

Ketterings, Q.M., H. Krol, W.S. Reid and P. Carey (2004). Sullivan County Soil Sample Survey 1995-2001. CSS Extension Bulletin E04-30. 38 pages.

# Soil Sample Survey

# Sullivan Co.

**Samples analyzed by CNAL in 1995-2001**

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**Summary compiled by**

**Quirine M. Ketterings, Hettie Krol, W. Shaw Reid and Peter Carey**

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

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Summary compiled by

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# 1. County Introduction

Sullivan County is located in the southeast portion of New York State. It is bordered by Orange County to the south, Delaware County to the north and northwest, Ulster County to the east and northeast, and the Delaware River and Pennsylvania to the west and southwest. The county is 986 square miles, approximately 631,040 acres. Sullivan County has a wide range of elevations ranging from less than 400 feet above sea level to more than 3000 feet in the Catskill Mountains in the northern part of the county. The generally topography of the county is hilly with many moderately steep slopes, to extreme in the northern part of the county. Most of the agriculture in the county is in the middle elevations between 1000 and 2000 feet of elevation on gentle to moderately steep hills. Sullivan County typically has shorter growing seasons compared to neighboring counties to the south and east due to the higher elevation. Due to the slopes and the shorter growing season a trend in grass-based farming has been developing and gaining momentum. During the last glacial period Sullivan County was completely covered. As a result most of the county is covered in glacial till which ranges from only a few inches of soil on hilltops to some very deep soils in valleys. With this glacial till the soils are very rocky and machinery wear tends to be high. This has also contributed to the shift towards grass-based farming.

In the past agriculture was the second largest industry in the county next to tourism. However, in recent years agriculture has passed tourism to become the number one industry in the county. According to the 2002 Census of Agriculture the number of farms in the county dropped from 383 in 1997 to 381 for 2002. However, the number of acres in farms increased from 61,060 acres in 1997 to 63,614 acres in 2002. In 2002, 210 farms harvested 29,107 tons of hay from 20,692 acres; 49 farms harvested 20,280 tons of haylage from 5,283 acres. The corn grown in the county is usually for silage, but some corn for grain is harvested. In 2002, 6 farms harvested 26,627 bushels of corn on 370 acres; 30 farms harvested 11,970 tons of silage from 1,324 acres.

Recently Sullivan County has seen an increase in the number of small farms specializing in livestock production and/or vegetable production. In 1997 there were 25 vegetable farms on a total of 146 acres while in 2002 there were 28 vegetable farms on 137 acres. In 2002 there were 8,900 head of cattle and calves on 155 farms, 875 head of beef cows

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on 75 farms, and 3,948 head of milk cows on 53 farms. The number of non-cattle livestock in 2002 was; 206 hogs and pigs on 19 farms, and 1,010 sheep and lambs on 48 farms.

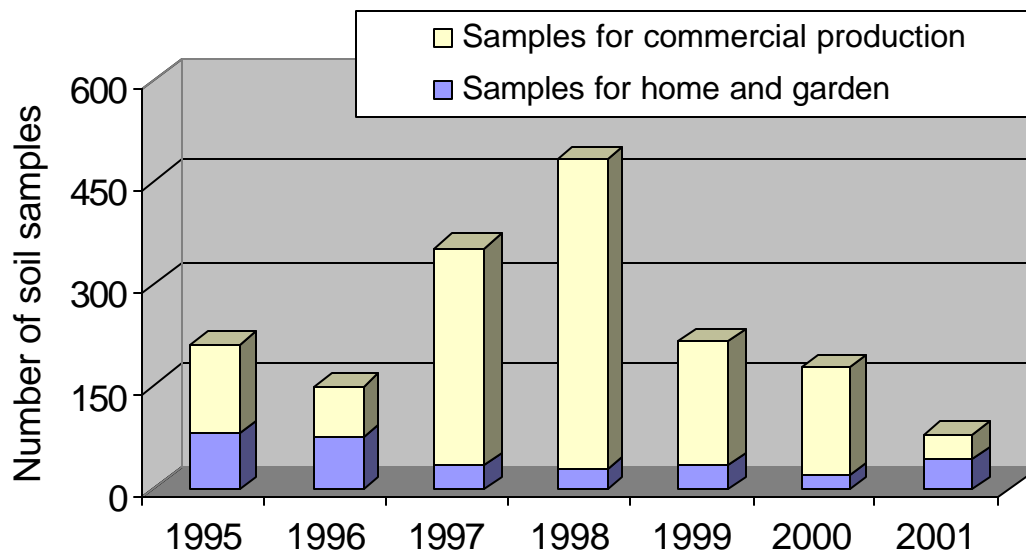
The poultry industry, which used to be one of the largest in the state, has been declining in size although according to the recent census the number of poultry farms has increased from 53 in 1997 to 83 in 2002. Much of this growth can be attributed to small farm operators beginning specialty and contract meat operations. Fifty-five of the farms had between 1 and 49 birds, while 2 had over 100,000 birds. With the history of Sullivan County as a strong poultry producing county most of the currently farmed agricultural land has had a history of chicken manure. Poultry manure is still regularly spread on a contract basis from the remaining poultry farms on nearby livestock and dairy farms.

