

# Soil Sample Survey

# Rockland Co.

Samples analyzed by CNAL in 1995-2001

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Summary compiled by

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

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

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# 1. General Survey Summary

This survey summarizes the soil test results from Rockland County soil samples submitted for analyses to the Cornell Nutrient Analysis Laboratory (CNAL) during 1995-2001. The total number of samples analyzed in is period amounted to 276 (see Figure 1).

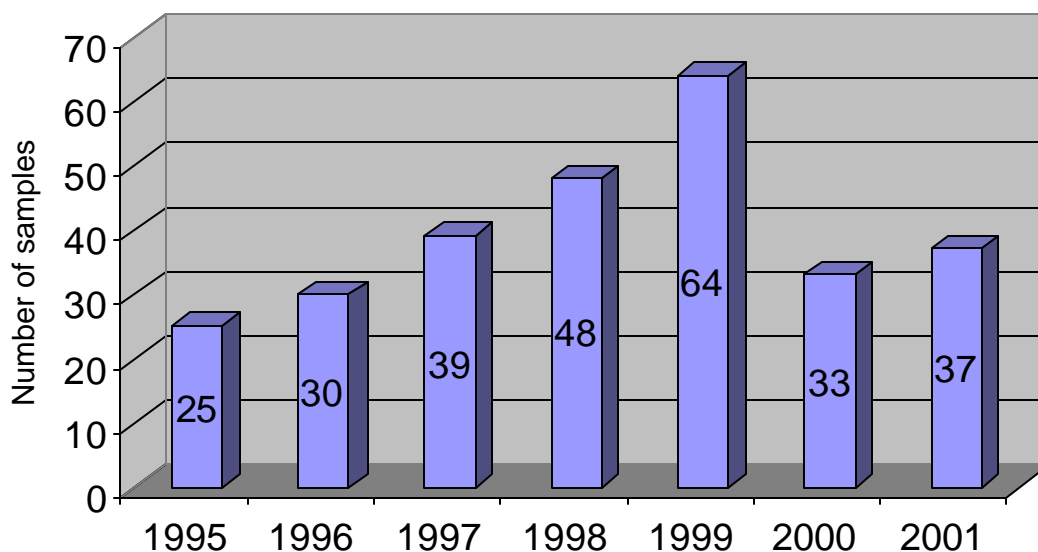


Figure 1: Distribution of home and garden samples submitted to the Cornell Nutrient Analysis Laboratory from 1995-2001.

Thirty-six percent of the samples were submitted to obtain soil fertility data and recommendations for lawns. Another 24% of the samples came from vegetable gardens while others requested recommendations for azaleas, athletic fields, fairways, flowering annuals, perennials, parks, roses, tree fruits or ornamentals.

The soil types of the home and garden samples that were submitted by people living in Rockland County were classified as silty soils (32%), silt loams (29%), sandy loams (26%) or sands (17%). The silty soils belong to soil management 2. The silt loams are from soil management group 3 while the sandy loams and sands belong to soil management groups 4 and 5, respectively. Table 1 on page 5 gives descriptions of each of the soil management groups.

Table 1: Characteristics of 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 of the samples varied from less than 1% to almost 50% for one sample (most likely an organic amendment or muck soil rather than a regular mineral soil sample). Eighteen percent of the samples had between 3 and 4% organic matter while 17% had organic matter levels between 2 and 3% and 20% tested between 4 and 5% organic matter. Organic matter levels greater than 5% were found in 36% of the samples while 8% contained less than 2% organic matter. Sixty-five percent of the samples had between 2 and 6% organic matter.

Soil pH is a measure of soil acidity. Some plants are adapted to lower pH while others grow best on higher pH soils (generally pH 6 and over). Table 2 on page 6 shows examples of ornamentals adapted to low versus higher pH status. The pH values of the soils submitted to the Cornell Nutrient Analysis Laboratory varied from pH 3.5 to pH 8.3. Four percent of the samples had a pH less than 5.0. Twenty-seven percent tested between pH 5 and pH 6 while pH values over 6 but less than 8 were found for 68% of the samples. Really high pH values of 8 and higher (calcareous soils) were found for 1% of the samples.

