



Vegetable Gardens Augusta Forestry Center

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South River Science Team
February 10, 2004

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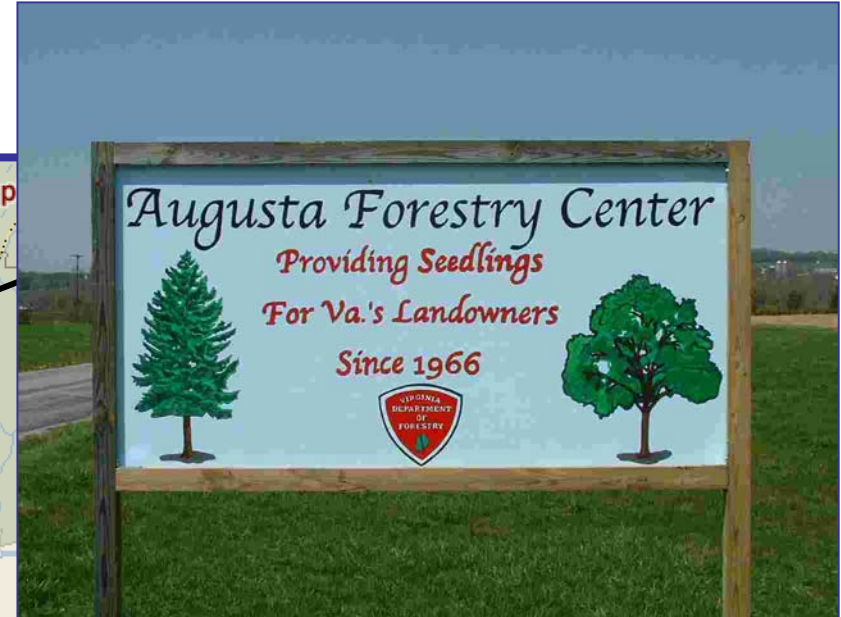
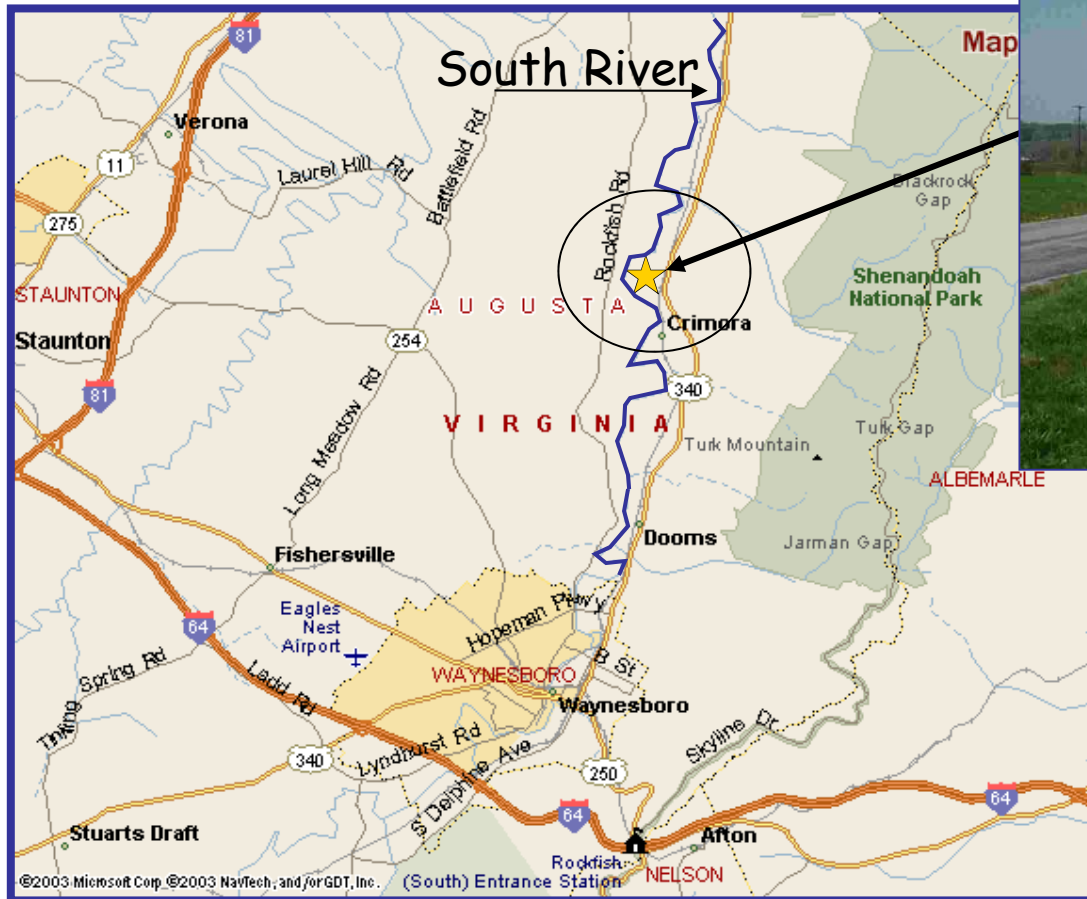


