COMMUNITY BASED RISK ASSESSMENT
PORT COLBORNE, ONTARIO

CROP STUDIES

VOLUME I - APPENDICES

(BINDER 2 OF 3)

Jacques Whitford

INCO

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COMMUNITY BASED RISK ASSESSMENT
PORT COLBORNE, ONTARIO
CROP STUDIES

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INCO

SOIL SELECTION AND CHARACTERISATION FOR THE YEAR 2000/2001 GREENHOUSE, FIELD PHYTOTOXICITY TRIALS AND BIOMONITORING STUDIES

VOLUME 1 - PART 2 – APPENDICES

DECEMBER, 2004

Jacques Whitford

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VOLUME 1 – PART 2 - APPENDICES

APPENDIX S-1

SUPPORTING STUDIES

APPENDIX S-1.1

ENPAR SOIL NOTES

October 23, 2001

Jacques Whitford Environmental Limited
1200 Denison St.
Markham, Ontario
L3R 8G6

Re: Reference notes: soils for greenhouse and field trials.

Attention: Dr. Jim Higgins

The following notes summary of the information requested for your report. If you have any questions regarding this report please contact me at any time.

Sincerely,

C. James Warren
Senior Soil Scientist
ENPAR Technologies Inc.

/cjw

Selection of Soils for Greenhouse Trials

The contaminated soils and their companion non-contaminated soils used in the 2001 greenhouse trials were selected through a series of logical steps and checks.

1. The regional soil map and associated report (Kingston and Presant, 1989) were first examined to identify the different soil series in the Port Colborne area. At lease 16 major soil series and land units are mapped in the contaminated area north and east of the City of Port Colborne. For the purposes of the greenhouse trials, these major soil series were grouped into six “soil groupings” (including a “not mapped” grouping). These groupings were based on similarities in soil texture, soil organic matter content, depth to bedrock and (only in special case of the “not mapped” grouping) land use (See Table 1).

2. The regional soil map (Kingston and Presant, 1989) was overlain with existing information reported on the aerial extent of contamination (OMOE, 2000a, 2000b data). The combined mapping information from these two sources was then used to estimate the percentage of area (total approximately 6.5 km^2) occupied by each soil grouping contaminated with >500 mg/kg total Ni (Table 1). A value of 500 mg/kg total Ni was chosen based on preliminary work conducted in previous studies (JacquesWhitford, 2000).

3. Soils representing each of the four soil groupings were chosen for the present greenhouse study. These groupings (identified here as organic, sand, heavy clay, and shallow soils, see Table 1), together represent more than 60% of the all soils contaminated with >500 mg/kg total Ni and more than 85% of the non-urban (agricultural and rural) soils contaminated with >500 mg/kg total Ni.

4. Candidate sample sites representative of each of the four soil groupings were selected from within the contaminated area based on prior knowledge of the contaminated soils (JacquesWhitford, 2000) combined with the ability to obtain permission from landowners to access the selected properties and collect samples. Specific contaminated sites from within a soil grouping were identified for investigative sampling. The investigative samples for each specific site were then collected, analyzed, and scrutinized for suitability before bulk soil material was collected for the greenhouse trials.

5. Candidate sites for non-contaminated soils (containing background concentrations of CoC’s) were also identified for investigative sampling using regional soil maps (Kingston and Presant, 1989). Candidate sites for each soil grouping were selected from areas outside (generally up-wind) of the “fall zone”, and within a 10 km radius of Port Colborne. Investigative sampling of specific background sites was also limited by the ability to gain access to properties and gaining permission from prospective landowners to collect samples.

6. Investigative samples were collected at all candidate contaminated and non-contaminated sites using an Oakfield-style hand-held tube sampler. Composite

samples were collected by combining approximately 25 to 30 increments representative of the 0-15 cm depth collected from an area of about 300 m^2. All investigative samples were analyzed for total concentration of Ni, soil fertility (plant available P, K, and Mg), organic, and inorganic carbon content, soil pH and (if the soil pH measurement was 6.0 or lower) soil buffer pH for agricultural limestone requirement. Analytical data for each selected soil pair (i.e. contaminated and non-contaminated soil for each grouping) are presented in Tables 2 – 4. This analytical data (with the exception of total Ni, Table 4) is typical of soil analyses obtained by agricultural producers (farmers) in the Province of Ontario as part of prudent on-farm soil management strategy. All values for soil fertility (plant available P, K, and Mg), organic matter content, and inorganic carbon content were matched as closely as possible for each pair of contaminated and non-contaminated soils. In the case of the shallow soil pair, selection of a contaminated sampling site was very restricted because few landowners having soils within this grouping would grant permission to collect samples. Consequently, the concentration of organic carbon for the shallow soil pair was very dissimilar for the two materials.

Table 1: Soil series, parent materials, textural range and percentage of contaminated area containing total concentrations of Ni in excess of 500 mg/kg (approximately 6.5 km^2) for each soil grouping identified for the greenhouse project.

Soil "Grouping"	**Soil Series**	**Parent Material**	**Textural Range**	**Percentage of Area with [Ni] > 500 mg/kg**
Heavy Clay[1]	Welland Niagara Haldimand	Lacustrine, Heavy Clay	> 40% Clay	23%
Shallow[2]	Farmington Franktown Brooke Alluvial	Shallow (<100 cm) Loam, Clay Loam and Siltly Clay Loam over Limestone bedrock	Variable < 30% Clay	20%
Organic	Quarry Lorraine	Organic (swamp) Organic (fen)	Organic matter 40 – 160 cm deep	17%
Clay Loam[3]	Jeddo Chinguacousy Peel Malton	Till: Clay and Clay Loam Siltly Clay textures	Variable 20 - 40% Clay	8%
Sand	Fonthill Walsingham (Undifferentiated)	Eolian Sand and Beach Sand	< 20% Clay	1%
Not Mapped	No Designation	Anthropogenic	Variable	30%

Notes:

[1] Heavy Clay soils are generally developed on glacio-lacustrine parent materials. Within the context of the Port Colborne area many of these soils appear to contain a higher iron oxide content (red colored) compared with other soils.

[2] Shallow soils are generally developed in up to 100 cm of variable textured unconsolidated material (lower clay content compared to the Heavy Clay soils) over cherty limestone bedrock.

[3] Clay Loam soils are generally developed on till and have a lower clay content compared to the Heavy Clay (lacustrine) soils of the area.

Table 2: Analyses for available P, K and Mg.

Soil	Contamination Level	Available P (mg/L)	Available K (mg/L)	Available Mg (mg/L)
Organic	Background	11	77	742
Organic	High Ni	14	123	398
Sand	Background	46	75	88
Sand	High Ni	9	101	256
Heavy Clay	Background	13	222	487
Heavy Clay	High Ni	40	263	409
Shallow	Background	21	122	157
Shallow	High Ni	22	270	623

Table 3: Concentration of inorganic, organic and total carbon.

Soil	Contamination Level	Inorganic C (%)	Organic C (%)	Total C (%)
Organic	Background	0.27	32.9	33.2
Organic	High Ni	0.45	40.0	40.4
Sand	Background	0.16	3.46	3.62
Sand	High Ni	2.22	5.05	7.27
Heavy Clay	Background	0.05	6.51	6.56
Heavy Clay	High Ni	0.19	8.46	8.65
Shallow	Background	0.07	6.28	6.35
Shallow	High Ni	0.79	16.30	17.1

Table 4: Total concentration of Ni for investigative samples used to determine blending rates.

Soil	Contamination Level	Total Ni (mg/kg)
Organic	Background	50
Organic	High Ni	10400
Sand	Background	54
Sand	High Ni	3920
Heavy Clay	Background	40
Heavy Clay	High Ni	8660
Shallow	Background	40
Shallow	High Ni	2760

The contaminated and non-contaminated soil pairs were blended to represent concentrations of CoC ranging from background levels (about 50 mg Ni /kg) to about 3000 mg Ni/kg. The total concentration of CoC's in each blend combination was based on analytical values for concentration of total nickel obtained from analyses of the investigative samples (Table 4). Each analytical value therefore represents a single analysis of a composite sample (0-15 cm depth) which was obtained prior to collection of the bulk materials. These analytical values can only be considered as a frame of reference to obtain approximate target values for each blend combination. Analytical values obtained for total Ni, Cu, and Co of the blend combination (individual soil mixtures) will not be exactly the same as the target number because of the variability of the composition of the bulk soil sample, and inherent difficulties obtaining complete homogenization with mixing of the bulk samples. Consequently the final concentrations for each blended mixture <u>must be determined after blending is complete</u>.

Ontario Ministry of Environment (OMOE), 2000a, Phytotoxicology Soil Investigation: INCO – Port Colborne (1998). Ecological Standards and Toxicology Section, Standards Development Branch, Ontario Ministry of Environment, 125 Resource Rd. Etobicoke, Ontario, January, 2000

Ontario Ministry of Environment (OMOE), 2000b, Phytotoxicology Soil Investigation: INCO – Port Colborne (1999). Ecological Standards and Toxicology Section, Standards Development Branch, Ontario Ministry of Environment, 125 Resource Rd. Etobicoke, Ontario, July, 2000

Ontario Ministry of Agriculture, Food and Rural Affairs (OMAFRA) 2000, Field Crop Recommendations, 2000-2001, Publication 296, OMAFRA, Toronto.

Kingston, M.S. and E.W. Presant, 1989, The soils of the regional municipality of Niagara, Volumes 1 and 2 including 7 map sheets at 1:25,000 scale. Land Resource Research Centre Contribution No. 89-17. Report No. 60 of the Ontario Institute of Pedology.

Soil pH: Initial Adjustment

Soil pH values measured in 0.01 mol/L $CaCl_2$ solution (Hendershot et al. 1993) are presented in Table 5. Measurements for soil pH were obtained for the bulk soil in its initial condition after collection and also after pH adjustment. Soil pH values were adjusted from their initial values to within a target range of 6.0 to 6.2 for mineral soils. This range is slightly below the average value (6.3) for the surface horizons of mineral soils (see Table 6) reported for the Regional Municipality of Niagara (Kingston, and Presant, 1989). The pH values for organic soils (see Table 7) are slightly lower (5.6 – 5.0), consequently the target pH value for the organic soil pair was below 6.0.

The amount of $CaCO_3$ added to increase soil pH values to the appropriate level, or the amount of aluminum sulfate ($Al_2(SO_4)_3 \cdot 14\text{-}18\ H_2O$) added to reduce soil pH values was determined for each soil material through preliminary calibration experiments as follows:

1. A series of six - 10 g samples of each bulk soil were weighed (in duplicate) into 125 ml plastic containers and treated with increasing amounts of either $CaCO_3$ or $Al_2(SO_4)_3 \cdot 14\text{-}18\ H_2O$ at equivalent rates ranging from 0 to 30 tonne/ha.

2. Twenty ml of 0.01 mol/L $CaCl_2$ were added to each container, the container was sealed and the samples were incubated at room temperature for at least three days swirling occasionally (at least twice a day).

3. Soil pH values were measured at the end of the incubation.

4. Soil pH values were regressed against the amount of either $CaCO_3$ or $Al_2(SO_4)_3 \cdot 14\text{-}18\ H_2O$ added to determine the amount of amendment required to adjust the soil pH to within the target range.

5. Soil pH of the bulk materials was adjusted by spreading the soil in a thin layer (about 10 cm thick) and spreading either $CaCO_3$ or $Al_2(SO_4)_3 \cdot 14\text{-}18\ H_2O$ in the appropriate ratio of amending compound to the amount of bulk soil to adjust the pH value to the desired target range (6.0 – 6.2 for mineral soils).

6. A composite sample of the bulk soil (pH adjusted) was then collected, mixed and allowed to stand for three days to allow for reaction. The soil pH was then measured to verify that the desired pH range had been obtained.

The pH of the sand was not adjusted because the presence of free $CaCO_3$ in these soils. Free $CaCO_3$ (measured as total inorganic carbon content) typically buffers the soil pH in the range of 7.8 to 8.2. Reducing the soil pH value of these highly buffered soils is nearly impossible and highly impractical.

Table 5: Soil pH values measured in 0.01 mol/L CaCl2.

Soil	**Contamination Level**	**pH($CaCl_2$) (initial)**	**pH($CaCl_2$) (adjusted)**
Organic	Background	6.2	5.8
Organic	High Ni	4.9	6.0
Sand	Background	6.9	6.9
Sand	High Ni	6.9	6.9
Heavy Clay	Background	5.8	6.2
Heavy Clay	High Ni	6.2	6.2
Shallow	Background	5.7	6.0
Shallow	High Ni	6.5	6.2

Table 6: Soil pH values (0.01 mol/L CaCl2) of the surface horizons of mineral soils from generalized soil profiles of the Regional Municipality of Niagara (data from Kingston and Presant, 1989).

Soil Series	**pH of surface horizons (0.01 mol/L $CaCl_2$)**
Allunium	6.2
Brooke	6.2, 6.7
Chinuacousy	6.5, 6.6, 6.3, 6.5, 6.3, 6.6
Farmington	6.8
Haldimand	6.2, 6.1
Jeddo	6.7, 6.3, 6.6, 6.6
Lincoln	5.9, 6.0
Niagara	6.1
Toledo	6.2, 6.2
Welland	6.0, 6.0
Mean pH value	6.3

Table 7: Soil pH values (0.01 mol/L CaCl2) of the surface horizons of organic soils from generalized soil profiles of the Regional Municipality of Niagara (data from Kingston and Presant, 1989).

Soil Series	**pH of surface horizons (0.01 mol/L $CaCl_2$)**
Lorraine	5.0
Quarry	5.6

References

Kingston, M.S. and E.W. Presant, 1989, The soils of the regional municipality of Niagara, Volumes 1 and 2 including 7 map sheets at 1:25,000 scale. Land Resource Research Centre Contribution No. 89-17. Report No. 60 of the Ontario Institute of Pedology.

Hendershot, W.H. Lalande, H. and Duquette, M. 1993, Soil reaction and exchangeable acidity. Pages, 141-145 IN M.R. Carter, (ed.) Soil sampling and methods of analysis. Canadian Society of Soil Science, Lewis Publishers, Boca Raton, Florida.

Choice of aluminum sulfate to reduce soil pH values.

Lowering soil pH values is not recommended as a general agricultural practice because of the high expense associated with most compounds used to decrease soil pH values. The practice of soil pH reduction is used in the commercial production of some high value crops such as blueberries, and to control disease in some root crops such as potatoes. Although powdered or granular elemental sulfur are most commonly used to reduce soil pH values, the reaction does not take effect immediately and may take 3 months to 1 year to complete, which is impractical for the current experiments. Other faster reacting soil acidifying compounds include ammonium sulfate, iron (ferrous) sulphate, and aluminum sulfate. Aluminum sulfate was chosen in the present case because it reacts quickly and does not overly complicate the pool of plant available nutrients. Ammonium (N), in the case of ammonium sulfate, is a major plant nutrient. The addition of ferrous iron may interfere with Ni uptake in plants. Aluminum is not a plant nutrient and is potentially toxic to plants, but not at soil pH values in the range of 5.5 to 8. Sulfur (as sulfate) is also a plant nutrient typically supplied by atmospheric deposition to field crops in southern Ontario, but is commonly marginal or deficient in greenhouse environments.

Ontario Ministry of Agriculture, Food and Rural Affairs (OMAFRA) 1998, Soil Fertility Handbook, Publication 611, OMAFRA, Toronto.

Ontario Ministry of Agriculture, Food and Rural Affairs (OMAFRA) 2000, Field Crop Recommendations, 2000-2001, Publication 296, OMAFRA, Toronto.

Sample splitting and mixing using a riffle splitter.

All collected soil samples were mixed and split using a Jones-type riffle splitter. Samples were air-dried if required, prior to mixing. Mixing of the samples prior to analyses required passing the material through the splitter and recombined it a minimum of seven times to homogenize the material as much as possible. The splitter was also used to separate the material into equal halves as required.

Specification for plant density in the field plots

Table 8: Recommended seeding rates, seeding depths and final plant population for field trials.

Crop	Planting Depth (cm)	Row Spacing (cm)	Seeding Rate (#seeds/m of row)	Final Plant Population (plants per m of row)	Final Plant Population (Plants/ha)
Corn	2.5-3.0	76	13	6	78,800
Oats	0.6-1.3	18	100	50	2.77×10^6
Soybean	0.6-1.3	18	20	10	555,000
Radish	0.6-1.3	15	80-100	40-50	3.00×10^6

Specifications for seeding rates, planting depths and final plant populations for field plots (Table 6) were based on government recommendations for the production of field crops (OMAFRA, 2000a) and vegetable crops (OMAFRA, 2000b). It is common practice in field plot studies to plant at double the recommended seeding rate and then thin seedlings to the required plant population after germination and emergence. This is done to compensate for non-uniformity of plant populations that may be encountered due to reduced seed germination or extremes in the environment such as excessive rainfall or drought that reduce germination and emergence.

Ontario Ministry of Agriculture, Food and Rural Affairs (OMAFRA) 2000a, Field Crop Recommendations, 2000-2001, Publication 296, OMAFRA, Toronto.

Ontario Ministry of Agriculture, Food and Rural Affairs (OMAFRA) 2000b, Vegetable Production Recommendations, 2000-2001, Publication 363, OMAFRA, Toronto.

Fertilizer Recommendations

Field Plots

Fertilizer application rates for the field plots were based on applying recommended rates of fertilizer (OMAFRA, 2000) based on interpretation of results for soil fertility analyses obtained for composite samples taken from each of the field plots. Soil fertility analysis for nitrogen was not performed because accurate analysis for soil nitrogen demands special handling requirements of the sample that could not be adequately or consistently met for all samples. Instead a general application rate for N was used which is based on individual crop requirements (OMAFRA, 2000). Nitrogen fertilizer was not supplied to soybeans in favor of the common practice of seed inoculation with soybean rhizobia to induce nitrogen fixation by the roots of the plants.

In cases where excessive ratings for soil analyses were found (Table 7) fertilizer was not added as per recommendations (OMAFRA, 2000). Fertilizer application in not recommended in the case of excessive ratings because this may cause problems due to reduced yields, nutrient imbalances or poor plant quality. Phosphate addition also increases the risk of water pollution. Potassium additions may induce magnesium deficiencies on soils low in magnesium.

Table 9: Fertility ratings (e.g. low, medium, high, excessive, etc.) for soil fertility analyses and the corresponding fertilizer requirements for each crop grown on the Site 2 (Inco) field plots.

	Soil Test Values			
Crop	Nitrogen*	Phosphate	Potassium	Magnesium
	-	73 mg/L_{soil}	310 mg/L_{soil}	445 mg/L_{soil}
Corn	General 160 kg/ha	Excessive 0 kg/ha	Excessive 0 kg/ha	Adequate 0 kg/ha
Oats	General 40 kg/ha	Excessive 0 kg/ha	Excessive 0 kg/ha	Adequate 0 kg/ha
Soybean	General 0 kg/ha	Excessive 0 kg/ha	Excessive 0 kg/ha	Adequate 0 kg/ha
Radish	General 60 kg/ha	Excessive 0 kg/ha	Excessive 0 kg/ha	Adequate 0 kg/ha

- Note: Fertilizer recommendations for nitrogen are general recommendations for plant requirements and are not based on soil fertility analyses.

Table 10: Ratings (e.g. low, medium, high, excessive, etc.) for soil fertility analyses and corresponding fertilizer requirements for each crop grown on the Site 3 (Hruska Field) field plots.

	Soil Test Values			
Crop	Nitrogen*	Phosphate	Potassium	Magnesium
	-	12 mg/L_{soil}	120 mg/L_{soil}	284 mg/L_{soil}
Corn	General 160 kg/ha	Medium 50 kg/ha	Medium 30 kg/ha	Adequate 0 kg/ha
Oats	General 40 kg/ha	Medium 20 kg/ha	Very High 0 kg/ha	Adequate 0 kg/ha
Soybean	General 0 kg/ha	Medium 30 kg/ha	Medium 30 kg/ha	Adequate 0 kg/ha

* Note: Fertilizer recommendations for nitrogen are general recommendations for plant requirements and are not based on soil fertility analyses.

Fertilizer Requirements

Greenhouse

All fertilizer application rates for greenhouse pots were based on general requirements for oats and radish crops (OMAFRA, 2000). Soil fertility analyses were used in the greenhouse trials to establish the general baseline soil fertility levels and to ensure that fertilizer application rates would not be excessive and cause problems affecting yield and nutrient imbalances. Higher rates of fertilizer must be applied in greenhouse pot studies (compared to the field) to compensate for the limited amount of soil in each pot that is explored by the roots to provide water and nutrients for the growing plants. Fertilizer rates for all soils are listed in Table 9. Phosphate was applied as a circular band of $CaHPO_4$ in each pot placed about 5 cm below the seed (about 6 cm below the soil surface). Nitrogen and potassium were applied as a solution of KNO_3 immediately after planting.

Table 11: Equivalent Rates of N, P and K fertilizer applied to each pot.

Crop	Nitrogen	Phosphate	Potassium
Oats and Radish	General 70 kg N/ha	General 218 kg P/ha (banded)	General 182 kg K/ha

Banding of Phosphate Fertilizer.

An effective method of providing a readily available supply of nutrients to growing seedlings is to place the fertilizer in a localized band usually about 5 cm below and 5 cm to either side of the seed (White and Collins, 1976). The practice of fertilizer banding reduces contact of the fertilizer with soil particles thus minimizing the opportunity for fixation of the nutrients, most notably phosphate, by the soil and provides a readily available source of plant nutrients early in the growth cycle when it is required most.

White, W.C. and Collins, D.N. (eds.) 1976. The fertilizer handbook. The Fertilizer Institute, Washington D.C. 208pp.

Agricultural Limestone Requirement

Rates of $CaCO_3$ and $MgCO_3$ applied to Greenhouse soils

The rate of application of $CaCO_3$ and $MgCO_3$ was based on the response of each soil to the application of $CaCO_3$ during the initial pH adjustment procedure (see above). An equimolar mixture (1:1) of finely powdered reagent grade $CaCO_3$ and $MgCO_3$ were substituted for dolomitic limestone ($Ca,Mg(CO_3)_2$) to maximize the rate of reaction and pH increase. All pH values were measured in 0.01 mol/L $CaCl_2$ solution (Hendershot et al. 1993). The amount of $CaCO_3$ applied to each soil mixture was calculated to increase soil pH values from the initial values to the target level. Soil pH values were measured in 0.01 mol/L $CaCl_2$ for soil samples collected from each pot to determine the final soil pH environment of the growing plants.

Table 12: Soil pH values measured in 0.01 mol/L CaCl2.

Soil	**pH($CaCl_2$) (initial)**	**pH($CaCl_2$) (target)**	**Rate of Agricultural Limestone Addition**
Organic	5.8	6.5	2.4 tonnes/ha
Heavy Clay	6.2	7.0	2.0 tonnes.ha
Shallow Loam	6.0	7.0	2.0 tonnes/ha
Sand	6.9	6.9	0 tonne/ha

The pH of the sand was not adjusted because free $CaCO_3$ was present in these soils buffered the soil pH at 6.9 (0.01 mol/L $CaCl_2$). As an alternative method of treatment these soils were amended with mushroom compost.

Rates of Agricultural Limestone applied to Field Plots

Three rates of agricultural limestone were applied to the field plots at Site 3 (Hruska Field). The lowest rate of application was 0 tonne/ha which represents the application of no agricultural limestone. The highest rate of application was 100 tonne/ha which represented an arbitrarily chosen rate sufficient to increase soil pH values up to 8.2 and provide excess limestone (free $CaCO_3$) in the topsoil to maintain soil pH at this level for several years.

The intermediate rate of agricultural limestone applied was 11 tonne/ha. This rate represents a prudent rate of application for agricultural limestone intended to increase the soil pH value to approximately 7.0. This rate was calculated using established relationships for pH adjustment (OMAFRA, 1998) and the buffer pH values measured for the 0-15 cm composite sample collected from the site (SC-07).

Ontario Ministry of Agriculture, Food and Rural Affairs (OMAFRA) 1998, Soil Fertility Handbook, Publication 611, OMAFRA, Toronto.

Characteristics of mushroom compost used to amend sand samples in greenhouse.

The purpose of adding this amendment was to increase the organic matter content of the sand, and subsequently to increase the metal sequestering potential of the soil and reduce the availability of the CoC's to the growing plants. Increasing the organic matter content of the soil increases the number of adsorption sites and consequently reduces the uptake of CoC's by the growing plants.

The compost used to amend the sand was PC Brand Mushroom Compost purchased from Zehrs. The characteristics of the material are as follows:

Moisture Content	1.64 g/g (164%)
Bulk Density	400 kg/m^3
Organic Matter Content	40.6%

Addition and mixing of 1 kg fresh compost to the soil in each 6.5 L pot should increase the soil organic matter content of the soil by 2.4% from an average of about 7.3% to about 9.7%. This can also be expressed as a 30% increase in total soil organic matter content of the soil.

THEORETICAL METAL UP-TAKE CALCULATION

Within the context of growing oat plants for one growing season in the greenhouse experiment using pots with a limited volume of soil, the question arises as to how much metal the growing plants will remove from the soil in the pot. The following calculation predicts the maximum amount of Ni taken up by 5 to 6 oat plants grown in 6.5 L pots containing soil with a low total concentration of Ni.

- Assume a soil contains a total of 200 mg Ni /kg soil (average background concentration for Ontario soil average = 34 mg/kg). This is the MOE's phytotoxicity limit for total Ni in soil. This value is low compared to the concentration of Ni in the greenhouse soils (with the exception of the background soils). The same amount of Ni removed by plants from soils with higher total concentrations will represent lower percentages of the soil Ni.

- Assume a 6.5 L pot contains 1.3 kg of organic soil (very light). This value represents the lowest mass of soil for all of the 2001 greenhouse experiments.

- Assume a dry matter yield (above ground) for oats = 20 g (very high). This value is greater than the highest dry matter yield for oats in any of the greenhouse experiments (highest about 15 g)

- Assume plant up-take of 100 mg Ni / kg dry matter (100 ppm, very high). This value it is used here for demonstrative purposes only. This value for plant up-take represents an extreme theoretical case and is very high relative to the total amount of Ni (200 ppm) in the soil. It also ignores the phytotoxicity effects of the Ni (i.e. 100 ppm Ni in the dry matter would likely result in dry matter yields lower than 20 g).

- Total mass of Ni in 1 pot of soil = 1.3 kg soil X 200 mg Ni /kg = 325 mg Ni/pot

- Total mass of Ni in plant dry matter = 20 g dry matter X 0.001 kg/g X 100 mg Ni / kg dry matter = 2 mg Ni

- Proportion of Total Ni removed from soil by plants = 2 mg Ni / 325 mg Ni/pot = 0.006 X 100 = 0.6%

- Considering the analytical uncertainty in the analysis of soil Ni will be at least 5% then removal of 0.6% (the maximum possible under these conditions) of the total soil Ni will not be detected in the analytical value for the soil. Actual percentages of removal will be much lower than in all other cases.

Soil Fertility and Organic Carbon Analyses and “Chain of Custody” forms.

Table 13: Key to Sample Identification

Code	Site Location	Status
CWM4-1	Contaminated Welland soil, 0-15 cm composite north of field site 2	Adopted for use in GH Expt
CMW8-1	Welland clay background, Wainfleet Dump, 0-15 cm composite about 100 m west of long beach road, 200 m south of dump site inside woodlot.	Discarded Site Inaccessible
SC-01	Contaminated Sand 0-15 cm composite sample. Site located south of Inco plant, north side of Lakeshore Rd. (prior site SS-23)	Adopted for use in GH Expt.
SC-02	Contaminated Welland clay, Ap horizon (0-23 cm) test pit sample, Hruska field, south of Site 3 field plots.	Preliminary data for field site 3.
SC-03	Background sand, 0-15 cm composite, east refinery, south end of Halloway Bay Road.	Discarded Insufficient Material
SC-04	(a.k.a. T517-2) Contaminated Shallow loam (Farmington series) 0-15 cm composite sample north of school, west of Elizabeth St.	Discarded [Ni] too low
SC-05	(a.k.a. OM4-2) Contaminated organic soil, 0-15 cm composite, former Grotelaars farm, about 20 m east of organic field plots, inside bush lot.	Adopted for use in GH Expt
SC-06	Background organic 0-15 cm composite, Zutt farm, 30 m east of Dritts, Rd, 80 m south of buildings on the edge of the wood lot.	Adopted for use in GH Expt
SC-07	Site 3 field plots, Hruska field, 0-15 cm composite, collected randomly from 50 X 60 m area.	Fertility data for Field Site 3.
SC-08	(a.k.a. LAM29-2) Contaminated Alluvium soil, 0-15 cm composite, about 120 m east of Snider Rd. and 100 m north of abandon CN tracks	Disallowed Site access denied
WeNim-31	(a.k.a. SC-09) Contaminated Welland soil, 0-15 cm composite sample of Site 2 Field plot area.	Fertility data for Field Site 2.
SC-10	(a.k.a. FC-065-1) Contaminated shallow loam, 0-15 cm composite, Farmington series, Robitaille property	Discarded [Ni] too low
SC-11	Background shallow loam, 0-15 cm composite, Farmington series, 50 m west of Morgan Road, 1.2 km south of Lakeshore Rd.	Discarded
SC-12	Welland clay background, Wainfleet Dump, 0-15 cm composite about 80 m west of long beach road, 200 m south of dump site inside woodlot.	Adopted for use in GH Expt
SC-13	Sand background, 0-15 cm composite site 1, about	Discarded

	150 m north of Lakeshore Rd. 1 km west of Cement Plant Rd.	
SC-14	Sand background, Lakeshore road, site 2, about 100 m north of Lakeshore Rd, 1 km west of Cement Plant Rd.	Adopted for use in GH Expt
SC-15	Background shallow loam, (Farmington series) 0-15 cm composite Sabo property 150 m south, of Lakeshore Rd. 150 m west of Morgan’s Point Rd.	Adopted for use in GH Expt
SC-16	(a.k.a. FL0626-1) Contaminated shallow loam, (Alluvium series) Inco/CN property, 0-15 cm composite	Adopted for use in GH Expt
SC-20	Mushroom Compost, composite from 12(?) samples from 12 - 18 kg bags	Amendment for sand in GH Expt.

Table II.2.2

SOIL GROUPINGS IN PORT COLBORNE AREA

Soil "Group"	Soil Series	Parent Materials*	Drainage**	Texture
Organic (T. Mesisol)	Quarry Lorraine	Organic (swamp) Organic (fen)	V Poor V Poor	160 cm organic over HC (60%)
Shallow over Bedrock	Farmington Franktown Brooke	100 cm /Limestn 50 cm /Limestn 100 cm /Limestn	Rapid Imp Poor	Variable < 30% Clay
Till P.M.	Jeddo Chingoucousy Peel (Malton)	Red CL Till Red CL Till Red C / CL Till SiC / C Till	Poor Imp Imp Poor	20 -40% Clay
Lacustrine P.M.	Welland Niagara Haldimand	Red-Lac HC Red-Lac HC Lac HC	Poor Imp Imp	> 40% Clay
Other	Alluvium Fonthill Walsingham	Variable / LacHC Red Coarse Sand Eaolian Sand	Well Rapid Imp	< 20% Clay
Not Mapped	Residential Incustrial Commercial	Anthropogenic	Variable	Variable

Notes: *Parent Materials (examples)
100 cm /Limestn = 100 cm variable textured soil over limestone bedrock

Red CL Till = Red colored Clay Loam textured glacial till
LacHC = lacustrine heavy clay
SiC = Silty Clay

**Drainage
V. Poor = Very Poor
Imp = Imperfect

Source: Kingston, M.S. and Presant, E.W. 1989. The soils of the regional municipality of Niagara. Land Resource Research Centre Contribution No. 89-17.

Table II-2.3
ESTIMATED AREAL DISTRIBUTION OF SOIL "GROUPS" WITHIN A 40 km^2 AREA NORTHEAST OF THE INCO SMELTER

Soil "Group"	% of Total Area	>500 mg Ni /kg	< 500 mg Ni /kg
Till P.M.	37%	8%	50%
Lacustrine P.M.	17%	23%	13%
Shallow over Bedrock	15%	20%	12%
Organic	5%	17%	2%
Other	<1%	1%	<1%
Not Mapped	24%	30%	22%

Estimates are based on an area of approximately 40 km^2 extending east and north of the Inco smelter, including all areas contaminated with >500 mg Ni/kg soil based on MOE (2000) Report.

Reference: Ontario Ministry of the Environment (2000) Phytotoxicology technical memorandum: Phytotoxicological soil investigation: Inco – Port Colborne (1999) Report No. SDB-032-3511-2000.

Table II-2. 4
CoC CONCENTRATIONS IN COLLECTED SOILS (mg/kg)

SOIL METAL LEVEL			ORGANIC SOIL					CLAY SOIL						SANDY SOIL	
	Total Nickel (mg/g)	Aqueous Nickel (mg/g)	Percentage (%)	DTPA Nickel (mg/g)	Percentage (%)	Total Nickel (mg/g)	Aqueous Nickel (mg/g)	Percentage (%)	DTPA Nickel (mg/g)	Percentage (%)	Total Nickel (mg/g)	Aqueous Nickel (mg/g)	Percentage (%)	DTPA Nickel (mg/g)	Percentage (%)
VERY HIGH	5,540.0	11.2	0.2%	410.0	7.4%	8,280.0	13.6	0.2%	565	6.8%	n/a	n/a	n/a	n/a	n/a
HIGH	3,160.0	9.1	0.3%	240.0	7.6%	3,430.0	8.6	0.3%	408.0	11.9%	1,350.0	3.0	0.2%	91.4	6.8%
MEDIUM	1,200.0	1.2	0.1%	99.2	8.3%	517.0	1.7	0.3%	70.3	13.6%	307.0	0.0	0.0%	23.0	7.5%
LOW	216.0	nd	0.0%	26.1	12.1%	194.0	0.5	0.3%	27.3	14.1%	494.0	0.7	0.1%	51.6	10.4%
CONTROL	33.0	nd	0.0%	2.6	7.9%	34.1	nd	0.0%	3.5	10.3%	5.0	nd	0.0%	nd	0.0%
	Total Copper (mg/g)	Aqueous Copper (mg/g)	Percentage (%)	DTPA Copper (mg/g)	Percentage (%)	Total Copper (mg/g)	Aqueous Copper (mg/g)	Percentage (%)	DTPA Copper (mg/g)	Percentage (%)	Total Copper (mg/g)	Aqueous Copper (mg/g)	Percentage (%)	DTPA Copper (mg/g)	Percentage (%)
VERY HIGH	560.0	1.0	0.2%	3.2	0.6%	890	2.1	0.2%	27.6	3.1%	n/a	n/a	n/a	n/a	n/a
HIGH	460.0	1.6	0.3%	5.0	1.1%	366.0	0.0	0.0%	29.9	8.2%	137.0	nd	0.0%	36.8	26.9%
MEDIUM	211.0	0.0	0.0%	7.3	3.5%	81.8	0.0	0.0%	15.7	19.2%	39.3	nd	0.0%	11.7	29.8%
LOW	59.0	0.0	0.0%	7.5	12.7%	42.1	0.0	0.0%	13.9	33.0%	71.3	nd	0.0%	22.4	31.4%
CONTROL	16.4	0.0	0.0%	2.0	12.2%	24.6	nd	0.0%	3.8	15.4%	nd	0.0	0.0%	nd	0.0%
	Total Cobalt (mg/g)	Aqueous Cobalt (mg/g)	Percentage (%)	DTPA Cobalt (mg/g)	Percentage (%)	Total Cobalt (mg/g)	Aqueous Cobalt (mg/g)	Percentage (%)	DTPA Cobalt (mg/g)	Percentage (%)	Total Cobalt (mg/g)	Aqueous Cobalt (mg/g)	Percentage (%)	DTPA Cobalt (mg/g)	Percentage (%)
VERY HIGH	72.8	nd	0.0%	0.5	0.7%	108	nd	0.0%	1.3	1.2%	n/a	n/a	n/a	n/a	n/a
HIGH	37.2	nd	0.0%	nd	0.0%	48.5	nd	0.0%	1.4	2.9%	27.9	nd	0.0%	0.6	2.2%
MEDIUM	15.0	nd	0.0%	0.5	3.3%	12.8	nd	0.0%	1.3	10.2%	6.1	nd	0.0%	nd	0.0%
LOW	7.6	nd	0.0%	0.5	6.6%	7.8	nd	0.0%	0.6	7.7%	7.0	nd	0.0%	nd	0.0%
CONTROL	nd	nd	0.0%	nd	0.0%	nd	nd	0.0%	nd	0.0%	nd	nd	0.0%	nd	0.0%

FACTORS CONSIDERED IN DATA ANALYSES

During the implementation of the Year 2000 Greenhouse Trials, experimental results were negatively impacted by several aspects, including:

1) Plants would not germinate and grow in the soil initially collected as the Organic Control soil. It was determined that the soil collected (which was taken from the edge of an onion field well west up the prevailing wind from Port Colborne was contaminated with a broad spectrum herbicide. This problem was resolved by discarding the soil (both in its drum and in the pot tests underway), and accessing a barrel of replacement soil that was not herbicide contaminated. This replacement Organic Control soil was taken near the initial location, but from a location in the bush where herbicide contamination was unlikely.

   After sieving and homogenizing, new pot tests were set up with the new Organic Control soil and the plants grew normally in them. The first ramification of this replacement is, however, that despite the fact that pot tests in new control soil were terminated after the same number of days as were those for the other members of their sets, conditions are never the same for a later pot tests run over different periods, even if they can the run over exactly the same number of days (e.g., different photo-periods)

   The second ramification is that comparative photographs of the plants for the full sequential tests could not be taken for the Organic soil experiments since the Control pot tests were at a different stage of growth.

2) Shortly after the plants in the Organic soil sequence (three experiments) began to grow, it was apparent that those in the High Organic pots were highly different compared to the plants of the others. In fact, corn, soybeans and oats grew so prolifically in the High Organic soil that plants in their sets were even larger and more vigorous looking than those in the sets of their sequence that were growing in much less impacted soils. Reference to the nutrient levels in the soils in question (see Table II 2) showed that phosphorus levels in the High Organic soil (muck soil from the former Groetelaar farm, taken near the location of the organic soil field test site) were somewhat high relative to those of other members of their sequence.

   It was speculated that the soil at this former operating farm had been heavily fertilized when it was in operation, and this might be part of the reason for the anomaly. To test this, one new experiment, a sequence of pot tests for one of the crops (corn), was set up. For it, very much higher amounts of phosphate fertilizers (10 times as much) were added to all of the sets (including the suspect High Organic one) to see if the anomaly went away if all the sets of the sequence were over-fertilized with phosphates.

The results of this experiment 10 (Organic Corn II) do suggest that the speculation may be at least partially true as the plants in the other sets of the sequence did grow much better and the anomaly was partially resolved (see the photographs in Appendix V of Volume III). However, it may not be the full story and more than just over-fertilization by phosphate fertilizers may have been involved with soils from the former Groetelaar farm muck soil site. Because of these results, for all of the dose-response curves for organic soils, the High Organic data was discounted. This reduced the amount of data available for determining regressions above the TCs for the Organic soil experiments and adds notes of caution to the absolute values of EC_{25} and EC_{50} values for oats and soybeans grown in organic soil. (Corn plants grown in Organic soil had so little uptake anyway that the caution is not a factor for them.)

The results also suggest that data for plants grown in soil from the muck soil site may not be indicative of what might be expected from other organic soils in the Port Colborne area. Further testing may have to be carried out to determine just what is the nature of the muck soil from the Groetelaar site and why it differs so much from other local organic soils.

A similar phenomenon became apparent when dose-response graphs were prepared for plants growing in the clay soils, when it was noticed that Control Clay soils had different (higher) relative yields than those of plants growing in Low Clay and medium Clay soils. Since the Clay Control soil had been accessed from just off the edge of a farmed field, it is possible that it too contained higher than normal amounts of fertilizers. It also had a much higher pH than the other Clay soils. For conservatism, the Clay Control results were discounted when defining the continuous points (i.e., relative yield = 1.0) on the Clay soil dose-response graphs. (This has less impact than discounting data above the TCs as these are input to regression analyses, while data below the TCs is only used to define the relative yield = 1.0 line of a dose-response graph.)

3) Many of the results obtained for plant tissue CoC concentration were below the limits of the analytical method used and are reported as ND, non-detect (see the data tables of Appendix II). This complicated statistical calculations as the option then existed to use the data as zero, or as the value of the detection limit (2.5 mg/kg for nickel), or to ignore the data completely. The latter was chosen, but this reduced the amount of data available for determining dose-response graphs.

This had its greatest impact on the results for cobalt, where the low initial values in the greenhouse soils resulted in many cases in plants with cobalt levels below non-detect. While the fact that cobalt uptake is so low indicates that cobalt contamination is not a major factor for the ERA, it does prevent any definitive conclusions from being made for this CoC. It suggests that for future greenhouse trials under the ERA that consideration might have to be given to having some or all of the plant metal analyses carried out under more rigorous (and much more expensive) analytical test procedures with much lower detection limits.

