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Home& Garden Soil Sample Survey

Westchester County

Samples analyzed by CNAL (2002-2006)

Fall gathering of Canada geese in northern Westchester County

(Picture credit: Gerald G. Giordano, CCE of Westchester County)

Summary compiled by

Renuka Rao, James G. Lee, Gerald G. Giordano,
Quirine M. Ketterings, and Hettie Krol

Cornell Nutrient Analysis Laboratory
http://www.css.cornell.edu/soiltest/newindex.asp
&
Nutrient Management Spear Program
http://nmsp.css.cornell.edu/

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Soil Sample Survey

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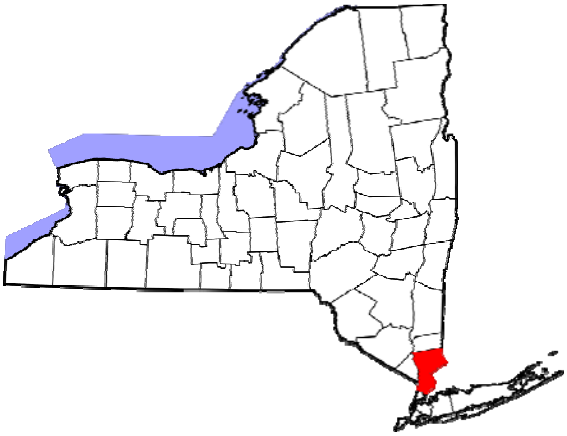
Flowering cherries at Hart's Brook Park and Preserve, Hartsdale, Westchester County.

(Picture credit: Richard Harper, CCE of Westchester County).

Hilltop Hanover Farm and Environmental Center, Yorktown Heights. Westchester County.

1. County Introduction

Westchester County is a community of over 900,000 residents. Its hilly terrain is bordered by New York City on the South, Connecticut to the East, the Hudson River on the West, and Putnam County to the North. The southern part of the county is a mix of urban as well as contiguous wooded suburban neighborhoods. The major cities of Yonkers, Mount Vernon, New Rochelle, and White Plains are located here. The northern part of the county still retains a rural character and farms are an important part of the landscape. Typical of the Northeast, Westchester County is home to many beautiful, mature tree specimens. The two largest sectors of agriculture in the county are the nursery and greenhouse business, and horse farms. Other agricultural sectors include hay, fruit, and vegetable production.



Water resources are important in Westchester County. These include the Croton, Kensico, and portions of the Long Island Sound watersheds. Along with the Catskill watershed, Westchester County supplies drinking water for millions of people within the county and in New York City. Efforts to protect farmland and water quality are priority issues for county government.

Consumer horticulture is a highly developed and sophisticated industry in Westchester County. High property values support an economically important landscape maintenance industry. Most home horticulture and gardening activities involve lawns and ornamental plants. However, a large number of people also grow vegetables, particularly tomatoes, and a variety of fruits.

An important factor to keep in mind when reading this summary is that, unlike farmers who may sample their soil on a routine basis, many non-farmers generally do not have their soil tested unless a problem exists with what they are trying to grow therefore, these summary results may be skewed toward problem soils. Even so, this soil test summary provides interesting and useful information. Like the results from 1995 – 2001, most soils

tested in Westchester County from 2002 – 2006 were not nutrient deficient, they had a soil pH range of 6 – 8, and also have adequate amounts of phosphorus to grow different plants including turfgrasses. The latter is especially important information because excess phosphorus continues to be a problem in certain bodies of water in Westchester County. One manageable source of this phosphorus is phosphorus-containing lawn fertilizers. While newly seeded lawns can benefit from a starter fertilizer containing phosphorus, fertilizers containing phosphorus should not be applied to established lawns unless a soil test report specifically indicates that it is needed. Because of the continuing problem concerning phosphorus in our county and the fact that most of our soils contain adequate amounts of phosphorus, our County Executive proposed a law in 2007 that would regulate phosphorus-containing lawn fertilizers. Ongoing research at Cornell University is investigating the role that lawn fertilizers and certain other potential sources of phosphorus may play in the phosphorus runoff question.