Vegetable Garden Study

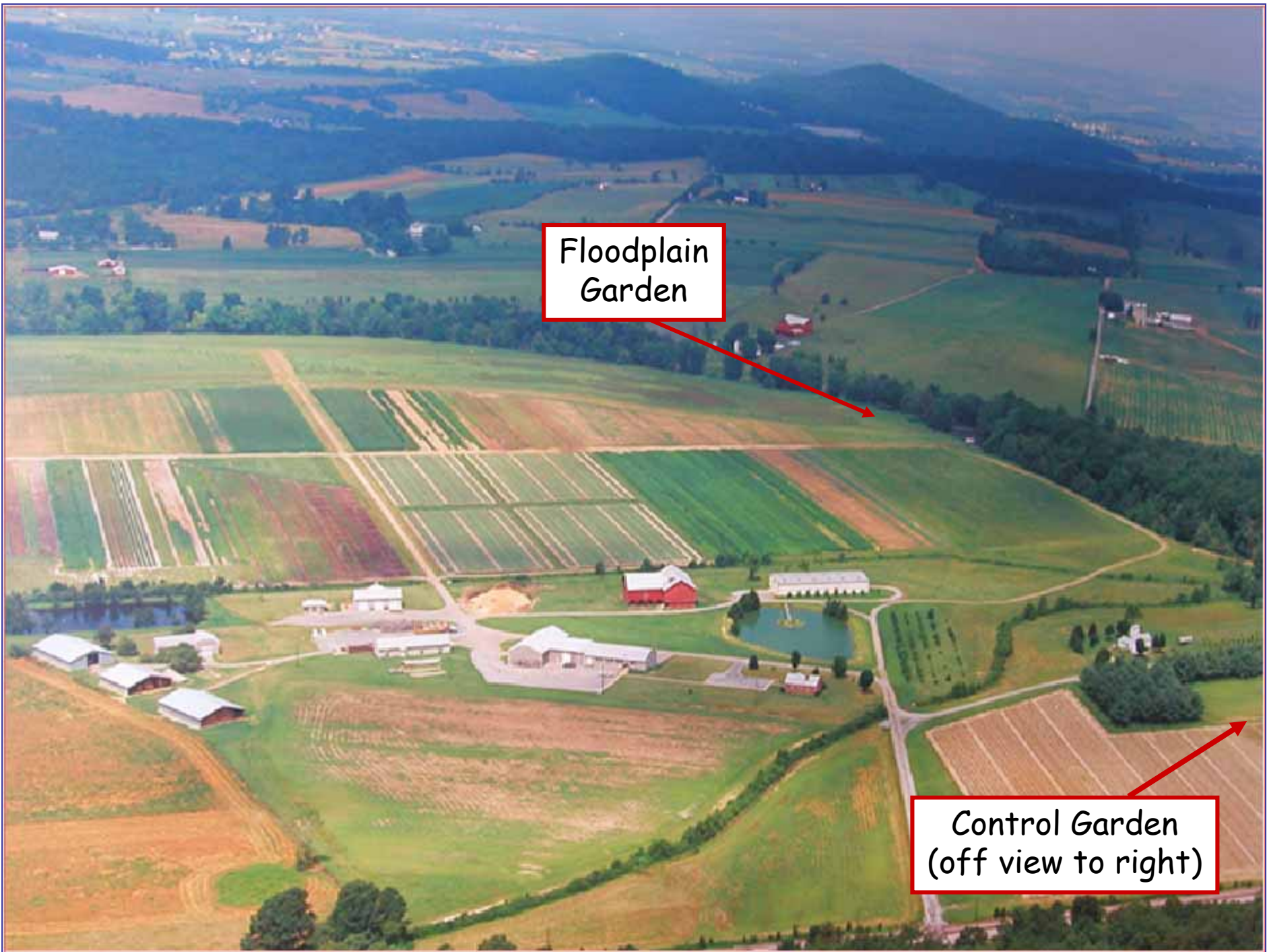
Objective -

Determine if soil-Hg is taken-up by vegetables at concentrations sufficient to be a health risk