4) As expected, the most sensitive crops used in the greenhouse testing turned out to be Oats and, as mentioned, all of the aboveground plant tissue were analyzed for CoC levels after drying and weighing. (This differs from the situation with Corn and Soybeans where only the dried lower leaves of the plants were sent for CoC analyses.) The first sequence to exhibit adverse effects sufficient to dictate terminating the pot tests was Oats in Clay soil. For the sets of the sequence showing the largest adverse effects (the sets of the sequence growing in High Clay and Very High Clay soils) as might be anticipated the amount of biomass was small, already complicating matters. The plants from this first harvest were, according to protocol, placed in paper bags, dried as required, weighed and sent to Philip Laboratories for CoC analyses.

After the plants were sent off, it was discovered that some of the dry weight (yields) obtained were negative numbers. The problem was quickly traced to the fact that the paper bags used to hold the samples were dehydrating in the drying ovens too, changing their weights as well. The protocol was then adjusted to prevent this problem from recurring. However, by this time the Oats in Clay soil plants had all been sent for analysis, and in the case of oats this involved the entire plants. The analytical procedure used made it impossible to recover the plants for re-weighing. As a result, for the Oats in Clay sequence, although plant tissue metal analyses are available, plant biomass results are not.

Table II-2.7

SOIL COLLECTION RECORD FOR YEAR 2001 GREENHOUSE TRIALS

Soil group: Heavy Clay, Highly-Contaminated (V)
Site code: none apparent
Collection date: **May 10/01**
Number of loader buckets taken: 4 x 2m^3
Date finished sieving: May 31/01
Date moved to onion barn: June 1/01
Barrel codes: WeNi1/10M11
WeNi2/10M11
WeNi3/10M11
WeNi4/10M11
WeNi5/10M11
WeNi6/10M11
WeNi7/10M11
WeNi8/10M11
WeNi9/10M30
WeNi10/10M31

Soil group: Sand, Highly-Contaminated
Site code: S517#1
Collection date: **May 30/01**
Number of loader buckets taken: 5 x 2m^3
Date finished sieving: June 25/01
Date moved to onion barn: June 1/01
Barrel codes: SaNi1/4M30
SaNi2/4M30
SaNi3/4M31
SaNi4/4M31

Soil group: Organic, Highly- Contaminated
Site code: OM4-2
Collection date: **May 31/01**
Number of loader buckets taken: 2 x 2m^3
Date finished sieving: May 31/01
Date moved to onion barn: June 1/01

Barrel codes: OrNi1/4M31
OrNi2/4M31
OrNi3/4M31
OrNi4/4M31

Soil group: Organic Control (C)
Site code: OBGM24
Collection date: **May 31/01**
Number of loader buckets taken: 4 x .89m^3
Date finished sieving: June 6/01
Date moved to onion barn: June 7/01
Barrel codes: OrBg1/4J5
OrBg2/4J6
OrBg3/4J6
OrBg4/4J6

Soil group: Heavy Clay, Control (two collection events)
Site code: CWM8-1
Collection date: **May 31/01, June 20/01**
Number of loader buckets taken: 9 x 2m^3;6 x 2m^3
Date finished sieving: July 5/01; July 26
Date moved to onion barn: July 6/01; July 26
Barrel codes: WeBg1/10J8
WeBg2/10J18
WeBg3/10J18
WeBg4/10J19
WeBg5/10J19
WeBg6/10Jy4
WeBg7/10Jy4
WeBg8/10Jy4
WeBg9/10Jy5
WeBg10/10Jy5
WeBg1/3Jy26
WeBg2/3Jy26
WeBg3/3Jy26

Soil group: Till Clay Shallow soils, Control
Site code: none apparent

Collection date: **June 20/01**
Number of loader buckets taken: 5 x .96m^3
Date finished sieving: June 25/01
Date moved to onion barn: June 22/01
Barrel codes: FaBg1/5J25;
FaBg2/5J25;
FaBg3/5J25
FaBg4/5J25
FaBg5/5J25

Soil group: Sand, Control
Site code: none apparent
Collection date: **June 20/01**
Number of loader buckets taken: 5 x .96m^3
Date finished sieving: June 21/01
Date moved to onion barn: June 22/01
Barrel codes: SaBg1/5J21
SaBg2/5J21
SaBg3/5J21
SaBg4/5J21
SaBg5/5J21

Soil group: Till Clay shallow soil, Highly-Contaminated
Site code: FL0626-1
Collection date: **July 5/01**
Number of loader buckets taken: 7 x .96m^3
Date finished sieving: July 11/01
Date moved to onion barn: July 12/01
Barrel codes: FaNi1/5Jy10
FaNi2/5Jy10
FaNi3/5Jy11
FaNi4/5Jy11
FaNi5/5Jy11

APPENDIX S-1.2

ENPAR SOIL TEST PITS
(2001 GREENHOUSE SOILS)

A Company Specialising in Environmental Protection and Remediation Technologies
449 Laird Rd. Unit 12, Guelph, ON, N1G 4W1
Tel.: (519) 836-6155 Fax: (519) 836-5683
E-mail: enpar@sympatico.ca Website: www.enpar-tech.com

September 10, 2001

Jacques Whitford Environment Limited
1200 Denison St.
Markham, Ontario
L3R 8G6

Re: Soil Test Pits – Greenhouse Soils

Attention: Jim Higgins:

The following report is a summary of descriptions for 9 soil test pits excavated and sampled in Port Colborne, Ontario between May 4, and July 9, 2001. These descriptions for sample sites and soil profiles were written using standardized terms, definitions, and protocols, for soil survey in Canada. The reader is referred to: "Day, J.H. ed. (1983) The Canada soil information system (CanSIS) - Manual for describing soils in the field, 1982 revised, Research Branch, Agriculture Canada" for all details. All descriptions are based on observations taken in the field. Soil texture was estimated using field hand-texturing procedures. Soil reaction is reported only for horizons displaying effervescence when treated with 10% HCl. If you have any questions regarding this report please contact me at any time.

Sincerely,

C. James Warren, Ph.D.
Senior Soil Scientist
ENPAR Technologies Inc.

/cjw

SOIL PROFILE DESCRIPTIONS

GREENHOUSE SOILS

As part of the Year 2001 Ecological Risk Assessment of the Inco Port Colborne CBRA process, top soils (approximately 0-15 cm depth) were collected for Greenhouse Trials for contaminated soils in the region. The attached report is a summary of descriptions for 9 soil test pits excavated and sampled in Port Colborne, Ontario between May 4, and July 9, 2001. Pits were excavated by hand to a depth of approximately 1 m. The sample sites and soil profiles were described using standardized terms, definitions, and protocols, used for soil survey in Canada (Day, 1983). A sample of each pedogenetic horizon in the soil profile was collected at the time of excavation. All descriptions are based on observations taken in the field. Soil texture was estimated using field hand-texturing procedures. Soil reaction is reported only for horizons displaying effervescence when treated with 10% HCl.

Reference

Day, J.H. ed. (1983) The Canada soil information system (CanSIS) - Manual for describing soils in the field, 1982 revised, Research Branch, Agriculture Canada.

SOIL PROFILE DESCRIPTION

ORGANIC SOIL - BACKGROUND

Site Description: Lot 11, Concession 2, Township of Wainfleet, about 40 m East of Wright Rd, 0.7 km North of Highway 3.

GPS Location: E 17 635760 N 4750683

Landform/Parent Materials:
Swamp-associated woody forest peat 40-160 cm deep over lacustrine heavy clay.

Slope and Aspect: Level

Stoniness: Non-Stony

Rock Outcrop: None

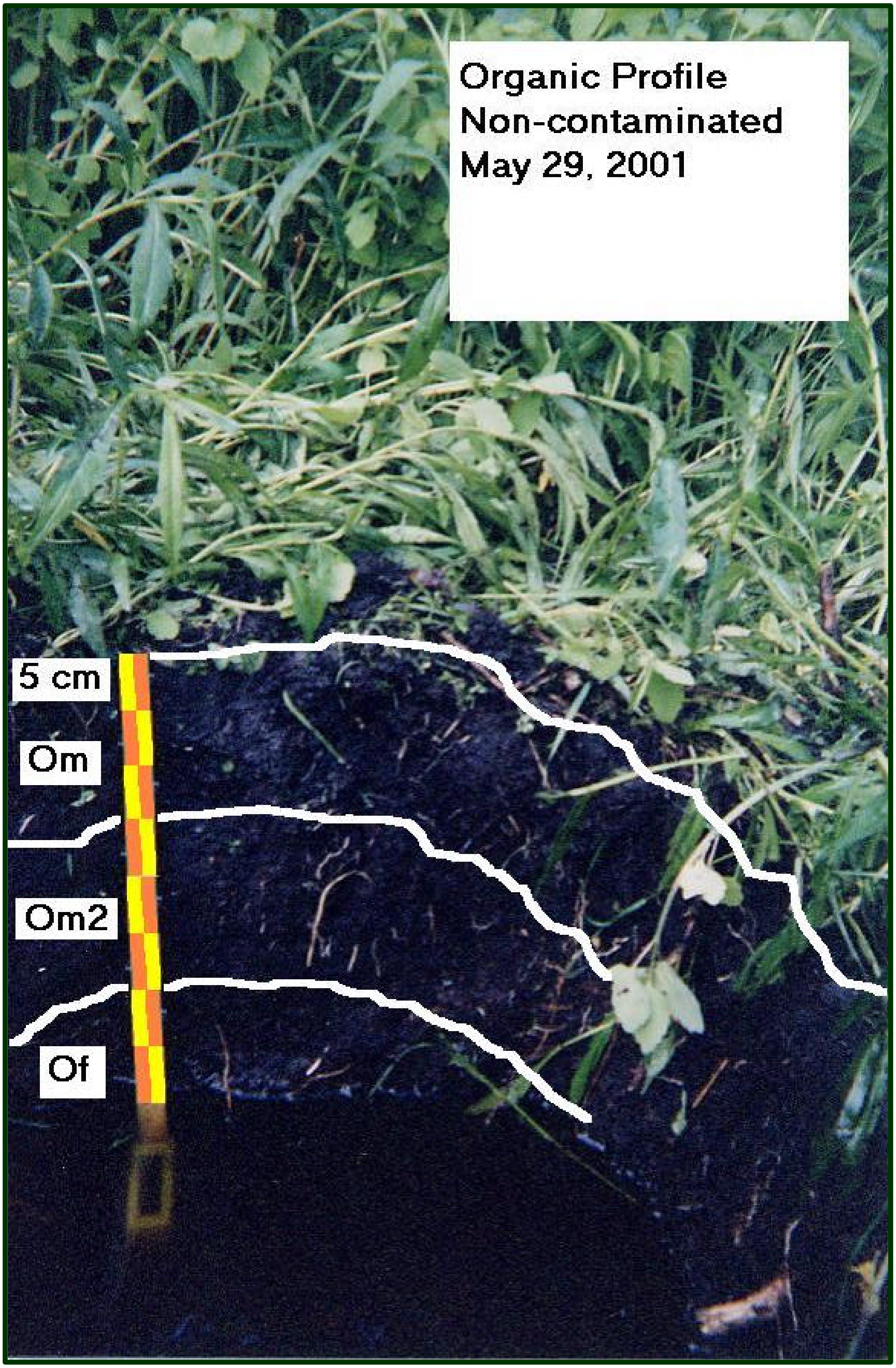
Soil Water Regime: Poorly drained; very high (18 cm) water table.

Present Land Use: Rural farm, border between open field and woodlot

Vegetation: Grasses, sedges

Date Sampled: May 29, 2001

Horizon	**Depth (cm)**	**Description**
Om	0-15	Black (10YR 2/1 m); moderately decomposed organic matter; plentiful fine and medium roots; gradual smooth boundary.
Om2	15-30	Black (10YR 2/1 m); strongly decomposed organic matter and semidecomposed wood fragments; few medium and coarse roots; gradual smooth boundary
Of	30-45	Black (10YR 2/1 m); weakly decomposed organic matter and semidecomposed wood fragments.


Organic Profile
Non-contaminated
May 29, 2001
5 cm
Om
Om2
Of

SOIL PROFILE DESCRIPTION

ORGANIC SOIL - CONTAMINATED

Site Description: Lot 23, Concession 1, City of Port Colborne, about 30 m East of Reuter Road, and 0.8 km South of Durham St.

GPS Location: E 17 644636 N 4748964

Landform/Parent Materials: Swamp-associated woody forest peat 40-160 cm deep over lacustrine heavy clay.

Slope and Aspect: Level

Stoniness: Non-Stony

Rock Outcrop: None

Soil Water Regime: Poorly drained; very high (48 cm) water table.

Present Land Use: Abandon rural farm, woodlot

Vegetation: Mature oak, maple, ivy

Date Sampled: May 25, 2001

Horizon	**Depth (cm)**	**Description**
LFH	4-0	Brown (7.5YR 4/4 d); semi- and non-decomposed leaves, twigs, moss and wood fragments; abundant fine and medium roots; abrupt smooth boundary.
Oh	0-15	Black (10YR 2/1 m); very strongly decomposed organic matter; plentiful medium roots; gradual diffuse boundary.
Oh2	15-30	Black (10YR 2/1 m); strongly decomposed organic matter and semidecomposed wood fragments; plentiful coarse roots; gradual diffuse boundary.
Om	30-45	Very dark grayish brown (10YR 3/2 m); strongly decomposed organic matter and semidecomposed wood fragments; few medium and coarse roots; gradual diffuse boundary.
Om2	45+	Very dark grayish brown (10YR 3/2 m); strongly decomposed organic matter and semidecomposed wood fragments; few fine roots.

SOIL PROFILE DESCRIPTION

HEAVY CLAY – BACKGROUND

Site Description:	Lot 20, Concession 1, Township of Wainfleet, about 500 m South of Wainfleet Dump Site
GPS Location:	E 17 632567 N 4748156
Landform/Parent Materials:	Glaciolacustrine
Slope and Aspect:	Level
Stoniness:	Non-Stony
Rock Outcrop:	None
Soil Water Regime:	Poorly drained; very high (30 cm) water table.
Present Land Use:	Woodlot
Vegetation:	Weeds, full grown maple, oak.
Date Sampled:	May 25, 2001

Horizon	**Depth (cm)**	**Description**
Ah	0-22	Black (2.5YR 2/0 m); clay; weak medium granular; friable; abrupt smooth boundary.
Aeg	22-33	Gray (10YR 6/1 m); heavy clay; few, large, distinct yellowish brown (10YR 5/6 m) mottles; massive; gradual diffuse boundary.
Bg	33-63	Light yellowish brown (10YR 6/4 m); heavy clay; many, large, distinct yellowish brown (10YR 5/6 m) mottles; massive; gradual smooth boundary.
Ckg	63+	Light brownish gray (10YR 6/2 m); heavy clay; many, medium, distinct yellowish brown (10YR 5/6 m) mottles; massive.

SOIL PROFILE DESCRIPTION

HEAVY CLAY – CONTAMINATED

Site Description:	Lot 24, Concession 1, City of Port Colborne, abandon farm field about 50 m West of Reuter Rd. and 70 m South of Durham St.
GPS Location:	E 17 644483 N 4749500
Landform/Parent Materials:	Glaciolacustrine, reddish-hued lacustrine heavy clay
Slope and Aspect:	Level
Stoniness:	Non-Stony
Rock Outcrop:	None
Soil Water Regime:	Poorly drained; moderately high (60 cm) water table.
Present Land Use:	Industrial - abandoned farmland
Vegetation:	Grasses, weeds
Date Sampled:	May 4, 2001

Horizon	Depth (cm)	Description
Ap	0-16	Black (10YR 2/1 m); heavy clay; strong medium and fine granular; friable; abrupt smooth boundary.
Bg1	16-29	Pale brown (10YR 6/3 m); heavy clay; few, large, distinct reddish brown (7.5YR 7/6 m) mottles; massive; gradual smooth boundary.
Bg2	29-55	Brown (10YR 4/3 m); heavy clay; many, large, distinct reddish brown (7.5YR 7/6 m) mottles; massive; gradual smooth boundary.
Ckg	55+	Light brown (7.5YR 6/4 m); heavy clay; many, large, distinct reddish brown (7.5YR 7/6 m) mottles; massive.

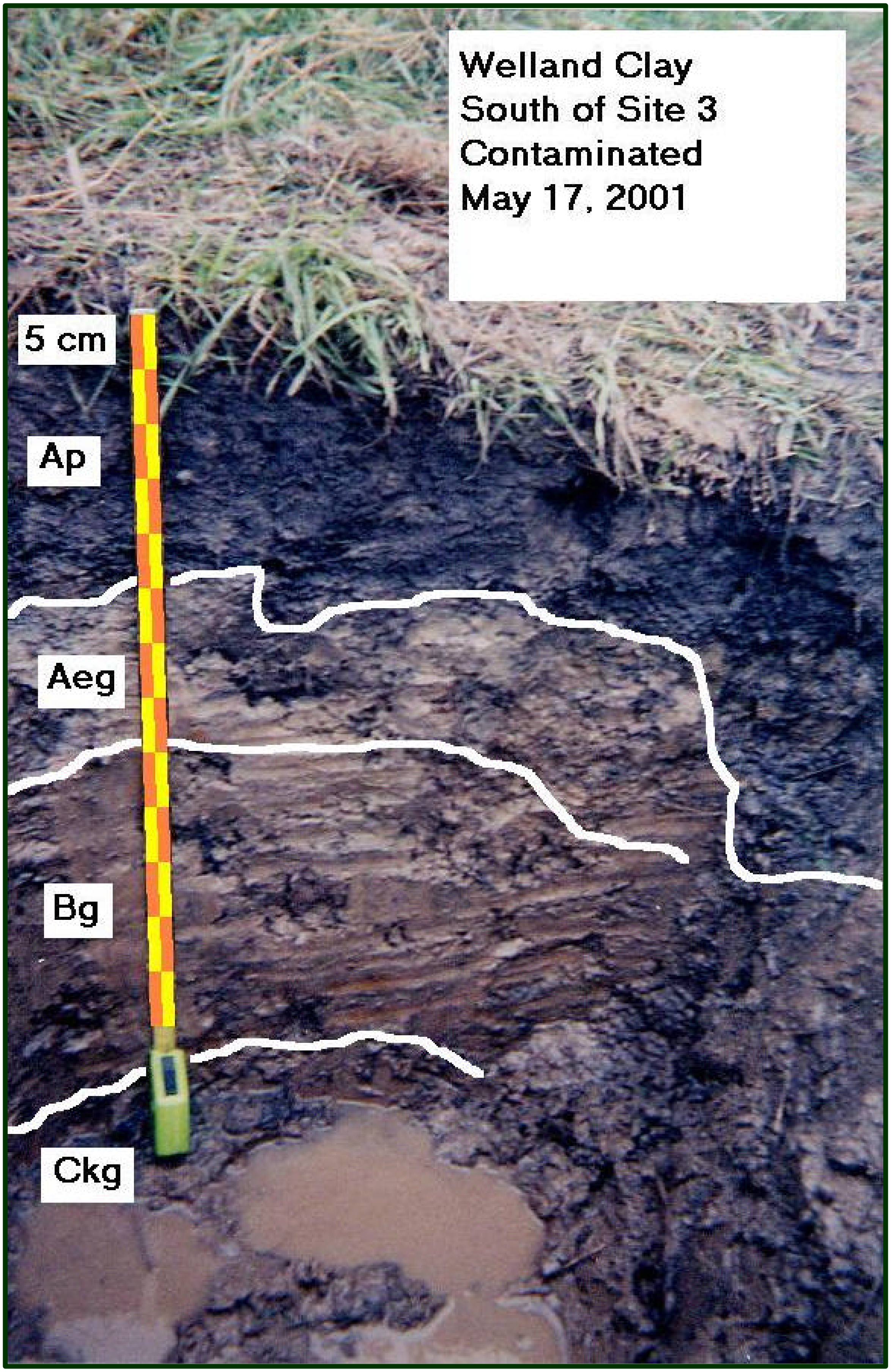
SOIL PROFILE DESCRIPTION

HEAVY CLAY – CONTAMINATED

(ENGINEERED FIELD PLOT AT CLAY 3 FIELD SITE)

Site Description:	Lot 23, Concession 1, City of Port Colborne, abandon farm field, about 100 m East of Reuter Rd. and 100 m North of former CN railway tracks.
GPS Location:	E 17 644682 N 4749668
Landform/Parent Materials:	Glaciolacustrine, reddish-hued lacustrine heavy clay
Slope and Aspect:	Level
Stoniness:	Non-Stony
Rock Outcrop:	None
Soil Water Regime:	Poorly drained; moderately high (68 cm) water table.
Present Land Use:	Abandoned farmland
Vegetation:	Grasses, weeds
Date Sampled:	May 17, 2001

Horizon	**Depth (cm)**	**Description**
Ap	0-23	Black (10YR 2/1 d); clay; strong medium granular; friable; abrupt smooth boundary.
Aeg	23-38	Light gray (10YR 7/2 d); heavy clay; few, medium, distinct reddish brown (7.5YR 7/6 d) mottles; massive; gradual smooth boundary.
Bg	38-70	Yellowish brown (10YR 5/4 d); heavy clay; many, medium, distinct reddish brown (7.5YR 7/6) mottles; massive; gradual smooth boundary.
Ckg	70+	Light brown (7.5YR 6/4 d); heavy clay; many, medium, distinct reddish brown (7.5YR 7/6) mottles; massive.


Welland Clay
South of Site 3
Contaminated
May 17, 2001
5 cm
Ap
Aeg
Bg
Ckg

SOIL PROFILE DESCRIPTION

SAND – BACKGROUND

Site Description: Lot 1, Concession 1, Township of Wainfleet, about 100 m North of Lakeshore Rd. between Cement Plant Rd and Augustine Rd.

GPS Location: E 17 639996 N 4748201

Landform/Parent Materials: Lake Erie beach sand.

Slope and Aspect: Level

Stoniness: Non-Stony

Rock Outcrop: None

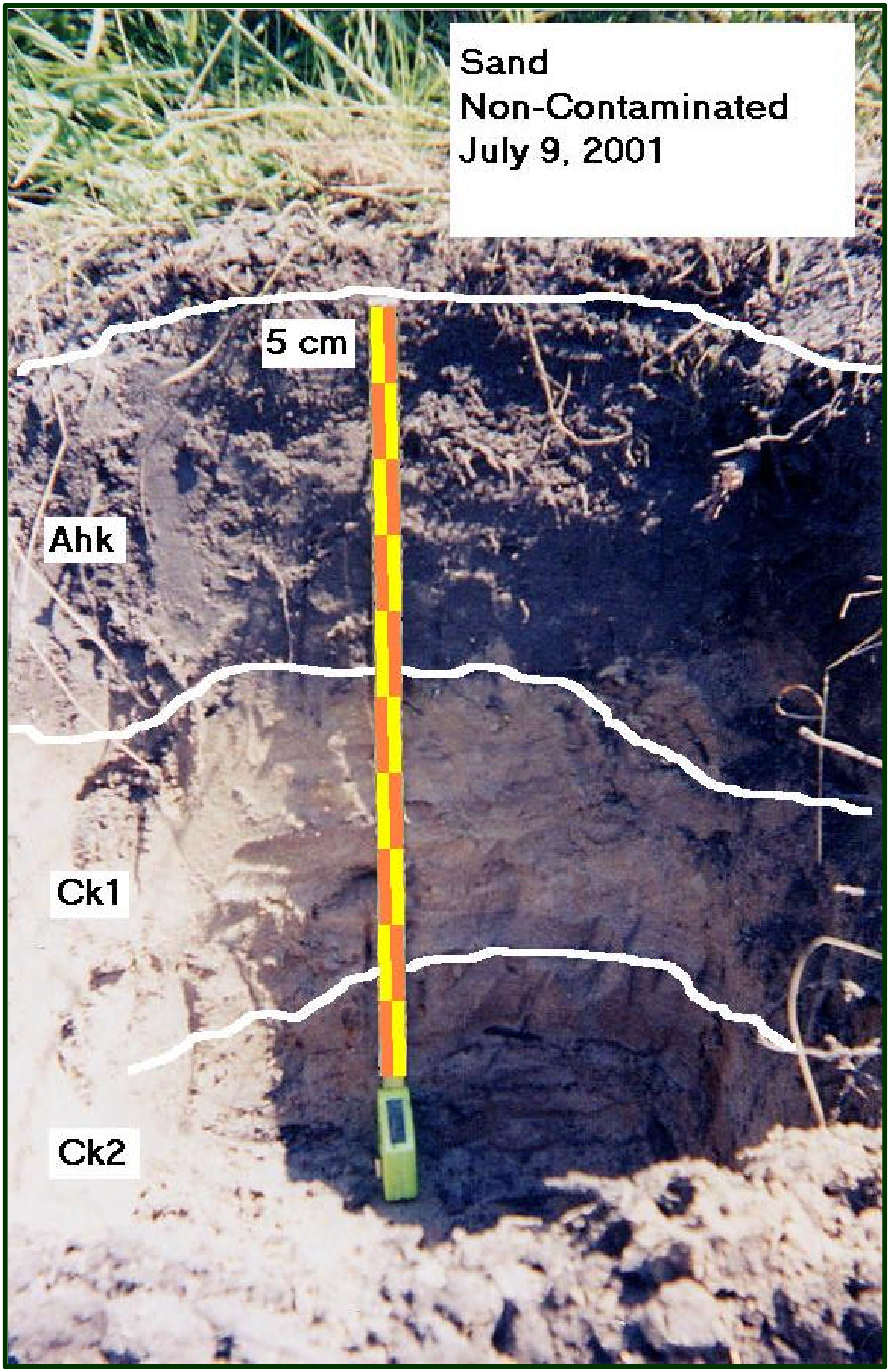
Soil Water Regime: Rapidly drained; moderately low (200-300 cm) water table.

Present Land Use: Re-vegetated area

Vegetation: Weeds, grasses, pine, small scrubs

Date Sampled: July 9, 2001

Horizon	**Depth (cm)**	**Description**
Ahk	0-26	Dark gray (10YR 4/1 m); sand; single grain; few fine roots; abrupt irregular boundary; mildly alkaline.
Ck1	26-44	Yellowish brown (10YR 5/6 m); sand; single grain; few coarse roots, irregular diffuse boundary; mildly alkaline.
Ck2	44+	Very pale brown (10YR 7/3 m); sand; single grain; mildly alkaline.


Sand
Non-Contaminated
July 9, 2001
5 cm
Ahk
Ck1
Ck2

SOIL PROFILE DESCRIPTION

SAND – CONTAMINATED

Site Description:	Lot 25, Concession 1, City of Port Colborne, near-shore sand – South of Inco refinery
GPS Location:	E 17 643541 N 4748524
Landform/Parent Materials:	Lake Erie beach sand.
Slope and Aspect:	Strong slope, East
Stoniness:	Non-Stony
Rock Outcrop:	None
Soil Water Regime:	Rapidly drained; very low (> 3 m) water table.
Present Land Use:	Wooded area
Vegetation:	Weeds, full grown trees, scrubs
Date Sampled:	May 17, 2001

Horizon	**Depth (cm)**	**Description**
Ahk	0-9	Very dark brown (10YR 2/2 m); sand; single grain; clear wavy boundary.
Ck1	9-29	Dark grayish brown (10YR 4/2 m); sand; single grain; diffuse wavy boundary.
Ck2	29+	Pale brown (10YR 6/3 m); sand; single grain; diffuse wavy boundary.

SOIL PROFILE DESCRIPTION

TILL CLAY – BACKGROUND

Site Description: Lot 14, Concession 1, Township of Wainfleet, Town of Burnaby, about 150 m South of Lakeshore Rd. and 200 m West of Morgans Point Road.

GPS Location: E 17 634953 N 4747322

Landform/Parent Materials: Shallow till veneer over carbonate bedrock.

Slope and Aspect: Very gentle slope, South

Stoniness: Slightly stony

Rock Outcrop: None

Soil Water Regime: Well drained; unknown depth to water table.

Present Land Use: Wooded area

Vegetation: Weeds, full grown oak and maple.

Date Sampled: July 9, 2001

Horizon	**Depth (cm)**	**Description**
Ah	0-10	Black (10YR 2/1 m); silt loam; weak medium granular; slightly hard; few fine roots; diffuse smooth boundary.
Ck	10-22	Black (10YR 2/6 m); silt loam with light gray (10YR 7/2) 5 – 10 cm carbonate stones; coarse granular; slightly hard; abrupt smooth boundary; mildly alkaline.
R	22+	Light gray (10YR 7/2); cherty carbonate bedrock; massive.

SOIL PROFILE DESCRIPTION

TILL CLAY – CONTAMINATED

Site Description: Lot 23, Concession 1, City of Port Colborne, about 50 m North of former CN railway tracks and 70 m West of Snider Rd.

GPS Location: E 17 644909 N 4749653

Landform/Parent Materials: Shallow till veneer over carbonate bedrock.

Slope and Aspect: Level

Stoniness: Non-Stony

Rock Outcrop: None

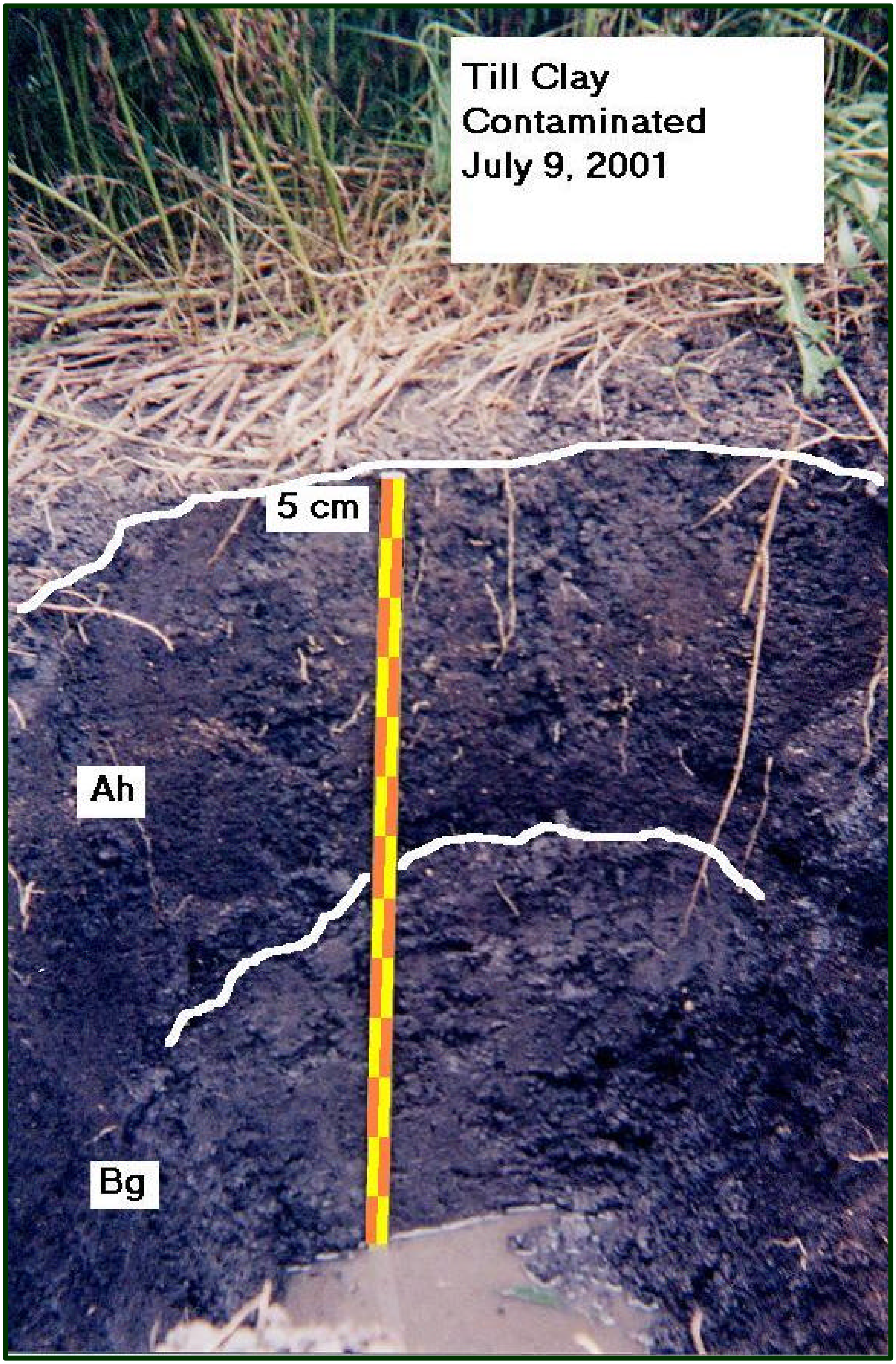
Soil Water Regime: Poorly drained; moderately high (72 cm) water table.

Present Land Use: Railway right-of-way, abandoned.

Vegetation: Weeds, scrubs

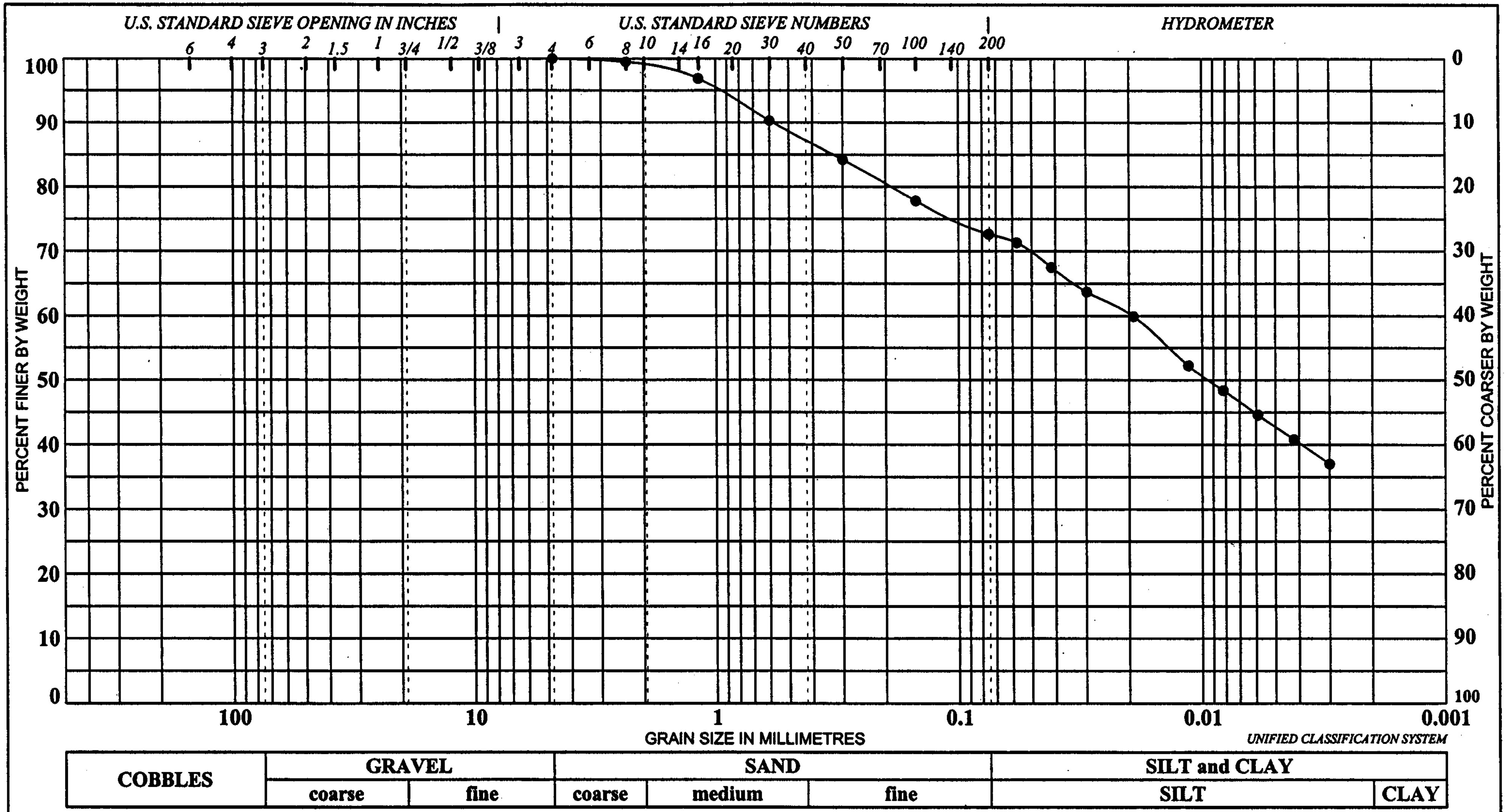
Date Sampled: July 9, 2001

Horizon	**Depth (cm)**	**Description**
Ah	0-33	Black (10YR 2/1 m); loam, strong medium granular; friable, abrupt smooth boundary.
Bg	33-75	Gray (10YR 5/1 m); clay loam; massive; abrupt irregular boundary.
R	75+	Light gray (10YR 7/2); cherty carbonate bedrock; massive.