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Residential home in Chappaqua, Westchester County

(Picture credit: Richard Harper, CCE of Westchester County).

2. General Survey Summary

This survey summarizes the soil test results from home and garden soil samples from Westchester County submitted for analyses to the Cornell Nutrient Analysis Laboratory (CNAL) during 2002-2006. The total number of samples analyzed in these years amounted to 693 (see Figure 1).

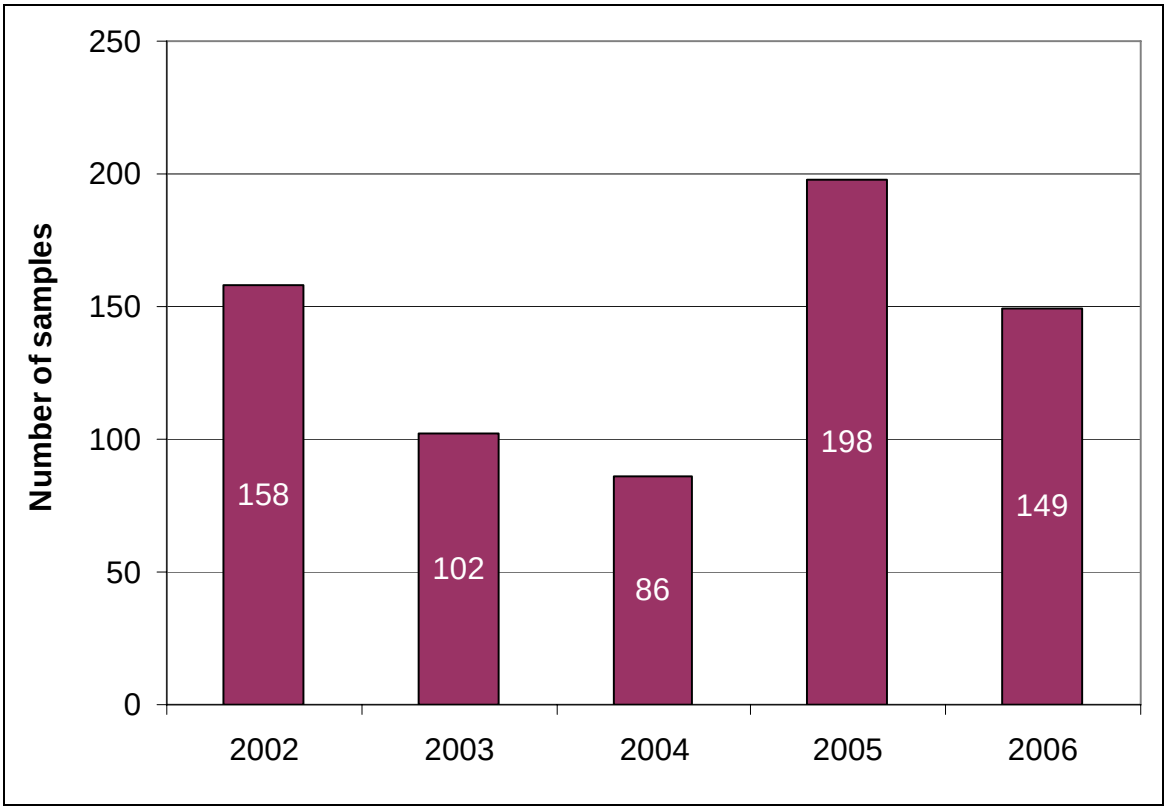

Figure 1: Distribution of Westchester County home and garden samples submitted to the Cornell Nutrient Analysis Laboratory (2002-2006).

Thirty-seven percent of the samples were submitted to obtain soil fertility data and recommendations for lawns. Another 12% of the samples were analyzed for ornamentals, 12% came from vegetable gardens, and 11% were for perennial while others requested recommendations for azaleas, athletic fields, flowering bulbs and other flowering annuals, parks, raspberries, roses, sod production, and other plants.