Table 2: Ornamentals adapted pH less than or greater than 6.0

Adapted to pH 4.5-6.0	Azalea, Bayberry, Chokeberry, Franklina, Holly, Inkberry, Leucothoe, Laurel, Oak, Pachistima, Pieris, Rhododendoron, Sheel Laurel, Snowball Hydrangea, Sourwood, Spicebush, Winter Holly
Adapted to pH 6.0-7.5	Abelia, Almond, Ajuga, Arborvitae, Ash, Barberry, Beautybush, Birch (White), Bittersweet, Boxwood, Chastetree, Chestnut, Clematis, Coralberry, Cotoneaster, Crabapple, Cranberry bush, Cypress, Daphne, Deutzia, Dogwood, Enkianthus, Euonymus, Firethorn, Fir, Forsythia, Fringe Tree, Germander, Ginko, Golden Chain, Hawthorn, Hemlock, Hollygrape, Honey Locust, Honeysuckle, Hornbeam, Hypericum, Ivy, Jetbead, Juniper, Larch, Lilac, Linden, Magnolia, Maple, Mockorange, Oak (English, Scarlet, Turkey), Pea Shrub, Pine, Plum (Flowering), Privet, Quince, Redbud, Rose of Sharon, Sassafras, Spirea, Spruce, Sweet Gum, Sweet Shrub, Sycamore, Tulip Tree, Tupello (Gum), Va. Creeper, Viburnum, Vinca, Walnut, Wayfaring Tree, Weigela, Willow, Wisteria, Witch Hazel, Yellow-wood, Yew.

Extractable nutrients such as phosphorus (P), potassium (K), magnesium (Mg), iron (Fe), manganese (Mn), and zinc (Zn) were measured using the Morgan chemical extraction solution and method. This solution contains sodium acetate buffered at a pH of 4.8. Other extraction methods exist that give very different results.

Soil test phosphorus 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 40 lbs P/acre or more are classified as very high.

Of the home and garden samples that were submitted to the Cornell Nutrient Analysis Laboratory between 1995 and 2001, no ne tested very low in phosphorus. Eleven percent of the samples tested bw in phosphorus while 18% were classified medium and 30% tested high in P. Forty-one percent of the samples tested very high in phosphorus. This meant that for 71% of the soils that were tested, for most plants, no additional phosphorus fertilizer would be needed.

Classifications for potassium depend on soil management group. The fine-textured soils of soil management group 1 contain a lot of potassium containing clay and have as a result a greater K supplying capacity than the coarse textured sandy soils (soil management group 5). Because of these differences in potassium supplying capacity

among soils of different origins (soil management groups as outlined in Table 1), the classification and interpretations for potassium availability differ among the six groups. This is shown in Table 3. So for example for soils in soil management group 5 (and 6), <60 lbs K/acre in the soil test means the soil is very low in K. If the soil test is between 60 and 114 lbs K/acre the soil is classified as low in potassium. Between 115 and 164 lbs K/acre is considered medium, between 165 and 269 lbs K/acre is high and >269 lbs K/acre is classified as very high in plant available potassium. For soils that are high or very high in potassium, the addition of potassium fertilizer is generally not needed for optimum plant growth and health.

Table 3: 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 submitted during 1995-2001, less than 4% were classified as very low in potassium. Eight percent had low potassium availability while 14% were classified as medium in potassium. High potassium availability was identified in 29% of the samples whereas 46% of the samples were classified as very high in potassium.

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.

Most soils tested high (16%) or very high (78%) for magnesium while only 4 samples tested low and 12 were medium in magnesium availability.

Soils with more than 50 lbs Morgan extractable iron per acre test excessive for iron availability. Anything lower than 50 lbs Fe/acre is considered normal. Of the 276 samples that were submitted, 254 (92%) were classified as normal in iron availability. The remainder of the samples had more iron than needed for optimum plant growth and were hence classified as excessive in iron.

Soils with more than 100 lbs Morgan extractable manganese per acre are classified as excessive in Mn. Anything less than 100 lbs Mn per acre is classified as normal. Of the 276 samples that were submitted, 246 (89%) were classified as normal in manganese availability. The remainder of the samples had more manganese than needed for optimum plant growth and were hence classified as excessive in manganese.

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, 97% tested high for zinc while 2% tested medium in zinc and only 2 samples were classified as low 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.