Augusta Forestry Center - Crimora, VA



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Floodplain
Garden

Control Garden
(off view to right)



Latest

- Sampled soils in Garden Plots 25-Nov-03
 - Total soil Hg
 - Soil test for plant-growth characterization
 - pH, buffer index
 - Organic matter, carbonates, soluble salts
 - Na, N, P, K, Ca, Mg, S, Zn, Mn, Cu, Fe, B,
 - Sand, silt, clay
- Harvested fall crop 13-Dec-03
 - Lettuce, radish, spinach for total Hg

Soil Sampling - Nov 23, 2003

- All 40 plots in floodplain garden; three plots in control garden
 - Composite of eight cores/plot
 - Surface to 15 cm deep
 - Total Hg and Moisture



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Control garden soil samples Nov 23, 2003

mg Hg/kg soil, dry weight basis

1	0.162†	Soil Hg, ug/g
2		< 1
3		Not Sampled
4		
5		
6		
7	0.054‡	
8		
9		
10	0.038‡	

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↓

† Mean value, n = 2

‡ Estimated value; results fall between MDL and PQL



MDL = Method Detection Limit

PQL = Practical Quantitation Limit

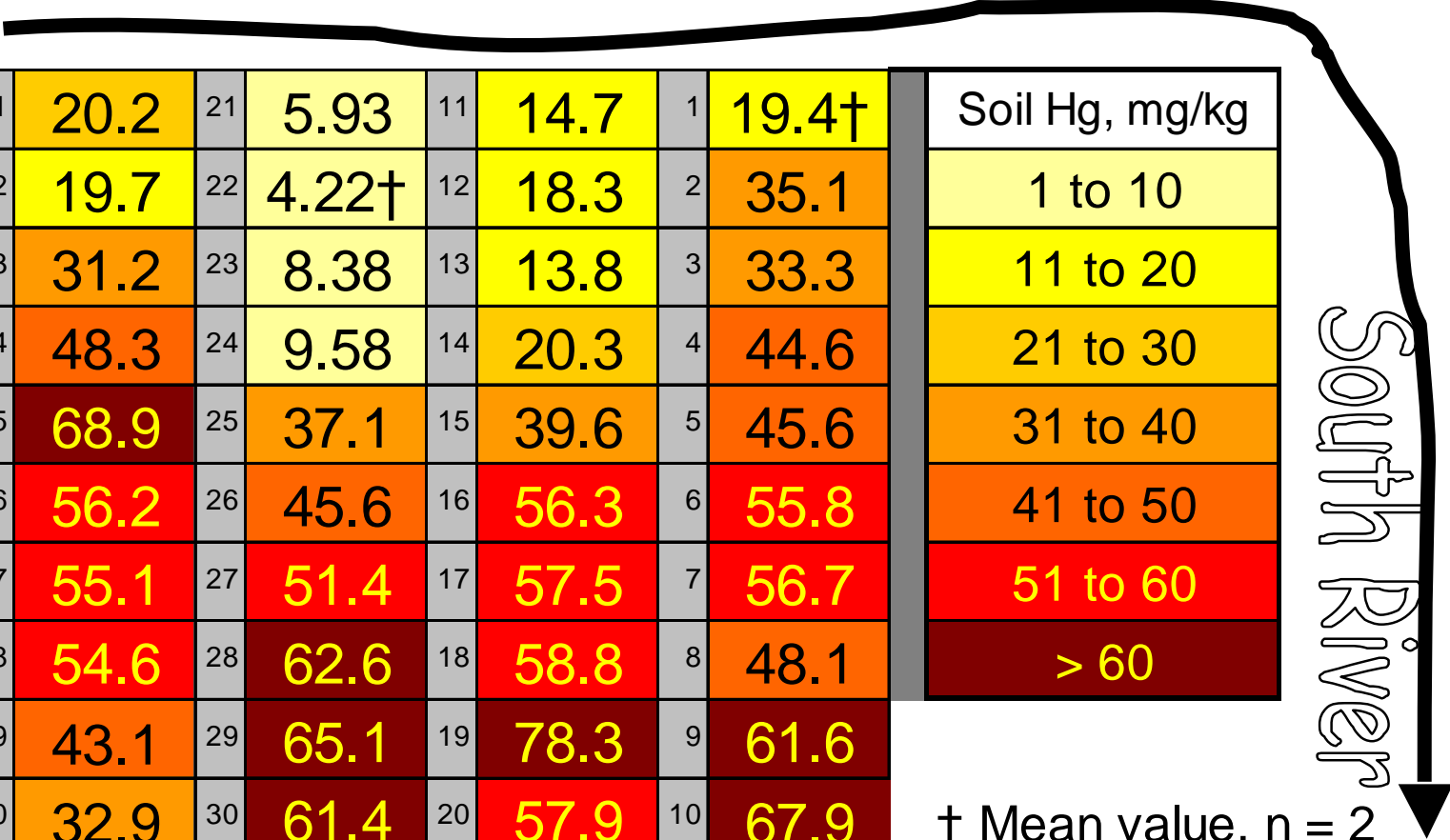
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Floodplain garden soil samples Nov 23, 2003