The soil types of the home and garden samples that were submitted by people living in Westchester County were classified as silty soils (20%), silt loams (33%), sandy loams (33%) or sands (14%). 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 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 55% (the latter were most likely organic amendments or muck soils rather than a regular mineral soil sample). Twenty-four percent of the samples had between 3 and 4% organic matter while 19% had organic matter levels between 2 and 3% and 18% tested between 4 and 5% organic matter. Organic matter levels greater than 5% were found in 31% of the samples while 8% contained less than 2% organic matter. Seventy-three 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 5 shows

examples of ornamentals adapted to low versus higher pH status. The pH values of the Westchester soils submitted to the Cornell Nutrient Analysis Laboratory varied from pH 3.8 to pH 8.5. Three percent of the samples had a pH less than 5.0. Twenty-two percent tested between pH 5 and pH 6 while pH values over 6 but less than 8 were found for 74% of the samples. Only 1% had really high pH values of 8 and higher (calcareous soils).

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, Rhododendron, 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 Westchester County home and garden samples that were submitted to the Cornell Nutrient Analysis Laboratory between 2002 and 2006, none tested very low in phosphorus. Eight percent of the samples tested low in phosphorus while 16% were classified medium and 45% tested high in P. Thirty-one percent of the samples tested very high in phosphorus. This meant that for 76% of the soils that were tested, for most plants, no additional phosphorus fertilizer would be needed.

Classifications for potassium depend on soil management groups. 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 groups.

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 2002-2006, 4% were low in potassium availability while 10% were classified as medium in potassium. High potassium availability was identified in 34% of the samples whereas 52% 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 Westchester soils tested high (13%) or very high (84%) for magnesium while only 1% tested low and 2% were medium in magnesium availability.

Soils with more than 50 lbs/acre Morgan extractable iron test excessive for iron availability. Anything lower than 50 lbs Fe/acre is considered normal. Of the 671 samples that were submitted, 656 (95%) 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 693 samples that were submitted, 671 (97%) 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 from Westchester County, 95% tested high for zinc while 4% tested medium in zinc and only 1% was 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 3.

3. Cropping Systems

Crops for which recommendations were requested by homeowners:

	2002	2003	2004	2005	2006	Total	%
ALG	15	1	6	9	6	37	5
APR	0	0	0	0	1	1	0
ATF	6	14	4	18	3	45	6
BLU	0	0	0	1	1	2	0
FLA	0	2	1	2	0	5	1
GRA	0	0	0	1	0	1	0
HRB	0	1	0	1	0	2	0
IDL	3	0	0	0	0	3	0
LAW	54	18	41	83	60	256	37
MVG	22	25	8	15	16	86	12
OTH	6	6	4	12	5	33	5
PER	14	7	8	27	20	76	11
PRK	5	0	0	1	16	22	3
ROD	0	0	1	0	0	1	0
ROS	1	0	0	4	2	7	1
RSP	1	0	0	1	2	4	1
SAG	26	18	10	22	10	86	12
SOD	0	1	0	0	1	2	0
SPB	1	0	0	0	0	1	0
SUB	1	0	0	0	1	2	0
TRF	2	1	2	1	2	8	1
Unknown	1	8	1	0	3	13	2
Total	158	102	86	198	149	693	100

See Appendix for Cornell crop codes.

4. Soil Types

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

	2002	2003	2004	2005	2006	Total	%
SMG 1 (clayey)	0	0	0	0	0	0	0
SMG 2 (silty)	35	19	14	51	21	140	20
SMG 3 (silt loam)	37	40	26	62	63	228	33
SMG 4 (sandy loam)	65	29	35	55	45	229	33
SMG 5 (sandy)	21	14	11	30	20	96	14
SMG 6 (mucky)	0	0	0	0	0	0	0
Total	158	102	86	198	149	693	100

Whippoorwill Golf Course, Armonk, Westchester County

(Picture credit: Richard Harper, CCE of Westchester County).