## 2. Cropping Systems

Crops/plants for which recommendations were requested by homeowners:

	1995	1996	1997	1998	1999	2000	2001	Total	%
ALG	0	1	1	1	8	3	0	14	5
ATF	0	1	2	0	0	2	1	6	2
FAR	0	0	0	6	3	0	0	9	3
FLA	0	1	0	0	2	0	1	4	1
GEN	0	0	0	1	0	0	0	1	0
HRB	0	1	0	0	0	0	0	1	0
IDL	0	0	0	0	1	0	0	1	0
LAW	16	16	12	17	17	9	12	99	36
MVG	5	8	8	9	15	10	11	66	24
OTH	1	1	0	0	1	1	0	4	1
PER	3	0	3	3	5	1	6	21	8
PRK	0	0	2	0	0	0	0	2	1
ROD	0	0	1	0	0	0	0	1	0
ROS	0	0	0	2	3	1	1	7	3
RSP	0	0	0	0	1	0	0	1	0
SAG	0	0	7	9	5	6	5	32	12
SOD	0	0	0	0	1	0	0	1	0
SUB	0	0	1	0	0	0	0	1	0
TRF	0	0	2	0	2	0	0	4	1
Unknown	0	1	0	0	0	0	0	1	0
Total	25	30	39	48	64	33	37	276	100

Notes:

See Appendix for Cornell crop codes.

### 3. Soil Types

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)	1	6	12	22	27	15	6	89
SMG 3 (silt loam)	10	10	12	15	11	12	10	80
SMG 4 (sandy loam)	7	11	7	8	21	4	15	73
SMG 5 (sandy)	7	3	8	3	5	2	6	34
SMG 6 (mucky)	0	0	0	0	0	0	0	0
Total	25	30	39	48	64	33	37	276

## 4. Organic Matter

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	2	1	4	7	1	2	7	25
1996	0	2	6	6	9	3	2	2	30
1997	2	7	6	2	6	5	3	8	39
1998	1	0	12	12	9	4	3	7	48
1999	0	6	15	15	7	5	6	10	64
2000	0	1	2	3	8	6	3	10	33
2001	0	1	6	8	8	4	1	9	37
Total	4	19	48	50	54	28	20	53	276

	1995	1996	1997	1998	1999	2000	2001	
Lowest:	0.6	1.2	0.3	0.9	1.0	1.3	1.2	
Highest:	15.5	22.8	29.0	27.6	14.0	25.1	49.5	
Mean:	5.8	4.6	5.6	5.0	4.5	6.5	8.6	
Median:	4.8	4.0	4.6	3.8	3.8	5.4	4.5	

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	4	8	4	16	28	4	8	28	100
1996	0	7	20	20	30	10	7	7	100
1997	5	18	15	5	15	13	8	21	100
1998	2	0	25	25	19	8	6	15	100
1999	0	9	23	23	11	8	9	16	100
2000	0	3	6	9	24	18	9	30	100
2001	0	3	16	22	22	11	3	24	100
Total	1	7	17	18	20	10	7	19	100

## 5. pH

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	2	0	5	1	4	7	6	0	0	25
1996	0	3	1	5	7	3	7	4	0	0	30
1997	0	1	2	5	3	9	13	5	1	0	39
1998	1	0	6	13	7	11	6	4	0	0	48
1999	0	3	6	10	11	13	15	5	1	0	64
2000	0	0	6	7	6	6	2	6	0	0	33
2001	1	0	4	5	6	14	5	2	0	0	37
Total	2	9	25	50	41	60	55	32	2	0	276

	1995	1996	1997	1998	1999	2000	2001	
Lowest:	4.5	4.5	4.9	4.3	4.8	5.0	3.5	
Highest:	7.8	7.8	8.5	7.5	8.1	7.8	7.9	
Mean:	-	-	-	-	-	-	-	
Median:	7.1	6.4	6.9	6.3	6.6	6.3	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	8	0	20	4	16	28	24	0	0	100
1996	0	10	3	17	23	10	23	13	0	0	100
1997	0	3	5	13	8	23	33	13	3	0	100
1998	2	0	13	27	15	23	13	8	0	0	100
1999	0	5	9	16	17	20	23	8	2	0	100
2000	0	0	18	21	18	18	6	18	0	0	100
2001	3	0	11	14	16	38	14	5	0	0	100
Total	1	3	9	18	15	22	20	12	1	0	100