Till Clay
Contaminated
July 9, 2001
5 cm
Ah
Bg

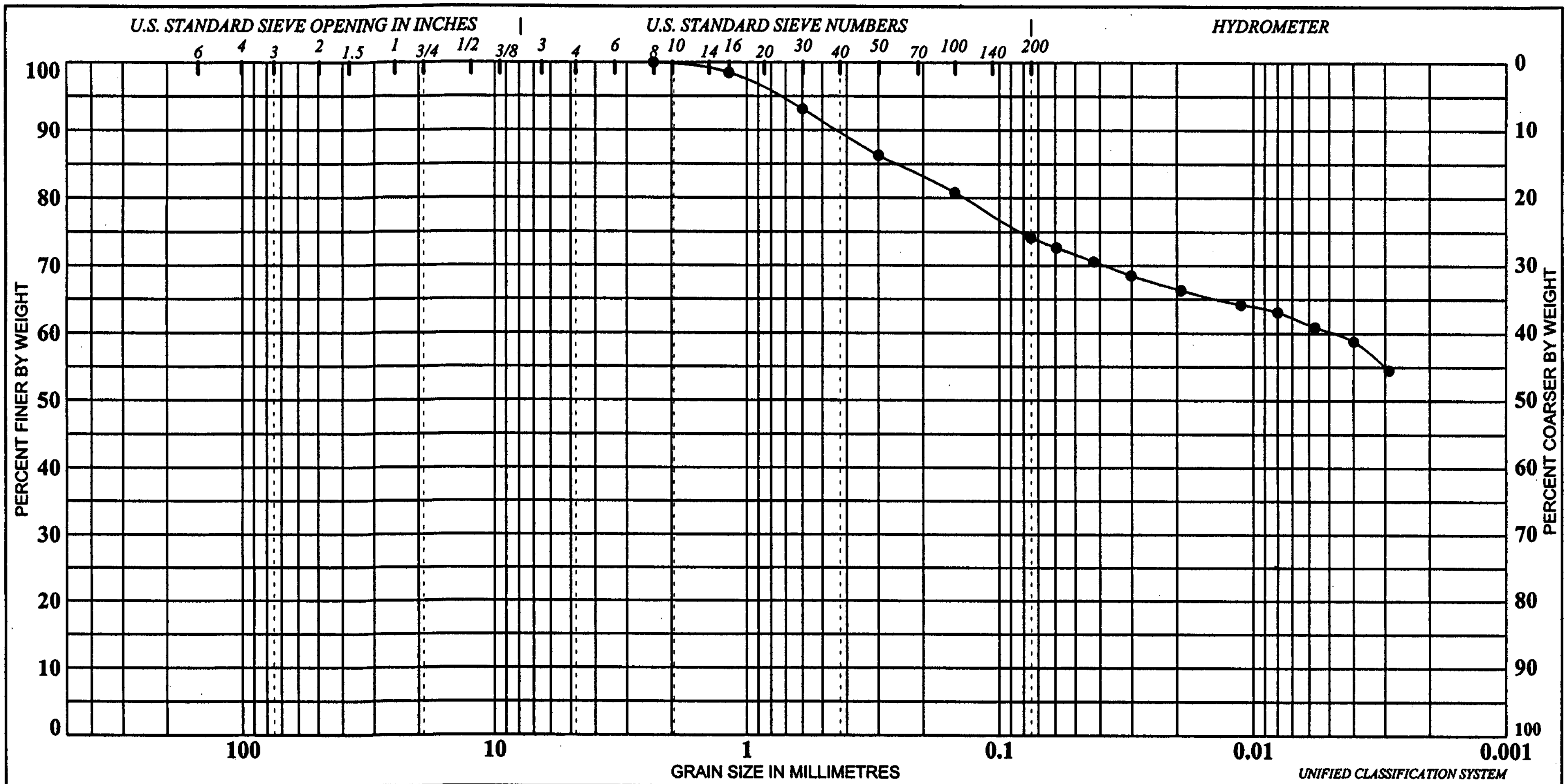
APPENDIX S-2

GRAIN SIZE ANALYSES CURVES, WELLAND CLAY



Specimen	Depth (m)	Description	W%	W_L	W_P	I_P	%Gravel	%Sand	%Silt	%Clay
● Welland Clay	0.1	Clayey SILT, with sand					0	27	41	32

Project: INCO	**GRADATION CURVE** (ASTM D422-63(1998))
Location: 106 Rodney Street, (Front Yard), Port Colborne	**Figure:** 2
Project No.:	**Remarks:** 2001-10-15



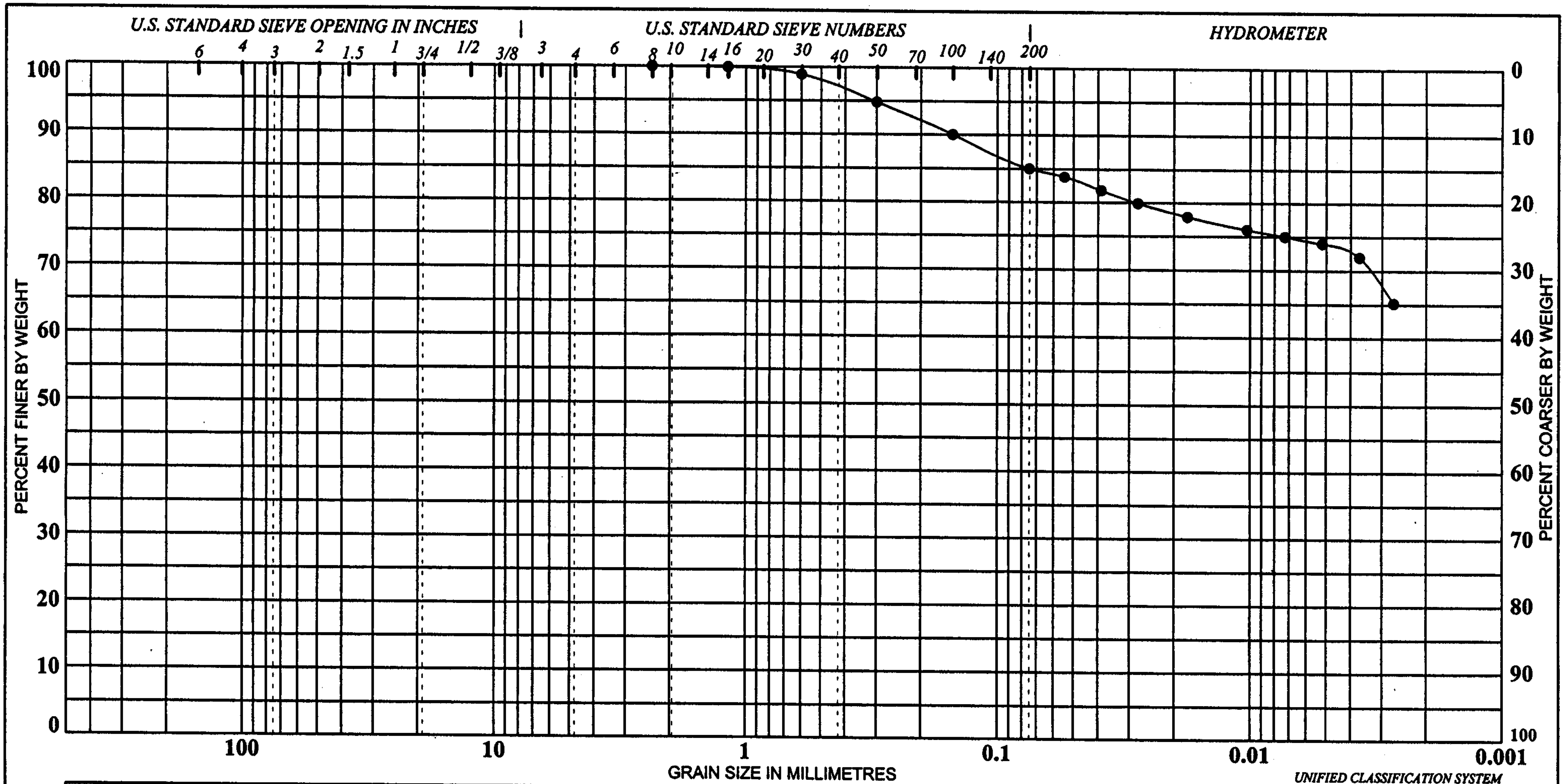
COBBLES	GRAVEL		SAND			SILT and CLAY	
	coarse	fine	coarse	medium	fine	SILT	CLAY

	Specimen	Depth (m)	Description	W%	W_L	W_P	I_P	%Gravel	%Sand	%Silt	%Clay
●	Welland Clay	0.2	CLAY, some silt and sand					0	26	24	51

Project: INCO
Location:
Project No.:

GRADATION CURVE (ASTM D422-63(1998))

Figure: 3
Remarks: 2001-10-15



COBBLES	GRAVEL		SAND			SILT and CLAY	
	coarse	fine	coarse	medium	fine	SILT	CLAY

Specimen	Depth (m)	Description	W%	WL	Wp	Ip	%Gravel	%Sand	%Silt	%Clay
● Welland Clay	0.4	Silty CLAY, some sand					0	15	23	62

Project: INCO
Location:
Project No.:

GRADATION CURVE (ASTM D422-63(1998))
Figure: 4
Remarks: 2001-10-15

APPENDIX S-3

EXTRACTABLE METALS

1.1 Extractable Metals – Year 2000 Greenhouse Soils

Table 1 shows total and extractable CoC concentrations for the 14 un-amended soils used for the Year 2000 Preliminary Greenhouse Trials. Extractable nickel, copper and cobalt were measured based on two extraction methods: aqueous (water) extraction, and DTPA extraction.

The water (aqueous) extractable CoCs are believed to comprise the most readily available fraction of soil metals (unbound or very weakly bound to soil), while DTPA-extractable metals are reported to be roughly equivalent to the amounts of metal contained in the exchangeable and carbonate soil fractions (Ernst, 1996). These fractions are traditionally thought to be slightly more difficult to access, but do contain phyto/bioavailable micronutrients and heavy metals.

Extractable nickel concentrations achieved via the water (aqueous) extraction did not exceed 1 % in any of the soils indicating that regardless of the total nickel concentrations, very low levels of nickel seem to be immediately available in solution from any of the soil samples.

Concentrations of DTPA extractable nickel in the three soils were somewhat higher than the aqueous extractable nickel. Concentrations ranged from 7 –12 % in Organic soils, 7 – 14 % in Clay soils, and 7 – 10 % in Sand soils.

Similar to nickel, very low percentages of soil copper were available via the aqueous extraction method in the three soil types. Low percentages of extractable copper were observed in the highly impacted Organic (460 and 560 mg copper/kg) and Clay (890 mg copper/kg) soils. At these CoC levels less than 1 % of the total copper was extracted from the high and very high impacted Organic and Clay soil.

DTPA-extractable copper ranged from less than 1 % to 13 % in Organic soils, and from 3 to 33 % in Clay soils. The DTPA-extractable copper percentages declined with increasing total copper concentration in Organic (from 12 to <1 %) and Clay (from 31.2 to 3 %) soils. Although the actual amount of copper extracted from the Clay soils increased (from 3.8 to 27.6 mg copper/kg) with increasing soil CoC concentrations (fractions), the percentage extracted declined from 31.2 to 3 %. In the low, medium and high impacted Sand soils DTPA extractable copper percentages ranged from 27 to 31.4 %.

No measurable cobalt was extracted from any soil under the aqueous treatment. DTPA extractions for the highest cobalt-impacted soil (maximum concentration of 108 mg cobalt/kg for Clay soil) extracted less than 2 mg cobalt/kg.

Overall, the bioavailable fraction of soil CoCs was relatively low, with DTPA-extractable CoCs not exceeding 31.4% of total levels in any soil.

Table 1 Total and Extractable CoC Concentrations (mg/kg) in the Year 2000 Greenhouse Soils

Soil CoC	Organic					Clay					Sand				
	Total Ni	Aqueous	%	DTPA	%	Total Ni	Aqueous	%	DTPA	%	Total Ni	Aqueous	%	DTPA	%
C	**33**	<0.6	NC	2.6	8	**34**	<0.6	NC	3.5	10	**5**	<0.6	NC	<0.6	NC
L	**216**	<0.6	NC	26.1	12	**194**	0.5	<1	27.3	14	**494**	0.7	<1	51.6	10
M	**1200**	1.2	<1	99.2	8	**517**	1.7	<1	70.3	14	**307**	<0.6	NC	23	8
H	**3180**	9.1	<1	240	8	**3430**	8.6	<1	408	12	**1350**	3	<1	91.4	7
V	**5550**	11.2	<1	410	7	**8280**	13.6	<1	565	7	**NA**	---	---	---	---
	Total Cu	**Aqueous**	**%**	**DTPA**	**%**	**Total Cu**	**Aqueous**	**%**	**DTPA**	**%**	**Total Cu**	**Aqueous**	**%**	**DTPA**	**%**
C	**16.4**	<0.2	NC	2	12	**12.2**	<0.2	NC	3.8	31.2	**<0.2**	<0.2	NC	<0.2	NC
L	**59**	<0.2	NC	7.5	13	**42.1**	<0.2	NC	13.9	33.0	**71.3**	<0.2	NC	22.4	31.4
M	**211**	<0.2	NC	7.3	4	**81.8**	<0.2	NC	15.7	19.2	**39.3**	<0.2	NC	11.7	29.8
H	**460**	1.6	<1	5	1	**366**	<0.2	NC	29.9	8	**137**	<0.2	NC	36.8	27
V	**560**	1	<1	3.2	<1	**890**	2.1	<1	27.6	3	**NA**	---	---	---	---
	Total Co	**Aqueous**	**%**	**DTPA**	**%**	**Total Co**	**Aqueous**	**%**	**DTPA**	**%**	**Total Co**	**Aqueous**	**%**	**DTPA**	**%**
C	**ND**	<0.2	NC	<0.2	NC	**ND**	<0.2	NC	<0.2	NC	**<0.2**	<0.2	NC	<0.2	NC
L	**7.6**	<0.2	NC	0.5	6.6	**8**	<0.2	NC	0.6	8	**7**	<0.2	NC	<0.2	NC
M	**15**	<0.2	NC	0.5	3	**12.8**	<0.2	NC	1.3	10.2	**6.1**	<0.2	NC	<0.2	NC
H	**37.2**	<0.2	NC	<0.2	NC	**48.5**	<0.2	NC	1.4	2.9	**27.9**	<0.2	NC	0.6	2.2
V	**72.8**	<0.2	NC	0.5	0.7	**108**	<0.2	NC	1.3	1	**NA**	---	---	---	---

Notes:

C – controlL – low   < - Value did not exceed the estimated quantification limit (EQL) for the analytical method. Symbol is followed by the EQL value.
M- medium   ND Not Detected. The analytcal result was lest than the Estimated Limit of Quantification (EQL) for the analytical method used
H – high   NC - Not Calculated. The % value was not calculated because the analytical value was ND
V – very high   NA - Not Applicable. No Soil was obtained for this CoC concentration due to accessibility issues
--- - No data

1.2 Extractable Metals – Year 2001 Greenhouse Soils

During year 2001 Greenhouse Trials, emphasis was given to chemical analyses of extractable metal concentrations and all the four suspected CoCs nickel, copper, cobalt and arsenic were analysed. Extraction data for the soil blends was only collected for the un-amended soils as the soils were identical before adding the amendment.

Table 2 shows total nickel content of the eight original Control and very high CoC (prior the amendment) soils used for the year 2001 Greenhouse Trials and the associated extractable (phytoavailable) nickel measured by four extraction methods using aqueous (water), strontium nitrate, DTPA, and ammonium oxalate extractants. The extractable nickel values measured for each soil using the strontium nitrate and aqueous extractants were very low, with no extraction exceeding 1% of the total nickel for any of the soils.

In contrast, ammonium oxalate extractions removed up to 41, 29 and 40 % of the total nickel from the Control Sand, Organic and Welland Clay (Heavy Clay) Control soils respectively. In one instance, oxalate extraction on Control Till Clay soil indicated that 68 ± 76 mg/kg nickel was available in the soil – a value exceeding the total nickel measured in this soil. Because of the uncertainty associated with these measurements, a percentage oxalate extraction could not be calculated.

For DTPA extraction, a consistent proportion of the soil nickel seems to be extractable regardless of CoC impact level. This proportion or percentage of DTPA extractable nickel remains relatively low (mean = 18 ± 7%).

As shown in Table 3, ammonium oxalate and DTPA extracts were more effective in extracting nickel from the blended soils. Up to 197 mg/kg of nickel was DTPA extracted from the 2386 mg nickel/kg Sand soil blend. However this represented only 8.26 percent of the total nickel. At the same nickel concentration, ammonium oxalate extraction resulted in up to 861 mg nickel/kg (36%) of nickel being extracted. On average, 12 and 40% of total nickel in the Sand blends was available to DTPA and ammonium oxalate extractions respectively.

Although the absolute amount of nickel extracted from the Organic soil by DTPA and ammonium oxalate increased with total nickel concentration as shown in Table 3, extractable nickel percentage remained fairly constant across all the blends. As nickel concentrations in the DTPA and ammonium oxalate extracts increased from 17 to 739 mg/kg and 24 to 804 mg/kg respectively, the percentage extracted averaged 31 ± 7 % and 35 ± 5 %.

As shown in Table 4, Till Clay (Shallow Clay) and Welland Clay (Heavy Clay) soils followed similar trends in DTPA and ammonium oxalate extractions in comparison to the Organic soil. Absolute concentrations of nickel extracted from the Till Clay (Shallow Clay) and Welland Clay (Heavy Clay) soils increased with total soil nickel concentrations, however, the proportion of nickel extracted remained consistent. In the Welland Clay (Heavy Clay) soil, DTPA and ammonium oxalate methods extracted up to 378 and 591 mg nickel/kg respectively, while the same extractions conducted on the Till Clay (Shallow Clay) soil extracted 309 and 477 mg nickel/kg respectively. In the Welland Clay (Heavy Clay) blends these extractions represent average extractable nickel percentage of less than 17 % for DTPA and less than 31 % for ammonium oxalate. In the Till Clay (Shallow Clay) blends, DTPA extractions account for approximately 14% of extractable nickel. Excluding the anomalous ammonium oxalate, Till Clay (Shallow Clay) Control soil (51 mg nickel/kg) results (extractable nickel previously indicated to be greater than the total nickel concentration), the average percentage nickel extracted with ammonium oxalate is approximately 20%.

From the results it is clear that increased amounts of nickel are shown to be available to stronger extractants, however this proportion remains low relative to the total nickel concentrations in each of the soil types. In the Clay and Sand soils, a substantial increase in the extractable nickel fraction is observed from the DTPA extraction to the oxalate extraction, this increase is not seen in the organic soil. It would appear that a majority of the available nickel is released by a weaker extractant, thereby potentially indicating a greater availability in this soil.

Low % of both Cu (Table 5, and 6) and Co (Table 7, and 8) were extracted from both water, and SrNitrate extractions. Extractable % increased substantially with DTPA and Oxalate extractions for both Cu and Co. No extraction exceeded 20 mg/kg for Co while >200 mg/kg of extractable Cu was measured for oxalate extractions in both Organic and Till Clay soils.

For the range of arsenic concentrations tested (up to 24 mg As/kg) arsenic was never present in adequate concentration to be examined in detail. Furthermore, with very few exceptions, concentrations of arsenic observed in plant tissues were below analytical detection limit (0.2 mg As/kg). As such, phytotoxicity testing with respect to extractable arsenic was not considered pertinent in examination of Port Colborne soils.

Table 2 **Total and Extractable Nickel Concentrations in the Year 2001 prior to pH adjustment. Control and Highly Impacted Soils (Unamended)**

Soil Type	CoC level	Total Nickel (mg/kg)	Total Extractable Nickel							
			Strontium nitrate		Aqueous (water)		DTPA		Oxalate	
			(mg/kg)	%	(mg/kg)	%	(mg/kg)	%	(mg/kg)	%
Organic	**Control (C)**	**82 ± 58**	<0.4	<1	<0.6	<1	16 ± 3	20	24	29
	Very High (V)	**10045 ± 502**	35.2	<1	40.5	<1	2990	30	3650	36
Sand	**Control (C)**	**46 ± 12**	<0.4	<1	<0.6	<1	11 ± 0.4	23	19 ± 4	41
	Very High (V)	**3920****	4.1	<1	6.3	<1	258	7	1296 ± 279	33
Till Clay (Shallow Clay)	**Control (C)**	**51 ± 7**	<0.4	<2	<0.6	<1	9 ± 0.3	17	68 ± 76	NC
	Very High (V)	**2545 ± 156**	0.8	<1	5 ± 0.1	<1	309 ± 9	12	477 ± 18	19
Welland Clay (Heavy Clay)	**Control (C)**	**39 ± 11**	<0.4	<1	<0.6	<2	8 ± 1	20	16 ± 5	40
	Very High (V)	**8655****	15.0	<1	22.0	<1	931	11	1770	20
		MEAN %		**<1**		**<1**		**18 ± 7**		**31 ± 9**

Notes:
*C – control soil V – very high CoC soil
**Sample size did not allow calculation of standard deviation
< - indicates that value did not exceed the estimated quantification limit (EQL) for the analytical method
NA - non-applicable or not calculated due to non-quantified value
NC – not able to calculate based on high level of uncertainty

Table 3 Total and Extractable Nickel Concentrations in the Year 2001 pH Adjusted, Blended Greenhouse Soils

Soil Type	Total Nickel (mg/kg)	Total Extractable Nickel							
		Strontium Nitrate		Aqueous		DTPA		Oxalate	
		(mg/kg)	%	(mg/kg)	%	(mg/kg)	%	(mg/kg)	%
Sand	**46**	<0.4	<1	<0.6	<1	10.7	22	19	39
	227	<0.4	<1	<0.6	<1	32.8	15	113	53
	406	<0.4	<1	0.7	<1	42.2	11	167	45
	530	<0.4	<1	0.9	<1	55.6	11	263	50
	756	<0.4	<1	1.3	<1	43.3	5	264	33
	1,630	<0.4	<1	2.3	<1	142	9	458	28
	2,310	<0.4	<1	2.8	<1	197	8	861	36
MEAN ± STD DEV		**<0.4**	**<1**	**1 ± 1**	**<1**	**75 ± 68**	**12 ± 5**	**306 ± 281**	**40 ± 9**
Organic	**89.5**	<0.4	<1	<0.6	<1	16.6	16	24	24
	283	<0.4	<1	0.8	<1	77.9	29	97	36
	239	<0.4	<1	0.6	<1	70	31	89	39
	596	<0.4	<1	1.9	<1	212	36	225	38
	683	0.4	<1	2.4	<1	259	38	258	38
	1,300	0.8	<1	4.3	<1	456	35	487	37
	1,640	1	<1	4.7	<1	515	34	536	36
	2,400	1.6	<1	6.7	<1	739	31	804	34
MEAN ± STD DEV		**1 ± 1**	**<1**	**2.7 ± 2.3**	**<1**	**293 ± 255**	**31 ± 7**	**315 ± 270**	**35 ± 5**

Table 4 **Total and Extractable Nickel Concentrations in the Year 2001 pH Adjusted, Blended Greenhouse Soils (continued)**

Soil Type	Total Nickel (mg/kg)	Total Extractable Nickel							
		Strontium Nitrate		Aqueous		DTPA		Oxalate	
		(mg/kg)	%	(mg/kg)	%	(mg/kg)	%	(mg/kg)	%
Welland Clay (Heavy Clay)	**45.3**	<0.4	<1	<0.6	<2	7.8	18	14	33
	188	<0.4	<1	0.8	<1	34	18	57	30
	347	<0.4	<1	1.1	<1	60	18	102	30
	498	<0.4	<1	1.4	<1	89.7	18	159	32
	673	0.6	<1	1.9	<1	118	18	189	29
	956	0.8	<1	2.7	<1	176	19	275	29
	1,130	1.1	<1	3.2	<1	189	17	325	30
	1,900	3.1	<1	6	<1	378	20	591	31
MEAN ± STD DEV		**1 ± 1**	**<1**	**2 ± 2**	**<1**	**132 ± 118**	**18 ± 1**	**214 ± 185**	**31 ± 1**
Till Clay (Shallow Clay)	**51**	<0.4	<1	<0.6	<1	8.9	17	NA	NA
	145	<0.4	<1	<0.6	<1	23.2	16	32	22
	262	<0.4	<1	<0.6	<1	37.8	14	61	23
	438	<0.4	<1	0.8	<1	48.5	11	72	16
	554	<0.4	<1	1.2	<1	69.5	13	100	18
	947	0.5	<1	2.7	<1	147	16	216	23
	1,380	0.5	<1	2.65	<1	176	13	257	19
	2,540	0.8	<1	5.05	<1	309	12	477	19
MEAN ± STD DEV		**1 ± 1**	**<1**	**2 ± 2**	**<1**	**102 ± 102**	**14 ± 2**	**174 ± 158**	**20 ± 3**

Notes: NA –Data not reported due to large uncertainty in result

Table 5 Total and Extractable Copper Concentrations in the Year 2001 pH Adjusted, Blended Greenhouse Soils

Soil Type	Total Copper (mg/kg)	Total Extractable Copper							
		Strontium Nitrate		Water		DTPA		Oxalate	
		(mg/kg)	%	(mg/kg)	%	(mg/kg)	%	(mg/kg)	%
Sand	**15**	<0.1	<1	0.2	1	7.3	49	11	73
	36	<0.1	<1	0.1	<1	16.2	45	26	72
	57	<0.1	<1	0.1	<1	20.2	35	39	68
	73	<0.1	<1	0.1	<1	26.9	37	61	84
	96.8	<0.1	<1	0.3	<1	19.3	20	60	62
	195	<0.1	<1	0.5	<1	69.4	36	97	50
	269	<0.1	<1	0.5	<1	93.7	35	178	66
MEAN ± STD DEV		**<0.1**	**<1**	**0.3 ± 0.2**	**<1**	**36 ± 32**	**37 ± 9**	**67 ± 56**	**68 ± 10**
Organic	**47**	<0.1	<1	<0.2	<1	15	32	25	53
	68	<0.1	<1	<0.2	<1	27.3	40	47	69
	64	<0.1	<1	<0.2	<1	25.9	40	42	66
	109	<0.1	<1	0.3	<1	56.4	52	82	75
	120	<0.1	<1	0.4	<1	67.6	56	93	78
	209	<0.1	<1	0.6	<1	115	55	168	80
	229	<0.1	<1	0.6	<1	129	56	180	79
	360	<0.1	<1	0.7	<1	183	51	264	73
MEAN ± STD DEV		**<1**	**<1**	**0.4 ± 0.2**	**<1**	**77 ± 60**	**48 ± 9**	**113 ± 84**	**72 ± 9**

Table 6 Total and Extractable Copper Concentrations in the Year 2001 pH Adjusted, Blended Greenhouse Soils (continued)

Soil Type	Total Copper (mg/kg)	Total Extractable Copper							
		Strontium Nitrate		Water		DTPA		Oxalate	
		(mg/kg)	%	(mg/kg)	%	(mg/kg)	%	(mg/kg)	%
Welland Clay (Heavy Clay)	**17.4**	0.1	<1	0.2	1	7.4	43	13	75
	34	0.1	<1	0.3	1	15.7	46	23	68
	52	0.1	<1	<0.2	<1	26.1	50	38	73
	69	0.1	<1	0.3	<1	36.4	53	54	78
	84	0.1	<1	0.4	<1	45.2	54	61	73
	116	0.1	<1	0.4	<1	66.2	57	88	76
	142	0.1	<1	0.7	<1	70.1	49	103	73
	234	0.1	<1	0.7	<1	136	58	193	82
MEAN ± STD DEV		**0.1**	**NC**	**0.4 ± 0.2**	**NC**	**50 ± 41**	**51 ± 5**	**72 ± 58**	**75 ± 4**
Till Clay (Shallow Clay)	**17**	<0.1	<1	0.2	1	6	35	9	53
	29	<0.1	<1	<0.2	1	11.6	40	16	55
	43	<0.1	<1	0.3	1	16.8	39	27	63
	68	<0.1	<1	0.3	<1	22.4	33	33	49
	81	<0.1	<1	0.4	<1	31.7	39	45	56
	131	<0.1	<1	0.8	1	73	56	100	76
	185	<0.1	<1	0.8	<1	85.1	46	121	65
	338	<0.1	<1	1.7	1	149	44	224	66
MEAN ± STD DEV		**<0.1**	**NC**	**1 ± 1**	**NC**	**49 ± 50**	**42 ± 7**	**72 ± 73**	**61 ± 9**

Notes: NC – not calculated due to uncertainty

Table 7 Total and Extractable Cobalt Concentrations in the Year 2001 pH Adjusted, Blended Greenhouse Soils

Soil Type	Total Cobalt (mg/kg)	Total Extractable Cobalt							
		Strontium Nitrate		Water		DTPA		Oxalate	
		(mg/kg)	%	(mg/kg)	%	(mg/kg)	%	(mg/kg)	%
Sand	**1.7**	<0.1	<6	<0.2	<12	0.6	35	1	59
	5	<0.1	<2	<0.2	<4	1.0	20	3	60
	9	<0.1	<1	<0.2	<2	1.0	11	5	56
	12	<0.1	<1	<0.2	<2	1.2	10	7	58
	17.9	<0.1	<1	<0.2	<1	<0.2	1	6	34
	34	<0.1	<1	<0.2	<1	2.5	7	10	29
	47	<0.1	<1	<0.2	<1	4.1	9	19	40
MEAN ± STD DEV		**<0.1**	**NC**	**<0.2**	**NC**	**2 ± 1**	**13 ± 11**	**7 ± 6**	**48 ± 13**
Organic	**6**	<0.1	<2	<0.2	<3	1.5	25	3	50
	8	<0.1	<1	<0.2	<3	2.3	29	5	63
	7.2	<0.1	<1	<0.2	<3	2.2	31	4	56
	12	<0.1	<1	<0.2	<2	4	33	6	50
	13	<0.1	<1	<0.2	<2	4.5	35	7	54
	21	<0.1	<1	<0.2	<1	6.5	31	11	52
	24	<0.1	<1	<0.2	<1	7.5	31	12	50
	36	<0.1	<1	<0.2	<1	9.6	27	16	44
MEAN ± STD DEV		**<1**	**NC**	**<0.2**	**NC**	**5 ± 3**	**30 ± 3**	**8 ± 5**	**52 ± 5**

Notes: NC – not calculated due to uncertainty

Table 8 Total and Extractable Cobalt Concentrations in the Year 2001 pH Adjusted, Blended Greenhouse Soils (continued)

Soil Type	Total Cobalt (mg/kg)	Total Extractable Cobalt							
		Strontium Nitrate		Water		DTPA		Oxalate	
		(mg/kg)	%	(mg/kg)	%	(mg/kg)	%	(mg/kg)	%
Welland Clay (Heavy Clay)	**5**	<0.1	<2	<0.2	<4	0.8	16	1	20
	7	<0.1	<1	<0.2	<3	1.1	16	2	29
	9	<0.1	<1	<0.2	<2	1.5	17	3	33
	11	<0.1	<1	<0.2	<2	2	18	4	36
	13	<0.1	<1	<0.2	<2	2.3	18	4	31
	17	<0.1	<1	<0.2	<1	2.9	17	6	35
	18	<0.1	<1	<0.2	<1	3	17	5	28
	27	<0.1	<1	<0.2	<1	5.2	19	12	44
MEAN ± STD DEV		**<0.1**	**NC**	**<0.2**	**NC**	**2 ± 1**	**17 ± 1**	**5 ± 3**	**32 ± 7**
Till Clay (Shallow Clay)	**7**	<0.1	<1	<0.2	<3	1.9	27	4	57
	9	<0.1	<1	<0.2	<2	2.2	24	4	44
	10	<0.1	<1	<0.2	<2	2.4	24	6	60
	13	<0.1	<1	<0.2	<2	2.8	22	6	46
	16	<0.1	<1	<0.2	<1	3.3	22	6	40
	22	<0.1	<1	<0.2	<1	5.8	26	9	41
	29	<0.1	<1	<0.2	<1	6.5	22	10	34
	47	<0.1	<1	<0.2	<1	10	21	16	34
MEAN ± STD DEV		**<0.1**	**NC**	**<0.2**	**NC**	**4 ± 3**	**24 ± 2**	**8 ± 4**	**45 ± 10**

Notes: NC – not calculated due to uncertainty

1.3 EXTRACTABLE METALS - Year 2000 Field Trials

1.3.1 Organic Field Site

Table 9 shows the extractable CoC concentrations of the Organic Field site. Generally, the DTPA extractions were much more effective in extracting CoCs from the organic soils than the aqueous extractions. Using the aqueous extraction method on organic soils, nickel was extracted at less than 1% efficiency, while copper and cobalt were not extracted at levels exceeding analytical detection limits. DTPA extractions ranged from 14 to 24 % for nickel, 2 to 14 % for copper, and <1 to 11.8 % for cobalt. With very few exceptions, no significant differences were observed between plots or between treatments for extractable CoCs via either Aqueous or DTPA methods. Plot 3 showed significantly higher nickel (ANOVA, F=7.383, p=0.012) and copper (ANOVA, F=7.635, p=0.012) extractions via DTPA extraction, however, this mirrored higher total nickel and copper concentrations observed in these soils. Another exception was observed where untreated soils showed significantly higher nickel concentrations via the aqueous extraction when compared to the treated (1X, and 2X) soils (ANOVA, F=757, p=0.011).

1.3.2 Clay 2 Field Site

Table 10 shows the extractable CoC concentrations of the Clay 2 Field site. Similar to the Organic soils, a very limited amount of CoCs were available in the Clay soils at the Clay 2 site via the aqueous extraction technique. As shown in Table 10, aqueous nickel extractions did not generally exceed 1% of total nickel. Copper and cobalt were not detected in any extractions conducted on Clay 2 site soils.

Table 10 indicates that CoCs are extracted in greater concentrations using the DTPA extraction. In general, DTPA extractable nickel ranged from 3 to 4% of total soil nickel with the exceptions of two samples that yielded 57 and 78% of total. This anomalous result is likely related to analytical error. DTPA extractable copper and cobalt ranged from 8 to 20% and 2.8 to 6.5% of total soil nickel.

1.3.3 Clay 1 Field Site

Table 11 shows the extractable CoC concentrations of the Clay 1 Field site. As noted in Table 11, limited amounts of CoCs were available in the Clay soils at the Clay 1 Field site via the aqueous extraction technique. Aqueous nickel extractions did not generally exceed 1% of total soil nickel, while copper and cobalt were not detected in any extractions conducted on these soils. As previously noted for the Organic and Clay 2 Field site soils, CoCs were extracted in greater concentrations using the DTPA extraction. DTPA extractable nickel, copper, and cobalt ranged from 1 to 9%, 11 to 20% and 2.2 to 5.3% of total soil nickel. No significant differences were observed in total extractable CoCs or Extractable percentages between field plots or treatment (amendment) blocks.

Table 9 Total Aqueous and DTPA Extractable CoC Concentrations in the Organic Soil at the Organic Field Site Expressed in mg/kg and as a Percentage of the Total Metal Concentration

Plot	Sample Number	Amendment Level	Total Nickel	Extractable Nickel (mg/kg)				Total Copper	Extractable Copper (mg/kg)				Total Cobalt	Extractable Cobalt (mg/kg)			
				Aqueous	%	DTPA	%		Aqueous	%	DTPA	%		Aqueous	%	DTPA	%
1	**OR/F/P4**	**U**	**1750**	5.32	<1	263	15	**317**	1.3	<1	6.1	2	**27.6**	<0.2	<0.01	2.2	8.0
	OR/F/P4	**1X**	**1780**	2.81	<1	288	16	**294**	<0.2	<0.001	27.4	9	**26.5**	<0.2	<0.01	3.0	11.3
	OR/F/P4	**2X**	**1900**	3.92	<1	293	15	**324**	<0.2	<0.001	19.3	6	**28.6**	<0.2	<0.01	2.9	10.1
2	**OR/F/P3**	**U**	**1850**	4.88	<1	295	16	**321**	<0.2	<0.001	16.7	5	**29.8**	<0.2	<0.01	3.0	10.1
	OR/F/P3	**1X**	**2020**	3.08	<1	315	16	**326**	<0.2	<0.001	23.7	7	**29.4**	<0.2	<0.01	3.3	11.2
	OR/F/P3	**2X**	**1550**	2.74	<1	376	24	**254**	<0.2	<0.001	35.3	14	**22.7**	<0.2	<0.01	1.6	7.0
3	**OR/F/P2**	**U**	**7360**	13.3	<1	1110	15	**993**	1.3	<1	14.7	1	**86.0**	<0.2	<0.01	0.5	<1
	OR/F/P2	**1X**	**2800**	4.72	<1	499	18	**422**	<0.2	<0.001	13.9	3	**39.0**	<0.2	<0.01	1.7	4.4
	OR/F/P2	**2X**	**5650**	10.1	<1	1080	19	**738**	<0.2	<0.001	26.5	4	**69.2**	<0.2	<0.01	1.4	2.0
4	**OR/F/P1**	**U**	**3410**	7.77	<1	492	14	**475**	<0.2	<0.001	9.9	2	**45.2**	<0.2	<0.01	0.9	2.0
	OR/F/P1	**1X**	**2760**	4.16	<1	519	19	**388**	<0.2	<0.001	19.5	5	**37.9**	<0.2	<0.01	3.5	9.2
	OR/F/P1	**2X**	**2080**	3.65	<1	362	17	**306**	<0.2	<0.001	36.1	12	**29.7**	<0.2	<0.01	3.5	11.8

Note: values for each plot are based on composite samples
U – Unamended.
1X– Lime amendment level recommended by OMAFRA (15 t/ha).
2X– Double the lime amendment level recommended by OMAFRA (30 t/ha).

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Table 10 Total Aqueous and DTPA Extractable CoC Concentrations in the Clay Soil from the Clay 2 Field Site Expressed in mg/kg and as a Percentage of the Total Metal Concentration

Plot	Sample Number	Amendment Level	Total Nickel	Extractable Nickel (mg/kg)				Total Copper	Extractable Copper (mg/kg)				Total Cobalt	Extractable Cobalt (mg/kg)			
				Aqueous	%	DTPA	%		Aqueous	%	DTPA	%		Aqueous	%	DTPA	%
1	**CL/F/P1**	**U**	**7140**	3.97	<1	237	3	**773**	<0.2	<0.001	100	13	**100.0**	<0.2	<0.01	3.6	3.6
	CL/F/P1	**1X**	**5550**	53.7	<1	3190	57	**628**	<0.2	<0.001	119	19	**81.8**	<0.2	<0.01	2.8	3.4
	CL/F/P1	**2X**	**4890**	67.7	1	3790	78	**569**	<0.2	<0.001	116	20	**71.8**	<0.2	<0.01	3.0	4.2
2	**CL/F/P2**	**U**	**7420**	4.87	<1	192	3	**865**	<0.2	<0.001	67.4	8	**89.7**	<0.2	<0.01	3.1	3.5
	CL/F/P2	**1X**	**7210**	5.53	<1	216	3	**760**	<0.2	<0.001	75.1	10	**81.7**	<0.2	<0.01	2.3	2.8
	CL/F/P2	**2X**	**7610**	3.15	<1	286	4	**785**	<0.2	<0.001	68.5	9	**90.7**	<0.2	<0.01	3.2	3.5
3	**CL/F/P3**	**U**	**5140**	3.89	<1	198	4	**567**	<0.2	<0.001	62.5	11	**68.7**	<0.2	<0.01	3.1	4.5
	CL/F/P3	**1X**	**6890**	4.2	<1	212	3	**780**	<0.2	<0.001	78.9	10	**85.5**	<0.2	<0.01	3.6	4.2
	CL/F/P3	**2X**	**5170**	3.29	<1	192	4	**575**	<0.2	<0.001	83.7	15	**72.6**	<0.2	<0.01	3.3	4.5
4	**CL/F/P4**	**U**	**4620**	3.08	<1	129	3	**530**	<0.2	<0.001	93.2	18	**58.0**	<0.2	<0.01	3.4	5.9
	CL/F/P4	**1X**	**4260**	1.95	<1	151	4	**490**	<0.2	<0.001	92	19	**60.9**	<0.2	<0.01	3.7	6.1
	CL/F/P4	**2X**	**5030**	3.26	<1	183	4	**599**	<0.2	<0.001	94.1	16	**71.0**	<0.2	<0.01	4.6	6.5

Note: values for each plot are based on composite samples
U – Unamended.
1X – Lime amendment level recommended by OMAFRA (7.5 t/ha).
2X – Double the lime amendment level recommended by OMAFRA (15 t/ha).

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Table 11 Total Aqueous and DTPA Extractable CoC Concentrations in the Clay Soil from the Clay 1 Field Site Expressed in mg/kg and as a Percentage of the Total Metal Concentration

Plot	Sample Number	Amendment Level	Total Nickel	Extractable Nickel (mg/kg)				Total Copper	Extractable Copper (mg/kg)				Total Cobalt	Extractable Cobalt (mg/kg)			
				Aqueous	%	DTPA	%		Aqueous	%	DTPA	%		Aqueous	%	DTPA	%
1	**CL/F/P1**	**U**	**581**	1.21	<1	50.1	9	**86**	<0.2	<0.01	16.5	19	**15.7**	<0.2	<0.1	0.7	4.5
	CL/F/P1	**1X**	**591**	0.99	<1	44.8	8	**85**	<0.2	<0.01	15.3	18	**15.3**	<0.2	<0.1	0.5	3.3
	CL/F/P1	**2X**	**557**	0.77	<1	38.4	7	**84**	<0.2	<0.01	14.8	18	**13.8**	<0.2	<0.1	0.3	2.2
2	**CL/F/P2**	**U**	**636**	1.34	<1	44.6	7	**104**	<0.2	<0.01	17.4	17	**14.7**	<0.2	<0.1	0.5	3.4
	CL/F/P2	**1X**	**646**	0.81	<1	46.1	7	**113**	<0.2	<0.01	16.3	14	**16.7**	<0.2	<0.1	0.8	4.8
	CL/F/P2	**2X**	**635**	1.14	<1	49.1	8	**112**	<0.2	<0.01	16.9	15	**15.0**	<0.2	<0.1	0.7	4.7
3	**CL/F/P3**	**U**	**693**	1.02	<1	51.6	7	**146**	<0.2	<0.01	16.1	11	**14.4**	<0.2	<0.1	0.7	4.9
	CL/F/P3	**1X**	**713**	0.95	<1	49.0	7	**137**	<0.2	<0.01	25.3	18	**15.2**	<0.2	<0.1	0.6	3.9
	CL/F/P3	**2X**	**675**	1.02	<1	4.7	1	**128**	<0.2	<0.01	22.5	18	**13.1**	<0.2	<0.1	0.6	4.6
4	**CL/F/P4**	**U**	**633**	1.24	<1	51.7	8	**96**	<0.2	<0.01	15.9	17	**15.0**	<0.2	<0.1	0.8	5.3
	CL/F/P4	**1X**	**617**	1.01	<1	46.6	8	**96**	<0.2	<0.01	17.7	19	**14.2**	<0.2	<0.1	0.6	4.2
	CL/F/P4	**2X**	**587**	1.13	<1	53.5	9	**93**	<0.2	<0.01	19	20	**14.6**	<0.2	<0.1	<0.2	<0.1

Note: values for each plot are based on composite samples
U – Unamended.
1X – Lime amendment level recommended by OMAFRA (7.5 t/ha).
2X – Double the lime amendment level recommended by OMAFRA (15 t/ha).

1.4 Extractable Metals - Year 2001 Field Trials

Tables 12 and 13 show extractable nickel, copper and cobalt data for the Clay 2 and Clay 3 field sites respectively. Generally, the water and DTPA extractable nickel and copper concentrations were the lowest in the calcareous plots. However, the cobalt concentrations did not show any variations.

Absolute concentrations of nickel extracted from the Welland Clay (Heavy Clay) soils increased with total soil nickel concentrations; however, the proportion of nickel extracted remained consistent. For unamended Welland Clay (Heavy Clay) soil, DTPA and ammonium oxalate methods extracted up to 246 and 1136 mg nickel/kg respectively for the Clay 2 site soil, while the same extractions conducted on the same soil type at the Clay 3 site yielded 560 and 864 mg nickel/kg respectively.