5. 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
2002	1	12	25	32	36	22	8	22	158
2003	1	5	19	24	21	13	6	13	102
2004	1	3	17	17	15	11	10	12	86
2005	0	19	42	54	26	20	8	29	198
2006	1	13	26	42	28	17	11	11	149
Total	4	52	129	169	126	83	43	87	693

	2002	2003	2004	2005	2006
Lowest:	0.8	0.6	0.7	1.0	0.9
Highest:	46.1	54.5	19.4	33.0	22.1
Mean:	5.2	5.3	5.0	4.8	4.2
Median:	4.2	4.1	4.3	3.6	3.8

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

	<1%	1.0-1.9	2.0-2.9	3.0-3.9	4.0-4.9	5.0-5.9	6.0-6.9	>6.9	Total
2002	1	8	16	20	23	14	5	14	100
2003	1	5	19	24	21	13	6	13	100
2004	1	3	20	20	17	13	12	14	100
2005	0	10	21	27	13	10	4	15	100
2006	1	9	17	28	19	11	7	7	100
Total	1	8	19	24	18	12	6	13	100

6. 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
2002	1	5	20	22	35	35	31	6	3	0	158
2003	1	1	6	16	25	26	24	3	0	0	102
2004	0	5	13	8	19	23	14	4	0	0	86
2005	5	2	16	23	32	72	39	9	0	0	198
2006	1	2	6	23	27	45	36	5	3	1	149
Total	8	15	61	92	138	201	144	27	6	1	693

	2002	2003	2004	2005	2006
Lowest:	4.1	3.8	4.5	3.8	4.0
Highest:	8.0	7.7	7.6	7.9	8.5
Mean:	-	-	-	-	-
Median:	6.4	6.5	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
2002	1	3	13	14	22	22	20	4	2	0	100
2003	1	1	6	16	25	25	24	3	0	0	100
2004	0	6	15	9	22	27	16	5	0	0	100
2005	3	1	8	12	16	36	20	5	0	0	100
2006	1	1	4	15	18	30	24	3	2	1	100
Total	1	2	9	13	20	29	21	4	1	0	100

7. 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	
2002	0	14	34	60	18	7	4	8	4	9	158
2003	0	11	13	41	16	4	1	4	3	9	102
2004	0	12	8	34	14	2	5	4	1	6	86
2005	0	12	39	100	15	5	4	12	3	8	198
2006	0	8	15	74	30	9	3	4	3	3	149
Total	0	57	109	309	93	27	17	32	14	35	693

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

	2002	2003	2004	2005	2006
Lowest:	1	1	1	1	1
Highest:	989	544	449	691	379
Mean:	58	60	55	45	40
Median:	18	23	28	18	24

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	
2002	0	9	22	38	11	4	3	5	3	6	100
2003	0	11	13	40	16	4	1	4	3	9	100
2004	0	14	9	40	16	2	6	5	1	7	100
2005	0	6	20	51	8	3	2	6	2	4	100
2006	0	5	10	50	20	6	2	3	2	2	100
Total	0	8	16	45	13	4	2	5	2	5	100

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

8. Potassium

Number of home and garden samples within each K range (lbs K/acre Morgan extraction):

Soil Management Group 2						
	<40	40-69	70-99	100-164	>164	Total
	Very Low	Low	Medium	High	Very High	
2002	0	0	2	14	19	35
2003	0	0	1	7	11	19
2004	0	0	2	1	11	14
2005	0	1	5	21	24	51
2006	0	0	0	4	17	21
Total (#)	0	1	10	47	82	140
Total (%)	0	1	7	34	59	100
Soil Management Group 3						
	<45	45-79	80-119	120-199	>199	Total
2002	0	3	2	8	24	37
2003	0	3	3	14	20	40
2004	0	0	3	9	14	26
2005	0	1	2	20	39	62
2006	0	3	6	22	32	63
Total (#)	0	10	16	73	129	228
Total (%)	0	4	7	32	57	100
Soil Management Group 4						
	<55	55-99	100-149	150-239	>239	Total
2002	0	3	6	21	35	65
2003	0	1	2	6	20	29
2004	0	4	1	15	15	35
2005	0	0	10	19	26	55
2006	0	4	9	16	16	45
Total (#)	0	12	28	77	112	229
Total (%)	0	5	12	34	49	100
Soil Management Group 5						
	<60	60-114	115-164	165-269	>269	Total
2002	1	1	2	8	9	21
2003	0	0	4	8	2	14
2004	0	1	1	6	3	11
2005	0	3	6	9	12	30
2006	0	2	4	6	8	20
Total (#)	1	7	17	37	34	96
Total (%)	1	7	18	39	35	100