mg Hg/kg soil, dry weight basis


31	20.2	21	5.93	11	14.7	1	19.4†	Soil Hg, mg/kg
32	19.7	22	4.22†	12	18.3	2	35.1	1 to 10
33	31.2	23	8.38	13	13.8	3	33.3	11 to 20
34	48.3	24	9.58	14	20.3	4	44.6	21 to 30
35	68.9	25	37.1	15	39.6	5	45.6	31 to 40
36	56.2	26	45.6	16	56.3	6	55.8	41 to 50
37	55.1	27	51.4	17	57.5	7	56.7	51 to 60
38	54.6	28	62.6	18	58.8	8	48.1	> 60
39	43.1	29	65.1	19	78.3	9	61.6	
40	32.9	30	61.4	20	57.9	10	67.9	

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† Mean value, n = 2

50 ft



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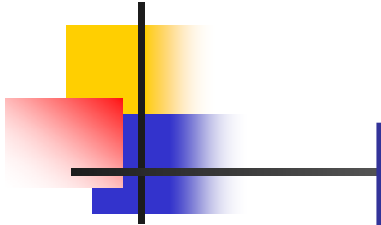
Summary - Soil Hg

- Total soil Hg, dry-weight basis
 - Control garden
 - Total soil Hg <0.162 mg/kg
 - Floodplain garden
 - 4.22 to 78.3 mg/kg
 - n = 40

Harvest Results



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Vegetable	Seeded/ Transplanted	Seeding/ Transplanting Date	Harvest Date
Cabbage	Transplanted	25-Jun-03	28-Aug-03
Pepper	Transplanted	25-Jun-03	28-Aug-03
Spinach	Seeded	25-Jun-03	28-Aug-03
Big squash	Transplanted	25-Jun-03	28-Aug-03
Small squash	Transplanted	25-Jun-03	28-Aug-03
Sweet corn	Seeded	25-Jun-03	11-Sep-03
Tomato	Transplanted	25-Jun-03	11-Sep-03
Carrot	Seeded	25-Jun-03	27-Sep-03
Onion	Transplanted	25-Jun-03	27-Sep-03
Lettuce	Seeded	30-Sep-03	13-Dec-03
Radish	Seeded	30-Sep-03	13-Dec-03
Spinach, 2nd planting	Seeded	30-Sep-03	13-Dec-03

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Vegetable Preparation

- Lettuce, Radish, Spinach
 - 13-Dec-03
- Harvested, washed, and stored cold
- Shipped to Lancaster Lab for Hg analysis
 - Samples blended, digested and Hg measured