Table 12 Year 2001 Clay 2 Site – Extractable CoCs in Field Soils

Plot	Treat EQL Units	DTPA Extractable			Aqueous Extractable			Strontium Nitrate Extract			Acid Ammonium Oxalate Extraction		
		Nickel 0.6 mg/kg	Copper 0.2 Mg/kg	Cobalt 0.2 mg/kg	Nickel 0.6 mg/kg	Copper 0.2 mg/kg	Cobalt 0.2 mg/kg	Nickel 0.4 mg/kg	Copper 0.1 mg/kg	Cobalt 0.1 mg/kg	Nickel 8 mg/kg	Copper 2 mg/kg	Cobalt 2 mg/kg
1A	**U**	246 ± 69	124 ± 15	0.7 ± 0.2	8.2 ± 1.4	2.3 ± 0.3	<0.2	3.3 ± 0.8	0.1 ± 0.1	<0.1	1136 ± 158	393 ± 690	24 ± 2
2A	**U**	227 ± 48	100 ± 7.0	0.8 ± 0.2	7.7 ± 1.5	1.9 ± 0.2	<0.2	2.9 ± 1.3	0.1 ± 0.1	<0.1	1086 ± 166	349 ± 46	23 ± 3
3A	**U**	146 ± 34	92 ± 11	0.6 ± 0.1	6.4 ± 1.0	2.1 ± 0.2	<0.2	1.7 ± 0.7	0.1 ± 0.1	<0.1	820 ± 165	300 ± 42	17 ± 3
4A	**U**	225 ± 21	118 ± 14	1.0 ± 0.1	8.8 ± 0.6	2.6 ± 0.2	<0.2	2.5 ± 0.5	0.2 ± 0.1	<0.1	1003 ± 70	359 ± 37	23 ± 2
1A	**1X**	210 ± 90	121 ± 10	0.6 ± 0.3	7.0 ± 2.3	2.2 ± 0.1	<0.2	1.9 ± 0.9	<0.1	<0.1	1111 ± 180	386 ± 43	23 ± 2
2A	**1X**	214 ± 29	104 ± 12	0.8 ± 0.2	7.5 ± 1.0	2.2 ± 0.4	<0.2	1.6 ± 0.4	0.1 ± 0.1	<0.1	956 ± 140	338 ± 45	22 ± 2
3A	**1X**	146 ± 23	93 ± 7	0.5 ± 0.1	5.8 ± 0.5	2.0 ± 0.1	<0.2	1.1 ± 0.1	0.1 ± 0.1	<0.1	845 ± 107	315 ± 40	18 ± 2
4A	**1X**	170 ± 12	104 ± 9	0.6 ± 0.1	6.8 ± 0.3	2.4 ± 0.1	<0.2	1.4 ± 0.1	0.2 ± 0.1	<0.1	864 ± 135	323 ± 41	20 ± 3
1A	**2X**	243 ± 65	132 ± 14	0.7 ± 0.2	7.4 ± 1.4	2.3 ± 0.3	<0.2	1.8 ± 0.8	<0.1	<0.1	1146 ± 344	383 ± 93	24 ± 6
2A	**2X**	217 ± 23	100 ± 5	0.7 ± 0.1	6.8 ± 0.4	1.8 ± 0.1	<0.2	1.3 ± 0.2	0.1 ± 0.1	<0.1	931 ± 114	333 ± 37	20 ± 2
3A	**2X**	149 ± 39	100 ± 15	0.5 ± 0.1	6.0 ± 0.9	2.1 ± 0.1	<0.2	1.1 ± 0.3	0.1 ± 0.1	<0.1	801 ± 168	311 ± 54	17 ± 4
4A	**2X**	176 ± 16	106 ± 10	0.7 ± 0.1	7.0 ± 0.3	2.4 ± 0.1	<0.2	1.4 ± 0.2	0.1 ± 0.1	<0.1	908 ± 81	342 ± 28	19 ± 2
1B	**CAL**	141 ± 32	98 ± 24	0.4 ± 0.1	5.3 ± 0.8	2.0 ± 0.3	<0.2	1.1 ± 0.2	0.1 ± 0.1	<0.1	859 ± 124	286 ± 59	17 ± 2
2B	**CAL**	138 ± 22	81 ± 15	0.5 ± 0.1	5.8 ± 0.8	1.8 ± 0.2	<0.2	0.9 ± 0.1	0.1 ± 0.1	<0.1	764 ± 194	257 ± 61	17± 4
3B	**CAL**	133 ± 16	99 ± 12	0.4 ± 0.1	5.5 ± 0.3	2.1 ± 0.2	<0.2	0.9 ± 0.1	0.1 ± 0.1	<0.1	891 ± 125	318 ± 41	20 ± 3
4B	**CAL**	122 ± 6	95 ± 4	0.5 ± 0.1	5.0 ± 0.3	2.0 ± 0.1	<0.2	0.9 ± 0.2	0.2 ± 0.1	<0.1	737 ± 51	274 ± 21	15 ± 2

Note: U – Unamended.
1X – Lime amendment level recommended by OMAFRA (7.5 t/ha).
2X –Double the lime amendment level recommended by OMAFRA (15 t/ha).
CAL – Lime amendment to make clay soil calcareous (100 t/ha).
EQL – Estimated quantification limit for analytical method.

Table 13 Year 2001 Clay 3 Site – Extractable CoC Concentrations in Field Soils

Plot	Treat	DTPA Extractable			Aqueous Extractable			Ammonium Oxalate Extractable			Strontium Nitrate Extractable		
		Nickel 0.6 mg/kg	Copper 0.2 mg/kg	Cobalt 0.2 mg/kg	Nickel 0.6 mg/kg	Copper 0.2 mg/kg	Cobalt 0.2 mg/kg	Nickel 8 mg/kg	Copper 2 mg/kg	Cobalt 2 mg/kg	Nickel 0.4 mg/kg	Copper 0.1 mg/kg	Cobalt 0.1 mg/kg
1	U	538 ± 38	124 ± 10	2.5 ± 0.4	18.7 ± 1.0	2.5 ± 0.1	<0.2	823 ± 58	249 ± 20	12 ± 2	15.5 ± 1.4	0.2 ± 0.1	0.2 ± 0.1
2	U	523 ± 48	119 ± 12	3.1 ± 0.7	19.9 ± 1.5	2.7 ± 0.2	<0.2	796 ± 86	245 ± 30	12 ± 2	20.5 ± 2.5	0.2 ± 0.1	0.3 ± 0.1
3	U	490 ± 170	115 ± 41	2.5 ± 0.9	21.1 ± 1.5	3.0 ± 0.4	<0.2	780 ± 73	227 ± 23	13 ± 2	16.0 ± 1.6	0.2 ± 0.1	0.2 ± 0.1
4	U	560 ± 68	125 ± 12	2.9 ± 0.7	19.6 ± 2.1	2.6 ± 0.3	<0.2	864 ± 106	242 ± 26	14 ± 2	18.9 ± 3.0	0.2 ± 0.1	0.2 ± 0.1
1	1X	415 ± 42	110 ± 15	1.3 ± 0.3	15.7 ± 1.1	2.3 ± 0.3	<0.2	740 ± 58	231 ± 23	11 ± 2	6.3 ± 1.1	0.2 ± 0.1	0.1 ± 0.1
2	1X	468 ± 44	126 ± 10	1.7 ± 0.4	17.1 ± 1.1	2.7 ± 0.2	<0.2	824 ± 74	263 ± 27	14 ± 1	7.7 ± 1.5	0.3 ± 0.1	0.1 ± 0.1
3	1X	424 ± 41	105 ± 13	1.5 ± 0.3	17.4 ± 1.4	2.9 ± 0.3	<0.2	763 ± 98	219 ± 28	12 ± 2	6.6 ± 1.3	0.2 ± 0.1	0.1 ± 0.1
4	1X	416 ± 74	111 ± 16	1.5 ± 0.4	15.5 ± 2.3	2.4 ± 0.4	<0.2	755 ± 120	229 ± 34	12 ± 1	6.6 ± 2.0	0.1 ± 0.1	0.1 ± 0.1
1	2X	347 ± 55	101 ± 14	1.0 ± 0.3	12.1 ± 1.1	2.1 ± 0.2	<0.2	700 ± 58	234 ± 20	11 ± 2	3.3 ± 0.6	0.2 ± 0.1	0.1 ± 0.1
2	2X	372 ± 72	110 ± 16	1.3 ± 0.6	13.7 ± 2.7	2.3 ± 0.3	<0.2	672 ± 79	218 ± 24	11 ± 1	4.8 ± 3.1	0.2 ± 0.1	0.1 ± 0.1
3	2X	330 ± 43	104 ± 14	1.0 ± 0.2	13.1 ± 1.3	2.6 ± 0.3	<0.2	769 ± 80	238 ± 22	12 ± 2	3.1 ± 0.5	0.2 ± 0.1	0.1 ± 0.1
4	2X	313 ± 62	98 ± 16	1.0 ± 0.3	11.8 ± 1.6	2.1 ± 0.2	<0.2	665 ± 86	216 ± 30	10 ± 1	3.3 ± 1.2	0.1 ± 0.1	0.1 ± 0.1

Note: U – Unamended.
1X– Lime amendment level recommended by OMAFRA (1X = "prudent farmer") to raise soil pH to 7.0.
2X–Lime amendment level recommended by OMAFRA to make clay soil calcareous.
EQL – Estimated quantification limit for analytical method.

GREENHOUSE TRIALS

2000 & 2001

VOLUME 1 - PART 3 – APPENDICES

DECEMBER, 2004

LIST OF APPENDICES
VOLUME 1 – PART 3 – APPENDICES

APPENDIX GH-1A
YEAR 2000 DATA TABLES

Table GH-1
Biomass Yield Ranges for Corn Shoots (grams DW/pot)

	Impact Level	Control	Low	Medium	High	Very High
CLAY	**Soil nickel (mg/kg)**	**34**	**200**	**500**	**3450**	**8300**
	UNAMENDED (U)	*	7.7 – 10.2	8.2 – 10.8	1.7 – 2.4	2.4 – 3.3
	OMAFRA(1X)	*	10.0 – 14.9	3.4 – 9.5	8.9 – 10.6	5.6 – 7.5
	2X OMAFRA(2X)	*	6.3 – 10.7	7.6 – 8.4	10.1 – 10.7	8.4 – 8.7
ORGANIC	**Soil nickel (mg/kg)**	**33**	**200**	**1200**	**3200**	**5550**
	UNAMENDED (U)	**	6.3 – 6.9	3.4 – 3.5	7.6 – 9.4	1.0 – 1.5
	OMAFRA(1X)	**	4.2 – 5.1	1.3 – 5.5	7.4 – 8.8	1.1 – 1.3
	2X OMAFRA(2X)	**	4.6 – 5.8	2.2 – 2.9	5.0 – 6.8	0.5 – 1.1
ORGANIC II	**Soil nickel (mg/kg)**	**33**	**200**	**1200**	**3200**	**5550**
	UNAMENDED (U)	9.1 – 11.	6.3 – 8.0	3.0 – 3.4	5.5 – 6.4	1.6 – 3.0
	OMAFRA(1X)	7.2 – 8.5	4.6 – 5.6	3.2 – 3.7	3.9 – 5.6	1.7 –2.8
	2X OMAFRA(2X)	7.7 – 10.4	5.7 – 6.1	2.0 – 3.2	3.4 – 4.2	1.4 – 3.4
SAND	**Soil nickel (mg/kg)**	**5**	**300**	**500**	**1350**	**NA**
	UNAMENDED (U)	13.5 – 15.4	10.0 – 11.6	4.7 – 7.3	5.0 – 7.4	NA
	OMAFRA(1X)	16.6 – 18.1	11.6 – 14.8	7.2 – 9.9	10.5 – 17.8	NA
	2X OMAFRA(2X)	7.3 – 13.9	10.9 – 13.0	5.8 – 7.3	11.0 – 11.5	NA

* **-** Clay Control biomass is not reported due to uncertainty of data
** **-** Organic Control results for corn were not available due to source soil problems – no germination
NA – no soil collected for this CoC concentration

Table GH-2
Average Corn Biomass Yield (g DW/pot) Compared Between Soil CoC Concentrations

	Impact Level	Control	Low	Medium	High	Very High
CLAY SOIL	**Soil nickel (mg/kg)**	**34**	**200**	**500**	**3450**	**8300**
	UNAMENDED (U)	*	8.8[b]	9.3[b]	2[c]	2.7[c]
	OMAFRA(1X)	*	5.8[c]	12.6[b]	9.7b[c]	6.4[c]
	2X OMAFRA(2X)	*	7.9[b]	8.1[b]	10.3[b]	8.6[b]
ORGANIC	**Soil nickel (mg/kg)**	**33**	**200**	**1200**	**3200**	**5550**
	UNAMENDED (U)	**	6.62[a]	3.44[b]	8.51[a]	1.25[c]
	OMAFRA(1X)	**	4.71[bc]	3.58[cd]	8.27[a]	1.2[d]
	2X OMAFRA(2X)	**	5.44[a]	2.51[b]	6.16[a]	0.88[c]
ORGANIC II	**Soil nickel (mg/kg)**	**33**	**200**	**1200**	**3200**	**5550**
	UNAMENDED (U)	9.97[a]	7.31[b]	3.23[c]	5.94[b]	2.18[c]
	OMAFRA(1X)	7.65[a]	4.97[b]	3.5[c]	4.79[b]	2.13[d]
	2X OMAFRA(2X)	8.69[a]	5.91[b]	2.59[c]	3.78[c]	2.48[c]
SAND CORN	**Soil nickel (mg/kg)**	**5**	**300**	**500**	**1350**	**NA**
	UNAMENDED (U)	14.6[a]	10.8[b]	6.2[c]	6.4[c]	NA
	OMAFRA(1X)	17.2[a]	12.4[ab]	8.3[b]	13.4[ab]	NA
	2X OMAFRA(2X)	10.7[a]	12.3[a]	6.7[b]	11.2[a]	NA

* - Clay Control biomass is not reported due to uncertainty of data
** - Organic Control results for corn were not available due to source soil problems – no germination
NA – no soil collected for this CoC concentration
(a, b, c, etc.) - Rank indicates statistical differences (95% confidence level) within rows (based on Student Neuman Keuls (SNK) Multiple Comparison of Means)

Table GH-3
Nickel Concentration Ranges (mg/kg DW) in Corn Shoot Tissue

	Impact Level	Control	Low	Medium	High	Very High
CLAY	**Soil nickel (mg/kg)**	**34**	**200**	**500**	**3450**	**8300**
	UNAMENDED (U)	<0.1	<0.1	<0.1	63 - 86	67 - 140
	OMAFRA(1X)	<0.1	<0.1	<0.1	4 - 9	7 - 11
	2X OMAFRA(2X)	<0.1	<0.1	<0.1	<0.1 - 3	5 - 6
ORGANIC	**Soil nickel (mg/kg)**	**33**	**200**	**1200**	**3200**	**5550**
	UNAMENDED (U)	*	<0.1	<0.1	3 - 4	9 - 14
	OMAFRA(1X)	*	<0.1	<0.1	3 - 17	7 - 12
	2X OMAFRA(2X)	*	<0.1	<0.1	3 - 4	10 - 13
ORGANIC II	**Soil nickel (mg/kg)**	**33**	**200**	**1200**	**3200**	**5550**
	UNAMENDED (U)	<0.1	<0.1	<0.1	<0.1	10 - 29
	OMAFRA(1X)	<0.1	<0.1	<0.1	<0.1 - 3	11 - 20
	2X OMAFRA(2X)	<0.1	<0.1	<0.1	3	4 - 5
SAND	**Soil nickel (mg/kg)**	**5**	**300**	**500**	**1350**	**NA**
	UNAMENDED (U)	<0.1	<0.1	<0.1	3 - 15	NA
	OMAFRA(1X)	<0.1	<0.1	<0.1	<0.1 - 3	NA
	2X OMAFRA(2X)	<0.1	<0.1	<0.1	<0.1	NA

* - Organic Control results for corn were not available due to source soil problems – no germination
NA – no soil collected for this CoC concentration
< - Below analytical detection limit for Nickel, (0.1 mg Ni/kg DW)

Table GH-4

Average Nickel Concentrations (mg/kg DW) in Corn Tissue Compare d between Soil CoC Concentrations

	Impact Level	Control	Low	Medium	High	Very High
CLAY	**Soil nickel (mg/kg)**	**34**	**200**	**500**	**3450**	**8300**
	UNAMENDED (U)	<0.1	<0.1	<0.1	73[a]	112[a]
	OMAFRA(1X)	<0.1	<0.1	<0.1	6.7[a]	8.5[a]
	2X OMAFRA(2X)	<0.1	<0.1	<0.1	2.7[b]	5.4[a]
ORGANIC	**Soil nickel (mg/kg)**	**33**	**200**	**1200**	**3200**	**5550**
	UNAMENDED (U)	*	<0.1	<0.1	2.8[b]	11.6[a]
	OMAFRA(1X)	*	<0.1	<0.1	7.9[a]	9.1[a]
	2X OMAFRA(2X)	*	<0.1	<0.1	3.5[b]	10.9[a]
ORGANIC II	**Soil nickel (mg/kg)**	**33**	**200**	**1200**	**3200**	**5550**
	UNAMENDED (U)	<0.1	<0.1	<0.1	<0.1	18.8
	OMAFRA(1X)	<0.1	<0.1	<0.1	2.7[b]	15.9[a]
	2X OMAFRA(2X)	<0.1	<0.1	<0.1	3.1[b]	4.6[a]
SAND	**Soil nickel (mg/kg)**	**5**	**300**	**500**	**1350**	**NA**
	UNAMENDED (U)	<0.1	<0.1	<0.1	6	NA
	OMAFRA(1X)	<0.1	<0.1	<0.1	<0.1	NA
	2X OMAFRA(2X)	<0.1	<0.1	<0.1	<0.1	NA

* - Organic Control results for corn were not available due to source soil problems – no germination

NA – no soil collected for this CoC concentration

(a, b, c, etc.) - Rank indicates statistically differences (95% confidence level) within rows (based on Student Neuman Keuls (SNK) Multiple Comparison of Means)

< - Below analytical detection limit for Nickel, (0.1 mg Ni/kg DW)

Table GH-5
Biomass Yield Ranges (grams) for Soybean Shoots

	Impact Level	Control	Low	Medium	High	Very High
CLAY	**Soil nickel (mg/kg)**	**34**	**200**	**500**	**3450**	**8300**
	UNAMENDED (U)	*	9.8 – 15.0	8.4 – 8.8	0.9 – 1.4	0.9 – 1.2
	OMAFRA(1X)	*	14. 0 – 18.0	6.5 – 7.3	6.0 – 6.9	5.0 – 6.4
	2X OMAFRA(2X)	*	6.3 – 9.5	6.4 – 9.4	6.4 – 7.5	5.8 – 6.8
ORGANIC	**Soil nickel (mg/kg)**	**33**	**200**	**1200**	**3200**	**5550**
	UNAMENDED (U)	6.7 – 9.0	11.2 – 12.4	11.4 – 14.2	8.6 – 10.6	3.3 – 4.6
	OMAFRA(1X)		8.7 – 11.3	10.3 – 12.7	9.8 – 10.3	2.9 – 3.9
	2X OMAFRA(2X)		7.6 – 12.0	11.5 – 13.4	10.3 – 12.0	2.8 – 5.5
SAND	**Soil nickel (mg/kg)**	**5**	**300**	**500**	**1350**	**NA**
	UNAMENDED (U)	15.9 – 16.9	10.7 – 12.3	7.5 - 9.7	5.0 – 7.1	NA
	OMAFRA(1X)	9.9 – 14.7	10.5 – 12.5	6.4 – 11.2	8.4 – 10.4	NA
	2X OMAFRA(2X)	5. 8 – 9.9	7.5 – 12.1	6.8 – 9.6	9.2 – 10.3	NA

* **-** analytical error has prevented inclusion of control clay soil soybean data
NA – No soil Collected at this CoC impact level

Table GH-6
Average Soybean Biomass Yield (g DW/pot) Compared Between Soil CoC Concentrations

	Impact Level	Control	Low	Medium	High	Very High
CLAY	**Soil nickel (mg/kg)**	**34**	**200**	**500**	**3450**	**8300**
	UNAMENDED (U)	*	13.3[a]	8.5[b]	1.1[c]	1[c]
	OMAFRA(1X)	*	15.4[a]	6.9[b]	6.5[b]	5.6[b]
	2X OMAFRA(2X)	*	8.3[b]	7.4[b]	6.9[b]	6.4[b]
ORG	**Soil nickel (mg/kg)**	**33**	**200**	**1200**	**3200**	**5550**
	UNAMENDED (U)	7.8[b]	11.6[a]	13[a]	8.5[b]	3.9[c]
	OMAFRA(1X)	7.4[b]	10.3[a]	11.5[a]	10[a]	3.6[c]
	2X OMAFRA(2X)	7.4[b]	10.1[a]	12.5[a]	11.2[a]	3.9[c]
SAND	**Soil nickel (mg/kg)**	**5**	**300**	**500**	**1350**	**NA**
	UNAMENDED (U)	16.4[a]	11.7[b]	8.6[c]	6.1[d]	NA
	OMAFRA(1X)	12.0[a]	11.3[a]	9.2[a]	8.5[a]	NA
	2X OMAFRA(2X)	10.1[a]	9.6[a]	8.1[a]	8.0[a]	NA

* - analytical error has prevented inclusion of control clay soybean data
NA - No soil collected at this CoC impact level
(a, b, or c) - indicates statistical differences (95% confidence level) within rows (based on Student Neuman Keuls (SNK) Multiple Comparison of Means)

Table GH-7
Nickel Concentration Ranges (mg/kg DW) in Soybean Shoot Tissue

	Impact Level	Control	Low	Medium	High	Very High
CLAY	**Soil nickel (mg/kg)**	**34**	**200**	**500**	**3450**	**8300**
	UNAMENDED (U)	<0.1	<0.1	9 - 17	218 - 242	156 - 204
	OMAFRA(1X)	<0.1	<0.1 –5	<0.1 - 15	48 - 77	57 - 90
	2X OMAFRA(2X)	<0.1	<0.1 - 3	5 - 9	24 - 40	25 - 47
ORGANIC	**Soil nickel (mg/kg)**	**33**	**200**	**1200**	**3200**	**5550**
	UNAMENDED (U)	<0.1	<0.1	<0.1	31 - 41	35 - 44
	OMAFRA(1X)	<0.1	<0.1	<0.1	20 - 37	28 - 33
	2X OMAFRA(2X)	<0.1	<0.1	<0.1	13 - 20	35 - 42
SAND	**Soil nickel (mg/kg)**	**5**	**300**	**500**	**1350**	**NA**
	UNAMENDED (U)	<0.1	<0.1 - 6	4.5 - 12	45 - 70	NA
	OMAFRA(1X)	<0.1	<0.1 - 6	4.3 – 7.3	36 - 48	NA
	2X OMAFRA(2X)	<0.1	<0.1	6 - 20	35 - 40	NA

NA - No soil Collected at this CoC impact level
< - Below analytical detection limit for Nickel, (0.1 mg Ni/kg DW)

Table GH-8
Average Nickel Concentrations (mg/kg DW) in Soybean Tissue Compared between Soil CoC Concentrations

	Impact Level	Control	Low	Medium	High	Very High
CLAY	**Soil nickel (mg/kg)**	**34**	**200**	**500**	**3450**	**8300**
	UNAMENDED (U)	<0.1	<0.1	11[c]	227[b]	186[b]
	OMAFRA(1X)	<0.1	<0.1	9[b]	62[a]	73[a]
	2X OMAFRA(2X)	<0.1	<0.1	7.7[b]	32[a]	33[a]
ORGANIC	**Soil nickel (mg/kg)**	**33**	**200**	**1200**	**3200**	**5550**
	UNAMENDED (U)	<0.1	<0.1	<0.1	35.6[a]	38.3[a]
	OMAFRA(1X)	<0.1	<0.1	<0.1	28.3[a]	30.5[a]
	2X OMAFRA(2X)	<0.1	<0.1	<0.1	17.1[b]	32.3[a]
SAND	**Soil nickel (mg/kg)**	**5**	**300**	**500**	**1350**	**NA**
	UNAMENDED (U)	<0.1	5.6[b]	8.6[b]	55[a]	NA
	OMAFRA(1X)	<0.1	4.2 [b]	5.6[b]	41[a]	NA
	2X OMAFRA(2X)	<0.1	<0.1	11.2[b]	37.3[a]	NA

NA - No soil Collected at this CoC impact level
(a, b, or c) - indicates statistical differences (95% confidence level) within rows (based on Student Neuman Keuls (SNK) Multiple Comparison of Means)
< - Below analytical detection limit for Nickel, (0.1 mg Ni/kg DW)

Table GH-9
Biomass Yield Ranges (grams) for Oat Shoots

	Impact Level	Control	Low	Medium	High	Very High
CLAY	**Soil nickel (mg/kg)**	**34**	**200**	**500**	**3450**	**8300**
	UNAMENDED (U)	*	*	*	*	*
	OMAFRA(1X)	*	*	*	*	*
	2X OMAFRA(2X)	*	*	*	*	*
ORGANIC	**Soil nickel (mg/kg)**	**33**	**200**	**1200**	**3200**	**5550**
	UNAMENDED (U)	2.5 – 2.9	2.0 – 3.5	0.5 – 0.8	4.8 – 5.9	0.3 - 0.6
	OMAFRA(1X)	2.3 – 2.4	3.0 – 5.0	0.7 – 1.5	1.7 – 2.3	0.6 - 0.7
	2X OMAFRA(2X)	0.4 – 1.4	2.1 – 4.3	0.5 – 1.4	0.7 – 1.6	0.5
SAND	**Soil nickel (mg/kg)**	**5**	**300**	**500**	**1350**	**NA**
	UNAMENDED (U)	1.9 - 3.1	1.2 – 1.4	0.9 – 1.1	0.4 – 0.5	NA
	OMAFRA(1X)	0.6 - 0.9	1.2 – 1.6	0.4 - 0.8	0.4 – 0.6	NA
	2X OMAFRA(2X)	0.2 - 0.3	0.8 – 1.2	0.7 - 0.8	0.6 - 0.7	NA

* - analytical error has prevented inclusion of biomass data for oat on clay soil
NA – No soil Collected at this CoC impact level

Table GH-10
Average Oat Biomass Yield (g DW/pot) Compared Between Soil CoC Concentrations

	Impact Level	Control	Low	Medium	High	Very High
CLAY	**Soil nickel (mg/kg)**	**34**	**200**	**500**	**3450**	**8300**
	UNAMENDED (U)	*	*	*	*	*
	OMAFRA(1X)	*	*	*	*	*
	2X OMAFRA(2X)	*	*	*	*	*
ORGANIC	**Soil nickel (mg/kg)**	**33**	**200**	**1200**	**3200**	**5550**
	UNAMENDED (U)	2.7[b]	2.6[b]	0.6[c]	5.1[a]	0.5[c]
	OMAFRA(1X)	2.4[b]	3.9[a]	1.1[c]	2.1[b]	0.6[c]
	2X OMAFRA(2X)	0.9[b]	2.9[a]	0.9[b]	1.1[b]	0.5[b]
SAND	**Soil nickel (mg/kg)**	**5**	**300**	**500**	**1350**	**NA**
	UNAMENDED (U)	2.4[a]	1.3[b]	0.9[bc]	0.43[c]	NA
	OMAFRA(1X)	0.74[b]	1.5[a]	0.59[b]	0.47[b]	NA
	2X OMAFRA(2X)	0.27[c]	0.99[a]	0.8[ab]	0.63[b]	NA

* - analytical error has prevented inclusion of biomass data for oat on clay soil
NA – No soil Collected at this CoC impact level
(a, b, or c) - indicates statistically differences (95% confidence level) within rows (based on Student Neuman Keuls (SNK) Multiple Comparison of Means)

Table GH-11
Nickel Concentration Ranges (mg/kg DW) in Oat Shoot Tissue

	Impact Level	Control	Low	Medium	High	Very High
CLAY	**Soil nickel (mg/kg)**	**34**	**200**	**500**	**3450**	**8300**
	UNAMENDED (U)	<0.1	4 - 6	20 - 25	213 - 237	136 - 203
	OMAFRA(1X)	<0.1	7 -12	16 - 18	77 - 86	105 - 217
	2X OMAFRA(2X)	<0.1	5 - 16	14 - 18	62 - 85	60 -125
ORGANIC	**Soil nickel (mg/kg)**	**33**	**200**	**1200**	**3200**	**5550**
	UNAMENDED (U)	<0.1	<0.1	5.6-10	45 - 59	76 - 88
	OMAFRA(1X)	<0.1	<0.1	10-12.5	33 - 42	76 - 92
	2X OMAFRA(2X)	<0.1	1.6 - 3	6.1-13.1	32 - 49	80 - 92
SAND	**Soil nickel (mg/kg)**	**5**	**300**	**500**	**1350**	**NA**
	UNAMENDED (U)	<0.1	27 - 50	35 - 56	105 - 123	NA
	OMAFRA(1X)	<0.1 - 4	32 - 49	54 - 65	93 - 121	NA
	2X OMAFRA(2X)	<0.1	36 - 63	47 - 74	104 - 135	NA

NA – No soil Collected at this CoC impact level
< - Below analytical detection limit for Nickel, (0.1 mg Ni/kg DW)

Table GH-12
Average Nickel Concentrations (mg/kg DW) in Oat Tissue Compared between Soil CoC Concentrations

	Impact Level	Control	Low	Medium	High	Very High
CLAY	**Soil nickel (mg/kg)**	**34**	**200**	**500**	**3450**	**8300**
	UNAMENDED (U)	<0.1	4.8[c]	21.9[c]	164[b]	223[a]
	OMAFRA(1X)	<0.1	8.5[c]	16.7[c]	80.2[b]	148[a]
	2X OMAFRA(2X)	<0.1	9.9[c]	15.8[c]	61.2[b]	102[a]
ORGANIC	**Soil nickel (mg/kg)**	**33**	**200**	**1200**	**3200**	**5550**
	UNAMENDED (U)	<0.1	<0.1	8.9[c]	47[b]	80.4[a]
	OMAFRA(1X)	<0.1	<0.1	11[c]	36.3[b]	83.1[a]
	2X OMAFRA(2X)	<0.1	2.1[d]	9.9[c]	38.9[b]	85[a]
SAND	**Soil nickel (mg/kg)**	**5**	**300**	**500**	**1350**	**NA**
	UNAMENDED (U)	<0.1	37.5[b]	48.4[b]	116[a]	NA
	OMAFRA(1X)	3[d]	37.4 [c]	59.7[b]	103[a]	NA
	2X OMAFRA(2X)	<0.1	50.7[c]	60.5[b]	123[a]	NA

NA - No soil Collected at this CoC impact level
(a, b, or c) indicates statistical differences (95% confidence level) within rows (based on Student Neuman Keuls (SNK) Multiple Comparison of Means)
< - Below analytical detection limit for Nickel, (0.1 mg Ni/kg DW)

Table GH-13
Average Copper Concentration (mg/kg DW) in Plant Tissue Compared Between Soil CoC Concentrations

A. CLAY SOIL

	Impact Level	Control	Low	Medium	High	Very High
CORN	Soil Copper (mg/kg)	25	42	100	400	900
	UNAMENDED (U)	3[b]	3[b]	6.2[b]	8.6[b]	33[a]
	OMAFRA(1X)	3.4[c]	2.5[c]	7.6[b]	12.8[a]	13[a]
	2X OMAFRA(2X)	2.8[c]	2.7[c]	17.6[a]	10.3[b]	19.4[a]
SOYBEAN						
	UNAMENDED (U)	3.6[b]	3.8[b]	4.2[b]	5.9[a]	6[a]
	OMAFRA(1X)	4[b]	3.6[b]	5.4[ab]	6.5[a]	7[a]
	2X OMAFRA(2X)	2.9[b]	2.9[b]	6.9[a]	6.8[a]	7.4[a]
OAT						
	UNAMENDED (U)	6.8[a]	8.6[a]	7.5[a]	6[a]	7.4[a]
	OMAFRA(1X)	7.1[b]	9.3[b]	10.2[b]	17[b]	24.7[a]
	2X OMAFRA(2X)	7.2[b]	9[b]	9.5[b]	17.5[a]	22.1[a]

(a, b, or c) indicates statistical differences (95% confidence level) within rows (based on Student Neuman Keuls (SNK) Multiple Comparison of Means)

Table GH-13 *continued…*
Average Copper Concentration (mg/kg DW) in Plant Tissue Compared Between Soil CoC Concentrations

B. ORGANIC SOIL

	Impact Level	Control	Low	Medium	High	Very High
CORN	**Soil Copper (mg/kg)**	**16**	**100**	**200**	**500**	**600**
	UNAMENDED (U)	2.3[c]	1.9[c]	2.4[c]	5.3[b]	12.5[a]
	OMAFRA(1X)	2.4[c]	1.9[c]	3.8[bc]	6.1[b]	11.9[a]
	2X OMAFRA(2X)	2.4[c]	2.5[c]	3.2[c]	6.1[b]	11.8[a]
CORN II						
	UNAMENDED (U)	2.6[b]	2.7[b]	3.9[b]	7.8[a]	9.2[a]
	OMAFRA(1X)	2.3[c]	2.1[c]	3.9[c]	6.5[b]	8.5[a]
	2X OMAFRA(2X)	2.8[c]	2.9[c]	3.3[c]	8[a]	5.9[b]
SOYBEAN						
	UNAMENDED (U)	3.2[a]	2.6[a]	2.8[a]	2.9[a]	3.7[a]
	OMAFRA(1X)	3.4[a]	3.6[a]	2.7[a]	3.1[a]	4.8[a]
	2X OMAFRA(2X)		3.3[b]	2.5[b]	3.4[ab]	4.4[a]
OAT						
	UNAMENDED (U)	2.4[d]	1.7[d]	3.9[c]	6[b]	9.8[a]
	OMAFRA(1X)	3[c]	1.6[d]	3.3[c]	7[b]	8.9[a]
	2X OMAFRA(2X)	2.1[c]	2.8[c]	3[c]	6.6[b]	9.9[a]

(a, b, or c) indicates statistical differences (95% confidence level) within rows (based on Student Neuman Keuls (SNK) Multiple Comparison of Means)

Table GH-13 *continued…*

Average Copper Concentration (mg/kg DW) in Plant Tissue Compared Between Soil CoC Concentrations

C. SAND SOIL

	Impact Level	Control	Low	Medium	High	Very High
CORN	Soil Copper (mg/kg)	<0.05	39	71	150	NA
	UNAMENDED (U)	2.2[c]	6[c]	15[b]	20[a]	NA
	OMAFRA(1X)	2.2[a]	7.7[a]	15.1[a]	15.8[a]	NA
	2X OMAFRA(2X)	2.3[c]	8.8[b]	14.8[a]	17.9[a]	NA
SOYBEAN						
	UNAMENDED (U)	1.9[b]	3.2[ab]	3[ab]	43.8[a]	NA
	OMAFRA(1X)	1.9[b]	3.3[ab]	3.3[ab]	4.6[a]	NA
	2X OMAFRA(2X)	1.9[c]	3.3[b]	4.1[ab]	5.2[a]	NA
OAT						
	UNAMENDED (U)	4.9[b]	17.3[a]	18.8[a]	14.1[a]	NA
	OMAFRA(1X)	7.5[c]	13.1[b]	20.9[a]	18[a]	NA
	2X OMAFRA(2X)	5.6[b]	17.9[a]	18.2[a]	21.3[a]	NA

NA - No soil collected at this CoC impact level

(a, b, or c) - indicates statistically differences (95% confidence level) within rows (based on Student Neuman Keuls (SNK) Multiple Comparison of Means)

Table GH-14
Average Copper Concentrations (mg/kg) in Plant Tissue compared between Soil Amendment Levels

A. CLAY SOIL

	Impact Level	Control	Low	Medium	High	Very High
CORN	**Soil Copper (mg/kg)**	**25**	**42**	**100**	**400**	**900**
	UNAMENDED (U)	3[a]	3[a]	6.2[b]	8.6[a]	33[a]
	OMAFRA(1X)	3.4[a]	2.5[a]	7.6[b]	12.8[a]	13[b]
	2X OMAFRA(2X)	2.8[a]	2.7[a]	17.6[a]	10.3[a]	19[b]
SOYBEAN						
	UNAMENDED (U)	3.6[a]	3.8[a]	4.2[b]	5.9[a]	6[a]
	OMAFRA(1X)	4[a]	3.6[a]	5.4[b]	6.5[a]	7[a]
	2X OMAFRA(2X)	2.9[a]	2.9[a]	6.9[a]	6.8[a]	7.4[a]
OAT						
	UNAMENDED (U)	6.8[a]	8.6[a]	7.5[a]	6[b]	7.4[b]
	OMAFRA(1X)	7.1[a]	9.3[a]	10.2[a]	17[a]	24.7[a]
	2X OMAFRA(2X)	7.2[a]	9[a]	7.5[a]	17.5[a]	22.1[a]

(a, b, or c) - indicates statistically differences (95% confidence level) within columns for each plant type (based on Student Neuman Keuls (SNK) Multiple Comparison of Means)

Table GH-14 *continued…*

Average Copper Concentrations (mg/kg) in Plant Tissue compared between Soil Amendment Levels

B. ORGANIC SOIL

	Impact Level	Control	Low	Medium	High	Very High
CORN	Soil Copper (mg/kg)	16	100	200	500	600
	UNAMENDED (U)	2.6[a]	2.7[a]	3.9[a]	7.8[a]	9.2[a]
	OMAFRA(1X)	2.3[a]	2.1[a]	3.9[a]	6.5[a]	8.5[a]
	2X OMAFRA(2X)	2.8[a]	2.9[a]	3.3[a]	8[a]	5.9[b]
CORN II						
	UNAMENDED (U)	3.3[a]	1.9[a]	2.4[a]	5.3[a]	12.5[a]
	OMAFRA(1X)	2.4[b]	1.9[a]	3.8[a]	6.1[a]	11.9[a]
	2X OMAFRA(2X)	2.4[b]	2.5[a]	3.2[a]	6.1[a]	11.8[a]
SOYBEAN						
	UNAMENDED (U)	<0.05	2.6[a]	2.8[a]	2.9[a]	3.7[a]
	OMAFRA(1X)	<0.05	3.6[a]	2.7[a]	3.1[a]	4.8[a]
	2X OMAFRA(2X)	<0.05	3.3[a]	2.5[a]	3.4[a]	4.4[a]
OAT						
	UNAMENDED (U)	2.4[a]	1.7[b]	3.9[a]	6[a]	9.8[a]
	OMAFRA(1X)	3[a]	1.6[b]	3.3[a]	7[a]	8.9[a]
	2X OMAFRA(2X)	2.1[a]	2.8[a]	3[a]	6.6[a]	9.9[a]

(a, b, or c) - indicates statistically differences (95% confidence level) within columns for each plant type (based on Student Neuman Keuls (SNK) Multiple Comparison of Means)

< - value is less than detection limit for analytical method (0.05 mg Cu/kg)

Table GH-14 *continued…*

Average Copper Concentrations (mg/kg) in Plant Tissue compared between Soil Amendment Levels

C. SAND SOIL

	Impact Level	Control	Low	Medium	High	Very High
CORN	Soil Copper (mg/kg)	ND	39	71	150	NA
	UNAMENDED (U)	2.2[a]	6[a]	15[a]	20[a]	NA
	OMAFRA(1X)	2.2[a]	7.7[a]	15.1[a]	15.8[a]	NA
	2X OMAFRA(2X)	2.3[a]	8.8[a]	14.8[a]	17.9[a]	NA
SOYBEAN						
	UNAMENDED (U)	<0.05	3[a]	3.3[a]	7.8[a]	NA
	OMAFRA(1X)	<0.05	7.7[a]	3[a]	4.6[a]	NA
	2X OMAFRA(2X)	<0.05	3.3[a]	3.3[a]	5.2[a]	NA
OAT						
	UNAMENDED (U)	4.9[a]	17.3[a]	17.3[a]	14[c]	NA
	OMAFRA(1X)	7.5[a]	13.1[a]	13.1[a]	18[b]	NA
	2X OMAFRA(2X)	5.6[a]	17.3[a]	17.9[a]	21.3[a]	NA

NA - No soil collected at this CoC impact level

(a, b, or c) - indicates statistically differences (95% confidence level) within columns for each plant type (based on Student Neuman Keuls (SNK) Multiple Comparison of Means)

< - value is less than detection limit for analytical method (0.05 mg Cu/kg)

Table GH-15a
Average Cobalt Concentrations (mg/kg) in Plant Tissue Compared Between Soil Amendment Levels