Sullivan County is on the verge of a potentially large population and housing boom. This expansion is due to a decrease in developable land in counties south of Sullivan County. Another unknown impact will be the potential development of up to three casinos in the county, which could push tourism back into the number one industry in the county.

Peter Carey, Cornell Cooperative Extension of Sullivan County

## 2. General Survey Summary

This survey summarizes the soil test results from Sullivan 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 1672. Of these 1672 samples, 1352 (81%) were submitted to obtain fertilizer recommendations for commercial production while 320 samples (19%) were submitted as home and garden samples.



<b>Homeowners</b>		<b>Commercial</b>		<b>Total</b>
1995	82	1995	128	210
1996	75	1996	75	150
1997	35	1997	319	354
1998	28	1998	455	483
1999	36	1999	180	216
2000	21	2000	158	179
<u>2001</u>	<u>43</u>	<u>2001</u>	<u>37</u>	<u>80</u>
<b>Total</b>	<b>320</b>	<b>Total</b>	<b>1352</b>	<b>1672</b>

Forty-seven percent of the home and garden samples were submitted to request fertilizer recommendations for lawns while 29% came from mixed vegetable gardens. Other samples were sent in to request recommendations for azaleas, athletic fields, flowering annuals, grapes, perennials, raspberries, ornamentals adapted to pH 6.0 to 7.5, and tree fruits. People submitting samples for commercial production requested fertilizer recommendations for hay production (59%), corn silage or grain production (15%), clover/grass or clover/legume or birdsfoot trefoil mixtures (7%), pastures (6%), or alfalfa, alfalfa/grass or alfalfa/trefoil mixtures (4%), while the remainder of the samples was sent to the laboratory to request recommendations for other crops including sorghum sudangrass hay and sweet corn.

Home and garden samples in Sullivan County were silty (27%), silt loams (33%), sandy loams (24%), 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, 88% belonged to soil management group 3 while 8% was classified group 4. The remainder was of unknown classification. The three most common soil series were Wellsboro (42%), Oquaga (15%), and Lackawanna (9%). These soils represent 25% (Wellsboro), 5% (Oquaga), and 3% (Lackawanna) of the 631,040 acres in the county.

Organic matter levels, as measured by loss on ignition, ranged from 1% to over 64% (most likely an organic soil or amendment) with median values ranging from 3.0 to 4.0% organic matter for home and garden samples and from 3.8 to 4.3% for samples submitted for commercial production. Fifty-six percent of the home and garden samples had between 2.0 and 4.9% organic matter with 20% testing between 2.0 and 2.9% organic matter, 19% between 3.0 and 3.9% organic matter and 17% between 4.0 and 4.9% organic matter. Twenty-three percent of the soils submitted for home and garden tested >4.9% in organic matter while 21% of the samples had less than 2.0% organic matter. Of the samples submitted for commercial production, 34% contained between 3.0 and 3.9% organic matter, 33% tested between 4.0 and 4.9% while 15% had organic matter concentrations of 5.0-5.9%. Thirteen percent had less than 3.0% organic matter while 6% of the samples had 6.0% or more organic matter. In total, 51% of the samples had organic matter levels between 4.0 and 6.9%.

Soil pH in water (1:1 extraction ratio) varied from pH 4.3 to pH 7.7 with the median for home and garden samples ranging from pH 5.9 to pH 6.6 and for samples submitted for commercial production ranging from pH 5.7 to pH 6.0. Of the home and garden samples, 60% tested between pH 6.0 and 7.4. For the samples submitted for commercial production, this was 43% while 52% 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, 11% tested low, 17% tested medium, 40% tested high and 32% tested very high.



This meant that 72% tested high or very high in P. Of the samples submitted for commercial production, 17% tested low in P. Twenty-two percent were medium in P, 41% tested high while 20% of the samples were very high in P. In total, 61% 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, 7% was classified as very low, 16% were low in potassium, 15% tested medium, another 24% were high and 38% were very high in potassium. For samples submitted for commercial production, 3% were very low in K, 22% tested low, 26% tested medium, 22% tested high and 24% 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 10 to 2028 lbs Mg/acre (Morgan extraction). There were only 5 samples in the commercial agriculture datasets that tested very low in Mg. Most soils tested high or very high for Mg (74% of the homeowner soils and 86% of the soils of the commercial growers). Fifteen percent of the home and garden samples and 5% of the commercial growers' soils tested low in Mg while 11% (home and garden) and 9% (commercial) tested medium in Mg availability.

