30	59	101	116	308
1997	0	24	60	85	123	292
1998	0	61	138	184	228	611
1999	7	32	65	99	101	304
2000	2	70	94	144	132	442
2001	4	27	90	125	149	395
Total (#)	16	276	595	879	1016	2782
Total (%)	1	10	21	32	37	100

Soil Management Group 4						
	<55	55-99	100-149	150-239	>239	Total
	Very Low	Low	Medium	High	Very High	
1995	0	1	4	3	1	9
1996	0	5	5	8	4	22
1997	2	6	18	18	11	55
1998	0	1	6	10	5	22
1999	4	0	2	3	2	11
2000	2	9	15	10	6	42
2001	0	8	11	11	14	44
Total (#)	8	30	61	63	43	205
Total (%)	4	15	30	31	21	100
Soil Management Group 5						
	<60	60-114	115-164	165-269	>269	Total
	Very Low	Low	Medium	High	Very High	
1995	0	1	1	1	0	3
1996	3	2	1	1	1	8
1997	0	0	0	0	0	0
1998	0	0	0	1	0	1
1999	0	1	2	1	0	4
2000	0	0	0	0	0	0
2001	4	2	4	1	0	11
Total (#)	7	6	8	5	1	27
Total (%)	26	22	30	19	4	100
Soil Management Group 6						
	<60	60-114	115-164	165-269	>269	Total
	Very Low	Low	Medium	High	Very High	
1995	0	0	1	2	0	3
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	1	2	0	3
Total (%)	0	0	33	67	0	100

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

Summary (#)	Very Low	Low	Medium	High	Very High	Un-known	Total
1995	1	35	100	168	199	25	528
1996	5	37	73	128	160	13	416
1997	2	37	84	115	156	14	408
1998	0	69	156	217	251	13	706
1999	11	33	70	117	113	32	376
2000	4	82	123	173	154	12	548
2001	8	38	117	152	178	12	505
Grand Total	31	331	723	1070	1211	121	3487

	1995	1996	1997	1998	1999	2000	2001	
Lowest:	40	34	43	48	1	35	12	
Highest:	9164	2003	914	1306	1788	1329	911	
Mean:	223	209	202	194	200	185	207	
Median:	163	166	164	155	148	139	158	

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

% summary	Very Low	Low	Medium	High	Very High	Un-known	Total
1995	0	7	19	32	38	5	100
1996	1	9	18	31	38	3	100
1997	0	9	21	28	38	3	100
1998	0	10	22	31	36	2	100
1999	3	9	19	31	30	9	100
2000	1	15	22	32	28	2	100
2001	2	8	23	30	35	2	100
Grand Total	1	9	21	31	35	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	1	0	3	23	27
1996	0	0	0	3	20	23
1997	0	1	2	5	18	26
1998	0	0	0	2	16	18
1999	0	0	1	0	5	6
2000	0	0	0	2	15	17
2001	0	0	0	0	9	9
Total	0	2	3	15	106	126

	1995	1996	1997	1998	1999	2000	2001	
Lowest:	31	146	58	180	96	162	246	
Highest:	6293	1858	555	1111	1185	1617	920	
Mean:	533	527	277	466	437	574	586	
Median:	307	424	269	424	343	475	513	

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	4	0	11	85	100
1996	0	0	0	13	87	100
1997	0	4	8	19	69	100
1998	0	0	0	11	89	100
1999	0	0	17	0	83	100
2000	0	0	0	12	88	100
2001	0	0	0	0	100	100
Total	0	2	2	12	84	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	10	8	52	458	528
1996	0	1	8	31	376	416
1997	0	3	7	25	373	408
1998	0	6	8	47	645	706
1999	0	4	5	21	346	376
2000	0	1	7	23	517	548
2001	0	4	5	32	464	505
Total	0	29	48	231	3179	3487

	1995	1996	1997	1998	1999	2000	2001	
Lowest:	21	62	54	30	51	58	32	
Highest:	2294	908	904	1077	909	1124	997	
Mean:	404	408	411	407	433	454	423	
Median:	392	410	419	395	425	446	424	

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	2	10	87	100
1996	0	0	2	7	90	100
1997	0	1	2	6	91	100
1998	0	1	1	7	91	100
1999	0	1	1	6	92	100
2000	0	0	1	4	94	100
2001	0	1	1	6	92	100
Total	0	1	1	7	91	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	19	8	27
1996	20	3	23
1997	18	8	26
1998	14	4	18
1999	5	1	6
2000	16	1	17
2001	9	0	9
Total	101	25	126

Percentages:

	0-49	>49	Total
	Normal	Excessive	
	70	30	100
	87	13	100
	69	31	100
	78	22	100
	83	17	100
	94	6	100
	100	0	100
	80	20	100