A. CLAY SOIL

	Impact Level	Control	Low	Medium	High	Very High
CORN	Soil Cobalt (mg/kg)	ND	8	13	49	100
	UNAMENDED (U)	<0.01	<0.01	<0.01	<0.01	1.4
	OMAFRA(1X)	<0.01	<0.01	<0.01	<0.01	<0.01
	2X OMAFRA(2X)	<0.01	<0.01	<0.01	<0.01	<0.01
SOYBEAN						
	UNAMENDED (U)	<0.01	<0.01	<0.01	1.5	1.4
	OMAFRA(1X)	<0.01	<0.01	<0.01	0.8	<0.01
	2X OMAFRA(2X)	<0.01	<0.01	<0.01	0.8	<0.01
OAT						
	UNAMENDED (U)	<0.01	<0.01	<0.01	<0.01	<0.01
	OMAFRA(1X)	<0.01	<0.01	<0.01	<0.01	<0.01
	2X OMAFRA(2X)	<0.01	<0.01	<0.01	<0.01	<0.01

< **-** value is less than detection limit for analytical method (0.01 mg Co/kg)

Table GH-15a *continued…*

Average Cobalt Concentrations (mg/kg) in Plant Tissue Compared Between Soil Amendment Levels

B. ORGANIC SOIL

	Impact Level	Control	Low	Medium	High	Very High
CORN	**Soil Cobalt (mg/kg)**	**<0.01**	**8**	**15**	**37**	**100**
	UNAMENDED (U)	<0.01	<0.01	<0.01	<0.01	<0.01
	OMAFRA(1X)	<0.01	<0.01	<0.01	<0.01	<0.01
	2X OMAFRA(2X)	<0.01	<0.01	<0.01	<0.01	<0.01
CORN II						
	UNAMENDED (U)	<0.01	<0.01	<0.01	<0.01	1.4
	OMAFRA(1X)	<0.01	<0.01	<0.01	<0.01	0.7
	2X OMAFRA(2X)	<0.01	<0.01	<0.01	<0.01	0.6
SOYBEAN						
	UNAMENDED (U)	<0.01	<0.01	<0.01	<0.01	<0.01
	OMAFRA(1X)	<0.01	<0.01	<0.01	<0.01	<0.01
	2X OMAFRA(2X)	<0.01	<0.01	<0.01	<0.01	<0.01
OAT						
	UNAMENDED (U)	<0.01	<0.01	<0.01	<0.01	<0.01
	OMAFRA(1X)	<0.01	<0.01	<0.01	<0.01	<0.01
	2X OMAFRA(2X)	<0.01	<0.01	<0.01	<0.01	<0.01

< - value is less than detection limit for analytical method (0.01 mg Co/kg)

Table GH-15a *continued…*

Average Cobalt Concentrations (mg/kg) in Plant Tissue Compared Between Soil Amendment Levels

C. SAND SOIL

	Impact Level	Control	Low	Medium	High	Very High
CORN	Soil Cobalt (mg/kg)	**<0.01**	**6**	**7**	**28**	**NA**
	UNAMENDED (U)	<0.01	<0.01	<0.01	<0.01	NA
	OMAFRA(1X)	<0.01	<0.01	<0.01	<0.01	NA
	2X OMAFRA(2X)	<0.01	<0.01	<0.01	<0.01	NA
SOYBEAN						
	UNAMENDED (U)	<0.01	<0.01	<0.01	0.7	NA
	OMAFRA(1X)	<0.01	<0.01	<0.01	0.5	NA
	2X OMAFRA(2X)	<0.01	<0.01	<0.01	0.8	NA
OAT						
	UNAMENDED (U)	<0.01	<0.01	<0.01	<0.01	NA
	OMAFRA(1X)	<0.01	<0.01	<0.01	<0.01	NA
	2X OMAFRA(2X)	<0.01	<0.01	<0.01	<0.01	NA

NA **-** No soil collected at this CoC impact level
< **-** value is less than detection limit for analytical method (0.01 mg Co/kg)

Table GH-15b
Average Nickel Concentration in Plant Tissue (mg/kg) Compared Between Soil Amendment Levels

A. CLAY SOIL

	Impact Level	Control	Low	Medium	High	Very High
CORN	**Soil nickel (mg/kg)**	**34**	**200**	**500**	**3450**	**8300**
	UNAMENDED (U)	<0.1	<0.1	<0.1	73 [a]	112[a]
	OMAFRA(1X)	<0.1	<0.1	<0.1	6.7[b]	8.5[b]
	2X OMAFRA(2X)	<0.1	<0.1	<0.1	2.7[b]	5.4[b]
SOY						
	UNAMENDED (U)	<0.1	<0.1	11.1[a]	227[a]	186[a]
	OMAFRA(1X)	<0.1	<0.1	8.1[a]	62.4[b]	73.2[b]
	2X OMAFRA(2X)	<0.1	<0.1	7.7[a]	32.4[c]	32.9[c]
OATS						
	UNAMENDED (U)	<0.1	4.8 [a]	21.9[a]	223 [a]	164[a]
	OMAFRA(1X)	<0.1	8.5 [a]	16.7[b]	80.2[b]	148 [a]
	2X OMAFRA(2X)	<0.1	9.9 [a]	15.8[b]	61.2[b]	102 [a]

NA **-** No soil Collected at this CoC impact level
(a, b, or c) indicates statistical differences (95% confidence level) between treatments at each soil CoC concentration (based on Student Neuman Keuls (SNK) Multiple Comparison of Means)
< **-** Below analytical detection limit for Nickel, (0.1 mg Ni/kg DW)

Table GH-15b *continued…*

Average Nickel Concentration in Plant Tissue (mg/kg) Compared Between Soil Amendment Levels

B. ORGANIC SOIL

	Impact Level	Control	Low	Medium	High	Very High
CORN	**Soil nickel (mg/kg)**	**33**	**200**	**1200**	**3200**	**5550**
	UNAMENDED (U)	<0.1	<0.1	<0.1	2.8 [a]	11.6 [a]
	OMAFRA(1X)	<0.1	<0.1	<0.1	7.9 [a]	9.1 [a]
	2X OMAFRA(2X)	<0.1	<0.1	<0.1	3.5 [a]	10.9 [a]
CORN II						
	UNAMENDED (U)	<0.1	<0.1	<0.1		19 [a]
	OMAFRA(1X)	<0.1	<0.1	<0.1	2.7[a]	16 [a]
	2X OMAFRA(2X)	<0.1	<0.1	<0.1	3.1 [a]	4.6 [a]
SOY						
	UNAMENDED (U)	<0.1	<0.1	<0.1	35.6 [a]	38.3 [a]
	OMAFRA(1X)	<0.1	<0.1	<0.1	28.3[ab]	30.5 [a]
	2X OMAFRA(2X)	<0.1	<0.1	<0.1	17.1[b]	39.3 [a]
OATS						
	UNAMENDED (U)	<0.1	<0.1	8.9 [a]	47 [a]	80.4 [a]
	OMAFRA(1X)	<0.1	<0.1	11 [a]	36.3 [a]	83.1 [a]
	2X OMAFRA(2X)	<0.1	<0.1	9.9 [a]	38.9 [a]	85 [a]

NA - No soil Collected at this CoC impact level
(a, b, or c) indicates statistical differences (95% confidence level) between treatments at each soil CoC concentration (based on Student Neuman Keuls (SNK) Multiple Comparison of Means)
< - Below analytical detection limit for Nickel, (0.1 mg Ni/kg DW)

Table GH-15b *continued…*

Average Nickel Concentration in Plant Tissue (mg/kg) Compared Between Soil Amendment Levels

C. SAND SOIL

	Impact Level	Control	Low	Medium	High	Very High
CORN	**Soil nickel (mg/kg)**	**5**	**300**	**500**	**1350**	**NA**
	UNAMENDED (U)	<0.1	<0.1	<0.1	<0.1	---
	OMAFRA(1X)	<0.1	<0.1	<0.1	<0.1	---
	2X OMAFRA(2X)	<0.1	<0.1	<0.1	<0.1	---
SOY						
	UNAMENDED (U)	<0.1	<0.1	8.6 [a]	54.6 [a]	---
	OMAFRA(1X)	<0.1	<0.1	5.6 [a]	40.6 [a]	---
	2X OMAFRA(2X)	<0.1	<0.1	11.3 [a]	37.3 [a]	---
OATS						
	UNAMENDED (U)	<0.1	37.5 [a]	48.4 [a]	116 [a]	---
	OMAFRA(1X)	<0.1	37.4 [a]	59.7 [a]	103 [a]	---
	2X OMAFRA(2X)	<0.1	50.7 [a]	60.5 [a]	123 [a]	---

NA - No soil Collected at this CoC impact level

(a, b, or c) indicates statistical differences (95% confidence level) between treatments at each soil CoC concentration (based on Student Neuman Keuls (SNK) Multiple Comparison of Means)

< - Below analytical detection limit for Nickel, (0.1 mg Ni/kg DW)

Table GH-15c
Average Plant Biomass (g/pot) Compared Between Soil Amendment Levels

A. CLAY SOIL

	Impact Level	Control	Low	Medium	High	Very High
CORN	**Soil nickel (mg/kg)**	**34**	**200**	**500**	**3450**	**8300**
	UNAMENDED (U)	22.8 [a]	8.8 [a]	9.3 [a]	2.0 [b]	2.7 [c]
	OMAFRA(1X)	17.6 [a]	12.6 [a]	5.9 [a]	9.7 [a]	6.4 [b]
	2X OMAFRA(2X)	22.0 [a]	7.9 [a]	8.1 [a]	10.3 [a]	8.6 [a]
SOY						
	UNAMENDED (U)	10.8 [a]	13.3 [a]	8.5 [a]	1.1 [b]	1.0 [b]
	OMAFRA(1X)	9.0 [a]	15.4 [a]	7.0 [a]	6.5 [a]	5.6 [a]
	2X OMAFRA(2X)	12.4 [a]	8.3 [b]	7.4 [a]	6.9 [a]	6.4 [a]
OATS						
	UNAMENDED (U)	1.0 [a]	1.1 [a]	0.8 [a]	0.4 [a]	0.5 [a]
	OMAFRA(1X)	1.2 [a]	1.3 [a]	0.6 [a]	0.8 [a]	0.6 [a]
	2X OMAFRA(2X)	0.85 [a]	0.7 [b]	0.6 [a]	0.7 [a]	0.6 [a]

NA - No soil Collected at this CoC impact level
(a, b, or c) indicates statistical differences (95% confidence level) between treatments at each soil CoC concentration (based on Student Neuman Keuls (SNK) Multiple Comparison of Means)
< - Below analytical detection limit for Nickel, (0.1 mg Ni/kg DW)

Table GH-15c *continued…*

Average Plant Biomass (g/pot) Compared Between Soil Amendment Levels

B. ORGANIC SOIL

	Impact Level	Control	Low	Medium	High	Very High
CORN	**Soil nickel (mg/kg)**	**33**	**200**	**1200**	**3200**	**5550**
	UNAMENDED (U)	7.16 [a]	6.6 [a]	3.4 [a]	8.5 [a]	1.2 [a]
	OMAFRA(1X)	7.09 [a]	4.7[b]	3.6 [a]	8.3 [a]	1.2 [a]
	2X OMAFRA(2X)	5.92 [a]	5.4[b]	2.5 [a]	6.2[b]	0.9 [a]
CORN II						
	UNAMENDED (U)	9.97 [a]	7.3 [a]	3.2 [a]	5.9 [a]	2.2 [a]
	OMAFRA(1X)	7.66 [a]	5[b]	3.5 [a]	4.8[ab]	2.1 [a]
	2X OMAFRA(2X)	8.69 [a]	5.9[b]	2.6 [a]	3.8[b]	2.5 [a]
SOY						
	UNAMENDED (U)	7.8 [a]	11.6 [a]	13 [a]	9.5 [a]	3.9 [a]
	OMAFRA(1X)	7.4 [a]	10.3 [a]	12.5 [a]	10.0 [a]	3.6 [a]
	2X OMAFRA(2X)	7.4 [a]	10.1 [a]	11.5 [a]	11.2 [a]	3.9 [a]
OATS						
	UNAMENDED (U)	2.7 [a]	2.6 [a]	0.6 [a]	5.1 [a]	0.5 [a]
	OMAFRA(1X)	2.4 [a]	3.9 [a]	1.1 [a]	2.0[b]	0.6 [a]
	2X OMAFRA(2X)	0.9[b]	2.9 [a]	0.9 [a]	1.1[b]	0.5 [a]

NA **-** No soil Collected at this CoC impact level
(a, b, or c) indicates statistical differences (95% confidence level) between treatments at each soil CoC concentration (based on Student Neuman Keuls (SNK) Multiple Comparison of Means)
< **-** Below analytical detection limit for Nickel, (0.1 mg Ni/kg DW)

Table GH-15c *continued…*
Average Plant Biomass (g/pot) Compared Between Soil Amendment Levels

C. SAND SOIL

	Impact Level	Control	Low	Medium	High	Very High
CORN	**Soil nickel (mg/kg)**	**5**	**300**	**500**	**1350**	**NA**
	UNAMENDED (U)	14.6[ab]	10.8 [a]	6.2 [a]	6.4[b]	---
	OMAFRA(1X)	17.2 [a]	12.4 [a]	8.3 [a]	13.3 [a]	---
	2X OMAFRA(2X)	10.7[b]	12.3 [a]	6.7 [a]	11.2 [a]	---
SOY						
	UNAMENDED (U)	16.4 [a]	11.7 [a]	8.6 [a]	6.1[b]	---
	OMAFRA(1X)	12.0[b]	11.3 [a]	8.6 [a]	9.2 [a]	---
	2X OMAFRA(2X)	7.8[c]	10.0 [a]	8.1 [a]	9.6 [a]	---
OATS						
	UNAMENDED (U)	2.40[a]	1.3 [a]	1.0 [a]	0.4 [a]	---
	OMAFRA(1X)	0.74[b]	1.5 [a]	0.6[b]	0.5 [a]	---
	2X OMAFRA(2X)	0.28[b]	1.0 [a]	0.8[ab]	0.6 [a]	---

NA - No soil Collected at this CoC impact level
(a, b, or c) indicates statistical differences (95% confidence level) between treatments at each soil CoC concentration (based on Student Neuman Keuls (SNK) Multiple Comparison of Means)
< - Below analytical detection limit for Nickel, (0.1 mg Ni/kg DW)

APPENDIX GH-1B
YEAR 2001 DATA TABLES

Table GH-16
Soil Properties for Unamended Sand Blends used in Year 2001 Greenhouse Trials

Total Metals (mg/kg)							Total Organic Carbon (%)	Total Carbon (as C) (%)	Total Inorganic Carbon (as C) (%)	Soil CEC (meq100)	Soil Conductivity (mS/cm)
CoCs				Fe	Mn	P					
Ni	Cu	Co	As								
***2**	**1**	**2**	**0.2**	**50**	**1**	**20**	**0.05**	**0.05**	**0.05**	**0.01**	**0.01**
46.2	14	1.7	2.5	5230	118	1110	2.44	3.08	0.64	2.4	0.35
227	35	5.3	4.3	5830	128	965	2.20	2.92	0.72	2.1	0.39
370	58	9.0	5.7	7290	147	953	2.36	2.84	0.48	2.1	0.35
530	72	12	7.2	8210	153	868	2.16	3.12	0.96	2.5	0.36
756	93	17	9.0	12700	195	845	1.90	2.66	0.76	2.0	0.33
1630	190	34	18	21700	280	692	2.48	3.72	1.24	2.0	0.35
2310	270	49	24	27600	333	561	3.12	3.88	0.76	1.9	0.35

Note:
* - indicates estimated limit of quantification (EQL) for analytical method
Soil CoC values are calculated from data specific to the Greenhouse experiments, therefore reported values may differ from those reported in the Soil Collection and Characterizations Report (Part 2).

Table GH-17
Soil pH before and after harvest for Oat grown on Sand

[Ni] Soil mg/kg	Unamended			Amended		
	Initial Soil	After Harvest		Initial Soil	After Harvest	
	pH	pH (H_2O)	pH ($CaCl_2$)	pH	pH (H_2O)	pH ($CaCl_2$)
46.2	7.34	7.16 ± 0.13[a*]	6.77 ± 0.09[a]	7.27	7.37 ± 0.07[c*]	7.19 ± 0.05[e]
227	7.29	7.16 ± 0.09[a]	6.83 ± 0.07[a]	7.28	7.31 ± 0.02[b,c]	7.13 ± 0.03[d]
370	7.38	7.31 ± 0.05[b]	6.82 ± 0.06[a]	7.26	7.31 ± 0.04[b,c]	7.10 ± 0.04[c,d]
530	7.38	7.11 ± 0.03[a]	6.74 ± 0.06[a]	7.21	7.28 ± 0.10[b,c]	7.05 ± 0.05[b,c]
756	7.21	7.15 ± 0.03[a]	6.76 ± 0.03[a]	7.14	7.17 ± 0.05[a]	6.95 ± 0.06[a]
1630	7.14	7.18 ± 0.06[a]	6.73 ± 0.06[a]	7.19	7.18 ± 0.03[a]	7.01 ± 0.02[a,b]
2310	7.28	7.16 ± 0.03[a]	6.80 ± 0.03[a]	7.13	7.23 ± 0.03[a,b]	7.00 ± 0.03[a,b]

∗ SNK (Student Newman-Keuls) multiple range test ($P<0.05$), n=5 - Means within column followed by the same letter are not significantly different.

Table GH-18a
Concentration of CoCs and nutrients in Biomass (tissue) of Oat grown on Sand (Unamended)

Soil Ni mg/kg	CoCs				Nutrients						
	Ni	Cu	Co	As	Ca	Fe	K	Mg	Mn	P	Zn
	mg/kg DW										
EQL	0.1	0.05	0.01	0.2	50	5	10	5	0.5	5	0.5
46.2	5.9 ± 0.5^{a}	9.69 ± 0.76^{a}	0.02 ± 0.01^{a}	0.59 ± 0.02^{a}	7114 ± 393^{a}	53 ± 5^{a}	46870 ± 1336^{a}	2510 ± 274^{a}	19.5 ± 3.5^{a}	9039 ± 901^{a}	75 ± 8.3^{a}
227	18 ± 1.0^{b}	12.8 ± 0.55^{b}	0.04 ± 0.01^{a}	0.78 ± 0.08^{a}	7522 ± 288^{ab}	61 ± 4^{b}	67220 ± 3395^{c}	2770 ± 117^{a}	18.3 ± 1.0^{a}	8358 ± 769^{ab}	87 ± 5.8^{ab}
370	32 ± 1.8^{c}	14.6 ± 0.52^{c}	0.07 ± 0.01^{a}	1.1 ± 0.11^{b}	7004 ± 258^{a}	54 ± 4^{a}	48880 ± 1186^{a}	2580 ± 174^{a}	17.9 ± 3.3^{a}	7936 ± 398^{b}	100 ± 8.0^{b}
530	36 ± 3.7^{cd}	14.4 ± 0.70^{c}	0.07 ± 0.02^{a}	1.1 ± 0.04^{b}	6869 ± 476^{a}	63 ± 6^{b}	65750 ± 4314$^{b\ c}$	2610 ± 220^{a}	19.1 ± 4.2^{a}	7626 ± 346^{b}	97 ± 4.3^{b}
756	40 ± 3.2^{d}	14.9 ± 0.99^{c}	0.06 ± 0.01^{a}	1.4 ± 0.17^{b}	7040 ± 408^{a}	48 ± 2^{a}	48320 ± 2889^{a}	2670 ± 136^{a}	23.7 ± 4.6^{a}	7426 ± 438^{b}	100 ± 2.6^{b}
1630	89 ± 4.8^{e}	16.1 ± 0.86^{d}	0.24 ± 0.04^{b}	2.1 ± 0.13^{d}	7892 ± 325^{b}	54 ± 2^{a}	62940 ± 1976^{b}	3250 ± 166^{b}	22.9 ± 3.9^{a}	6434 ± 454^{c}	120 ± 8.8^{c}
2310	130 ± 1.4^{f}	12.9 ± 1.1^{b}	0.42 ± 0.10^{c}	2.4 ± 0.33^{e}	7717 ± 296^{b}	47 ± 3^{a}	47990 ± 2437^{a}	3180 ± 162^{b}	20.2 ± 4.0^{a}	6175 ± 374^{c}	82 ± 12^{a}

Table GH-18b
Concentration of CoCs and nutrients in Biomass (tissue) of Oat grown on Sand (Amended)

Soil Ni mg/kg	CoCs				Nutrients						
	Ni	Cu	Co	As	Ca	Fe	K	Mg	Mn	P	Zn
	mg/kg DW										
EQL	0.1	0.05	0.01	0.2	50	5	10	5	0.5	5	0.5
46.2	5.7± 0.3	12.1 ± 0.57^{a}	0.02 ± 0.00^{a}	0.26 ± 0.05^{a}	4706 ± 305^{a}	56.6 ± 5.68^{a}	63420 ±5190^{a}	2190 ± 116^{a}	23.2 ± 5.1^{ab}	8224 ± 290^{b}	122 ± 7.5^{a}
227	18 ± 0.5^{b}	14.7 ± 0.57^{b}	0.04 ± 0.01^{ab}	0.44 ± 0.05^{b}	4762 ± 126^{a}	46.8 ± 2.39^{abc}	46500 ±2154^{c}	2248 ± 94^{a}	18.1 ± 3.3^{a}	8148 ± 382^{b}	131 ± 6.2^{ab}
436	32 ± 1.5^{c}	15.8 ± 0.34^{c}	0.09 ± 0.02^{ab}	0.62 ± 0.08^{c}	4706 ± 364^{a}	49.7 ± 1.99^{ab}	59090 ±3336^{ab}	2218 ± 103^{a}	26.4 ± 6.0^{b}	7400 ± 177^{a}	133 ± 8.6^{ab}
530	39 ± 5.2^{d}	16.7 ± 0.78^{cd}	0.10 ± 0.03^{ab}	0.68 ± 0.04^{c}	5272 ± 568^{b}	37.0 ± 5.29^{cd}	49440 ±1415^{c}	2376 ± 181^{ab}	26.5 ± 3.9^{b}	7948 ± 103^{b}	139 ± 0.3^{b}
756	53 ± 2.6^{e}	17.3 ± 0.73^{e}	0.14 ± 0.04^{b}	0.67 ± 0.10^{c}	5284 ± 115^{ab}	43.4 ± 1.95^{bc}	56380 ±2582^{b}	2540 ± 99^{b}	40.1 ± 5.4^{c}	7747 ± 381^{ab}	167 ± 8.8^{c}
1630	103 ± 2.3^{f}	19.2 ± 0.27^{f}	0.46 ± 0.05^{c}	1.34 ± 0.11^{d}	5460 ± 395^{b}	25.7 ± 14.39^{e}	50540 ±2427^{c}	3072 ± 118^{c}	29.0 ± 3.8^{b}	7956 ± 214^{b}	180 ± 3.8^{c}
2310	144 ± 10^{g}	18.7 ± 1.5^{f}	0.70 ± 0.13^{d}	2.10 ± 0.10^{e}	6689 ± 179^{c}	30.8 ± 3.11^{de}	60280 ±2248^{ab}	3679 ± 241^{d}	42.7 ± 5.3^{c}	9086 ± 328^{c}	148 ± 8.5^{b}

Table GH-19a
Extractable iron and manganese oxides in sand (mg/kg and %)

Soil [Ni]	46.2	227	370	530	756	1630	2310
Extractable Fe	2738	4075	3450	6920	8870	16200	19150
% of total* Fe	52.3	69.9	47.3	84.3	69.6	74.7	69.3
Extractable Mn	83	77	60	100	113	163	185
% of total* Mn	70.5	60.2	40.8	65.4	57.9	58.2	55.6

*see Table GH-16 for total soil metal concentrations

Table GH-19b
Correlations for total and extractable nickel in Sand soil blends

Pearson Correlation	Ni Aqueous Extract (mg/kg)	Ni DTPA Extraction (mg/kg)	Ni Oxalate Extraction (mg/kg)	Ni Sr Nitrate Extraction (mg/kg)
Ni (Biomass)	0.939*	0.986*	0.980*	0.100

* Correlation is significant at the 0.01 level (2-tailed).

Table GH-20
Biomass Produced by Oat grown on Unamended and Amended Sand Soil Blends
(dry weight per pot measured in grams)

[Ni] Soil mg/kg	Unamended	Amended
46.2	$2.75 \pm 0.3^{ab*}$	2.84 ± 0.3^{a}
227	3.12 ± 0.4^{a}	2.73 ± 0.6^{a}
370/436	2.68 ± 0.4^{ab}	2.83 ± 0.4^{a}
530	2.51 ± 0.2^{b}	2.27 ± 0.6^{ab}
756	2.70 ± 0.3^{ab}	2.24 ± 0.3^{ab}
1630	1.69 ± 0.2^{c}	1.73 ± 0.2^{b}
2310	0.65 ± 0.1^{d}	1.01 ± 0.3^{c}

∗ SNK (Student Newman-Keuls's) multiple range test (P<0.05), n=5. Means within column followed by the same letter are not significantly different

Table GH-21
Soil properties for unamended Organic blends used in Year 2001 Greenhouse Trials

Total Metals (mg/kg)							Total Organic Carbon (%)	Total Carbon (as C) (%)	Total Inorganic Carbon (as C) (%)	Soil CEC (meq100)	Soil Conductivity (mS/cm)
CoCs				Fe	Mn	P					
Ni	Cu	Co	As								
***2**	**1**	**2**	**0.2**	**50**	**1**	**20**	**0.05**	**0.05**	**0.05**	**0.01**	**0.01**
89.5	46	6.0	6.0	15560	250	1150	30.6	31.2	0.60	13.2	1.48
283	71	8.6	7.8	15260	245	1120	31.4	31.4	0.03	13.9	1.44
239	65	7.7	7.9	15660	246	1130	30.8	32.2	1.4	13.1	1.38
596	120	12	9.6	15160	245	1110	35.4	35.4	0.03	14.5	1.36
683	120	13	10	14820	245	1100	37.0	37.0	0.03	14.8	1.27
1300	210	21	14	14780	254	1110	34.8	34.8	0.03	14.8	1.28
1640	230	37	15	15460	256	1120	33.2	34.0	0.80	14.2	1.24
2400	360	36	18	15080	265	1130	32.4	32.4	0.03	16.0	1.26

Note:
* **-** indicates estimated limit of quantification (EQL) for analytical method
Soil CoC values are calculated from data specific to the Greenhouse experiments, therefore reported values may differ from those reported in the Soil Collection and Characterizations Report (Part 2).

Table GH-22
Soil pH before and after harvest for Oat grown on Organic Soil (Unamended)

[Ni] Soil mg/kg	Unamended			Amended		
	Initial Soil	After Harvest		Initial Soil	After Harvest	
	pH	pH (H_2O)	pH ($CaCl_2$)	pH	pH (H_2O)	pH ($CaCl_2$)
89.5	5.81	6.05 ± 0.04 [b=]	5.84 ± 0.03 [c]	6.08	6.45 ± 0.03 [b,c=]	6.21 ± 0.03 [b]
283	5.85	6.06 ± 0.01 [b]	5.86 ± 0.02 [c]	6.09	6.39 ± 0.06 [a,b,c]	6.20 ± 0.05 [b]
239	5.86	6.04 ± 0.02 [a,b]	5.86 ± 0.02 [c]	6.10	6.39 ± 0.04 [a,b,c]	6.21 ± 0.01 [b]
596/719	5.84	5.93 ± 0.05 [a,b]	5.74 ± 0.03 [b]	6.13	6.51 ± 0.24 [c]	6.18 ± 0.03 [b]
683/835	5.90	5.92 ± 0.04 [a]	5.64 ± 0.01 [a]	6.07	6.45 ± 0.06 [b,c]	6.20 ± 0.02 [b]
1300/1070	5.91	6.06 ± 0.17 [b]	5.87 ± 0.15 [c]	6.04	6.22 ± 0.03 [a]	6.05 ± 0.01 [a]
1640	5.84	5.97 ± 0.04 [a,b]	5.77 ± 0.02 [b,c]	6.13	6.29 ± 0.15 [a,b]	6.08 ± 0.14 [a]
2400	5.65	5.96 ± 0.03 [a,b]	5.76 ± 0.03 [b,c]	5.99	6.35 ± 0.07 [a,b,c]	6.12 ± 0.03 [a,b]

∗ SNK (Student Newman-Keuls) multiple range test (P<0.05), n=5 - Means within column followed by the same letter are not significantly different.

Table GH-23a
Concentration of CoCs and nutrients in biomass (tissue) of Oat grown on organic soil (Unamended)

[Ni] Soil mg/kg	CoCs				Nutrients						
	Ni	Cu	Co	As	Ca	Fe	K	Mg	Mn	P	Zn
	mg/kg DW										
EQL	**0.1**	**0.05**	**0.01**	**0.2**	**50**	**5**	**10**	**5**	**0.5**	**5**	**0.5**
89.5	0.6 ± 0.2^{a}	6.05 ± 0.62^{a}	>0.01	>0.2	5160 ± 622^{a}	28 ± 3^{a}	27370 ± 2475^{a}	3280 ± 371^{a}	4.57 ± 0.41^{a}	1974 ± 308^{a}	30 ± 4.6^{a}
283	3.7 ± 0.7^{a}	7.04 ± 0.73^{ab}	0.02 ± 0.0^{a}	>0.2	5518 ± 454^{ab}	32 ± 3^{a}	30840 ± 1429^{ab}	3500 ± 322^{ab}	4.66 ± 0.83^{a}	2342 ± 371^{ab}	35 ± 4.8^{abc}
239	3.0 ± 0.2^{a}	6.41 ± 0.45^{a}	>0.01	>0.2	5730 ± 799^{ab}	30 ± 2^{a}	33020 ± 3205^{ab}	3530 ± 405^{ab}	4.42 ± 1.00^{a}	2252 ± 222^{ab}	31 ± 4.2^{ab}
596	9.5 ± 2.3^{b}	7.04 ± 0.52^{a}	0.026 ± 0.01^{ab}	>0.2	6344 ± 481^{ab}	29 ± 4^{a}	35130 ± 4138^{b}	3750 ± 374^{ab}	4.45 ± 0.48^{a}	2904 ± 334^{b}	34 ± 5.5^{abc}
683	11 ± 2.3^{b}	7.70 ± 0.61^{bc}	0.026 ± 0.01^{ab}	>0.2	6406 ± 820^{ab}	30 ± 6^{a}	36740 ± 5812^{b}	4080 ± 423^{b}	4.72 ± 1.03^{a}	2754 ± 469^{b}	38 ± 4.6^{abc}
1300	15 ± 1.9^{c}	8.20 ± 0.58^{bc}	0.034 ± 0.01^{c}	0.24 ± 0.05^{a}	6740 ± 655^{bc}	28 ± 2^{a}	38260 ± 6388^{b}	4130 ± 389^{b}	4.48 ± 0.72^{a}	2866 ± 393^{b}	41 ± 3.7^{bcd}
1640	21 ± 4.5^{d}	8.08 ± 1.20^{bc}	0.054 ± 0.01^{d}	0.28 ± 0.04^{a}	6196 ± 763^{b}	28 ± 4^{a}	34410 ± 3561^{ab}	3780 ± 458^{ab}	4.47 ± 0.44^{a}	2672 ± 522^{ab}	43 ± 8.2^{cd}
2400	35 ± 4.7^{e}	8.78 ± 0.45^{c}	0.098 ± 0.01^{e}	0.40 ± 0.07^{a}	7286 ± 845^{c}	31 ± 2^{a}	33300 ± 1463^{a}	4140 ± 354^{b}	4.68 ± 1.04^{a}	2846 ± 561^{b}	49 ± 4.2^{d}

Table GH-23b
Concentration of CoCs and nutrients in biomass (tissue) of Oat grown on organic soil (Amended)

[Ni] Soil mg/kg	CoCs				Nutrients						
	Ni	Cu	Co	As	Ca	Fe	K	Mg	Mn	P	Zn
	mg/kg DW										
EQL	0.1	0.05	0.01	0.2	50	5	10	5	0.5	5	0.5
89.5	0.68 ± 0.2 [a]	5.98 ± 0.30 [a]	0.02 ± 0.0 [a]	>0.2	5138 ± 346 [a]	27 ± 4 [a]	29440 ± 2273 [a]	3612 ± 144 [a]	4.28 ± 0.45 [a]	2024 ± 151 [a]	28 ± 2.4 [a]
283	3.4 ± 0.4 [a]	7.16 ± 0.74 [abc]	0.02 ± 0.0 [a]	>0.2	6193 ± 528 [a]	27 ± 5 [a]	33880 ± 3155 [ab]	3933 ± 326 [a]	4.08 ± 0.79 [a]	2515 ± 250 [ab]	35 ± 4.0 [abc]
239	2.9 ± 0.6 [a]	6.69 ± 0.58 [ab]	0.02 ± 0.0 [a]	>0.2	6114 ± 576 [a]	26 ± 2 [a]	35900 ± 4950 [ab]	3904 ± 248 [a]	4.04 ± 0.57 [a]	2398 ± 211 [ab]	33 ± 2.5 [ab]
719	10 ± 2.7 [b]	8.40 ± 0.48 [bcd]	0.03 ± 0.0 [a]	>0.2	6300 ± 522 [a]	31 ± 2 [a]	43460 ± 2769 [b]	3818 ± 137 [a]	3.74 ± 0.27 [a]	2944 ± 397 [b]	43 ± 2.5 [bcd]
835	9.6 ± 3.6 [b]	7.82 ± 2.8 [abc]	0.03 ± 0.01 [ab]	>0.2	5496 ± 1832 [a]	31 ± 1 [a]	37360 ± 11484 [ab]	3246 ± 1124 [a]	3.39 ± 1.04 [a]	2765 ± 917 [ab]	40 ± 12.0 [bcd]
1070	12 ± 3.2 [b]	8.46 ± 1.0 [bcd]	0.04 ± 0.01 [b]	>0.2	6608 ± 603 [a]	31 ± 2 [a]	38160 ± 3553 [ab]	3716 ± 197 [a]	3.32 ± 0.38 [a]	2574 ± 339 [ab]	39 ± 2.8 [bc]
1640	18 ± 1.8 [c]	9.44 ± 0.54 [cd]	0.07 ± 0.01 [c]	>0.2	5998 ± 405 [a]	30 ± 4 [a]	35880 ± 5180 [ab]	3588 ± 245 [a]	3.98 ± 1.16 [a]	2684 ± 234 [ab]	44 ± 4.2 [cd]
2400	29.08 ± 2.92 [d]	10.42 ± 0.57 [d]	0.102 ± 0.01 [d]	0.24 ± 0.09 [a]	6688 ± 519 [a]	32 ± 4 [a]	36500 ± 2348 [ab]	3842 ± 166 [a]	4.24 ± 1.04 [a]	2834 ± 283 [ab]	50 ± 3.9 [d]

Table GH-24a
Extractable Iron and Manganese Oxides in Organic Soil (mg/kg)

Soil [Ni]	89.5	283	239	596	683	1300	1640	2400
Extractable Fe	15867	16400	15600	15300	15200	16900	16800	16750
% of total* Fe	100	100	100	100	100	100	100	100
Extractable Mn	251	285	256	256	247	285	259	286
% of total* Mn	100	100	100	100	100	100	100	100

*see Table GH-21 for total soil metal concentrations

Table GH-24b
Correlations for total and extractable CoCs in organic soil

Pearson Correlation	Ni Aqueous Extract (mg/kg)	Ni DTPA Extraction (mg/kg)	Ni Oxalate Extraction (mg/kg)	Ni SR Nitrate Extraction (mg/kg)
Ni (Biomass)	0.954**	0.958**	0.961**	0.910**

** Correlation is significant at the 0.01 level (2-tailed).

Table GH-25
Tissue biomass produced by oat grown in unamended organic soil (dry weight per pot measured in grams)

[Ni] Soil mg/kg	Unamended	Amended
89.5	12.25 ± 1.11[a]	11.92 ± 1.45* [c]
283	11.70 ± 0.69 [a]	9.94 ± 1.51[abc]
239	11.42 ± 1.64 [a]	10.83 ± 0.89 [bc]
596/719	11.57 ± 0.84 [a]	8.30 ± 0.88 [a]
683/835	11.38 ± 1.10 [a]	8.16 ± 1.08 [a]
1300/1070	10.77 ±0.78 [a]	7.93 ± 0.69 [a]
1640	11.50 ± 0.86 [a]	8.63 ± 1.27 [ab]
2400	10.28 ± 1.48 [a]	9.00 ± 1.74 [ab]

* - SNK (Student Newman-Keuls's) multiple range test ($P<0.05$), n=5. Means within column followed by the same letter are not significantly different.

Table GH-26
Soil Properties for Unamended Welland Clay blends used in Year 2001 Greenhouse Trials

Total Metals (mg/kg)							Total Organic Carbon (%)	Total Carbon (as C) (%)	Total Inorganic Carbon (as C) (%)	Soil CEC (meq100)
CoCs				Fe	Mn	P				
Ni	Cu	Co	As							
*2	1	2	0.2	50	1	20	0.05	0.05	0.05	0.01
45.3	18.2	4.8	2.2	12170	159	682	5.49	6.32	0.83	4.50
188	34.0	7.0	3.0	12680	165	699	5.84	6.00	0.16	4.70
347	53.5	8.6	3.4	12540	164	708	5.76	5.76	0.03	4.50
498	70.5	11	4.1	12840	165	725	5.44	5.44	0.03	5.90
673	81.3	13	4.6	13160	170	744	5.60	5.60	0.03	4.80
956	121	17	5.8	13760	170	762	6.40	6.40	0.03	5.50
1130	147	19	7.0	13500	168	808	6.24	6.24	0.03	6.70
1900	240	29	10	13500	171	878	7.2	7.20	0.03	6.20

Note:

* - indicates estimated limit of quantification (EQL) for analytical method

Soil CoC values are calculated from data specific to the Greenhouse experiments, therefore reported values may differ from those reported in the Soil Collection and Characterizations Report (Part 2).