## 6. Phosphorus

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	5	3	6	1	0	1	5	0	4	25
1996	0	3	6	6	5	1	0	2	3	4	30
1997	0	6	5	8	5	3	1	5	3	3	39
1998	0	1	11	21	3	0	2	3	2	5	48
1999	0	8	18	17	3	4	2	5	2	5	64
2000	0	3	3	13	5	0	1	2	0	6	33
2001	0	4	5	11	2	2	1	0	5	7	37
Total	0	30	51	82	24	10	8	22	15	34	276

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

	1995	1996	1997	1998	1999	2000	2001	
Lowest:	1	1	2	3	1	2	2	
Highest:	744	493	486	538	571	762	1229	
Mean:	113	90	73	71	55	102	160	
Median:	31	39	49	19	14	33	30	

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	12	24	4	0	4	20	0	16	100
1996	0	10	20	20	17	3	0	7	10	13	100
1997	0	15	13	21	13	8	3	13	8	8	100
1998	0	2	23	44	6	0	4	6	4	10	100
1999	0	13	28	27	5	6	3	8	3	8	100
2000	0	9	9	39	15	0	3	6	0	18	100
2001	0	11	14	30	5	5	3	0	14	19	100
Total	0	11	18	30	9	4	3	8	5	12	100

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

## 7. Potassium

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	1	1
1996	0	0	0	2	4	6
1997	0	4	0	2	6	12
1998	0	0	4	12	6	22
1999	1	0	4	10	12	27
2000	0	1	3	3	8	15
2001	0	0	0	2	4	6
Total (#)	1	5	11	31	41	89
Total (%)	1	6	12	35	46	100
Soil Management Group 3						
	<45	45-79	80-119	120-199	>199	Total
	Very Low	Low	Medium	High	Very High	
1995	0	1	2	4	3	10
1996	0	0	1	2	7	10
1997	0	1	1	3	7	12
1998	0	0	1	5	9	15
1999	0	1	2	4	4	11
2000	1	0	2	3	6	12
2001	0	0	0	2	8	10
Total (#)	1	3	9	23	44	80
Total (%)	1	4	11	29	55	100

Soil Management Group 4						
	<55	55-99	100-149	150-239	>239	Total
	Very Low	Low	Medium	High	Very High	
1995	0	1	0	2	4	7
1996	0	3	3	2	3	11
1997	0	0	2	2	3	7
1998	0	2	3	2	1	8
1999	0	0	3	6	12	21
2000	0	0	1	1	2	4
2001	0	2	3	2	8	15
Total (#)	0	8	15	17	33	73
Total (%)	0	11	21	23	45	100
Soil Management Group 5						
	<60	60-114	115-164	165-269	>269	Total
	Very Low	Low	Medium	High	Very High	
1995	1	3	0	1	2	7
1996	2	0	0	0	1	3
1997	4	1	1	2	0	8
1998	1	0	0	1	1	3
1999	0	0	2	2	1	5
2000	0	0	0	0	2	2
2001	0	1	1	2	2	6
Total (#)	8	5	4	8	9	34
Total (%)	24	15	12	24	26	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	5	2	7	10	25
1996	2	3	4	6	15	30
1997	4	6	4	9	16	39
1998	1	2	8	20	17	48
1999	1	1	11	22	29	64
2000	1	1	6	7	18	33
2001	0	3	4	8	22	37
Total #	10	21	39	79	127	276

	1995	1996	1997	1998	1999	2000	2001	
Lowest:	53	37	17	59	7	43	80	
Highest:	4613	749	1570	667	1122	4561	8065	
Mean:	469	267	232	198	289	459	868	
Median:	167	208	182	150	186	245	266	

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

Summary (%)	Very Low	Low	Medium	High	Very High	Total
1995	4	20	8	28	40	100
1996	7	10	13	20	50	100
1997	10	15	10	23	41	100
1998	2	4	17	42	35	100
1999	2	2	17	34	45	100
2000	3	3	18	21	65	100
2001	0	8	11	22	59	100
Total	4	8	14	29	46	100