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. Eighty-eight percent of the home and garden samples were classified as normal in Fe while 80% of the commercial samples tested in the normal range for Fe. Similarly, almost all soils (94% of the home and garden samples and 93% 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. Seven percent of the commercial samples and 6% of the home and garden samples were excessive in Mn. Soils with less than 0.5 lb zinc per acre in the Morgan extraction are classified as low in Zn. Medium testing soils have between 0.5 and 1 lb of Morgan extractable Zn per acre. If more than 1 lb of Zn/acre is extracted with the Morgan solution, the soil tests high in Zn. For the home and garden samples, four samples tested low for zinc while 35 (11%) tested medium and 281 (88%) tested high for zinc. Of the samples for commercial production, 1% tested low in zinc, 7% tested medium while 91% 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.

### 3. Cropping Systems

#### 3.1 Samples for Home and Garden

Crops for which recommendations are requested by homeowners:

	1995	1996	1997	1998	1999	2000	2001	Total	%
ALG	2	1	0	0	0	0	0	3	1
ATF	0	2	1	0	0	0	2	5	2
APR	1	0	0	0	0	0	0	1	0
BLU	2	0	0	0	0	2	0	4	1
FLA	0	0	0	0	0	1	2	3	1
GEN	1	0	0	0	0	0	0	1	0
GPA	0	0	0	0	1	0	0	1	0
GRA	0	1	1	1	3	0	0	6	2
HRB	0	0	1	0	0	1	0	2	1
LAW	46	44	16	13	11	4	16	150	47
MVG	13	17	12	12	13	11	15	93	29
OTH	0	0	0	0	1	1	2	4	1
PER	5	3	2	1	6	0	1	18	6
PTO	1	0	0	0	0	0	0	1	0
ROS	0	0	0	0	0	1	0	1	0
RSP	2	1	0	0	0	0	0	3	1
SAG	2	3	2	0	1	0	1	9	3
STR	1	0	0	0	0	0	0	1	0
TOM	1	0	0	0	0	0	0	1	0
TRF	5	3	0	1	0	0	0	9	3
Unknown	0	0	0	0	0	0	4	4	1
Total	82	75	35	28	36	21	43	320	100

Notes:

See Appendix for Cornell crop codes.

### 3.2 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	3	1	0	0	0	8	0	12	1
AGE/AGT	8	5	17	3	1	2	0	36	3
ALE/ALT	7	3	0	2	0	1	0	13	1
BCE/BCT	4	7	7	0	1	1	0	20	1
BGE/BGT	7	4	7	2	4	2	1	27	2
BLB	0	1	0	1	0	0	0	2	0
BTE	3	0	0	1	0	1	0	5	0
BUK	1	1	0	2	1	0	0	5	0
CBS	2	0	0	0	0	0	0	2	0
CGE/CGT	7	8	0	9	0	2	4	30	2
CLE/CLT	3	4	2	12	4	6	0	31	2
COG/COS	3	2	96	69	6	21	1	198	15
GIE/GIT	2	0	0	0	1	5	1	9	1
GPV	0	0	0	0	1	0	0	1	0
GRE/GRT	52	24	180	330	123	61	17	787	58
IDL	1	0	1	3	2	3	0	10	1
MIX	4	0	0	1	1	3	0	9	1
OAS	0	1	0	0	0	0	0	1	0
ONS	1	0	1	0	0	0	0	2	0
OTH	0	1	0	2	4	0	0	7	1
PGE/PGT	0	1	1	0	2	2	3	9	1
PLE/PLT	2	0	0	0	0	3	0	5	0
PNE/PNT	12	7	5	5	25	16	4	74	5
POT	0	0	0	1	0	4	0	5	0
PUM	0	2	0	1	0	2	1	6	0
RYC	0	0	0	0	2	0	0	2	0
RYS	0	0	0	1	0	0	0	1	0
SOG	0	0	0	1	0	0	0	1	0
SOY	0	0	0	0	0	0	1	1	0
SSH	0	0	0	0	0	12	0	12	1
SWC	2	3	2	2	0	0	2	11	1
TRE/TRT	3	0	0	2	0	1	0	6	0
WHT	0	0	0	0	2	0	0	2	0
Unknown	1	0	0	5	0	2	2	10	1
Total	128	75	319	455	180	158	37	1352	100

## 4. Soil Types

### 4.1 Samples for Home and Garden

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

	1995	1996	1997	1998	1999	2000	2001	Total	%
SMG 1 (clayey)	0	0	0	0	0	0	0	0	0
SMG 2 (silty)	25	30	7	5	6	5	7	85	27
SMG 3 (silt loam)	35	20	16	7	10	3	15	106	33
SMG 4 (sandy loam)	12	14	11	11	12	7	10	77	24
SMG 5 (sandy)	10	11	1	5	8	6	11	52	16
SMG 6 (mucky)	0	0	0	0	0	0	0	0	0
Total	82	75	35	28	36	21	43	320	100

## 4.2 Samples for Commercial Production

Soil series for samples submitted for commercial production:

Name	SMG	1995	1996	1997	1998	1999	2000	2001	Total	%
Arnot	3	8	1	21	14	7	4	3	58	4
Barbour	3	13	3	9	14	6	5	0	50	4
Bash	3	0	0	0	1	0	1	0	2	0
Chenango	3	2	1	4	1	1	0	0	9	1
Cheshire	4	3	0	0	6	1	1	0	11	1
Elka	4	0	0	0	2	0	1	0	3	0
Hawksnest	3	2	0	0	0	1	2	2	7	1
Lackawanna	3	15	3	22	43	18	14	1	116	9
Lewbeach	3	0	0	0	2	2	1	1	6	0
Lordstown	3	2	0	0	0	0	0	0	2	0
Manlius	3	0	0	0	1	0	0	0	1	0
Mongaup	3	4	0	8	11	9	2	0	34	3
Morris	3	1	3	12	1	3	6	0	26	2
Onteora	3	0	0	0	0	0	2	0	2	0
Oquaga	3	7	4	65	77	19	24	8	204	15
Otisville	4	2	2	0	0	1	0	0	5	0
Pompton	4	0	0	0	0	0	1	0	1	0
Pope	4	2	0	2	4	0	0	0	8	1
Red Hook	4	0	0	0	1	0	0	0	1	0
Riverhead	4	1	0	2	2	0	1	0	6	0
Scio	3	0	0	0	1	0	1	0	2	0
Scriba	4	0	2	0	7	2	1	0	12	1
Swartswood	4	6	2	0	7	3	11	1	30	2
Tuller	3	0	0	0	0	1	0	0	1	0
Tunkhannock	3	5	1	16	17	2	2	3	46	3
Unadilla	3	0	0	0	1	0	0	0	1	0
Valois	3	0	0	0	0	2	0	0	2	0
Wellsboro	3	39	41	136	205	79	53	16	569	42
Willowemoc	3	6	1	3	12	13	17	2	54	4
Wurtsboro	4	8	7	0	20	9	1	0	45	3
Unknown	-	2	4	19	5	1	7	0	38	3
Total	-	128	75	319	455	180	158	37	1352	100

## 5. Organic Matter

### 5.1 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	1	10	15	13	19	12	5	7	82
1996	3	17	21	12	7	7	3	5	75
1997	1	10	5	5	7	3	1	3	35
1998	2	6	5	6	4	3	0	2	28
1999	5	2	7	7	6	5	1	3	36
2000	0	0	2	9	2	2	1	5	21
2001	7	4	10	8	9	2	1	2	43
Total	19	49	65	60	54	34	12	27	320

	1995	1996	1997	1998	1999	2000	2001	
Lowest:	0.4	0.1	0.8	0.5	0.1	2.1	0.2	
Highest:	64.0	14.4	10.4	11.8	10.8	9.2	22.5	
Mean:	4.8	3.6	3.6	3.5	3.8	4.9	3.5	
Median:	4.0	2.8	3.6	3.3	3.5	3.9	3.0	

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

	<1%	1.0-1.9	2.0-2.9	3.0-3.9	4.0-4.9	5.0-5.9	6.0-6.9	>6.9	Total
1995	1	12	18	16	23	15	6	9	100
1996	4	23	28	16	9	9	4	7	100
1997	3	29	14	14	20	9	3	9	100
1998	7	21	18	21	14	11	0	7	100
1999	14	6	19	19	17	14	3	8	100
2000	0	0	10	43	10	10	5	24	100
2001	16	9	23	19	21	5	2	5	100
Total	6	15	20	19	17	11	4	8	100

## 5.2 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	8	20	34	35	19	8	2	128
1996	1	7	10	24	22	8	2	1	75
1997	0	8	20	103	109	59	16	4	319
1998	3	13	38	189	152	46	10	4	455
1999	2	7	17	49	62	31	6	6	180
2000	1	7	11	49	45	31	9	5	158
2001	0	0	3	10	15	5	3	1	37
Total	9	50	119	458	440	199	54	23	1352

	1995	1996	1997	1998	1999	2000	2001	
Lowest:	0.5	0.9	1.4	0.5	0.8	0.6	2.0	
Highest:	13.1	12.8	9.8	11.9	12.3	18.9	7.3	
Mean:	4.0	3.8	4.3	3.9	4.3	4.3	4.4	
Median:	4.0	3.8	4.2	3.9	4.2	4.2	4.3	

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	2	6	16	27	27	15	6	2	100
1996	1	9	13	32	29	11	3	1	100
1997	0	3	6	32	34	18	5	1	100
1998	1	3	8	42	33	10	2	1	100
1999	1	4	9	27	34	17	3	3	100
2000	1	4	7	31	28	20	6	3	100
2001	0	0	8	27	41	14	8	3	100
Total	1	4	9	34	33	15	4	2	100



## 6. pH

### 6.1 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	2	7	5	10	11	30	13	4	0	0	82
1996	0	4	3	12	19	19	15	3	0	0	75
1997	0	2	10	7	7	8	1	0	0	0	35
1998	1	3	3	3	6	9	2	1	0	0	28
1999	1	5	8	4	6	4	6	2	0	0	36
2000	1	0	1	4	5	6	3	1	0	0	21
2001	0	2	4	13	7	10	6	1	0	0	43
Total	5	23	34	53	61	86	46	12	0	0	320