Table GH-27
Soil pH before and after harvest for Oat grown on Welland Clay (Unamended)

[Ni] Soil mg/kg	Unamended			Amended		
	Initial Soil	After Harvest		Initial Soil	After Harvest	
	pH	pH (H_20)	pH ($CaCl_2$)	pH	pH (H_20)	pH ($CaCl_2$)
45.3	6.35	$6.36 \pm 0.10*$ [a]	6.05 ± 0.12 [a]	6.81	$6.67 \pm 0.02*$ [a,b]	6.38 ± 0.04 [a]
188/248	6.38	6.41 ± 0.06 [a]	6.07 ± 0.05 [a]	6.55	6.67 ± 0.04 [a,b]	6.40 ± 0.04 [a,b]
347	6.37	6.32 ± 0.03 [a]	6.01 ± 0.04 [a]	6.67	6.65 ± 0.06 [a]	6.37 ± 0.06 [a]
498	6.26	6.35 ± 0.05 [a]	6.05 ± 0.03 [a]	6.65	6.74 ± 0.04 [b]	6.48 ± 0.01 [c]
673/497	6.21	6.32 ± 0.04 [a]	6.02 ± 0.02 [a]	6.51	6.70 ± 0.05 [a,b]	6.42 ± 0.03 [a,b,c]
956	6.05	6.31 ± 0.04 [a]	6.04 ± 0.02 [a]	6.51	6.74 ± 0.02 [b]	6.46 ± 0.02 [b,c]
1130	6.07	6.29 ± 0.09 [a]	6.01 ± 0.04 [a]	6.54	6.73 ± 0.05 [a,b]	6.44 ± 0.05 [a,b,c]
1900	5.86	6.34 ± 0.04 [a]	6.03 ± 0.02 [a]	6.30	6.71 ± 0.04 [a,b]	6.44 ± 0.02 [a,b,c]

∗ SNK (Student Newman-Keuls's) multiple range test ($P<0.05$), n=5. Means within column followed by the same letter are not significantly different

Table GH-28a: Concentration of CoCs and nutrients in Biomass (tissue) of Oat grown on Welland Clay (Unamended)

[Ni] Soil mg/kg	CoCs				Nutrients						
	Ni	Cu	Co	As	Ca	Fe	K	Mg	Mn	P	Zn
	mg/kg DW										
EQL	0.1	0.05	0.01	0.2	50	5	10	5	0.5	5	0.5
45.3	2.4 ± 0.2*^{a}	2.99 ± 0.45^{a}	0.02 ± 0.01^{ab}	<0.2	5002 ± 383^{a}	40 ± 6^{ab}	43860 ± 2298^{a}	3050 ± 137^{ab}	27.7 ± 1.1^{e}	2518 ± 201^{a}	27 ± 1.1^{a}
188	6.8 ± 0.7^{b}	4.65 ± 0.60^{b}	0.02 ± 0.01^{ab}	<0.2	5614 ± 699^{ab}	43 ± 7^{b}	47550 ± 3506^{a}	3240 ± 326^{ab}	19.6 ± 1.6^{d}	2902 ± 345^{ab}	28 ± 2.4^{a}
347	11 ± 0.8^{b}	4.75 ± 0.66^{b}	0.01 ± 0.01^{a}	<0.2	4774 ± 1075^{a}	33 ± 6^{ab}	44580 ± 6624^{a}	2850 ± 478^{a}	17.2 ± 2.5^{bc}	2352 ± 547^{a}	26 ± 5.2^{a}
498	17 ± 0.9^{c}	5.04 ± 0.54^{bc}	0.03 ± 0.0^{bc}	<0.2	5212 ± 689^{ab}	40 ± 4^{ab}	42540 ± 4780^{a}	3360 ± 383^{ab}	15.3 ± 1.9^{c}	3838 ± 585^{bc}	29 ± 3.6^{a}
673	170 ± 1.5^{c}	5.30 ± 0.33^{bcd}	0.02 ± 0.0^{ab}	<0.2	5347 ± 612^{ab}	37 ± 6^{ab}	48040 ± 3793^{a}	3130 ± 206^{ab}	11.4 ± 0.4^{b}	2580 ± 300^{a}	27 ± 1.8^{a}
956	26 ± 0.9^{d}	5.93 ± 0.27^{cd}	0.03 ± 0.01 abc	<0.2	4620 ± 245^{a}	29 ± 2^{a}	40440 ± 2085^{a}	2950 ± 257^{a}	9.9 ± 1.9^{b}	2950 ± 840^{ab}	28 ± 3.0^{a}
1130	30 ± 1.8^{e}	6.12 ± 0.45^{d}	0.04 ± 0.01^{c}	<0.2	4946 ± 518^{a}	32 ± 4^{a}	40280 ± 4487^{a}	3090 ± 316^{ab}	9.5 ± 1.4^{ab}	3220 ± 700^{abc}	28 ± 3.5^{a}
1900	52 ± 5.1^{f}	8.93 ± 0.28^{e}	0.1 ± 0.01^{d}	0.3 ± 0.0^{a}	6520 ± 565^{ab}	39 ± 4^{ab}	48760 ± 4209^{a}	3600 ± 255^{b}	6.4 ± 0.5^{a}	4233 ± 385^{c}	38 ± 4.3^{a}

*Means within column followed by the same letter are not significantly different according to Student Newman-Keuls's multiple range test ($P<0.05$), n=5

Table GH-28b: Concentration of CoCs and nutrients in Biomass (tissue) of Oat grown on Welland Clay (Amended)

[Ni] Soil mg/kg	CoCs				Nutrients						
	Ni	Cu	Co	As	Ca	Fe	K	Mg	Mn	P	Zn
	mg/kg DW										
EQL	0.1	0.05	0.01	0.2	50	5	10	5	0.5	5	0.5
45.3	2.6 ± 0.10 [a]	2.54 ± 0.28 [a]	0.03 ± 0.01 [a]	>0.2	4675 ± 112 [a]	42 ± 5.7 [a]	36325 ± 713 [a]	3236 ± 74 [cde]	41 ± 3.0 [e]	3168 ± 117 [c]	26 ± 2.4 [a]
248	10 ± 1.85 [b]	3.72 ± 0.24 [b]	0.03 ± 0.0 [a]	>0.2	5056 ± 585 [a]	42 ± 3.2 [a]	40480 ± 4002 [a]	3672 ± 513 [e]	28 ± 3.7 [d]	3522 ± 311 [c]	26 ± 2.3 [a]
347	11 ± 1.32 [b]	4.43 ± 1.12 [b]	0.02 ± 0.01 [a]	>0.2	4120 ± 560 [a]	40 ± 5.4 [a]	36140 ± 1961 [a]	2772 ± 488 [bcde]	19 ± 4.8 [c]	2450 ± 645 [bc]	24 ± 1.6 [a]
498	12 ± 1.69 [b]	5.19 ± 0.24 [c]	0.02 ± 0.0 [a]	>0.2	4934 ± 694 [a]	38 ± 6.3 [a]	42840 ± 4999 [a]	2822 ± 354 [ab]	15 ± 0.7 [b]	2306 ± 341 [a]	26 ± 2.3 [a]
497	16 ± 1.16 [b]	5.47 ± 0.85 [c]	0.02 ± 0.0 [a]	>0.2	4772 ± 427 [a]	36 ± 1.5 [a]	41040 ± 3215 [a]	2818 ± 223 [abcd]	12 ± 2.9 [b]	2362 ± 180 [ab]	24± 1.2 [a]
956	21 ± 2.31 [d]	6.65 ± 0.61 [d]	0.02 ± 0.01 [a]	>0.2	4521 ± 1004 [a]	34 ± 1.5 [a]	40510 ± 4704 [a]	2529 ± 402 [a]	8.3 ± 0.7 [a]	2228 ± 609 [a]	25 ± 2.4 [a]
1130	27 ± 8.02 [e]	8.09 ± 1.54 [d]	0.05 ± 0.02 [a]	>0.2	5460 ± 1299 [a]	40 ± 7.4 [a]	46600 ± 6477 [a]	3088 ± 492 [abc]	7.4 ± 1.3 [a]	2522 ± 494 [ab]	30 ± 5.2 [a]
1900	32 ± 3.45 [f]	8.50 ± 0.69 [e]	0.09 ± 0.02 [b]	0.2 ± 0.1 [a]	7208 ± 1233 [b]	38 ± 12 [a]	57133 ± 2743 [b]	3645 ± 359 [de]	6.3 ± 1.9 [a]	3445 ± 478 [c]	31 ± 2.5 [a]

∗Means within column followed by the same letter are not significantly different according to Student Newman-Keuls's multiple range test (P<0.05), n=5

Table GH-29a
Extractable Iron and Manganese Oxides in Welland Clay (mg/kg)

Soil [Ni]	45.3	188	347	498	673	956	1130	1900
Extractable Fe	7569	7460	8125	7865	8175	8055	8200	8845
% of total* Fe	62	59	65	61	62	59	61	66
Extractable Mn	107	87	99	92	102	122	119	105
% of total* Mn	67	53	60	56	60	72	71	62

Table GH-29b
Correlation for total and extractable nickel in Welland clay blends

Pearson Correlation	Ni Aqueous Extract (mg/kg)	Ni DTPA Extraction (mg/kg)	Ni Oxalate Extraction (mg/kg)	Ni SR Nitrate Extraction (mg/kg)
Ni (Biomass)	0.987**	0.988**	0.991**	0.942**

** Correlation is significant at the 0.01 level (2-tailed).

Table GH-30
Biomass Produced by Oat grown on Unamended and Amended Welland Clay Blends
(dry weight per pot measured in grams)

[Ni] Soil mg/kg	Unamended	Amended
45.3	31.41 ± 1.83 [b]	33.34 ± 1.59 [c]
188/248	26.99 ± 4.42 [ab]	30.01 ± 1.89 [bc]
347	30.30 ± 5.10 [b]	31.72 ± 2.36 [c]
498	30.36 ± 2.98 [b]	28.50 ± 3.32 [bc]
673/497	27.96 ± 3.01[ab]	29.30 ± 3.17 [bc]
956	30.41 ± 1.72 [b]	28.10 ± 4.05 [bc]
1130	31.42 ± 2.55 [b]	22.37 ± 6.12 [b]
1900	22.93 ± 2.17 [a]	15.04 ± 3.17 [a]

*Means within column followed by the same letter are not significantly different according to Student Newman-Keuls's multiple range test ($P<0.05$), n=5

Table GH-31a – Concentration of CoCs and nutrients in Biomass (All Leaves) of Radish grown on Welland Clay (Unamended)

[Ni] Soil mg/kg	CoCs				Nutrients						
	Ni	Cu	Co	As	Ca	Fe	K	Mg	Mn	P	Zn
45.3	0.9 ± 0.2^{a}	3.36 ± 0.70^{a}	0.06 ± 0.01^{a}	>0.2	35680 ± 4408^{a}	68.9 ± 8.8^{a}	44790 ± 5536^{a}	5834 ± 593^{a}	28.5 ± 4.2^{c}	3540 ± 522^{a}	35.09 ± 3.23^{b}
188	5.7 ± 0.8^{b}	3.58 ± 0.31^{a}	0.08 ± 0.01^{ab}	>0.2	37000 ± 3027^{a}	75.6 ± 25.1^{a}	48440 ± 8540^{a}	6078 ± 343^{a}	21.0 ± 1.8^{b}	3680 ± 583^{a}	33.58 ± 6.18^{ab}
347	6.1 ± 2.0^{b}	3.23 ± 0.37^{a}	0.07 ± 0.01^{ab}	>0.2	41150 ± 5289^{a}	68.2 ± 14.9^{a}	44180 ± 4537^{a}	6450 ± 419^{a}	19.8 ± 1.4^{b}	2886 ± 797^{a}	33.66 ± 4.49^{ab}
498	13 ± 2.1^{c}	5.12 ± 3.17^{ab}	0.16 ± 0.05^{cd}	>0.2	36440 ± 1083^{a}	63.2 ± 18.6^{a}	43820 ± 8141^{a}	6036 ± 766^{a}	24.9 ± 3.5^{c}	3998 ± 359^{a}	35.04 ± 3.39^{b}
673	15 ± 2.2^{c}	3.82 ± 0.19^{a}	0.14 ± 0.03^{bc}	>0.2	38520 ± 2521^{a}	71.4 ± 13.4^{a}	47780 ± 3935^{a}	5778 ± 370^{a}	17.3 ± 0.3^{ab}	3586 ± 389^{a}	31.88 ± 1.56^{ab}
956	19 ± 2.1^{d}	4.10 ± 0.24^{a}	0.17 ± 0.01^{cd}	>0.2	39540 ± 3082^{a}	74.0 ± 5.2^{a}	43040 ± 4870^{a}	6420 ± 415^{a}	17.2 ± 2.8^{ab}	3370 ± 492^{a}	27.86 ± 0.43^{a}
1130	25 ± 4.7^{e}	4.32 ± 0.46^{ab}	0.22 ± 0.04^{d}	>0.2	38540 ± 1369^{a}	65.0 ± 3.7^{a}	40400 ± 3803^{a}	6314 ± 1005^{a}	16.8 ± 3.8^{ab}	3592 ± 504^{a}	31.90 ± 0.76^{ab}
1900	45 ± 5.8^{f}	6.25 ± 1.14^{b}	0.52 ± 0.10^{e}	>0.2	37960 ± 1812^{a}	59.6 ± 6.8^{a}	39640 ± 4342^{a}	5898 ± 1159^{a}	14.0 ± 3.0^{a}	3750 ± 498^{a}	31.30 ± 3.04^{ab}

Table GH-31b – Concentration of CoCs and nutrients in Biomass (All Leaves) of Radish grown on Welland Clay (Amended)

[Ni] Soil mg/kg	CoCs				Nutrients						
	Ni	Cu	Co	As	Ca	Fe	K	Mg	Mn	P	Zn
45.3	1.1 ± 0.3^{a}	4.00 ± 0.88^{a}	0.16 ± 0.01^{a}	>0.2	39120 ± 4376^{a}	70.0 ± 2.9^{a}	46540 ± 6540^{a}	6923 ± 726^{a}	46.4 ± 8.1^{d}	4198 ± 475^{a}	32.47 ± 3.52^{a}
248	5.2 ± 0.7^{b}	3.67 ± 0.44^{a}	0.15 ± 0.03^{a}	>0.2	37560 ± 2622^{a}	62.5 ± 6.7^{a}	42740 ± 4036^{a}	6777 ± 435^{a}	29.3 ± 5.3^{c}	3902 ± 513^{a}	32.47 ± 5.61^{a}
347	8.1 ± 1.5^{c}	3.72 ± 0.41^{a}	0.25 ± 0.08^{b}	>0.2	38960 ± 2713^{a}	68.8 ± 12.3 ^{a}	44390 ± 5487^{a}	6873 ± 576^{a}	33.3 ± 2.6^{c}	3645 ± 411^{a}	30.33 ± 2.28^{a}
498	9.8 ± 0.5^{c}	3.96 ± 0.38^{a}	0.13 ± 0.01^{a}	>0.2	38725 ± 2718^{a}	66.3 ± 9.1^{a}	48000 ± 4297^{a}	6610 ± 437^{a}	19.2 ± 1.5^{b}	3378 ± 316^{a}	31.28 ± 1.54^{a}
497	9.5 ± 1.5^{c}	3.46 ± 0.25^{a}	0.14 ± 0.01^{a}	>0.2	38320 ± 4069^{a}	69.4 ± 12.6^{a}	47100 ± 3526^{a}	6273 ± 297^{a}	15.9 ± 1.3^{ab}	3331 ± 516^{a}	30.71 ± 4.14^{a}
956	15 ± 1.7^{d}	3.91 ± 0.26^{a}	0.18 ± 0.04^{ab}	>0.2	39980 ± 1843^{a}	63.6 ± 7.6^{a}	44940 ± 4332^{a}	6446 ± 497^{a}	14.6 ± 1.4^{ab}	3322 ± 440^{a}	28.28 ± 1.19^{a}
1130	18 ± 2.5^{e}	4.34 ± 0.49^{a}	0.25 ± 0.04^{b}	>0.2	38600 ± 2310^{a}	67.0 ± 7.1^{a}	44560 ± 3320^{a}	6440 ± 527^{a}	14.2 ± 0.5^{ab}	3530 ± 535^{a}	28.84 ± 2.76^{a}
1900	29 ± 3.0^{f}	5.39 ± 0.81^{b}	0.48 ± 0.10^{c}	>0.2	38540 ± 4060^{a}	68.4 ± 5.7^{a}	45580 ± 6906^{a}	6130 ± 691^{a}	11.3 ± 1.2^{a}	3656 ± 680^{a}	27.40 ± 3.25^{a}

Table GH-32a – Concentration of CoCs in Biomass (Basal Leaves) of Radish grown on Welland Clay (Unamended)

[Ni] Soil mg/kg	CoCs				Nutrients						
	Ni	Cu	Co	As	Ca	Fe	K	Mg	Mn	P	Zn
45.3	0.5 ± 0.3[a]	2.61 ± 0.28[a]	0.05 ± 0.01[a]	>0.2	50610 ± 2975[a]	65 ± 17[a]	47650 ± 4701[ab]	7299 ± 538[a]	33.0 ± 4.0[d]	2291 ± 165[a]	31.9 ± 1.6[a]
188	2.5 ± 0.5[ab]	2.86 ± 0.21[a]	0.06 ± 0.01[ab]	>0.2	50940 ± 5965[a]	63 ± 13[a]	46530 ± 5421[ab]	7679 ± 563[a]	22.8 ± 4.2[bc]	2332 ± 234[a]	30.8 ± 6.7[a]
347	3.9 ± 1.8[abc]	2.78 ± 0.42[a]	0.06 ± 0.01[ab]	>0.2	47740 ± 7102[a]	54 ± 4[a]	45020 ± 4926[ab]	7246 ± 1073[a]	18.4 ± 2.6[ab]	2304 ± 387[a]	29.9 ± 3.9[a]
498	6.3 ± 1.1[bc]	2.69 ± 0.30[a]	0.12 ± 0.05[cd]	>0.2	49540 ± 2628[a]	47 ± 14[a]	43860 ± 7964[ab]	7316 ± 619[a]	25.0 ± 5.7[c]	2434 ± 452[a]	29.5 ± 1.8[a]
673	7.6 ± 2.2[cd]	2.91 ± 0.32[a]	0.10 ± 0.03[abcd]	>0.2	54490 ± 7169[a]	55 ± 21[a]	52870 ± 8956[b]	7136 ± 757[a]	15.7 ± 1.7[a]	2403 ± 805[a]	30.8 ± 6.4[a]
956	10 ± 1.0[d]	2.92 ± 0.25[a]	0.11 ± 0.02[bcd]	>0.2	62360 ± 9922[a]	55 ± 15[a]	38880 ± 5705[d]	8736 ± 936[a]	15.7 ± 3.7[a]	1950 ± 362[a]	24.2 ± 3.1[a]
1130	15 ± 3.6[e]	2.97 ± 0.30[a]	0.15 ± 0.04[d]	>0.2	55300 ± 7512[a]	53 ± 15[a]	40100 ± 5825[a]	7914 ± 699[a]	14.3 ± 4.2[a]	2004 ± 424[a]	28.9 ± 5.0[a]
1900	32 ± 5.3[f]	4.99 ± 0.29[b]	0.42 ± 0.06[e]	0.2 ± 0.1[a]	51920 ± 7381[a]	53 ± 9[a]	38200 ± 4551[a]	7002 ± 1370[a]	12.3 ± 3.3[a]	2352 ± 408[a]	28.9 ± 4.2[a]

Table GH-32b – Concentration of CoCs in Biomass (Basal Leaves) of Radish grown on Welland Clay (Amended)

[Ni] Soil mg/kg	CoCs				Nurients						
	Ni	Cu	Co	As	Ca	Fe	K	Mg	Mn	P	Zn
45.3	0.4 ± 0.2[a]	2.81 ± 0.54[ab]	0.12 ± 0.04[abc]	>0.2	52680 ± 9936[a]	52 ± 8[a]	44940 ± 6488[a]	8634 ± 1320[ab]	53.6 ± 6.9[e]	2880 ± 449[a]	27.1 ± 3.4[a]
248	2.0 ± 0.4[ab]	2.59 ± 0.10[a]	0.12 ± 0.03[abc]	>0.2	54360 ± 4433[a]	55 ± 7[a]	41880 ± 7351[a]	8756 ± 741[ab]	34.3 ± 8.7[c]	2466 ± 416[a]	27.8 ± 3.9[a]
347	3.7 ± 1.3[bc]	3.18 ± 0.39[ab]	0.19 ± 0.06[d]	>0.2	58760 ± 4606[a]	57 ± 12[a]	41060 ± 4325[a]	9244 ± 988[b]	43.8 ± 6.2[d]	2122 ± 540[a]	26.1 ± 5.1[a]
498	4.2 ± 1.0[c]	2.79 ± 0.28[ab]	0.09 ± 0.01[a]	>0.2	55700 ± 2550[a]	61 ± 8[a]	44800 ± 5932[a]	8448 ± 267[ab]	17.9 ± 2.1[b]	2113 ± 380[a]	26.3 ± 3.9[a]
497	4.8 ± 1.5[c]	2.95 ± 0.32[ab]	0.10 ± 0.01[ab]	>0.2	52400 ± 7715[a]	63 ± 16[a]	44770 ± 4523[a]	7683 ± 996[ab]	15.6 ± 2.1[ab]	2365 ± 430[a]	29.2 ± 5.3[a]
956	7.3 ± 0.5[d]	3.44 ± 1.51[ab]	0.14 ± 0.02[abc]	>0.2	54120 ± 4605[a]	56 ± 21[a]	43240 ± 4127[a]	8110 ± 677[ab]	13.7 ± 0.9[ab]	2162 ± 74[a]	25.2 ± 1.4[a]
1130	9.7 ± 1.4[e]	3.32 ± 0.16[ab]	0.18 ± 0.04[cd]	>0.2	54940 ± 2735[a]	66 ± 12[a]	45220 ± 4365[a]	7990 ± 501[ab]	13.0 ± 0.5[ab]	2286 ± 234[a]	26.1 ± 3.9[a]
1900	16 ± 2.9[f]	4.06 ± 0.50[b]	0.33 ± 0.07[d]	>0.2	51780 ± 3854[a]	58 ± 6[a]	46040 ± 6633[a]	7404 ± 446[a]	9.1 ± 0.6[a]	2382 ± 375[a]	23.8 ± 2.3[a]

Table GH-33a – Concentration of CoCs in Biomass (Globes) of Radish grown on Welland Clay (Unamended)

[Ni] Soil mg/kg	CoCs				Nutrients						
	Ni	Cu	Co	As	Ca	Fe	K	Mg	Mn	P	Zn
45.3	1.3 ± 0.1[a]	2.53 ± 0.45[a]	0.06 ± 0.01[a]	>0.2	6374 ± 940[a]	48 ± 6[ab]	83380 ± 11318[a]	3246 ± 347[a]	5.4 ± 0.5[b]	3772 ± 220 [a]	34.6 ± 3.0[a]
188	8.7 ± 1.1[b]	3.80 ± 2.30[a]	0.09 ± 0.01[ab]	>0.2	7333 ± 1353[a]	54 ± 10[b]	82050 ± 13403[a]	3417 ± 227[a]	5.0 ± 0.4[ab]	3784 ± 777[a]	34.7 ± 4.6[a]
347	10 ± 0.7[b]	2.37 ± 0.18[a]	0.08 ± 0.01[ab]	>0.2	6315 ± 880[a]	50 ± 9[ab]	74790 ± 7845[a]	3125 ± 450[a]	4.8 ± 0.4[ab]	3293 ± 270[a]	32.0 ± 4.5[a]
498	18 ± 2.1[c]	2.62 ± 0.43[a]	0.17 ± 0.03[bcd]	>0.2	6600 ± 259[a]	42 ± 5[ab]	77700 ± 11720[a]	3286 ± 474[a]	5.4 ± 0.3[b]	3998 ± 466[a]	33.5 ± 2.4[a]
673	18 ± 2.5[c]	2.55 ± 0.16[a]	0.14 ± 0.02[abc]	>0.2	7560 ± 1159[a]	45 ± 7[ab]	80680 ± 10927[a]	3476 ± 527[a]	4.3 ± 0.6[ab]	3206 ± 472[a]	33.3 ± 2.7[a]
956	26 ± 2.8[d]	2.98 ± 0.18[a]	0.19 ± 0.02[cd]	>0.2	8170 ± 1785[a]	39 ± 3[a]	63760 ± 30390[a]	3788 ± 630[a]	4.1 ± 0.6[a]	3322 ± 307[a]	32.7 ± 3.3[a]
1130	32 ± 5.2[e]	3.06 ± 0.26[a]	0.25 ± 0.05[d]	>0.2	7228 ± 327[a]	44 ± 6[ab]	76420 ± 8201[a]	3748 ± 755[a]	4.4 ± 1.0[ab]	3616 ± 765[a]	33.1 ± 3.1[a]
1900	54 ± 5.8[f]	5.30 ± 0.84[b]	0.57 ± 0.4[e]	>0.2	7162 ± 1064[a]	37 ± 4[a]	71900 ± 7346[a]	3340 ± 767[a]	4.0 ± 0.3[a]	3762 ± 575[a]	32.8 ± 3.5[a]

Table GH-33b – Concentration of CoCs in Biomass (Globes) of Radish grown on Welland Clay (Amended)

[Ni] Soil mg/kg	CoCs				Nutrients						
	Ni	Cu	Co	As	Ca	Fe	K	Mg	Mn	P	Zn
45.3	1.3 ± 0.2[a]	2.40 ± 0.56[a]	0.18 ± 0.03[ab]	>0.2	7492 ± 1186[a]	50 ± 7[a]	87510 ± 8063[a]	3928 ± 612[a]	7.7 ± 0.8[d]	3962 ± 430[b]	33.7 ± 5.7[ab]
248	7.2 ± 0.6[b]	2.72 ± 0.32[a]	0.17 ± 0.05[ab]	>0.2	7600 ± 1328[a]	46 ± 7[a]	82200 ± 7492[a]	3914 ± 850[a]	6.5 ± 1.2[c]	3964 ± 413[b]	35.7 ± 3.2[b]
347	10 ± 1.2[c]	2.52 ± 0.48[a]	0.26 ± 0.09[b]	>0.2	7426 ± 1403[a]	42 ± 8[a]	81860 ± 6253[a]	3520 ± 509[a]	5.6 ± 0.5[b]	3486 ± 201[ab]	33.8 ± 0.6[ab]
498	14 ± 0.8[d]	2.85 ± 0.09[a]	0.14 ± 0.02[a]	>0.2	8365 ± 611[a]	51 ± 11[a]	62600 ± 35222[a]	3930 ± 478[a]	4.8 ± 0.4[a]	3055 ± 161[a]	32.5 ± 1.6[ab]
497	12 ± 2.3[d]	2.61 ± 0.30[a]	0.15 ± 0.02[a]	>0.2	7642 ± 1335[a]	43 ± 8[a]	85120 ± 6974[a]	3580 ± 404[a]	4.2 ± 0.3[a]	3266 ± 358[a]	33.2 ± 6.1[ab]
956	19 ± 1.1[e]	2.86 ± 0.26[a]	0.20 ± 0.03[ab]	>0.2	7850 ± 313[a]	42 ± 4[a]	71840 ± 15142[a]	3530 ± 263[a]	4.0 ± 0.4[a]	3082 ± 296[a]	27.4 ± 1.4[a]
1130	21 ± 2.5[f]	3.19 ± 0.53[a]	0.25 ± 0.04[b]	>0.2	7659 ± 1331[a]	42 ± 5[a]	80880 ± 8049[a]	3589 ± 267[a]	4.0 ± 0.2[a]	3186 ± 396[a]	26.7 ± 3.1[a]
1900	34 ± 1.1[g]	4.19 ± 0.36[b]	0.53 ± 0.08[c]	>0.2	8890 ± 821[a]	52 ± 15[a]	79900 ± 13326[a]	3888 ± 310[a]	3.7 ± 0.1[a]	3286 ± 274[a]	29.2 ± 2.3[ab]

∗ SNK (Student Newman-Keuls's) multiple range test ($P<0.05$), n=5. Means within column followed by the same letter are not significantly different

Table GH-34
Tissue biomass produced by Radish grown on unamended Welland Clay soil
(dry weight per pot measured in grams)

[Ni] Soil mg/kg	Unamended			Amended		
	DW Biomass	DW Basal Leaves	DW Globes	DW Biomass	DW Basal Leaves	DW Globes
45.3	2.977 ± 0.525[a]	1.183 ± 0.291[a]	2.228 ± 0.426[a]	4.089 ± 0.621[ab]	1.895 ± 0.533[ab]	2.989 ± 0.777[ab]
188/248	3.301 ± 0.567[a]	1.814 ± 0.624[a]	2.351 ± 0.525[a]	4.257 ± 0.360[ab]	2.065 ± 0.424[b]	3.394 ± 0.254[b]
347	3.689 ± 0.273[ab]	1.583 ± 0.270[a]	2.993 ± 0.411[ab]	4.881 ± 0.945[b]	1.544 ± 0.156[ab]	3.544 ± 1.108[b]
498	3.398 ± 0.345[a]	1.648 ± 0.214[a]	2.907 ± 0.599[ab]	3.276 ± 0.770[a]	1.356 ± 0.048[a]	1.921 ± 0.043[a]
673/497	3.459 ± 0.814[a]	1.464 ± 0.335[a]	2.366 ± 0.474[a]	3.936 ± 0.607[ab]	1.595 ± 0.236[ab]	2.868 ± 0.650[ab]
956	3.882 ± 0.959[ab]	1.462 ± 0.294[a]	3.418 ± 0.869[ab]	3.669 ± 0.811[ab]	1.831 ± 0.433[ab]	2.708 ± 0.701[ab]
1130	4.669 ± 0.469[b]	1.774 ± 0.378[a]	4.010 ± 0.730[b]	3.063 ± 0.796[a]	1.639 ± 0.301[ab]	2.634 ± 0.605[ab]
1900	3.998 ± 0.685[ab]	1.734 ± 0.565[a]	3.227 ± 1.134[b]	2.867 ± 0.495[a]	1.474 ± 0.204[ab]	1.834 ± 0.348[a]

Table GH-35
Soil properties for unamended Till Clay blends used in Year 2001 Greenhouse Trials

Total Metals (mg/kg)							Total Organic Carbon (%)	Total Carbon (as C) (%)	Total Inorganic Carbon (as C) (%)	Soil CEC (meq100)
CoCs				Fe	Mn	P				
Ni	Cu	Co	As							
*2	1	2	0.2	50	1	20	0.05	0.05	0.05	0.01
51.0	17	7	4.4	20730	952	1415	3.36	3.96	1.28	5.00
145	29	9	4.9	21940	958	978	3.92	4.08	0.16	5.10
262	43	10	5.5	22100	929	980	4.00	4.00	0.03	4.10
438	68	13	6.3	22970	894	1016	4.64	4.64	0.03	4.10
554	81	15	6.8	23260	885	1038	4.44	4.44	0.03	5.00
947	131	22	8.5	24280	778	1092	7.04	7.84	0.80	6.30
1380	185	29	10	25450	691	1147	9.16	9.16	0.03	7.15
2540	338	47	16	28750	388	1312	13.4	14.5	2.16	9.50

Note:

* - indicates estimated limit of quantification (EQL) for analytical method

Soil CoC values are calculated from data specific to the Greenhouse experiments therefore reported values may differ from those reported in the Soil Collection and Characterizations Report (Part 2).

Table GH-36
Soil pH before and after harvest for Oat grown on Till Clay Soil

[Ni] Soil mg/kg	Initial Soil	Unamended After Harvest		Amended After Harvest	
	pH	pH (H_20)	pH ($CaCl_2$)	pH (H_20)	pH ($CaCl_2$)
51.0	5.49	6.19 ± 0.06 [a]	5.55 ± 0.05 [a]	6.70 ± 0.04 [a]	6.09 ± 0.04 [a]
145	5.59	6.27 ± 0.03 [b]	5.65 ± 0.03 [b]	6.74 ± 0.04 [a,b]	6.14 ± 0.04 [a]
262	5.61	6.36 ± 0.04 [c]	5.76 ± 0.03 [c]	6.80 ± 0.03 [b,c]	6.20 ± 0.04 [b]
438	5.73	6.43 ± 0.02 [d]	5.83 ± 0.01 [d]	6.82 ± 0.01 [c]	6.27 ± 0.02 [c]
554	5.76	6.46 ± 0.03 [d]	5.89 ± 0.02 [e]	6.91 ± 0.08 [d]	6.34 ± 0.03 [d]
947	6.48	6.54 ± 0.02 [e]	5.98 ± 0.02 [f]	7.00 ± 0.07 [e]	6.40 ± 0.09 [d,e]
1380	5.96	6.63 ± 0.02 [f]	6.06 ± 0.02 [g]	7.00 ± 0.05 [e]	6.45 ± 0.04 [e]
2540	6.13	6.59 ± 0.04 [f]	6.15 ± 0.01 [h]	6.97 ± 0.04 [d,e]	6.57 ± 0.02 [f]

∗ SNK (Student Newman-Keuls) multiple range test ($P<0.05$), n=5 - Means within column followed by the same letter are not significantly different.

Table GH-37a:
Concentration of CoCs and nutrients in biomass (tissue) of Oat grown on Till Clay soil (Unamended)

[Ni] Soil mg/kg	CoCs				Nutrients						
	Ni	Cu	Co	As	Ca	Fe	K	Mg	Mn	P	Zn
	mg/kg DW										
EQL	0.1	0.05	0.01	0.2	50	5	10	5	0.5	5	0.5
51.0	2.5 ± 0.3* a	2.68 ± 0.21 a	0.01 ± 0.0 a	>0.2	4482 ± 233 a	29 ± 2.7 a	21920 ± 954 a	2060 ± 76 b	54.5 ± 4.8 e	2241 ± 379 a	19 ± 1.1 a
145	6.5 ± 0.3 b	3.88 ± 0.25 b	0.01 ± 0.0 a	>0.2	4064 ± 166 a	27 ± 4.0 a	24900 ± 1120 ab	1780 ± 120 a	48.2 ± 3.1 e	2330 ± 375 a	19 ± 1.0 a
262	9.4 ± 1 c	4.34 ± 0.22 bc	0.02 ± 0.0 a	>0.2	3878 ± 213 a	33 ± 17 a	26800 ± 2586 bc	1720 ± 82 a	38.8 ± 4.0 d	2272 ± 455 a	18 ± 0.8 a
438	11 ± 0.6 cd	5.10 ± 0.53 cd	0.01 ± 0.0 a	>0.2	4006 ± 118 a	23 ± 1.9 ab	29560 ± 1426 cd	1910 ± 88 ab	37.4 ± 3.1 d	2863 ± 418 a	19 ± 1.0 ab
554	14 ± 1 d	5.48 ± 0.29 d	0.01 ± 0.0 a	>0.2	4002 ± 89 a	25 ± 2.0 a	31960 ± 1356 de	1900 ± 31 ab	28.2 ± 3.8 c	2976 ± 412 a	20 ± 0.4 abc
947	17 ± 1 e	6.01 ± 0.30 de	0.01 ± 0.01 a	>0.2	3844 ± 268 a	28 ± 4.0 a	32500 ± 1719 de	1750 ± 130 a	25.1 ± 3.3 c	2864 ± 301 a	22 ± 1.5 bc
1380	18 ± 2 e	6.77 ± 0.43 e	0.01 ± 0.0 a	>0.2	3890 ± 169 a	26 ± 2.6 a	34030 ± 1515 e	1810 ± 67 a	14.8 ± 2.0 b	2874 ± 412 a	22 ± 1.9 c
2540	25 ± 2 f	11.56 ± 1.22 f	0.03 ± 0.0 a	0.5 ± 0.07 b	8540 ± 959 b	45 ± 10 b	59170 ± 2167 f	3100 ± 180 c	6.23 ± 0.4 a	5952 ± 1208 b	36 ± 2.0 d

Table GH-37b:
Concentration of CoCs and nutrients in biomass (tissue) of Oat grown on Till Clay soil (Amended)

[Ni] Soil mg/kg	CoCs				Nutrients						
	Ni	Cu	Co	As	Ca	Fe	K	Mg	Mn	P	Zn
	mg/kg DW										
EQL	0.1	0.05	0.01	0.2	50	5	10	5	0.5	5	0.5
51.0	2.0 ± 0.3* a	2.45 ± 0.26 a	0.02 ± 0.02 a	>0.2	4744 ± 482 b	25 ± 2 a	25760 ± 2000 a	2660 ± 187 d	22 ± 2.2 f	3260 ± 581 a	17 ± 1.0 a
145	4.2 ± 0.5 ab	3.76 ± 0.55 b	0.01 ± 0.0 a	>0.2	4306 ± 212 ab	27 ± 6 a	28320 ± 909 ab	2320 ± 93 c	22 ± 1.2 f	3184 ± 232 a	18 ± 1.0 ab
262	6.7 ± 1.0 bc	4.43 ± 0.46 bc	0.03 ± 0.06 a	>0.2	4156 ± 196 ab	25 ± 3 a	31220 ± 756 bc	2250 ± 131 c	17 ± 0.4 e	3379 ± 189 a	18 ± 1.4 ab
438	8.4 ± 0.8 cd	4.63 ± 0.21 c	0.02 ± 0.03 a	>0.2	4056 ± 247 a	25 ± 4 a	31300 ± 1870 c	2180 ± 131 bc	16 ± 1.0 de	2974 ± 361 a	17 ± 1.3 a
554	9.6 ± 0.9 d	5.19 ± 0.29 c	0.01 ± 0.0 a	>0.2	3996 ± 140 a	29 ± 8 a	34620 ± 1960 c	2040 ± 87 abc	14 ± 1.7 cd	3344 ± 476 a	19 ± 2.1 abc
947	13 ± 1.0 e	6.22 ± 0.16 d	0.01 ± 0.01 a	>0.2	3783 ± 273 a	28 ± 4 a	33960 ± 2200 c	1900 ± 144 ab	12 ± 0.7 bc	2886 ± 363 a	22 ± 2.6 c
1380	16 ± 2.0 e	6.39 ± 0.45 d	0.01 ± 0.0 a	>0.2	3764 ± 245 a	31 ± 2 a	35040 ± 4060 c	1800 ± 128 a	10 ± 1.2 b	2850 ± 496 a	21 ± 2.0 abc
2540	23 ± 2.4 f	10.84± 0.60 e	0.04 ± 0.01 a	0.34 ± 0.05 b	8146 ± 451 c	44 ± 2 a	62020± 2320 d	3640 ± 183 e	5.6 ± 1.0 a	5490± 1309 a	32 ± 2.2 d

∗ SNK (Student Newman-Keuls's) multiple range test (P<0.05), n=5. Means within column followed by the same letter are not significantly different

Table GH-38a
Extractable Iron and Manganese on Till Clay (mg/kg)

Soil [Ni]	51.0	145	262	438	554	947	1380	2540
Extractable Fe	17450	17100	18300	18100	18400	19200	19250	20100
% of Total	84	78	83	79	79	79	76	70
Extractable Mn	1030	841	880	939	748	669	637	283
% of Total	108	88	95	105	85	86	92	73

Table GH-38b
Correlation for total and extractable CoCs on Till Clay soil

Pearson Correlation	Ni Aqueous Extract (mg/kg)	Ni DTPA Extraction (mg/kg)	Ni Oxalate Extraction (mg/kg)	Ni Sr Nitrate Extraction (mg/kg)
Ni (Biomass)	0.251	0.851**	0.797**	0.795**

** Correlation is significant at the 0.01 level (2-tailed).

Table GH-39
Tissue and seed biomass produced by oat grown on unamended Till Clay soil (dry weight per pot measured in grams)

[Ni] Soil mg/kg	Unamended		Amended	
	DW Biomass	DW Seed and Hull	DW Biomass	DW Seed and Hull
51.0	22.93 ± 0.86	4.46 ± 0.79	20.84 ± 0.78 [a]	3.06 ± 0.57
145	23.93 ± 2.25[a]	3.91 ± 0.57	23.13 ± 3.30 [a]	3.69 ± 0.83
262	23.70 ± 2.64 [a]	4.66 ± 1.32	21. 91 ± 0.89 [a]	3.64 ± 0.30
438	24.60 ± 2.08 [a]	3.74 ± 0.64	23.25 ± 2.23 [a]	4.60 ± 0.61
554	22.91 ± 1.5 [a] 0	4.67 ± 0.38	23.46 ± 2.52 [a]	4.18 ± 0.71
947	24.13 ± 2.05 [a]	4.61 ± 1.51	23.87 ± 0.79 [a]	3.84 ± 0.74
1380	22.21 ± 0.52 [a]	4.29 ± 1.12	23.27 ± 2.79[a]	3.97 ± 1.07
2540	6.55 ± 1.63 [b]	Insufficient Sample	8.13 ± 2.68[b]	4.05 ± 0.20

Table GH-40
Background and impacted Welland Clay soil pH following pH adjustment

[Ni] Soil mg/kg	Treat	pH H_20 (after)	pH $CaCl_2$ (after)	[Ni] Soil mg/kg	Treat	pH H_20 (after)	pH $CaCl_2$ (after)
Bckg	**pHT1**	4.83 ± 0.11 [a]	4.67 ± 0.07 [a]	**1900**	**T1**	5.78 ± 0.27 [b]	5.64 ± 0.25 [b]
Bckg	**pHT2**	5.36 ± 0.04 [b]	5.11 ± 0.02 [ab]	**1900**	**T2**	5.26 ± 0.07 [a]	5.14 ± 0.04 [a]
Bckg	**pHT3**	5.78 ± 0.24 [bc]	5.54 ± 0.24 [bc]	**1900**	**T3**	6.13 ± 0.02 [c]	5.96 ± 0.01 [c]
Bckg	**pHT4**	6.20 ± 0.38 [c]	5.97 ± 0.39 [c]	**1900**	**T4**	6.56 ± 0.18 [d]	6.37 ± 0.16 [d]
Bckg	**pHT5**	6.88 ± 0.35 [d]	6.66 ± 0.36 [d]	**1900**	**T5**	7.11 ± 0.11 [e]	6.93 ± 0.10 [e]

Note – Tukey's HSD test used to generate rank

Table GH-41
Oat biomass production on pH adjusted background and impacted Welland Clay soil

[Ni] Soil mg/kg	Treat	Sample Dry Weight (g)	[Ni] Soil mg/kg	Treat	Sample Dry Weight (g)
Bckg	**pHT1**	0.675 ± 0.182 [a]	**1900**	**T1**	0.128 ± 0.015 [a]
Bckg	**pHT2**	0.736 ± 0.092 [a]	**1900**	**T2**	0.096 ± 0.016 [a]
Bckg	**pHT3**	0.684 ± 0.169 [a]	**1900**	**T3**	0.176 ± 0.027 [a]
Bckg	**pHT4**	0.655 ± 0.073 [a]	**1900**	**T4**	0.323 ± 0.110 [b]
Bckg	**pHT5**	0.576 ± 0.097 [a]	**1900**	**T5**	0.334 ± 0.017 [b]

Table GH-42a
Tissue CoCs and nutrients concentrations in oat on pH adjusted background Welland Clay soil

Treat*	CoCs				Nutrients				
	Ni	Cu	Co	As	Ca	Fe	K	Mg	Mn
PHT1	3.3 ± 0.3^{b}	8.77 ± 0.36^{c}	0.14 ± 0.04^{b}	>0.2	4283 ± 505^{a}	76 ± 7^{a}	61367 ± 1945^{a}	3512 ± 350^{a}	233 ± 55.4^{c}
PHT2	3.0 ± 0.1^{b}	7.98 ± 0.19^{bc}	0.11 ± 0.01^{ab}	>0.2	4577 ± 273^{ab}	85 ± 5^{a}	75300 ± 3718^{b}	3710 ± 129^{a}	184 ± 12.4^{bc}
PHT3	2.2 ± 0.2^{a}	7.71 ± 0.80^{ab}	0.08 ± 0.03^{a}	>0.2	4464 ± 261^{ab}	80 ± 9^{a}	73000 ± 1247^{b}	3502 ± 176^{a}	138 ± 73.9^{ab}
PHT4	2.2 ± 0.2^{a}	7.16 ± 0.35^{a}	0.10 ± 0.03^{ab}	>0.2	4824 ± 369^{bc}	87 ± 5^{a}	72640 ± 1537^{b}	3482 ± 87^{a}	88.3 ± 23.1^{a}
PHT5	1.9 ± 0.3^{a}	6.87 ± 0.16^{a}	0.11 ± 0.02^{ab}	>0.2	5168 ± 172^{c}	85 ± 2^{a}	73050 ± 1640^{b}	3475 ± 104^{a}	77.1 ± 5.2^{a}