## 8. Magnesium

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	6	18	25
1996	0	1	0	3	26	30
1997	0	0	0	10	29	39
1998	0	0	4	6	38	48
1999	0	3	3	10	48	64
2000	0	0	3	2	28	33
2001	0	0	1	8	28	37
Total	0	4	12	45	215	276

	1995	1996	1997	1998	1999	2000	2001	
Lowest:	92	41	112	73	35	95	94	
Highest:	2644	2093	2217	1608	1473	2745	4763	
Mean:	575	491	471	435	411	541	741	
Median:	395	345	340	363	328	451	380	

Percent of home and garden samples within each Mg range (lbs Morgan Mg/acre):

	<20	20-65	66-100	101-199	>199	Total
	Very Low	Low	Medium	High	Very High	
1995	0	0	4	24	72	100
1996	0	3	0	10	87	100
1997	0	0	0	26	74	100
1998	0	0	8	13	79	100
1999	0	5	5	16	75	100
2000	0	0	9	6	85	100
2001	0	0	3	22	76	100
Total	0	1	4	16	78	100

## 9. Iron

Iron (lbs Fe/acre Morgan extraction) in samples for home and garden:

Total number of samples:

	0-49	>49	Total
	Normal	Excessive	
1995	23	2	25
1996	25	5	30
1997	37	2	39
1998	45	3	48
1999	61	3	64
2000	30	3	33
2001	33	4	37
Total	254	22	276

Percentages:

	0-49	>49	Total
	Normal	Excessive	
	92	8	100
	83	17	100
	95	5	100
	94	6	100
	95	5	100
	91	9	100
	89	11	100
	92	8	100

	1995	1996	1997	1998	1999	2000	2001	
Lowest:	2	2	2	2	2	3	2	
Highest:	255	115	166	179	60	106	3456	
Mean:	27	25	16	19	17	18	107	
Median:	12	12	10	9	11	8	5	

## 10. Manganese

Manganese (lbs Mn/acre Morgan extraction) in samples for home and garden:

Total number of samples:

	0-99	>99	Total
	Normal	Excessive	
1995	19	6	25
1996	26	4	30
1997	34	5	39
1998	46	2	48
1999	61	3	64
2000	30	3	33
2001	30	7	37
Total	246	30	276

Percentages:

0-99	>99	Total
Normal	Excessive	
76	24	100
87	13	100
87	13	100
96	4	100
95	5	100
91	9	100
81	19	100
89	11	100

	1995	1996	1997	1998	1999	2000	2001	
Lowest:	17	10	16	7	13	13	9	
Highest:	362	368	556	405	205	560	641	
Mean:	69	55	73	45	44	62	85	
Median:	43	36	54	33	38	32	24	

## 11. Zinc

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	1	24	25
1996	1	0	29	30
1997	0	0	39	39
1998	0	0	48	48
1999	1	2	61	64
2000	0	1	32	33
2001	0	2	35	37
Total	2	6	268	276

Percentages:

<0.5	0.5-1.0	>1	Total
Low	Medium	High	
0	4	96	100
3	0	97	100
0	0	100	100
0	0	100	100
2	3	95	100
0	3	97	100
0	5	95	100
1	2	97	100

	1995	1996	1997	1998	1999	2000	2001	
Lowest:	0.9	0.3	1.1	1.3	0.3	0.1	0.7	
Highest:	135.8	30.2	167.1	67.8	45.6	109.8	268.8	
Mean:	19.2	8.4	14.6	12.7	9.0	17.1	19.7	
Median:	8.3	5.9	6.6	6.1	6.3	10.3	8.2	

## Appendix: Cornell Crop Codes

Crop codes are used in the Cornell Nutrient Analyses Laboratory.

Crop Code	Crop Description
ALG	Azalea
ATF	Athletic Field
FAR	Fairway
FLA	Flowering Annuals
GEN	Green
HRB	Herbs
IDL	Idle land
LAW	Lawn
MVG	Mixed vegetables
OTH	Other
PER	Perennials
PRK	Park
ROD	Roadside
ROS	Roses
RSP	Raspberries
SAG	Ornamentals adapted to pH 6.0 to 7.5
SOD	Sod production
SUB	Summer flowering bulbs
TRF	Tree Fruits