	1995	1996	1997	1998	1999	2000	2001	
Lowest:	3	2	4	2	4	2	4	
Highest:	127	97	192	222	131	99	49	
Mean:	43	23	47	41	45	22	12	
Median:	36	11	24	16	19	16	5	

49.2 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	482	46	528
1996	394	22	416
1997	383	25	408
1998	664	42	706
1999	351	25	376
2000	526	22	548
2001	487	18	505
Total	3287	200	3487

Percentages:

	0-49	>49	Total
	Normal	Excessive	
	91	9	100
	95	5	100
	94	6	100
	94	6	100
	93	7	100
	96	4	100
	96	4	100
	94	6	100

	1995	1996	1997	1998	1999	2000	2001	
Lowest:	2	3	2	2	1	2	2	
Highest:	228	183	165	275	148	254	281	
Mean:	23	21	18	19	18	16	16	
Median:	15	15	13	12	11	10	10	

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	23	4	27
1996	22	1	23
1997	21	5	26
1998	16	2	18
1999	6	0	6
2000	17	0	17
2001	9	0	9
Total	114	12	126

Percentages:

0-99	>99	Total
Normal	Excessive	
85	15	100
96	4	100
81	19	100
89	11	100
100	0	100
100	0	100
100	0	100
90	10	100

	1995	1996	1997	1998	1999	2000	2001	
Lowest:	11	8	14	21	34	10	15	
Highest:	354	112	541	290	80	85	91	
Mean:	66	45	90	66	56	47	42	
Median:	43	34	63	47	50	35	37	

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	515	13	528
1996	410	6	416
1997	399	9	408
1998	694	12	706
1999	365	11	376
2000	541	7	548
2001	491	14	505
Total	3415	72	3487

Percentages:

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

	1995	1996	1997	1998	1999	2000	2001	
Lowest:	4	6	8	9	6	3	5	
Highest:	654	220	249	264	214	262	168	
Mean:	37	40	37	36	36	30	40	
Median:	30	35	31	32	29	26	33	

11. Zinc

11.1 Samples for Home and Garden

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

Total number of samples:					Percentages:				
	<0.5	0.5-1.0	>1	Total	<0.5	0.5-1.0	>1	Total	
	Low	Medium	High		Low	Medium	High		
1995	0	3	24	27	0	11	89	100	
1996	1	2	20	23	4	9	87	100	
1997	0	3	23	26	0	12	88	100	
1998	0	0	18	18	0	0	100	100	
1999	0	1	5	6	0	17	83	100	
2000	0	1	16	17	0	6	94	100	
2001	0	1	8	9	0	11	89	100	
Total	1	11	114	126	1	9	90	100	

	1995	1996	1997	1998	1999	2000	2001	
Lowest:	0.8	0.3	0.6	1.1	1.0	1.0	1.0	
Highest:	1216.9	47.3	74.3	11.7	33.5	34.7	33.6	
Mean:	49.7	7.8	11.6	4.3	8.3	7.1	10.7	
Median:	2.5	2.5	3.4	2.8	4.1	3.5	8.4	

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	25	157	346	528
1996	5	162	249	416
1997	11	102	295	408
1998	17	216	473	706
1999	29	83	264	376
2000	13	167	368	548
2001	14	107	384	505
Total	114	994	2379	3487

Percentages:

<0.5	0.5-1.0	>1	Total
Low	Medium	High	
5	30	66	100
1	39	60	100
3	25	72	100
2	31	67	100
8	22	70	100
2	30	67	100
3	21	76	100
3	29	68	100

	1995	1996	1997	1998	1999	2000	2001	
Lowest:	0.1	0.3	0.3	0.1	0.1	0.1	0.1	
Highest:	142.8	22.6	14.7	72.0	60.7	52.7	60.8	
Mean:	2.3	1.7	1.8	2.3	3.6	2.1	2.4	
Median:	1.3	1.2	1.4	1.3	1.6	1.3	1.6	

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
BLU/BLB	Blueberries
CEM	Cemetery
END	Endives
FAR	Fairway
FLA	Flowering Annuals
GPA	Grapes, American
GPF	Grapes, French
GRA	Grapes
GEN	Green
HRB	Herbs
IDL	Idle land
LAW	Lawn
LET	Lettuce
MIX/MVG	Mixed vegetables
MML	Muskmelon
ONP	Onions, Transplanted
ONS	Onions, Seeded
OTH	Other
PAR	Pears
PEA	Peach
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
SQS	Squash, Summer
SQW	Squash, Winter
STE	Strawberries, Ever
STR	Strawberries (homeowners)
STS	Strawberries, Spring

Crop Code	Crop Description
SUB	Summer flowering bulbs
SUN	Sunflowers
SWC	Sweet corn
TOM	Tomatoes
TRE	Christmas trees, Established
TRF	Tree fruits
TRT	Christmas trees, Topdressing