* - pH value for soil pH designation is located in Table GH-42

Table GH-42b
Tissue CoCs and nutrients concentrations in oat on pH adjusted impacted Welland Clay soil

Treat *	CoCs				Nutrients				
	Ni	Cu	Co	As	Ca	Fe	K	Mg	Mn
T1	170 ± 23.5^{b}	6.33 ± 1.00^{a}	1.01 ± 0.24^{a}	0.5 ± 0.1^{b}	11280 ± 1402^{a}	36 ± 3^{ab}	24680 ± 7638^{ab}	3044 ± 651^{ab}	21.8 ± 3.9^{c}
T2	241 ± 12.6^{c}	5.04 ± 0.35^{a}	1.36 ± 0.11^{b}	0.2 ± 0.0^{a}	7990 ± 660^{a}	40 ± 5^{bc}	8454 ± 923^{a}	2144 ± 144^{a}	29.8 ± 1.5^{d}
T3	149 ± 7.0^{b}	7.04 ± 0.11^{a}	0.95 ± 0.07^{a}	0.3 ± 0.1^{ab}	9702 ± 4791^{a}	29 ± 4^{a}	29158 ± 14883^{b}	2747 ± 1342^{a}	17.3 ± 1.3^{b}
T4	122 ± 11.3^{a}	12.84 ± 3.17^{b}	0.89 ± 0.14^{a}	0.3 ± 0.1^{ab}	9876 ± 1666^{a}	40 ± 10^{bc}	53300 ± 9448^{c}	3278 ± 289^{ab}	12.1 ± 2.9^{a}
T5	115 ± 2.7^{a}	21.35 ± 1.30^{c}	1.38 ± 0.20^{b}	0.3 ± 0.1^{ab}	9917 ± 208^{a}	48 ± 2^{c}	60050 ± 1773^{c}	4065 ± 135^{b}	10.4 ± 0.6^{a}

*- pH value for soil pH designation is located in Table GH-42

Table GH-43a
Tissue CoC Concentration in Oat Tissue: OAT on Unamended Engineered Welland Clay Soil

[Ni] Soil mg/kg	As	Ca	Co	Cu	Fe	K	Mg	Mn	Ni	P	Zn
45.3	<0.2	2617 ± 312	0.19 ± 0.06	3.39 ± 0.54	52.8 ±6.6	21783 ± 2775	1197 ± 165	44.7 ± 7.51	15.7 ± 3.95	1965 ± 398	19.2 ± 3.5
188	<0.2	2495 ± 138	0.21 ± 0.05	3.49 ± 0.33	53.5 ± 5.43	19717 ± 1981	1082 ± 77	36.8 ± 3.19	20.9 ± 3.11	2332 ± 365	17.6 ± 2.50
347	<0.2	2583 ± 218	0.18 ± 0.05	4.10 ± 0.48	54.7 ± 8.14	21417 ± 1770	1132 ± 106	33.1 ± 6.04	21.9 ± 5.34	2307 ± 629	19.3 ± 2.81
498	<0.2	2777 ± 216	0.21 ± 0.06	4.48 ± 0.39	55.3 ± 4.6	23633 ± 1491	1233 ± 98	35.0 ± 4.92	26.1 ± 2.86	2872 ± 830	19.9 ± 2.25
673	<0.2	2720 ± 295	0.18 ± 0.02	4.85 ± 0.82	58.2 ± 6.53	22540 ± 1853	1296 ± 156	31.3 ± 5.12	25.9 ± 5.76	2606 ± 695	21.7 ± 3.51
956	<0.2	2633 ± 171	0.23 ± 0.03	4.68 ± 0.62	58 ± 9.57	20917 ± 1597	1167 ± 71	29.1 ± 7.46	27.2 ± 5.77	1920.8 ± 245	18.9 ± 2.08
1130	<0.2	2669 ± 372	0.21 ± 0.02	4.86 ± 0.68	55.6 ± 8.24	22817 ± 2012	1171 ± 186	27.7 ± 9.90	31.2 ± 8.56	1940 ± 462	18.4 ± 2.70
1900	<0.2	3243 ± 278	0.28 ± 0.04	6.88 ± 0.84	71.1 ± 10.2	25808 ± 3274	1423 ± 144	16.1 ± 5.40	56.1 ± 12.29	3264 ± 678	27.2 ± 4.03

Table GH-43b
Tissue CoC Concentration in Oat Tissue: OAT on Amended Engineered Welland Clay Soil

[Ni] Soil mg/kg	As	Ca	Co	Cu	Fe	K	Mg	Mn	Ni	P	Zn
45.3	<0.2	2385 ± 221	0.18 ± 0.04	2.99 ± 0.45	57.5 ± 7.66	20983 ± 2325	1136 ± 108	37.2 ± 2.07	16.5 ± 4.80	2171.7 ± 870	18.99 ± 3.10
248	<0.2	2295 ± 243	0.19 ± 0.05	3.38 ± 0.39	52.9 ± 6.39	20633 ± 2228	1102 ± 123	35.5 ± 6.27	19.1 ± 3.87	1806.7 ± 491	18.7 ± 2.67
347	<0.2	2344 ± 179	0.21 ± 0.05	4.06 ± 1.29	56.2 ± 7.85	19820 ± 1491	1099 ± 131	35.0 ± 8.26	21.2 ± 4.78	1912 ± 412	16.92 ± 2.40
498	<0.2	2358 ± 111	0.18 ± 0.02	3.87 ± 0.60	54.4 ± 7.79	19242 ± 3303	1130 ± 145	28.2 ± 6.89	22.5 ± 5.12	2044.2 ± 525	17.8 ± 3.79
497	<0.2	2422 ± 134	0.18 ± 0.01	3.94 ± 0.33	60.2 ± 21.64	19680 ± 2210	1161 ± 114	24.1 ± 2.79	25.7 ± 4.13	2360 ± 651	17.92 ± 1.77
956	<0.2	2426 ± 197	0.17 ± 0.03	4.87 ± 0.10	56.4 ± 2.88	21760 ± 2862	1194 ± 56	19.9 ± 5.43	24.8 ± 3.41	1674 ± 160	18.64 ± 1.54
1130	<0.2	2278 ± 189	0.21 ± 0.02	4.12 ± 0.56	53.3 ± 5.57	19050 ± 2727	1019 ± 126	23.8 ± 6.99	25.5 ± 4.31	1515 ± 307	14.9 ± 2.35
1900	<0.2	2548 ± 221.5	0.25 ± 0.03	4.93 ± 1.01	55.6 ± 17.85	21100 ± 2582	1096 ± 171	21.1 ± 6.73	32.6 ± 3.45	1842 ± 450	16.9 ± 3.76

Table GH-44a – Biomass Yield: OAT on Unamended Engineered Welland Clay Soil

[Ni] Soil mg/kg	Biomass Dry Weight (g)	DW Seeds and Hulls (g)	DW Hull (g)	DW Seeds (g)
45.3	43.558 ± 4.799	2.400 ± 1.135	2.250 ± 1.056	No Seeds
188	44.453 ± 5.582	3.066 ± 1.437	2.799 ± 1.296	No Seeds
347	38.511 ± 7.365	2.432 ± 1.048	2.296 ± 0.997	No Seeds
498	39.066 ± 3.994	1.133 ± 0.714	1.060 ± 0.672	No Seeds
673	42.315 ± 4.150	2.533 ± 1.697	2.361 ± 1.602	No Seeds
956	42.310 ± 5.945	2.639 ± 0.936	2.403 ± 0.889	No Seeds
1130	31.922 ± 6.087	1.747 ± 0.806	1.633 ± 0.712	No Seeds
1900	26.806 ± 6.778	1.997 ± 1.093	1.843 ± 1.017	No Seeds

Table GH-44b – Biomass Yield: OAT on Amended Engineered Welland Clay Soil

[Ni] Soil mg/kg	Biomass Dry Weight (g)	DW Seeds and Hulls (g)	DW Hull (g)	DW Seeds (g)
45.3	41.164 ± 6.492	4.066 ± 1.414	3.706 ± 1.254	No Seeds
248	38.994 ± 5.732	4.436 ± 0.839	4.074 ± 0.774	No Seeds
347	41.983 ± 3.990	4.054 ± 0.869	3.716 ± 0.800	No Seeds
498	40.439 ± 6.426	4.222 ± 1.050	3.842 ± 0.937	No Seeds
497	41.161 ± 10.206	3.810 ± 1.182	3.517 ± 1.163	No Seeds
956	39.335 ± 7.199	4.148 ± 0.768	3.888 ± 0.710	No Seeds
1130	38.408 ± 2.634	4.294 ± 0.894	3.941 ± 0.748	No Seeds
1900	31.286 ± 1.90	3.196 ± 0.503	2.956 ± 0.467	No Seeds

APPENDIX GH-2A
PHOTO PLATES - YEAR 2000

PHOTO PLATES 2000

Plate 1	Corn on unamended clay soil at five CoC concentrations (left to right: Control; Low; Medium; High; Very High). Photo dated Aug 18, 2000.
Plate 2	Corn on High CoC clay soil amended at OMAFRA (1X) recommended lime levels. Photo dated Aug 18, 2000.
Plate 3	Corn on unamended organic soil at four CoC concentrations (left to right: Low; Medium; High; Very High). Photo dated Aug 18, 2000.
Plate 4	Corn on unamended (left column of pots), amended 1X (centre), and 2X (right) OMAFRA recommended lime levels on Very High CoC organic soil. Photo dated Aug 18, 2000.
Plate 5	Corn on unamended sand soil at four CoC concentrations (left to right: Control; Low; Medium; High). Photo dated Aug 18, 2000.
Plate 6	Corn on unamended (left), amended 1X (centre), and 2X (right) OMAFRA recommended lime levels on High CoC sand soil. Photo dated Aug 18, 2000.
Plate 7	Soybean on unamended clay soil at five CoC concentrations (left to right: Control; Low; Medium; High; Very High). Photo dated Aug 18, 2000.
Plate 8	Soybean on unamended (left), amended 1X (centre), and 2X (right) OMAFRA recommended lime levels on Very High CoC clay soil. Photo dated Aug 18, 2000.
Plate 9	Soybean on unamended organic soil at four CoC concentrations (left to right: Low; Medium; High; Very High). Photo dated Aug 18, 2000.
Plate 10	Soybean on unamended (left), amended 1X (centre), and 2X (right) OMAFRA recommended lime levels on Very High CoC organic soil. Photo dated Aug 18, 2000.
Plate 11	Soybean on unamended sand soil at four CoC concentrations (left to right: Control; Low; Medium; High). Photo dated Aug 18, 2000.
Plate 12	Oat on clay soil amended with 1X OMAFRA recommended lime levels at five CoC concentrations (left to right: Very High; High; Medium; Low; Control). Photo dated Jul 24, 2000.
Plate 13	Oat on unamended (left), amended 1X (centre), and 2X (right) OMAFRA recommended lime levels on Very HighCoC clay soil. Photo dated Jul 24, 2000.
Plate 14	Oat on unamended (left), amended 1X (centre), and 2X (right) OMAFRA recommended lime levels on Very High CoC organic soil. Photo dated Aug 18, 2000.
Plate 15	Oat on unamended (left), amended 1X (centre), and 2X (right) OMAFRA recommended lime levels on Low CoC sand soil. Photo dated Jul 31, 2000.
Plate 16	Oat on unamended (left), amended 1X (centre), and 2X (right) OMAFRA recommended lime levels on Medium CoC sand soil. Photo dated Jul 31, 2000.

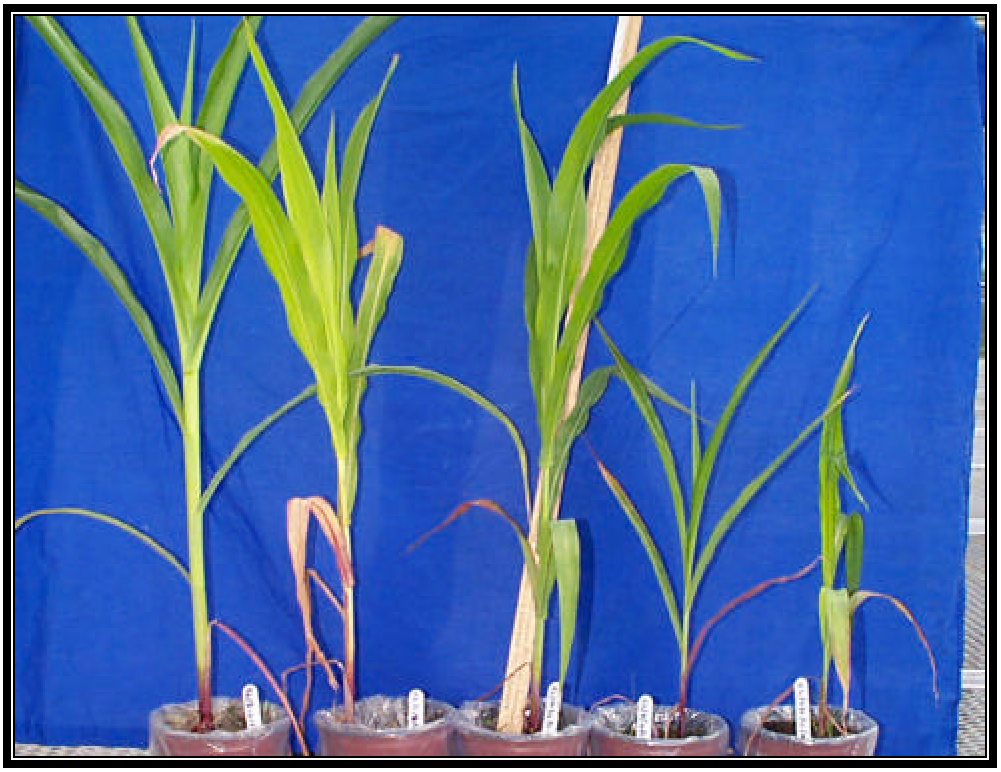

Plate 1: Corn on un-amended clay soil at five CoC concentrations (left to right: Control; Low; Medium; High; Very High). Photo dated Aug 18, 2000.

Plate 2: Corn on High CoC clay soil amended at OMAFRA (1X) recommended lime levels. Photo dated Aug 18, 2000.

Plate 3: Corn on un-amended organic soil at four CoC concentrations (left to right: Low; Medium; High; Very High). Photo dated Aug 18, 2000.

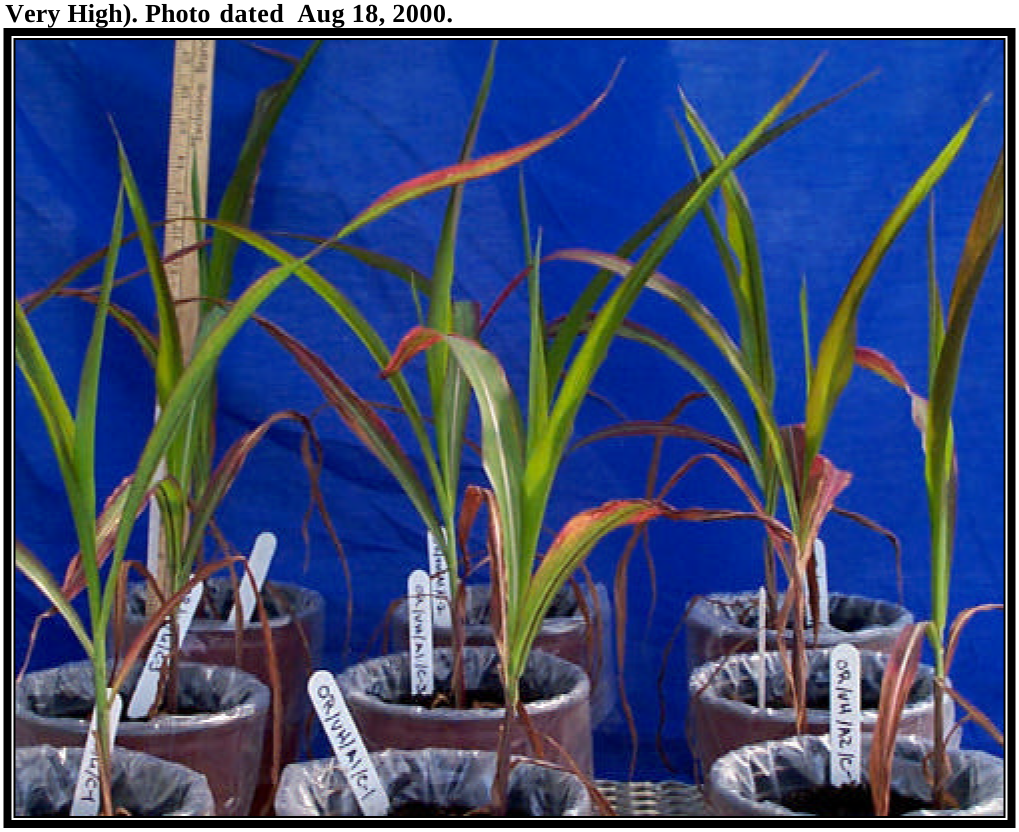

Plate 4: Corn on unamended (left column of pots), amended 1X (centre), and 2X (right) OMAFRA recommended lime levels on Very High CoC organic soil. Photo dated Aug 18, 2000.

Plate 5: Corn on un-amended sand soil at four CoC concentrations (left to right: Control; Low; Medium; High). Photo dated Aug 18, 2000.

Plate 6: Corn on unamended (left), amended 1X (centre), and 2X (right) OMAFRA recommended lime levels on High CoC sand soil. Photo dated Aug 18, 2000.

Plate 7: Soybean on un-amended clay soil at five CoC concentrations (left to right: Control; Low; Medium; High; Very High). Photo dated Aug 18, 2000.

Plate 8: Soybean on unamended (left), amended 1X (centre), and 2X (right) OMAFRA recommended lime levels on Very High CoC clay soil. Photo dated Aug 18, 2000.

Plate 9: Soybean on un-amended organic soil at four CoC concentrations (left to right: Low; Medium; High; Very High). Photo dated Aug 18, 2000.

Plate 10: Soybean on unamended (left), amended 1X (centre), and 2X (right) OMAFRA recommended lime levels on Very High CoC organic soil. Photo dated Aug 18, 2000.

Plate 11: Soybean on un-amended sand soil at four CoC concentrations (left to right: Control; Low; Medium; High). Photo dated Aug 18, 2000.

Plate 12: Oat on clay soil amended with 1X OMAFRA recommended lime levels at five CoC concentrations (left to right: Very High; High; Medium; Low; Control). Photo dated Jul 24, 2000.

Plate 13: Oat on unamended (left), amended 1X (centre), and 2X (right) OMAFRA recommended lime levels on Very HighCoC clay soil. Photo dated Jul 24, 2000.

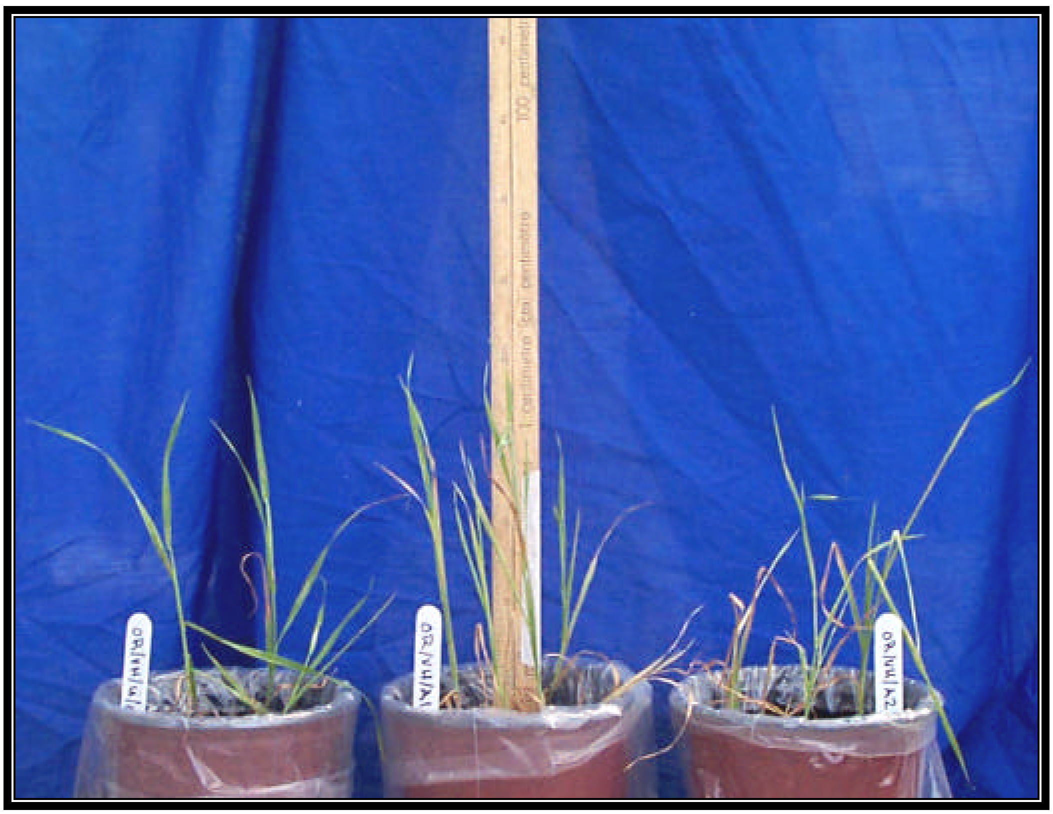

Plate 14: Oat on un-amended (left), amended 1X (centre), and 2X (right) OMAFRA recommended lime levels on Very High CoC organic soil. Photo dated Aug 18, 2000.

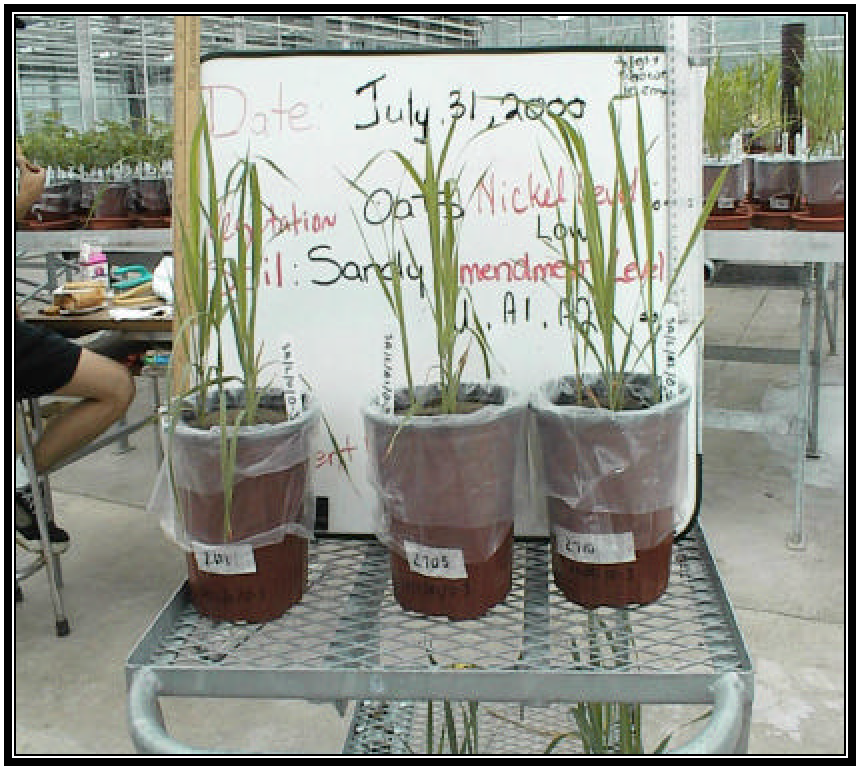

Plate 15: Oat on un-amended (left), amended 1X (centre), and 2X (right) OMAFRA recommended lime levels on Low CoC sand soil. Photo dated Jul 31, 2000.

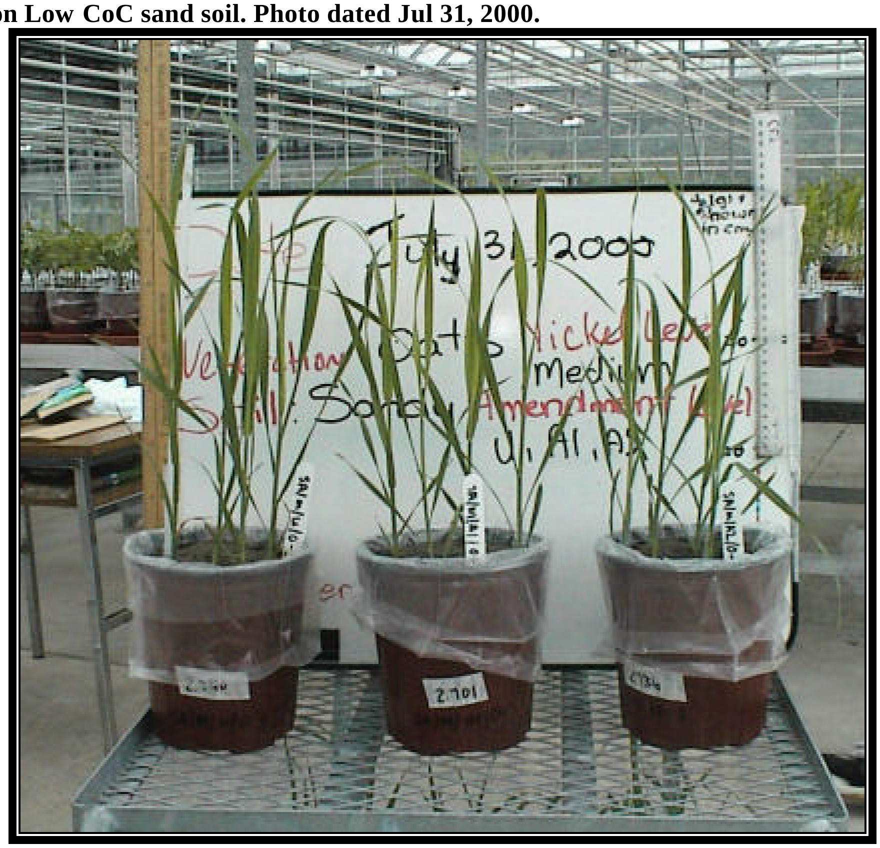

Plate 16: Oat on un-amended (left), amended 1X (centre), and 2X (right) OMAFRA recommended lime levels on Medium CoC sand soil. Photo dated Jul 31, 2000.

APPENDIX GH-2B
PHOTO PLATES - YEAR 2001

PHOTO PLATES 2001

Plate 17	Oat on Unamended Sand soil: Background to 2312 mg Ni /Kg (at harvest)
Plate 18	Oat on Amended Sand soil: Background to 2312 mg Ni /kg (at harvest)
Plate 19	Oat on Unamended Organic soil: Background to 2398 mg Ni/kg (at harvest)
Plate 20	Oat on Amended Organic soil: Background to 2398 mg Ni/kg (at harvest)
Plate 21	Oat on Unamended Welland Clay soil: Background to 1902 mg Ni/kg (at harvest)
Plate 22	Oat on Amended Welland Clay soil: Background to 1902 mg Ni/kg (at harvest)
Plate 23	Radish on Unamended Heavy Clay soil: Background to 1902 mg Ni/kg (at harvest)
Plate 24	Radish on Amended Heavy Clay soil: Background to 1902 mg Ni/kg (at harvest)
Plate 25	Oat on Till Clay Unamended soil: Background to 2545 mg Ni/kg (at harvest)
Plate 26	Oat on Amended Till Clay soil: Background to 2545 mg Ni/kg (at harvest)

Plate 17: Oat on unamended Sand soil: Background to 2310 mg Ni /kg (at harvest)

Plate 18: Oat on Amended Sand soil: Background to 2310 mg Ni /kg (at harvest)

Plate 19: Oat on unamended organic soil: Background to 2400 mg Ni/kg (at harvest)

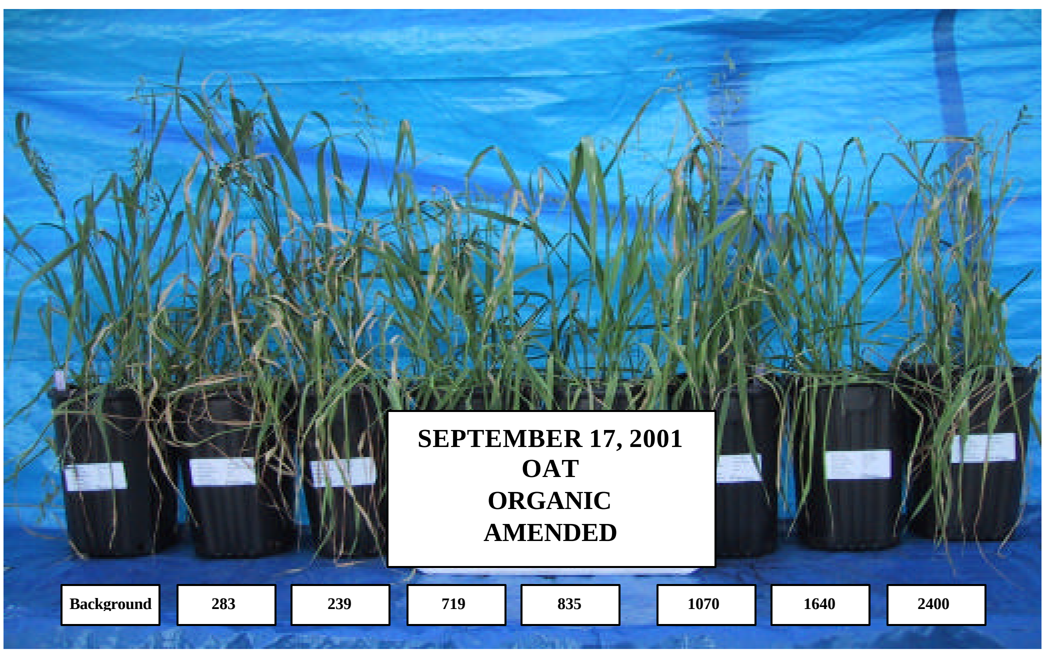

Plate 20: Oat on amended organic soil: Background to 2400 mg Ni/kg (at harvest)

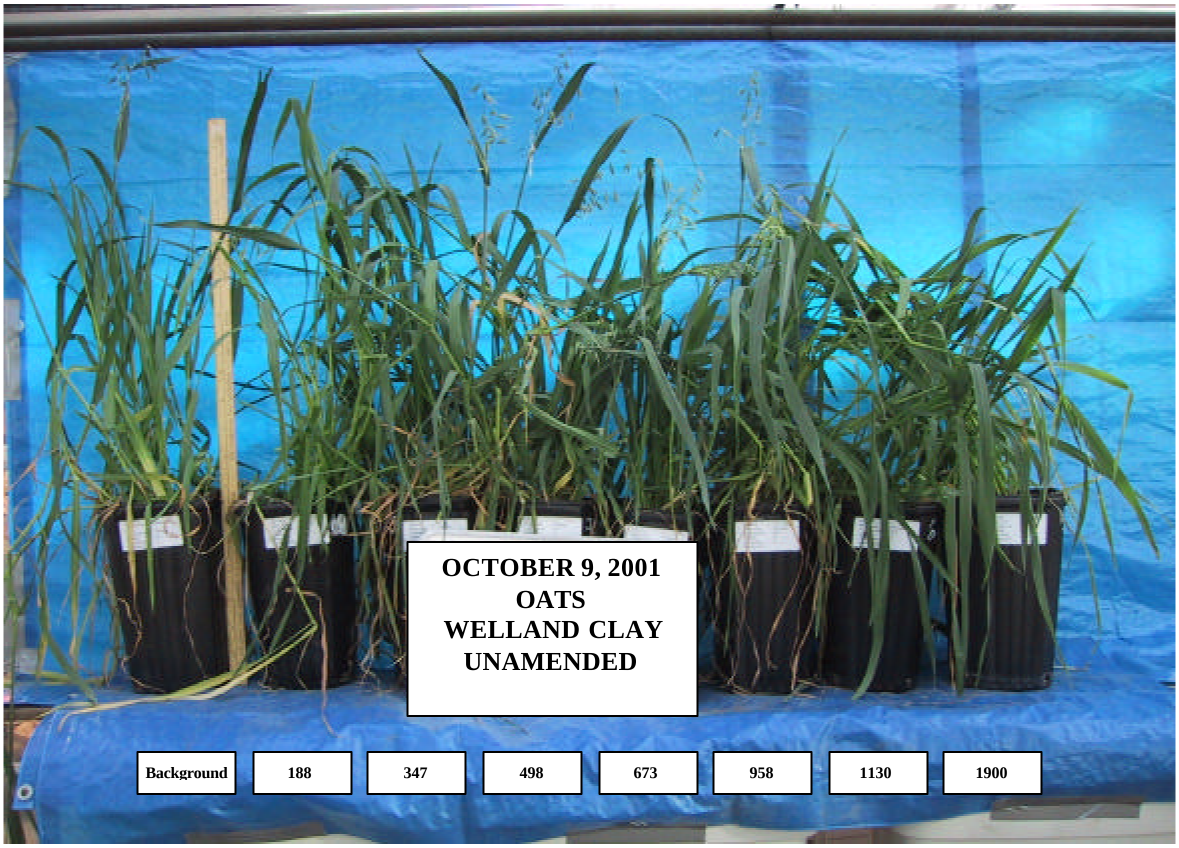

Plate 21: Oat on unamended Welland clay soil: Background to 1900 mg Ni/kg (at harvest)

Plate 22: Oat on amended Welland clay soil: Background to 1900 mg Ni/kg (at harvest)

Plate 23: Radish on unamended Welland Clay soil: Background to 1900 mg Ni/kg (at harvest)

Plate 24: Radish on amended Welland Clay soil: Background to 1900 mg Ni/kg (at harvest)

Plate 25: Oat on unamended Till clay soil: Background to 2540 mg Ni/kg (at harvest)

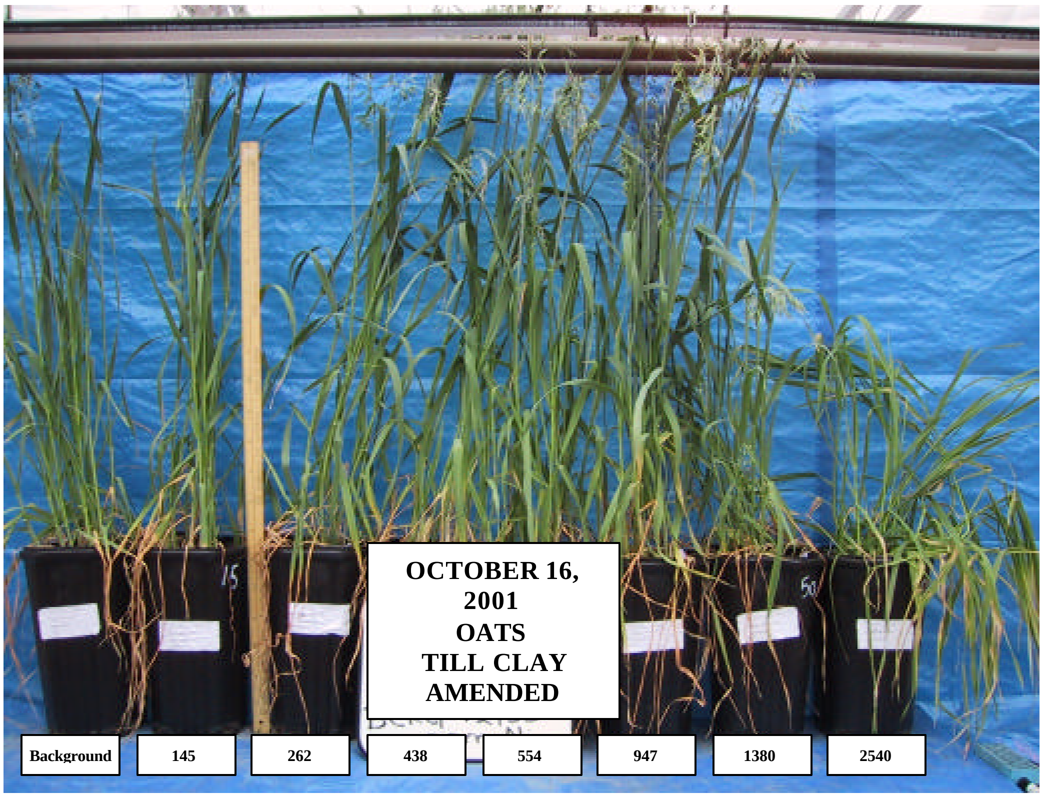

Plate 26: Oat on amended Till clay soil: Background to 2540 mg Ni/kg (at harvest)

APPENDIX GH-3

ANALYSIS OF SOIL PROPERTIES WITH RESPECT TO BLENDING: IMPLICATIONS FOR THE INTERPRETATION OF THE 2001 GREENHOUSE TRIALS DATA

APPENDIX GH-3

ANALYSIS OF SOIL PROPERTIES WITH RESPECT TO BLENDING: IMPLICATIONS FOR THE INTERPRETATION OF THE 2001 GREENHOUSE TRIALS DATA

The 2001 Greenhouse Trials used the technique of soil blending to create a range of soil Ni concentrations in which to study growth response of crop species (oat and radish). This method was chosen over the common practice of spiking soil with a soluble metal salt, which would have resulted in soil metal chemistries quite different from that naturally occurring in the field.

The blending process involved the sequential mixing of a high Ni soil and a background Ni soil for each of four soil types (Organic, Sand, Welland Clay and Till Clay) to achieve soil Ni concentrations that would allow construction of dose-response curves based on yield. The objective of the study was to generate specific EC (environmental concentrations for which toxic effects are observed) values for soil Ni and tissue Ni.

The selection of high and low Ni soils for each type was based on overall similarity of a number of soil parameters, including pH, cation exchange capacity (CEC), and concentrations of soil elements other than Ni. Despite the exhaustive search for soils that were comparable, a number of these variables were found to be heterogeneous between the pairs of high and low Ni soils, and this heterogeneity was subsequently carried through the blends.

Correlations between measures of soil variables and soil Ni concentration in the soil blends were determined using SPSS 11.0 software. Pearson r-values that describe the extent of the correlation are reported for individual soil types in Tables 1 to 4. Variables that are significantly correlated ($p<0.05$) with soil Ni concentration are confounded with this measure and must be taken into account when interpreting dose-response data based on Ni toxicity.

These tables also include percent differences between soil variable background values and the highest (or lowest when the highest value is in the background soil, which results in a negative percentage) values in the blends. For example, in Table 1, the highest As concentration measured in the organic soil is 19 μg/g; the percent difference between this value and the background value measured is 206.5 percent. This information provides important context for discussing the potential influence of the magnitude of these differences among the blends on plant growth. This influence can be exerted in one or more ways depending on the nature of the soil variable, including direct or indirect toxic or nutritional effects.

These tables show that there are large percent differences for a number of soil variables between background soil values and the highest (or lowest) blend values. It is impossible to fully understand the implications of these differences on plant growth, as direct effects cannot necessarily be predicted from soil concentrations or measures, nor can the influence of potential interactions between soil variables on plant response be completely understood.

In terms of magnitude, however, Ni shows the greatest difference, of all soil variables measured, between background soil concentrations and concentrations in the soil blends. And as confounding variables that could potentially exert toxic effects on plant growth are strongly correlated with soil Ni, protection of the environment from high Ni concentrations should provide protection from these by default.

TABLE 1. CORRELATIONS BETWEEN SOIL PROPERTIES FOR ORGANIC SOIL.

Correlations of soil properties with soil Ni (sig at 0.001; * sig at 0.05)**		**Percent difference between value of soil property in background soil and the highest (or lowest) value in the blends**		
Parameter	**Ni**	**Parameter**	**% diff**	**High Value**
Al	-.534**	Al	-22.5	9927
As	.948**	As	206.5	19
Be	-.579**	Be	-13.9	0.72
Co	.996**	Co	506.7	36.4
Cr	-.095	Cr	11.0	13.0
Cu	.994**	Cu	671.3	360.2
Mn	.590**	Mn	8.0	264.6
Ni	1.00**	Ni	2256	2370
Pb	.887**	Pb	59.5	47.2
Se	.923**	Se	266.7	6.6
V	-.693**	V	-13.7	26.43
Zn	.803**	Zn	15.7	129.6
CEC	.835**	CEC	221	16
LOI	.902**	LOI	10.0	68.5
MnO	.517	MnO	6.5	16900
FeO	.452	FeO	13.5	285
Totorgan	.375	Totorg	20.9	37.0
%org	-.966**	%org	-12.7	44.2
%sand	-.958**	%sand	-12.1	5.8
%silt	-.966**	%silt	-6.9	53.5
%clay	.968**	%clay	10.8	45.1
pH	-.213	pH	-2.8	5.81

TABLE 2. CORRELATIONS BETWEEN SOIL PROPERTIES FOR SAND SOIL.