Lettuce Harvest Dec 13, 2003

mg Hg/kg lettuce, wet weight basis

Estimated values: The value falls between the MDL and PQL

31	20.2	21	5.93	11	14.7	1	19.4†	Soil Hg, mg/kg
32	19.7	22	4.22†	12	18.3	2	35.1	1 to 10
33	31.2	23	8.38	13	13.8	3	33.3	11 to 20
34	48.3	24	9.58	14	20.3	4	44.6	21 to 30
35	68.9	25	37.1	15	30.8	5	45.6	31 to 40
36	56.2	26	45.6	16	56.3	6	55.8	41 to 50
37	55.1	27	51.4	17	57.5	7	56.7	51 to 60
38	54.6	28	62.6	18	58.8	8	48.1	> 60
39	43.1	29	65.1	19	78.3	9	61.6	
40	32.9	30	61.4	20	57.9	10	67.9	

0.0201

0.0525

0.0323

0.0730

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Radish Harvest Dec 13, 2003

mg Hg/kg lettuce, wet weight basis

Estimated values: The value falls between the MDL and PQL

31	20.2	21	5.93	11	14.7	1	19.4†	Soil Hg, mg/kg
32	19.7	22	4.22†	12	18.3	2	35.1	1 to 10
33	31.2	23	8.38	13	13.8	3	33.3	11 to 20
34	48.3	24	9.58	14	20.3	4	44.6	21 to 30
35	68.9	25	37.1	15	39.6	5	45.6	31 to 40
36	56.2	26	45.6	16	56.3	6	55.8	0.0967
37	55.1	27	51.4	17	57.5	7	56.7	51 to 60
38	54.6	28	62.6	18	58.8	8	48.1	0.0980
39	43.1	29	65.1	19	78.3	9	61.0	0.0977
40	32.9	30	61.4	20	57.9	10	67.9	0.0996

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Spinach Harvest Dec 13, 2003

mg Hg/kg lettuce, wet weight basis

Estimated values: The value falls between the MDL and PQL

31	20.2	21	5.93	11	14.7	1	19.4†	Soil Hg, mg/kg
32	19.7	22	4.22†	12	18.3	2	35.1	1 to 10
33	31.2	23	8.38	13	13.8	3	33.3	11 to 20
34	48.3	24	9.58	14	20.3	4	41.2	21 to 30
35	68.9	25	37.1	15	39.6	5	45.6	31 to 40
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37	55.1	27	51.4	17	56.7	7	56.7	51 to 60
38	54.6	28	62.6	18	58.8	8	48.1	> 60
39	43.1	29	65.1	19	78.3	9	61.6	
40	32.9	30	61.4	20	67.9			

0.0958

0.0978

0.0966

0.0966

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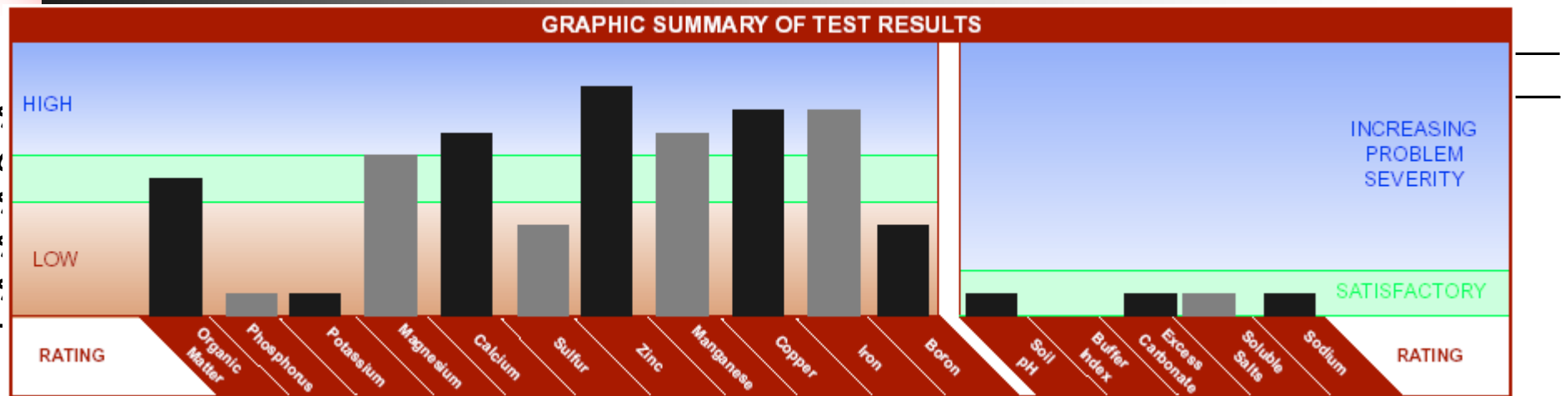
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Summary - Crop Hg