	1995	1996	1997	1998	1999	2000	2001	
Lowest:	4.0	4.7	4.8	4.3	4.3	4.3	4.7	
Highest:	7.7	7.6	7.0	7.5	7.7	7.5	7.5	
Mean:	-	-	-	-	-	-	-	
Median:	6.6	6.4	5.9	6.3	5.9	6.4	6.0	

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	2	9	6	12	13	37	16	5	0	0	100
1996	0	5	4	16	25	25	20	4	0	0	100
1997	0	6	29	20	20	23	3	0	0	0	100
1998	4	11	11	11	21	32	7	4	0	0	100
1999	3	14	22	11	17	11	17	6	0	0	100
2000	5	0	5	19	24	29	14	5	0	0	100
2001	0	5	9	30	16	23	14	2	0	0	100
Total	2	7	11	17	19	27	14	4	0	0	100

## 6.2 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	1	13	25	27	26	20	13	3	0	0	128
1996	1	5	20	17	17	11	4	0	0	0	75
1997	1	6	50	100	92	58	11	1	0	0	319
1998	1	15	68	182	126	50	13	0	0	0	455
1999	0	8	51	68	27	16	8	2	0	0	180
2000	0	3	23	53	30	23	21	5	0	0	158
2001	0	6	5	10	5	8	3	0	0	0	37
Total	4	56	242	457	323	186	73	11	0	0	1352

	1995	1996	1997	1998	1999	2000	2001	
Lowest:	4.4	4.3	4.4	4.2	4.5	4.7	4.6	
Highest:	7.7	7.3	7.5	7.4	7.6	7.7	7.4	
Mean:	-	-	-	-	-	-	-	
Median:	5.9	5.8	6.0	5.9	5.7	5.9	5.8	

Percent of samples for commercial production within each pH range:

	<4.5	4.5-4.9	5.0-5.4	5.5-5.9	6.0-6.4	6.5-6.9	7.0-7.4	7.5-7.9	8.0-8.4	>8.4	Total
1995	1	10	20	21	20	16	10	2	0	0	100
1996	1	7	27	23	23	15	5	0	0	0	100
1997	0	2	16	31	29	18	3	0	0	0	100
1998	0	3	15	40	28	11	3	0	0	0	100
1999	0	4	28	38	15	9	4	1	0	0	100
2000	0	2	15	34	19	15	13	3	0	0	100
2001	0	16	14	27	14	22	8	0	0	0	100
Total	0	4	18	34	24	14	5	1	0	0	100

## 7. Phosphorus

### 7.1 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	11	7	33	9	2	2	4	4	10	82
1996	0	3	8	39	6	2	0	4	3	10	75
1997	0	3	9	17	1	2	1	0	0	2	35
1998	0	3	5	9	4	0	2	1	1	3	28
1999	0	5	12	10	0	0	1	2	0	6	36
2000	0	1	2	7	2	0	0	3	2	4	21
2001	0	9	10	14	0	1	2	2	3	2	43
Total	0	35	53	129	22	7	8	16	13	37	320

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

	1995	1996	1997	1998	1999	2000	2001	
Lowest:	1	2	1	2	2	1	1	
Highest:	1122	600	504	565	559	670	410	
Mean:	84	86	45	73	76	137	52	
Median:	23	26	12	29	9	44	10	

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	13	9	40	11	2	2	5	5	12	100
1996	0	4	11	52	8	3	0	5	4	13	100
1997	0	9	26	49	3	6	3	0	0	6	100
1998	0	11	18	32	14	0	7	4	4	11	100
1999	0	14	33	28	0	0	3	6	0	17	100
2000	0	5	10	33	10	0	0	14	10	19	100
2001	0	21	23	33	0	2	5	5	7	5	100
Total	0	11	17	40	7	2	3	5	4	12	100

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

## 7.2 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	27	30	41	5	2	5	4	1	13	128
1996	0	19	18	25	5	2	1	0	2	3	75
1997	0	30	66	135	26	17	5	15	6	19	319
1998	0	49	102	222	23	21	6	17	4	11	455
1999	0	59	34	62	7	4	1	1	1	11	180
2000	0	35	32	54	3	5	3	4	1	21	158
2001	0	7	10	9	2	1	1	3	3	1	37
Total	0	226	292	548	71	52	22	44	18	79	1352

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:	643	475	682	531	566	844	453	
Mean:	62	33	51	33	39	68	49	
Median:	10	9	20	13	8	14	10	

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	21	23	32	4	2	4	3	1	10	100
1996	0	25	24	33	7	3	1	0	3	4	100
1997	0	9	21	42	8	5	2	5	2	6	100
1998	0	11	22	49	5	5	1	4	1	2	100
1999	0	33	19	34	4	2	1	1	1	6	100
2000	0	22	20	34	2	3	2	3	1	13	100
2001	0	19	27	24	5	3	3	8	8	3	100
Total	0	17	22	41	5	4	2	3	1	6	100