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Number of home and garden samples within each potassium classification:

Summary (#)	Very Low	Low	Medium	High	Very High	Total
2002	1	7	12	51	87	158
2003	0	4	10	35	53	102
2004	0	5	7	31	43	86
2005	0	5	23	69	101	198
2006	0	9	19	48	73	149
Total #	1	30	71	234	357	693

	2002	2003	2004	2005	2006
Lowest:	51	45	76	67	62
Highest:	7575	1504	4475	3305	958
Mean:	375	266	332	315	232
Median:	220	217	233	207	200

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

Summary (%)	Very Low	Low	Medium	High	Very High	Total
2002	1	4	8	32	55	100
2003	0	4	10	34	52	100
2004	0	6	8	36	50	100
2005	0	3	12	35	51	100
2006	0	6	13	32	49	100
Grand Total	0	4	10	34	52	100

9. 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	
2002	0	2	6	20	130	158
2003	0	0	1	15	86	102
2004	1	1	1	11	72	86
2005	0	3	1	24	170	198
2006	0	3	3	18	125	149
Total	1	9	12	88	583	693

	2002	2003	2004	2005	2006
Lowest:	53	100	14	27	35
Highest:	4689	4550	3193	1922	1190
Mean:	485	537	497	458	399
Median:	390	390	403	378	363

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	
2002	0	1	4	13	82	100
2003	0	0	1	15	84	100
2004	1	1	1	13	84	100
2005	0	2	1	12	86	100
2006	0	2	2	12	84	100
Total	0	1	2	13	84	100

10. Iron

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

Total number of samples:

	0-49	>49	Total
	Normal	Excessive	
2002	153	5	158
2003	97	5	102
2004	77	9	86
2005	185	13	198
2006	144	5	149
Total	656	37	693

Percentages:

0-49	>49	Total
Normal	Excessive	
97	3	100
95	5	100
90	10	100
93	7	100
97	3	100
95	5	100

	2002	2003	2004	2005	2006
Lowest:	2	2	2	2	1
Highest:	78	6339	270	339	76
Mean:	14	76	23	21	13
Median:	9	9	10	11	10

11. Manganese

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

Total number of samples:

	0-99	>99	Total
	Normal	Excessive	
2002	152	6	158
2003	95	7	102
2004	83	3	86
2005	192	6	198
2006	149	0	149
Total	671	22	693

Percentages:

0-99	>99	Total
Normal	Excessive	
96	4	100
93	7	100
97	3	100
97	3	100
100	0	100
97	3	100

	2002	2003	2004	2005	2006
Lowest:	7	5	9	7	6
Highest:	561	213	199	269	82
Mean:	37	41	34	36	28
Median:	27	27	26	27	24

12. 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	
2002	0	3	155	158
2003	2	3	97	102
2004	1	2	83	86
2005	1	18	179	198
2006	1	5	143	149
Total	5	31	657	693

Percentages:

<0.5	0.5-1.0	>1	Total
Low	Medium	High	
0	2	98	100
2	3	95	100
1	2	97	100
1	9	90	100
1	3	96	100
1	4	95	100

	2002	2003	2004	2005	2006
Lowest:	0.6	0.3	0.3	0.2	0.4
Highest:	118.7	97.8	102.5	209.5	165.3
Mean:	14.2	11.9	12.9	12.4	11.1
Median:	8.4	8.6	7.2	6.0	6.7

Appendix: Cornell Crop Codes

Crop codes are used in the Cornell Nutrient Analyses Laboratory.

Crop Code	Crop Description
ALG	Azalea
APR	Asparagus
ATF	Athletic field
BLU	Blueberries
FLA	Flowering annuals
GRA	Grapes
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
SPB	Spring-flowering bulbs
SUB	Summer-flowering bulbs
TRF	Tree fruits