- Harvested 10 crops in 2003
 - Tomato, carrot, sweet corn, green pepper, big and small squash, onion, radish, spinach, lettuce
- Lettuce, Radish, and Spinach
 - Harvested Dec. 13, 2003
 - Hg concentrations not measurable
 - Hg < Practical Quantitation Limit (PQL)
 - PQL < 0.1 mg Hg/kg wet weight

Floodplain Garden Soil Analysis

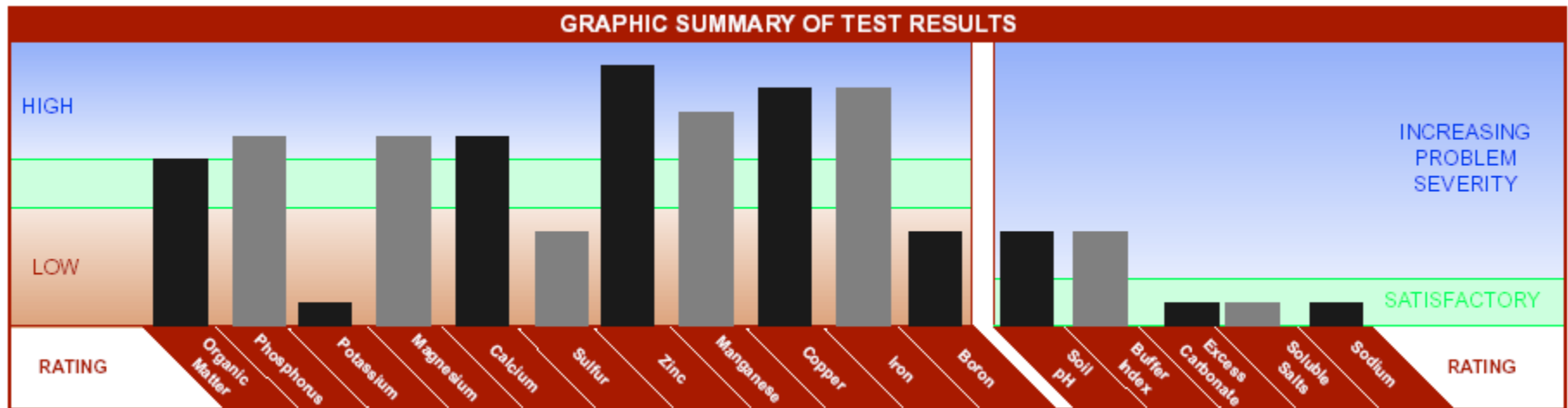


31	21	11	1	Composite
32	22	12	2	1
33	23	13	3	2
34	24	14	4	3
35	25	15	5	4
36	26	16	6	5
37	27	17	7	
38	28	18	8	
39	29	19	9	
40	30	20	10	

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Control Garden Soil Analysis



**Control Garden
Composite**

% OM	2
CEC	6.6
% Sand	41
% Silt	43
% Clay	16
Texture	LOAM

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Path Forward

- Validate plant Hg analysis method
- Learn more about acceptable concentrations of Hg in crops
- Completely Random or Randomized Complete Block design?
- Planning for Spring 2004
 - Fertilize, till, plant. . .
 - Crops being considered. . .



Path Forward

- Crops being considered
 - Selection to include
 - Root crops
 - Leafy vegetables
 - Fruit crops
 - Tubers
 - **New for 2004**

Vegetable	Earliest Planting Window
Beans	Apr 15-30
Beets	Mar 15-Apr 3
Cabbage	Mar 7-Apr 15
Carrots	Mar 7-31
Lettuce	Mar 1-31
Onion	Mar 1-31
Peas	Mar 7-31
Peppers	Apr 1-30
Potato	Apr 1-30
Radish	Mar 7-31
Spinach	Mar 15-Apr 20
Squash	Apr 15-30
Sweet corn	Apr 1-17
Tomato	Apr 7-30
Turnips	Mar 15-31

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Questions???

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