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

## 8. Potassium

### 8.1 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	2	0	1	22	25
1996	1	0	6	14	9	30
1997	0	1	2	2	2	7
1998	0	0	0	3	2	5
1999	0	1	0	2	3	6
2000	0	0	0	4	1	5
2001	0	2	1	3	1	7
Total (#)	1	6	9	29	40	85
Total (%)	1	7	11	34	47	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	9	21	35
1996	2	4	6	3	5	20
1997	0	6	5	2	3	16
1998	0	2	2	2	1	7
1999	1	2	0	3	4	10
2000	0	1	0	0	2	3
2001	2	2	3	2	6	15
Total (#)	5	18	20	21	42	106
Total (%)	5	17	19	20	40	100

Soil Management Group 4						
	<55	55-99	100-149	150-239	>239	Total
	Very Low	Low	Medium	High	Very High	
1995	0	4	2	2	4	12
1996	0	2	1	4	7	14
1997	0	2	1	4	4	11
1998	0	3	1	2	5	11
1999	3	2	2	2	3	12
2000	0	0	1	1	5	7
2001	0	2	2	3	3	10
Total (#)	3	15	10	18	31	77
Total (%)	4	19	13	23	40	100
Soil Management Group 5						
	<60	60-114	115-164	165-269	>269	Total
	Very Low	Low	Medium	High	Very High	
1995	0	4	3	2	1	10
1996	2	1	4	3	1	11
1997	0	0	0	1	0	1
1998	0	3	0	2	0	5
1999	3	2	0	1	2	8
2000	0	0	0	1	5	6
2001	7	3	1	0	0	11
Total (#)	12	13	8	10	9	52
Total (%)	23	25	15	19	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 home and garden samples within each potassium classification:

Summary (#)	Very Low	Low	Medium	High	Very High	Total
1995	0	11	9	14	48	82
1996	5	7	17	24	22	75
1997	0	9	8	9	9	35
1998	0	8	3	9	8	28
1999	7	7	2	8	12	36
2000	0	1	1	6	13	21
2001	9	9	7	8	10	43
Total #	21	52	47	78	122	320

	1995	1996	1997	1998	1999	2000	2001	
Lowest:	51	25	51	59	28	69	16	
Highest:	14792	1374	2903	1380	1621	1400	8525	
Mean:	448	199	256	250	278	453	388	
Median:	229	144	128	145	127	321	102	

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

Summary (%)	Very Low	Low	Medium	High	Very High	Total
1995	0	13	11	17	59	100
1996	7	9	23	32	29	100
1997	0	26	23	26	26	100
1998	0	29	11	32	29	100
1999	19	19	6	22	33	100
2000	0	5	5	29	62	100
2001	21	21	16	19	23	100
Grand Total	7	16	15	24	38	100

## 8.2 Samples for Commercial Production

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

Soil Management Group 1						
	<35	35-64	65-94	95-149	>149	Total
	Very Low	Low	Medium	High	Very High	
1995	0	0	0	0	0	0
1996	0	0	0	0	0	0
1997	0	0	0	0	0	0
1998	0	0	0	0	0	0
1999	0	0	0	0	0	0
2000	0	0	0	0	0	0
2001	0	0	0	0	0	0
Total (#)	0	0	0	0	0	0
Total (%)	-	-	-	-	-	-
Soil Management Group 2						
	<40	40-69	70-99	100-164	>164	Total
	Very Low	Low	Medium	High	Very High	
1995	0	0	0	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 3						
	<45	45-79	80-119	120-199	>199	Total
	Very Low	Low	Medium	High	Very High	
1995	1	15	24	20	44	104
1996	0	18	8	21	11	58
1997	9	68	61	69	89	296
1998	4	88	132	94	83	401
1999	4	20	55	37	47	163
2000	7	38	29	28	32	134
2001	0	11	9	9	7	36
Total (#)	25	258	318	278	313	1192
Total (%)	2	22	27	23	26	100



Ketterings, Q.M., H. Krol, W.S. Reid and P. Carey (2004). Sullivan County Soil Sample Survey 1995-2001. CSS Extension Bulletin E04-30. 38 pages.

Soil Management Group 4						
	<55	55-99	100-149	150-239	>239	Total
	Very Low	Low	Medium	High	Very High	
1995	0	5	10	4	3	22
1996	2	4	5	1	1	13
1997	1	1	0	2	0	4
1998	6	17	10	11	5	49
1999	1	3	8	4	0	16
2000	0	6	5	4	2	17
2001	0	1	0	0	0	1
Total (#)	10	37	38	26	11	122
Total (%)	8	30	31	21	9	100
Soil Management Group 5						
	<60	60-114	115-164	165-269	>269	Total
	Very Low	Low	Medium	High	Very High	
1995	0	0	0	0	0	0
1996	0	0	0	0	0	0
1997	0	0	0	0	0	0
1998	0	0	0	0	0	0
1999	0	0	0	0	0	0
2000	0	0	0	0	0	0
2001	0	0	0	0	0	0
Total (#)	0	0	0	0	0	0
Total (%)	-	-	-	-	-	-
Soil Management Group 6						
	<60	60-114	115-164	165-269	>269	Total
	Very Low	Low	Medium	High	Very High	
1995	0	0	0	0	0	0
1996	0	0	0	0	0	0
1997	0	0	0	0	0	0
1998	0	0	0	0	0	0
1999	0	0	0	0	0	0
2000	0	0	0	0	0	0
2001	0	0	0	0	0	0
Total (#)	0	0	0	0	0	0
Total (%)	-	-	-	-	-	-

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

Summary (#)	Very Low	Low	Medium	High	Very High	Un-known	Total
1995	1	20	34	24	47	2	128
1996	2	22	13	22	12	4	75
1997	10	69	61	71	89	19	319
1998	10	105	142	105	88	5	455
1999	5	23	63	41	47	1	180
2000	7	44	34	32	34	7	158
2001	0	12	9	9	7	0	37
Grand Total	35	295	356	304	324	38	1352

	1995	1996	1997	1998	1999	2000	2001	
Lowest:	33	28	12	21	30	36	50	
Highest:	964	778	1424	2424	1299	799	1051	
Mean:	190	161	190	154	183	149	168	
Median:	118	124	123	112	123	107	108	

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

% summary	Very Low	Low	Medium	High	Very High	Un-known	Total
1995	1	16	27	19	37	2	100
1996	3	29	17	29	16	5	100
1997	3	22	19	22	28	6	100
1998	2	23	31	23	19	1	100
1999	3	13	35	23	27	1	100
2000	4	28	22	20	22	4	100
2001	0	32	24	24	19	0	100
Grand Total	3	22	26	22	24	3	100

## 9. Magnesium

### 9.1 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	10	2	16	54	82
1996	0	4	8	19	44	75
1997	0	4	8	10	13	35
1998	0	6	10	4	8	28
1999	0	11	4	9	12	36
2000	0	1	2	4	14	21
2001	0	13	1	10	19	43
Total	0	49	35	72	164	320

	1995	1996	1997	1998	1999	2000	2001	
Lowest:	20	28	45	28	21	50	31	
Highest:	1954	2664	786	1410	1996	1692	2028	
Mean:	349	346	218	195	230	416	250	
Median:	278	220	158	84	122	299	143	

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	12	2	20	66	100
1996	0	5	11	25	59	100
1997	0	11	23	29	37	100
1998	0	21	36	14	29	100
1999	0	31	11	25	33	100
2000	0	5	10	19	67	100
2001	0	30	2	23	44	100
Total	0	15	11	23	51	100

## 9.2 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	1	15	18	35	59	128
1996	0	9	12	25	29	75
1997	2	7	15	96	199	319
1998	0	10	36	173	236	455
1999	2	12	25	72	69	180
2000	0	9	15	54	80	158
2001	0	3	6	14	14	37
Total	5	65	127	469	686	1352

	1995	1996	1997	1998	1999	2000	2001	
Lowest:	14	21	10	37	14	23	22	
Highest:	1183	717	1148	1289	1428	1170	699	
Mean:	233	221	280	236	220	229	201	
Median:	182	173	242	206	167	200	174	

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

	<20	20-65	66-100	101-199	>199	Total
	Very Low	Low	Medium	High	Very High	
1995	1	12	14	27	46	100
1996	0	12	16	33	39	100
1997	1	2	5	30	62	100
1998	0	2	8	38	52	100
1999	1	7	14	40	38	100
2000	0	6	9	34	51	100
2001	0	8	16	38	38	100
Total	0	5	9	35	51	100

## 10. Iron

### 10.1 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	67	15	82
1996	71	4	75
1997	31	4	35
1998	21	7	28
1999	33	3	36
2000	19	2	21
2001	41	2	43
Total	283	37	320

Percentages:

	0-49	>49	Total
	Normal	Excessive	
	82	18	100
	95	5	100
	89	11	100
	75	25	100
	92	8	100
	90	10	100
	95	5	100
	88	12	100

	1995	1996	1997	1998	1999	2000	2001	
Lowest:	2	1	3	3	1	1	2	
Highest:	271	76	94	200	124	792	89	
Mean:	35	17	22	34	23	57	19	
Median:	10	11	17	13	16	11	11	

## 10.2 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	98	30	128
1996	53	22	75
1997	277	42	319
1998	393	62	455
1999	115	65	180
2000	121	37	158
2001	24	13	37
Total	1081	271	1352

Percentages:

	0-49	>49	Total
	Normal	Excessive	
	77	23	100
	71	29	100
	87	13	100
	86	14	100
	64	36	100
	77	23	100
	65	35	100
	80	20	100

	1995	1996	1997	1998	1999	2000	2001	
Lowest:	2	3	1	2	1	2	2	
Highest:	390	303	248	556	226	634	160	
Mean:	49	42	27	28	45	46	38	
Median:	22	17	15	18	35	23	19	

## 11. Manganese

### 11.1 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	79	3	82	96	4	100
1996	69	6	75	92	8	100
1997	32	3	35	91	9	100
1998	26	2	28	93	7	100
1999	32	4	36	89	11	100
2000	20	1	21	95	5	100
2001	42	1	43	98	2	100
Total	300	20	320	94	6	100

	1995	1996	1997	1998	1999	2000	2001	
Lowest:	6	7	18	12	5	8	2	
Highest:	161	226	152	101	130	176	102	
Mean:	38	44	50	42	51	41	34	
Median:	31	34	40	35	39	34	33	

## 11.2 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	118	10	128
1996	69	6	75
1997	305	14	319
1998	424	31	455
1999	162	18	180
2000	146	12	158
2001	34	3	37
Total	1258	94	1352

Percentages:

	0-99	>99	Total
	Normal	Excessive	
	92	8	100
	92	8	100
	96	4	100
	93	7	100
	90	10	100
	92	8	100
	92	8	100
	93	7	100

	1995	1996	1997	1998	1999	2000	2001	
Lowest:	6	8	5	5	4	5	17	
Highest:	254	838	168	736	181	304	110	
Mean:	46	59	46	50	55	51	52	
Median:	37	36	40	38	49	41	46	



## 12. Zinc

### 12.1 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	1	10	71	82
1996	1	5	69	75
1997	0	4	31	35
1998	0	1	27	28
1999	0	6	30	36
2000	0	0	21	21
2001	2	9	32	43
Total	4	35	281	320

Percentages:

<0.5	0.5-1.0	>1	Total
Low	Medium	High	
1	12	87	100
1	7	92	100
0	11	89	100
0	4	96	100
0	17	83	100
0	0	100	100
5	21	74	100
1	11	88	100

	1995	1996	1997	1998	1999	2000	2001	
Lowest:	0.4	0.4	0.5	1.0	0.6	1.2	0.3	
Highest:	441.6	119.4	33.2	19.6	56.0	69.1	37.9	
Mean:	10.8	10.0	4.4	6.2	8.2	13.1	4.2	
Median:	3.7	4.5	2.7	4.1	4.0	6.2	1.9	

## 12.2 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	4	19	105	128
1996	1	8	66	75
1997	1	11	307	319
1998	4	43	408	455
1999	3	7	170	180
2000	4	11	143	158
2001	0	1	36	37
Total	17	100	1235	1352

Percentages:

<0.5	0.5-1.0	>1	Total
Low	Medium	High	
3	15	82	100
1	11	88	100
0	3	93	100
1	9	90	100
2	4	94	100
3	7	91	100
0	3	97	100
1	7	91	100

	1995	1996	1997	1998	1999	2000	2001	
Lowest:	0.3	0.3	0.4	0.3	0.2	0.1	0.8	
Highest:	51.6	228.2	136.4	67.4	250.9	39.9	23.6	
Mean:	4.5	6.8	4.2	3.0	5.4	4.0	4.2	
Median:	2.6	2.4	2.3	2.1	2.8	2.9	2.6	

## Appendix: Cornell Crop Codes

Crop codes are used in the Cornell Nutrient Analyses Laboratory.

Crop Code	Crop Description
<b>Alfalfa</b>	
ABE	Alfalfa trefoil grass, Establishment
ABT	Alfalfa trefoil grass, Established
AGE	Alfalfa grass, Establishment
AGT	Alfalfa grass, Established
ALE	Alfalfa, Establishment
ALT	Alfalfa, Established
<b>Birdsfoot</b>	
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
<b>Barley</b>	
BSP	Spring barley
BSS	Spring barley with legumes
BUK	Buckwheat
BWI	Winter barley
BWS	Winter barley with legumes
<b>Clover</b>	
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
<b>Corn</b>	
COG	Corn grain
COS	Corn silage
<b>Grasses, pastures, covercrops</b>	
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
<b>Small grains</b>	
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
<b>Others</b>	
ALG	Azalea
APP	Apples
APR	Apricots

Crop Code	Crop Description
ASP	Asparagus
ATF	Athletic Field
BDR/BND	Beans-dry
BLU/BLB	Blueberries
CBS	Cabbage, Seeded
CEM	Cemetery
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	Onions, Seeded
OTH	Other
PAR	Pears
PCH	Peaches
PEA	Peas
PEP	Peppers
PER	Perennials
POP	Popcorn
PRK	Park
POT/PTO	Potatoes
PUM	Pumpkins
ROD	Roadside
ROS	Roses
ROU	Rough
RSF	Raspberries, Fall
RSP	Raspberries (homeowners)

Crop Code	Crop Description
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