Correlations of soil properties with soil Ni (** sig at 0.001; * sig at 0.05)		Percent difference between value of soil property in background soil and the highest (or lowest) value in the blends		
Parameter	**Ni**	**Parameter**	**% diff**	**High Value**
Al	-.018	Al	-19.5	3320
As	.997**	As	858	22.9
Be	.701**	Be	80.0	0.18
Co	.998**	Co	2641.2	46.6
Cr	.896**	Cr	-63.1	64.0
Cu	.994**	Cu	1735	269.4
Fe	.981**	Fe	442.5	27620
Mn	.988**	Mn	185.5	333.2
Ni	1.00**	Ni	4916	2386
P	-.803**	P	-49.8	1118
Pb	.987**	Pb	209.9	66
Sb	.033	Sb	114	0.3
Se	.975**	Se	1152.9	4.3
Ti	.564**	Ti	63.5	246.4
V	.423**	V	17.7	16.3
Zn	.794**	Zn	25.0	286.2
CEC	-.455	CEC	19.8	2.4
LOI	.024	LOI	22.4	6.8
MnO	.950**	MnO	185.5	333.2
FeO	.984**	FeO	597.2	18900
Totorgan	.520	Totorg	19.8	2.4
%org	.935**	%org	11.8	5.7
%sand	.994**	%sand	3.3	84.9
%silt	-.992**	%silt	-20.3	6.4
%clay	-.994**	%clay	-34.4	6.4
pH	-.319	pH	-2.7	7.4

TABLE 3. CORRELATIONS BETWEEN SOIL PROPERTIES FOR WELLAND CLAY SOIL.

Correlations of soil properties with soil Ni (sig at 0.001; * sig at 0.05)**		**Percent difference between value of soil property in background soil and the highest (or lowest) value in the blends**		
Parameter	**Ni**	**Parameter**	**% diff**	**High Value**
Al	-.276	Al	12.4	16150
As	.951**	As	378	10.2
Ba	.832**	Ba	29.0	104.4
Be	.778**	Be	32.8	0.7
Cd	.647**	Cd	138	0.7
Co	.990**	Co	458.5	27.2
Cr	.052	Cr	13.8	18.2
Cu	.988**	Cu	1235	233.6
Fe	.596**	Fe	12.9	13760
Mn	.522**	Mn	6.9	170.6
Ni	1.00**	Ni	4110	1806
P	.844**	P	27.8	878
Se	.882**	Se	456.5	2.6
V	-.148	V	17.7	25.0
Zn	.854**	Zn	26.4	79
CEC	.783**	CEC	48.9	6.7
LOI	.640**	LOI	49	21
MnO	.182	MnO	16.1	121.5
FeO	.297	FeO	18.4	8845
Totorgan	.873**	Totorg	31.1	7.2
%org	.975**	%org	19.8	13.3
%sand	-.986**	%sand	-12.4	12.1
%silt	.987**	%silt	1.6	38.2
%clay	.981**	%clay	-3.3	39.2
pH	-.781**	pH	7.6	6.4

TABLE 4. CORRELATIONS BETWEEN SOIL PROPERTIES FOR TILL CLAY SOIL.

Correlations of soil properties with soil Ni (sig at 0.001; *sig at 0.05)**		**Percent difference between value of soil property in background soil and the highest (or lowest) value in the blends**		
Parameter	**Ni**	**Parameter**	**% diff**	**High Value**
Al	.732**	Al	26.9	23033
As	.991**	As	276	16.5
Ba	.945**	Ba	72.3	144.2
Be	.973**	Be	85.7	1.3
Cd	.835**	Cd	241.3	1.3
Co	.998**	Co	574.3	47.2
Cr	.655**	Cr	25.9	29.2
Cu	.997**	Cu	1853	337.8
Fe	.909**	Fe	38.7	28750
Mn	-.984**	Mn	-59.3	952
Ni	1.00**	Ni	4871	2545
Pb	.884**	Pb	84.4	44.8
Sb	.612**	Sb	150	0.23
Se	.946**	Se	671	5.6
V	.624**	V	27.1	41.3
Zn	.967**	Zn	81.8	168.7
CEC	.946**	CEC	90	9.5
LOI	.992**	LOI	200	36.5
MnO	-971**	MnO	72.6	1030
FeO	.948**	FeO	15.2	20100
Totorgan	.960**	Totorg	299	13.4
%org	.982**	%org	79.2	13.8
%sand	-.980**	%sand	73.6	23.1
%silt	-.983**	%silt	39.7	52.6
%clay	.983**	%clay	191.6	48.4
pH	.927**	pH	11.7	6.13

APPENDIX GH-4
RADISH EXPERIMENTS ON WELLAND CLAY

APPENDIX GH-4: RADISH EXPERIMENTS ON WELLAND CLAY

The Dose-Response testing with Radish consisted of 80 pot tests, involving:

1. One Soil: Heavy Clay.
2. Eight Concentration Levels of Soil CoCs: background (Control) soil, and blended soils ranging from ~ 250 mg Ni/kg to 3,000 mg Ni/kg.
3. One Plant: Radish.
4. Unamended soil and soil receiving a calculated quantity of carbonate*.
5. Five Replications.

* - amendment application for the radish trial are the same as that listed for Welland Clay in the oat trials

Radish on Welland Clay

Radish was exposed to eight CoC concentrations (blends) in the Welland Clay soil. Nickel concentrations of 45.3 (Background), 188/248, 347, 498, 673/497, 956, 1130 and 1900 mg Ni/kg were used where the nickel concentrations separated by a slash were significantly different for unamended and amended soils respectively. The amended soils received an application of a mixture of reagent grade calcium and magnesium carbonate.

Symptoms Developed

In the greenhouse, 100% of the radish seeds sown in Heavy Clay soil germinated within 24 hrs of planting. Only the Radish plants grown in the 1900 mg Ni/kg pot tests with un-amended Heavy Clay soil exhibited very mild interveinal chlorosis of the older leaves. However, even then the globes appeared well developed and no malformations of the tubers were noticed during harvest.

Plant Yield

Generally, Plant Yield for radish did not change significantly with increasing soil CoC concentrations (Table GH-33a&b). The plant yield (compared to the plants growing in the background soil) remained constant despite increasing soil metal concentration in the plants exposed up to 1900 mg Ni/kg soil. The application of carbonate amendments was not observed to significantly affect the plant yield.

The Effective Concentration $_{25}$ (EC_{25}) was not determined for radish. Relatively low nickel concentrations in radish tissue across all soil CoC concentrations did not indicate that there was any nickel induced biomass effects for radish. The EC_{25} values applied to radish will be adopted based on those determined for the oat grown on Welland Clay as oat is more sensitive to nickel.

Welland Clay Soil Characteristics

Soils in which radish were planted were from the same bulk sample as those used for oat therefore, soil information applicable to radish is contained in Tables GH-27, GH-18, and GH-20 (Oat on Welland Clay soil characterization data) in Appendix GH-1B of this section.

Elemental Composition of Plants

Nickel concentrations measured in all radish tissues increased with increasing soil nickel levels (Tables GH-31a, GH-32d and GH-33a). In the “all leaves” samples, tissue nickel concentrations ranged from <1 mg/kg in the radish grown on unamended background soils up to 45 mg/kg in the highest nickel impacted soils (1900 mg/kg). Similarly for the basal leaves and the globes, tissue nickel concentrations ranged from 0.5 to 32 and 1.3 to 54 mg/kg respectively.

The application of the calcium and magnesium carbonates reduce tissue concentrations of nickel in all radish tissue types at the higher soil nickel concentrations. At the highest nickel concentrations, carbonate amendment resulted in reductions in tissue nickel from 45 to 29 mg/kg in “all leaves” samples; from 32 to 16 mg/kg in basal leaves; and from 54 to 34 mg/kg in radish globes (Tables GH-32 vs. b, GH-32a vs. b, and GH-33a vs. b,). These changes represent reduced metal uptake of approximately 50%. Similar decreases were observed between amended and unamended radish at lower soil CoC levels.

In all three tissue types, significant increases in tissue copper concentrations were observed only at the highest soil copper concentrations (Table GH-31a, GH-32a, and GH-33a). The application of the carbonate amendments did not change these trends (Table GH-31a, GH-32b, and GH-33b), however where significant increases in tissue copper were observed, application of carbonates significantly decreased uptake in all three tissues (amended vs. Un-amended at highest soil CoC concentrations). Overall, copper accumulation in the “all leaves” samples were significantly higher than that in the globes and basal leaves, however all concentrations were low in the normal range for copper in plant tissues (4-30 mg/kg) (Raven et al, 1992). Tissue concentrations ranged from 2.37 to 6.25 mg/kg. The highest concentration of tissue copper was found in plants exposed to highest soil CoC concentrations (1900 mg Ni/kg).

Cobalt accumulation in the radish increased significantly in all tissues as soil cobalt concentration increased (Table GH-31a, GH-32a, and GH-33a). This trend did not change with application of the carbonate mixture ((Table GH-31b, GH-32b, and GH-33b). Cobalt concentration did not exceed 0.57 mg/kg in any tissue or treatment. Generally, cobalt concentrations in radish were found to be limited in all treatments (close to the detection limits). Cobalt is indicated (Raven et al, 1992) as being necessary in trace amounts in plants. Even at the highest observed concentrations in radish, the cobalt levels observed here are not out of the normal range for plant tissues.

In the case of arsenic, accumulation in radish did not increase significantly across the various soil CoCs concentrations. Additionally, arsenic concentrations remained extremely low (all cases at or below the analytical detection limit). Application of the carbonate amendments had no obvious effect on As accumulation.

In all radish tissue, magnesium was observed to decline significantly with increasing soil CoC concentration while manganese was observed to increase. In the case of manganese, the increasing concentrations fall within the normal range of plant tissue concentrations, however, for magnesium, the concentrations observed are quite low compared to normal (0.1 – 0.8%) (Raven et al 1992) and could contribute substantially to deficiency symptoms (where observed). The CoC accumulation in the radish was elevated relative to that observed in oat.

Conclusion

Radish was chosen an alternative crop species in the 2001 Greenhouse trials to provide context for the EC25 values based on relative oat yield. However, results showed that radish yield was not adversely affected by increasing soil CoC concentrations in the Welland Clay blends, thereby making calculation of EC_{25}s impossible and limiting the resulting comparison value of the data.

APPENDIX GH-5:
pH EXPERIMENT ON WELLAND CLAY

APPENDIX GH-5: PH EXPERIMENT ON WELLAND CLAY

The pH Testing with Oat consisted of 50 tests, involving:

1. One Soil: Heavy Clay.
2. Two Concentration Levels of Soil CoCs: background (Control) soil and a blended soil with ~1900 mg Ni/kg.
3. Five pH Levels: 5.0, 5.5, 6.0, 6.5, and 7.0
4. One Plant: Oat.
5. Unamended soil (No amendments applied).
6. Five Replications.

pH Experiment

Application of reagent grade calcium carbonate ($CaCO_3$) and magnesium carbonate ($MgCO_3$) were used to create an incremental pH range in background and highly CoC impacted (~ 1900 mg Ni/kg) Welland clay soil. Following alteration, pH ranged from 4.83 (acidic) to 6.88 (near-neutral) in background soil, and from 5.78 to 7.11 in the impacted soil (Table GH-40). Reported pH measurements were obtained from soil/water slurries.

In oat grown on Welland clay soil containing background CoC levels, biomass (0.675 to 0.576 g/pot) did not change significantly through the range of increased pH observed. In contrast, plant biomass in the contaminated soil was observed to increase significantly with increased carbonate applications (as pH was raised above 6.2)(Table GH-41). Biomass produced on the impacted soil was noticeably lower than that of the background soil. However, biomass on the impacted soils was observed to double with higher carbonate application.

Although nickel and copper concentrations in shoot tissue of oat were relatively low in those plants grown on the background soils (Table GH-42a) a significant decrease for both metals was observed at higher pH levels. Very little difference was observed in cobalt uptake while arsenic levels were not detected in tissue samples. Manganese concentrations in oat tissue decreased significantly at higher pH levels while calcium uptake appeared to increase with pH.

In the highly impacted soil, nickel levels measured in oat tissue was markedly higher than that of the background soil (Table GH-42b), however, increased pH resulted in significant decline in tissue nickel concentrations. At near neutral pH levels, nickel uptake was almost cut in half relative to that observed in the oat growing on more acidic soil. Although copper levels in plant tissue remained low, a significant increase was observed as the soil pH was adjusted towards neutral levels. This increase was observed in both background and impacted soils but were more pronounced in the impacted soil with Cu tissue levels increasing from 6to 21mg/kg. Clear trends were not observed in cobalt and arsenic uptake.

Similarly to that observed in the background soil, manganese tissue concentrations were observed to decline significantly at the higher pH levels, indicating that carbonate amendments may interfere with Mn uptake.

From this brief experiment, it appears that carbonate application to impacted Welland clay soils results in soil pH increase and in the case of nickel a certain degree of protection to plants. The protection is likely due to the binding of nickel to carbonates at near neutral pH levels.

APPENDIX GH-6:

RELATIONSHIP BETWEEN SOIL EXTRACTABLE METALS AND PLANT METALS

APPENDIX GH-6: RELATIONSHIP BETWEEN SOIL EXTRACTABLE METALS AND PLANT METALS

Oat on Sand

Metals are extracted from soils by various methods as a means of predicting the amount of a metal contaminant that may be available to a plant and thereby determine if that contaminant is present in an adequate quantity to be potentially toxic. These methods may indicate the fraction of the soil contaminant that must be addressed when selecting treatments for phytotoxicity. Extraction methods have a predictive value if there is a correlation between the extractable pool of metal in a soil and the uptake of metal by a plant. Ideally, such a relationship should be linear, meaning that plant uptake is proportional to the extractable pool of metal in the soil. This is not usually the case under conditions of extreme metal toxicity. In extreme conditions, plant physiological processes are strongly affected, leading to an exponential increase in plant tissue contaminant concentration and an abnormal uptake of other essential and nonessential elements. In our study, water-based extractions along with three other extraction methods (based on quite different extraction principles) were used to examine potentially available metals in the various soils. The methods used the following extractants:

1. Water (Aqueous extraction)
2. Acid Ammonium Oxalate (Oxalate extraction)
3. DTPA
4. $Sr(NO_3)_2$

Each method was applied to a separate sub-sample of the soils, therefore the concentrations of CoCs extracted by each method will extract CoCs from similar fractions of the soil samples, with the weaker extractants affecting the more mobile/bioavailable fractions, and the stronger extractants affecting both the mobile/bioavailable and more strongly adsorbed CoC's. In effect, there will be an overlap in the fraction of total metals that are extracted by the different methods. In this regard, a range of available fractions can be observed for correlation to the varying accessibility of the different plant species.

The Geologic Survey of Canada (GSC) uses sodium acetate (NaOAc) extractions to indicate exchangeable/adsorbed metal fractions in soil (Hall and Pelchat, 1999). The water-based extraction used in this work is weaker than the GSC's sodium acetate method and as a result, the water extraction is expected to indicate only the easily soluble and/or immediately available metal in soil pore water (unbound metals that are essentially rinsed from the soil).

Total and Extractable nickel, copper, and cobalt in each of the greenhouse blends for each soil type are listed in Tables GH-18 to GH-20 of the Soil Selection and Characterization Report (Part 2). As previously indicated, the soil CoC values reported in the Soil Selection and Characterization report (Part 2) differ slightly from those in this volume as data sets were specific to each report.

In the sand soil, the concentrations of immediately available nickel extracted by the aqueous method was very low (in most cases <0.2% of the total metal concentration). In this type of extraction, severe nickel toxicity has been observed (in previous studies) in oat even at low (3.25 ppm) soil solution Ni concentrations.

The DTPA method has previously been used to assess availability in soils contaminated with nickel (Brown et al. 1989; Sauerbeck and Hein, 1991; Sheets et al. 1982) and is considered to be indicative of soil plant available nickel for soils within a small pH range. In the sand soil, the percentage of total nickel extracted with DTPA decreased with increasing soil metal concentration. At low soil CoC concentrations (up to 215 mg Ni/kg) DTPA extractions resulted in removal of up to 22% of the total soil nickel. Although the concentration of extractable nickel increased at the higher CoC concentrations, the percentage of DTPA extractable nickel decreased and remained low (9 and 8% at 1658 and 2386 mg Ni/kg respectively), possibly indicating that once deposited, substantial percentages of the metals become strongly bound within the soil. Decreased DTPA-extractable nickel may also have resulted from changes in nickel species in the soil. Nickel speciation will continually shift to maintain equilibrium and thereby provide a constant supply of DTPA extractable nickel species relative to soil concentration.

Acid ammonium oxalate, as the strongest treatment, extracted up to 53 % of the total nickel in the 215 mg Ni/kg soil blend. A similar decline in extraction % was observed for acid ammonium oxalate at higher CoC concentrations as was seen in the DTPA extractions.

Absolute concentrations of nickel extracted by the strontium nitrate extraction were low at all soil CoC concentrations. No extraction was measured to exceed 1% and in most cases, nickel concentrations in the extract were at or near the non-detection limit for the analytical method used.

With the exception of copper in the highest sand blend (269 mg/kg), neither copper nor cobalt concentrations exceed MOE Table A guidelines. As a result, extractable copper and cobalt have not been closely examined for the sand soil. Generally, the copper and cobalt concentrations in the soil are much lower than that of nickel. Previous statistical analysis has indicated that the deposition ratios for nickel, copper, and cobalt in soils collected from the Port Colborne Area (approximately 66: 8: 1 for the more impacted soils) shows a high correlation coefficient ($R^2 > 0.9$) (MOE 2000b).

There was no correlation between $Sr(NO_3)_2$-extractable soil nickel and its concentration in oat shoots because of the low extraction levels (at the detection limits for all the soil blends). Aqueous, DTPA, and acid ammonium oxalate extractable nickel were relatively well correlated with metal concentrations in plant (Table GH-19b shoots).

Oat on Organic

Aqueous extractable nickel percentage in the organic soil was generally low with only the lowest CoC blend exceeding 1 % , thus indicating a small pool of unbound nickel.

Stronger extractants (i.e., DTPA) resulted in a higher percentage of available nickel throughout the observed range of CoC concentrations. The percentage of total nickel extracted with DTPA increased with increasing soil nickel concentration. Up to 38 % of total nickel was extracted from middle CoC range blends (e.g., 687 mg/kg), while at the highest blend (2370 mg/kg) this extractable percentage dropped slightly to 31%. Although percentage extracted remained similar, larger absolute nickel quantities were extracted from the high blend compared to the intermediate blends. The decline in extraction percentage at the highest CoC concentration may result from the DTPA solution becoming saturated (with a variety of different metal ions), and thereby becoming ineffective in continued extraction. A more likely scenario is that (as indicated in the sand soil) nickel speciation shifts resulting in a normal percentage of the total nickel being available to DTPA at any given time.

acid ammonium oxalate, as the strongest treatment, extracted up to 39 % of the total nickel in the 227 mg/kg soil blend. A similar decline in % extraction was seen for acid ammonium oxalate as was seen in the DTPA extractions, likely for the same reasons.

Strontium nitrate, similar to the aqueous extractions did not result in significant amounts of the total nickel being extracted from the organic soil.

Aqueous, DTPA, and oxalate and strontium nitrate extractable nickel were relatively well correlated with tissue metal concentrations in oat shoots (Table GH-24b)

Oat on Welland Clay

Aqueous extraction in the Welland Clay soil did not exceed 2 %, indicating an extremely small pool of unbound nickel.

A stronger extractant (DTPA) resulted in extractions to a maximum of 21 % of the total nickel from any of the soil blends (0 = 18± 1%).

Acid ammonium oxalate extracted up to 33 % of the total nickel in the highest soil blend. The acid ammonium oxalate extraction percentages were similar (0 = 31 ± 1%) through all Welland Clay blends.

The lower nickel totals extracted from the Welland Clay soils with the stronger extractants (as compared to the Sand and Organic soils), is likely due to a greater capacity of the clay soil (relative to sand and organic soil) for binding metals.

Immediately available (aqueous extractable) copper was extremely low in the Welland Clay Soil.

DTPA extractions resulted ranged from 43 to 58 % of total copper being extracted from the soil (0 = 51 ± 5%).

acid ammonium oxalate proved to be the most efficient treatment for copper extraction in the Welland Clay soil. The mean recovery percentage was 75 ± 4%. This extraction also proved to extract the maximum copper concentration (193 mg/kg) from the highest Welland Clay blend.

Generally, cobalt was present in very low concentrations in the Welland Clay soil and as a result, very low absolute levels of cobalt were extracted by the various extraction methods. Immediately available (aqueous extractable) and strontium nitrate extractable cobalt was extremely low and although DTPA and Oxalate extraction percentages reached 19 and 44% respectively, absolute extractions did not exceed 12 mg Co/kg.

Aqueous, DTPA, oxalate and strontium nitrate extractable nickel and were all highly correlated with metal concentrations in plant shoots (Table GH-29b).

Oat on Till Clay

The nickel percentage considered to be immediately available (aqueous extraction) in the Till Clay soil did not exceed 1 %, indicating an extremely small pool of unbound nickel in this soil type.

A stronger extractant (DTPA) removed up to 17 % of the total nickel from any Till Clay soil blend, unlike in sand and organic soils. Extractable percentage also showed a slight decline with increasing CoC concentration..

Acid ammonium oxalate, as the strongest treatment, extracted up to 23% of the total nickel in the 262 mg/kg soil blend.The mean extraction was slightly lower (0 = 20 ± 3). The lower total nickel extracted from the Till Clay with the stronger extractants (as compared to the Sand and Organic soils), may result from the nature of the clay soil. Fine particle size and the resulting increase in soil surface area will provide more binding sites for metal ion, thus reducing the total metal available for extraction regardless of soil metal loading. Essentially, the capacity of clay to bind metals results in a competition between the extractant and the clay particles for the metal ions which ultimately decreases the amount of the metal ions extracted.

A greater quantity of the total copper and cobalt metal loads was extracted by the DTPA and acid ammonium oxalate methods relative to the other methods. Copper extractions reached 76% (acid ammonium oxalate) and cobalt reached 60 % (both with acid ammonium oxalate) however; the actual concentrations extracted (100 and 6 mg/kg respectively) were very low relative to the nickel extractions. The maximum total copper and cobalt extracted from the Till Clay soils was 224 and 16 mg/kg respectively in the highest CoC blends.

Aqueous extractable nickel was not correlated with the amount of Ni found in the plant shoots, because all the concentrations measured were at very low levels (detection limits). DTPA, and oxalate and strontium nitrate extractable Ni and were relatively well correlated with metal concentrations in plant shoots (Table GH-38b)

APPENDIX GH-7:

DESCRIPTION OF SOIL CHARACTERISTICS AND PLANT ELEMENTAL COMPOSITION

APPENDIX GH-7: DESCRIPTION OF SOIL CHARACTERISTICS AND PLANT ELEMENTAL COMPOSITION

Oat On Sand

Sand Soil Characteristics

The properties of the Sand soils used in this study are listed in Table GH-16 (Appendix GH-1B) and the pH of the soils prior to planting and after harvest in Table GH-17. As indicated in these tables CEC ranged from 1.9 to 2.5 meq/100 (mean = 2.1 ± 0.2), TOC ranged from 1.9 to 3.12 % (mean = 2.38 ± 0.38), and conductivity ranged from 0.33 to 0.39 mS/cm (mean = 0.35 ± 0.02). Sand pH measured in distilled water at harvest ranged from 7.11 to 7.31 (mean = 7.18 ± 0.06). Sand pH values had generally declined from that measured at the outset of the experiment.

Small value ranges and standard deviations for these parameters in sand blends indicate that a similar soil matrix (with the exception of the four CoCs) was achieved . Further, these characteristics did not co-vary with soil CoC concentration.

The concentrations of the CoC's in soil co-vary. Nickel concentrations in blends ranged from 46.2 mg/kg in the background soil, to 2310 mg/kg in the highest sand blend. Copper, cobalt, and arsenic also increased with background to high blend ranges of 14 to 270 mg Cu/kg, 1.7 to 49 mg Co/kg), and 2.5 to 24 mg As/kg.

Iron, (Fe), Manganese (Mn) and Phosphorus (P) are specifically addressed because they function as essential plant nutrients (Raven et. al, 1992), and they appear to co-vary with soil CoC concentration. Co variance is a result of the blending process and the fact that these soil characteristics differed between the raw background and High CoC soils. As a result, the blending process created a range of Fe, Mn, and P in the experimental blends. In the sand soils, iron and manganese concentrations were observed to increase substantially with CoC concentration while phosphorus was generally observed to decline (Table GH-16) ($mean_{Fe}$ = 12660 ± 8718; $mean_{Mn}$ = 193 ± 82; $mean_{P}$ = 857 ± 183). Iron increased five-fold in concentration from 5230 to 27600 mg/kg from the low to the high CoC blend, while manganese more then doubled (118 to 333 mg/kg). Across the soil blends, phosphorus concentrations were reduced by 50% (1110 to 561 mg/kg). Despite the variation in concentration ranges, these nutrients were found in amounts adequate for plant growth.

Elemental Composition of Plants

The observed tissue concentrations for the essential metals (i.e., Fe, Mn, P) were neither deficient nor phytotoxic in oat growing on unamended sand (unamended sand : $mean_{Fe} = 54 \pm 6$; $mean_{Mn} = 20 \pm 2$; $mean_{P} = 7571 \pm 1014$) (Table GH-18a). (Raven et. al, 1992).

Copper concentrations in oat shoot tissue increased significantly with increased soil Cu concentrations when compared to oat grown on those soils with background CoC concentrations (Table GH-18a). The highest concentration of Cu was found in plants exposed to the high level of CoCs (1630 mg Ni/kg) despite the fact that even higher Cu concentrations were present in the next blend (2310 mg Ni/kg).

Tissue Co concentrations increased as soil Ni concentrations increased, in both amended and unamended soils (Table GH-18a, Table GH-18b). However, these did not reach phytotoxic levels (Anderson et al., 1973; Hunter and Vergnano, 1952)

Arsenic accumulations in oat tissue also increased with soil CoC concentrations. The highest concentration of As found in oat shoots (2.4 mg/kg DW) was measured at the highest soil CoC concentration.

In a comparison of un-amended vs amended soils (Table GH-18a vs GH-18b), no decline in tissue concentrations was observed for any of the four CoCs in oat tissues for plants grown on the amended soils. It could be concluded that mushroom compost did not reduce the bioavailability of Ni to oat plants grown on high Ni soil (Table GH-18b), and therefore may not be an effective means of protecting oat from CoC toxicity in sand soils.

Plant analysis of the other elements in the un-amended treatment (Table GH-18a) and in the amended treatments (Table GH-18b) suggested that neither deficiency nor phytotoxicity would be expected to influence plant yield, thus the EC_{25} established for soil Ni would be independent of these elements.

Oat on Organic Soil

Organic Soil Characteristics

The properties of the organic soils used in this study are listed in Table GH-21 while the pH of the soils before and after harvest are listed in Table GH-22. As indicated in these tables, soil properties such as pH, CEC, and organic matter, are similar across the blends. Soil CEC ranged from 13.2 to 16.0 meq/100 (mean = 14.4 ± 0.8), TOC ranged from 30.6 to 37.0 % (mean = 33.3 ± 2.3), and conductivity ranged from 1.26 to 1.48 mS/cm (0= 1.35 ± 0.10). The pH for unamended Organic soil measured in distilled water at harvest ranged from 5.92 to 6.06 (mean = 6.00 ± 0.06). Organic soil pH values had generally increased from that measured at the outset of the experiment.

Small value ranges and standard deviations indicate that (as was seen in the sand blends) a relatively uniform soil matrix was achieved through blending of organic soils.

Nickel concentrations in blends ranged from 89.5 mg/kg in the background soil, up to 2400 mg/kg in the highest organic blend. Copper, cobalt, and arsenic also increased in background to high blends ranged from 46 to 360, 6 to 36, and 6 to 18 mg/kg respectively.

Iron (Fe), manganese (Mn) and phosphorus (P) concentrations remained relatively constant across blends regardless of CoC concentration ($mean_{Fe}$ = 15222 ± 326; $mean_{Mn}$ = 251 ± 7; $mean_{P}$ = 1120 ± 16). At the measured concentrations, Fe, Mn, and P are present in amounts adequate for plant growth (AAFRD, 1998; OMAFRA, 1997).

Elemental Composition of Plants

Although nickel accumulations in oat tissue remained relatively low (<1 - 35 mg/kg DW), concentrations increased significantly with increased soil nickel concentration with the shoots exposed to the highest soil nickel concentrations accumulating 35 mg/kg (Table GH-23a). The application of the calcium and magnesium carbonate as amendments did not significantly reduce the amount of tissue nickel in the plants in soil nickel concentrations, but was correlated with nickel in the plants exposed to high CoC concentrations (Table GH-23b).

The copper critical toxicity level in the leaves for most crop species is above 20-30 mg Cu/kg DW (Robson and Reuter, 1981). The levels of copper measured in the plant shoots were well below these levels (6 - 10 mg/kg DW). However, a statistically significant increase was observed when comparing the copper concentrations found in the plant growing in the background soil with the ones found in the plant exposed to various CoCs levels (Table GH-23a). The highest concentration of copper in plants was found in plants exposed to highest levels of soil CoCs (2400 mg Ni/kg). Amendment application did not reduce the amount of copper accumulated in the plants (Table GH-23b).

Cobalt accumulation in the plant shoots was found to be limited in all the plants and well below the critical toxicity level although accumulation did increase significantly as the soil CoCs concentrations increased (Table GH-23a). The highest cobalt concentration measured in the oat tissue did not exceed 0.1 mg/kg DW in the plant exposed to the highest soil CoCs concentrations. Application of the carbonate amendments was not observed to have an effect on the amount of Co accumulated in the oat tissue (Table GH-23b).

In the case of arsenic, accumulation in the plant shoots did not increase significantly relative to various soil As concentrations, with the exception of the plants growing in the highest soil As concentrations. The highest concentration of arsenic found in the plant shoots was 0.4 mg/kg DW (Table GH-23a).

Plant analysis indicated a severe Mn deficiency (<5 mg/kg Mn DW) despite the attempt in correcting the Mn induced deficiency by foliar spraying with manganese sulfate. Amendment application significantly decreased Mn concentrations in plants. Mn deficiencies have been shown to occur in organic soils following liming (Kukier and Chaney, 2000).

Oat on Welland Clay

Welland Clay Soil Characteristics

The properties of the Welland Clay soils used in this study are described in Table GH-26 and the pH of the soils before and after harvest in Table GH-27. As indicated in these tables, soil properties such as pH, CEC, and organic matter, are similar across the blends. Soil CEC ranged from 4.5 to 6.7 meq/100 (mean = 5.4 ± 0.8), and TOC ranged from 5.4 to 7.2 % (mean = 6.0 ± 0.6). Conductivity was not measured in Welland Clay.

The pH for unamended Welland Clay soil pH measured in distilled water at harvest ranged from ranged from 6.29 to 6.41 (mean = 6.34 ± 0.04). Welland Clay soil pH values generally increased from that measured at the outset of the experiment.

Nickel concentrations in blends ranged from 45.3 mg/kg in the background soil, up 1900 mg/kg in the highest blend. Copper, cobalt, and arsenic also increased with background to high blend ranges from 18.2 to 240, 4.8 to 29, and 2.2 to 10 mg/kg respectively (Table GH-26). The range of metal concentrations in each of the Welland Clay blends increased as originally projected.

From low to high soil CoC concentrations, Fe, Mn and P increase with CoC concentration. The concentrations of iron, manganese and phosphorus in Welland Clay soil were considered adequate for plant growth at the outset of the experiment (AAFRD, 1998; OMAFRA, 1997) and therefore the effects of nutrient toxicity or deficiencies were not expected to influence plant growth.

Elemental Composition of Plants

Nickel accumulation in plant shoots increased significantly as the soil CoCs concentrations increased. The highest Ni concentration measured was 52 mg/kg DW in the shoots exposed to the highest level of nickel in the soil (Table GH-28a). The increase in pH (from 6.34 to 6.71) by the application of calcium and magnesium had a statistically significant effect on the amount of nickel accumulated in the plants. This translated into a reduction in the amount of nickel accumulated by plants from 52 to 32mg/kg DW in the shoots. This decrease was observed in all the plants exposed to all soil CoC levels (Table GH-28b).

A statistically significant increase was observed in the copper concentrations found in the plants exposed to various CoCs levels with the ones found in the plants growing in the background soil (Table GH-28a). The highest concentration of copper in plants was found in plants exposed to highest levels of CoCs in the soil, (1900 mg Ni/kg), but was found to be well below the toxic threshold for this element. Amendment application had no effect on the amount of copper accumulated in the plants (Table 4. 14b).

Cobalt accumulation in the plant shoots was found to be low in all the plants and well below the toxic threshold for this element; accumulation did increase slightly with soil CoC concentrations (Table GH-28a). Although cobalt levels measured in the plant shoots were low across all treatments, a statistically significant increase was observed at the highest soil CoC levels where the plant shoots accumulated 0.04 and 0.1 mg Co/kg DW. No effect on the amount of Co accumulated in the plant shoots was observed by the application of amendment (Table 4. 14b).

In the case of arsenic, accumulation in the plant shoots did not increase significantly with increased soil CoC concentrations. The highest concentration of arsenic found in the plant shoots was 0.3 mg/kg DW (Table 4. 14a), again well below the toxic threshold. Amendment application did not have any observable effect on the amount of arsenic accumulating in the plant shoots (Table 4. 14b).

Oat on Till Clay

Till Clay Soil Characteristics

The properties of the Till Clay soils used in this study are described in Table GH-35 and the pH of the soils before and after harvest in Table GH-36. Unlike the other soils, properties such as pH, CEC, and organic matter varied substantially among blends. Soil CEC nearly doubled from low to high CoC concentrations, ranging from 4.10 to 9.50 meq/100 (mean = 5.78 ± 1.8). This increase may contribute to increased binding of CoCs in the higher blends and contribute slightly to protecting the plants from CoC impacts. TOC ranged from 3.36 to 13.40 % (mean = 6.25 ± 3.5) This difference may be indicative of variation in soil types used to create the Till Clay blends. The pH for unamended Till Clay soil measured in distilled water at harvest increased significantly from low to high CoC blends. This increase however was slight ranging from 6.19 to 6.63 (mean = 6.43 ± 0.15). Till Clay soil pH values generally increased in all blends from that measured at the outset of the experiment.

Nickel concentrations in blends ranged from 51 mg/kg in the background soil, up 2540 mg/kg in the highest blend. Copper, cobalt, and arsenic also increased with background and high blend ranges from 17 to 338, 7 to 47, and 4.4 to 16 mg/kg respectively.

Iron (mean = 23685 ± 2509 mg/kg) and phosphorus (mean = 809 ± 193 mg/kg) concentrations were similar (30% analytical acceptability for soil) across CoC concentrations. Manganese on the other hand declined slowly with increasing CoC concentration and was observed to decline drastically in the highest CoC concentration. Fe, Mn, and P were considered to be present in amounts adequate for plant growth (AAFRD, 1998; OMAFRA, 1997) at the outset of the experiment.

Elemental Composition of Plants

Nickel accumulation in plant shoots increased significantly with soil CoC concentrations (Table GH-37a). However total tissue concentrations were relatively low overall with the highest tissue concentration reaching only 25 mg Ni/kg DW in the shoots exposed at the highest level of soil nickel. The application of the calcium and magnesium carbonates (pH increase from 6.59 to 6.97) did not affect the accumulation of nickel in oat tissue (Table GH-37b).

Copper accumulation in the plant shoots increased significantly with soil CoC concentration. Tissue concentrations ranged from 2.68 to 11.56 mg/kg (Table GH-37a). The highest concentration of tissue copper was found in plants exposed to highest soil CoC concentrations (2540 mg Ni/kg). Carbonate application had no effect copper accumulation in oat (Table GH-37b).

Cobalt accumulation in the oat shoots was found to be limited in all blends (close to the detection limits). Increase in tissue cobalt was not statistically significant with increased soil CoC concentrations (Table GH-37a). Oat shoots accumulations of Co were not affected by the application of carbonates (Table GH-37b).

In the case of arsenic, accumulation in the plant shoots did not increase significantly across the various soil CoCs concentrations, with the exception of plants exposed to the highest levels of CoCs in the soil. The highest concentration of As found in the plant shoots was 0.5 mg/kg DW (Table GH-37a). Application of the carbonate amendments had no effect on the amount of As accumulated in the plant shoot tissue (Table GH-37b).

Oat plants grown in the blends with the highest CoC content demonstrated a statistically significant increase in tissue calcium, iron, magnesium and zinc concentrations, while manganese content decreased significantly.

APPENDIX GH-8
SOIL BLENDING SENSITIVITY ANALYSIS DATA TABLE

APPENDIX GH-8:

Soil Blending Sensitivity Analysis Data Table: Total, DTPA- and H_20-extractable Ni concentrations in Unblended Clay, Blended Welland Clay and Blended Till Clay

Unblended clay[3]			Blended Welland Clay[2]			Blended Till Clay[1]		
Total Ni (mg/g)	**DTPA-Ni (mg/g)**	**H_2O-Ni (mg/g)**	**Total Ni (mg/g)**	**DTPA-Ni (mg/g)**	**H_2O-Ni (mg/g)**	**Total Ni (mg/g)**	**DTPA-Ni (mg/g)**	**H_2O-Ni (mg/g)**
34	4	0	45	8	0.3	51	9	0.3
194	27	0.5	188	34	0.8	145	23	0.3
517	70	1.7	347	60	1.1	262	38	0.8
636	50	1.2	498	90	1.4	438	49	0.8
1040	66	4.2	650	118	1.9	553	70	1.2
1350	232	6.6	957	176	2.7	947	147	2.7
3110	528	19.8	1129	189	3.2	1375	176	2.7
3430	408	8.6	1902	378	6.0	2545	309	5.1
5920	817	28.9	-	-	-	-	-	-

Notes:
1. Data from yr 2001 greenhouse Till Clay blends
2. Data from yr 2001 greenhouse Welland Clay blends
3. Data accumulated from unblended clay soils in 2001 field work, yr 2000 greenhouse trials and yrs 2000 and 2001 field trials; unblended soils include both Till Clay and Welland Clay soil types

FIELD TRIALS
2000 & 2001

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APPENDIX F-1

TISSUE CoC CONCENTRATIONS FOR CROPS GROWN DURING 2001 FIELD TRIALS

Table 1 Uptake Of CoCs into Agronomic Corn Tissue at C2 And C3 Test Sites During 2001.[1]

Test Site	Amend.[2]	Nickel			Copper			Cobalt			Arsenic		
		Soil (mg/kg)	Tissue (mg/kg)	Ratio[3] (as %)	Soil (mg/kg)	Tissue (mg/kg)	Ratio (as %)	Soil (mg/kg)	Tissue (mg/kg)	Ratio (as %)	Soil (mg/kg)	Tissue (mg/kg)	Ratio (as %)
C2	UN	4950 ± 1200	**2.6** [a] **± 0.5**	<1	596 ± 126	6.40 ± 5.74	1	75 ± 13	**0.12** [a] **± 0.05**	<1	28.8 ± 3.8	nd[4]	-
	1X	4730 ± 930	**2.3** [a] **± 0.7**	<1	584 ± 94	5.08 ± 0.84	1	72 ± 10	**0.12** [a] **± 0.05**	<1	28.2 ± 3.3	nd	-
	2X	5030 ± 1490	**2.5** [a] **± 0.8**	<1	596 ± 128	5.08 ± 0.58	1	76 ± 18	**0.13** [a] **± 0.04**	<1	28.9 ± 5.1	nd	-
	Cal	4020 ± 830	**1.2** [b] **± 0.3**	<1	490 ± 87	3.98 ± 0.50	1	64 ± 10	**0.17** [b] **± 0.04**	<1	25.3 ± 5.0	0.2 ± 0.1	1
C3	UN	**3210** [a] **± 350**	**19.6** [a] **± 6.1**	1	388 ± 39	5.19 ± 0.90	1	**48** [a] **± 5**	**0.38** [a] **± 0.15**	1	17.7 ± 2.1	nd	-
	1X	**3110** [ab] **± 410**	**6.1** [b] **± 0.8**	<1	380 ± 46	5.37 ± 0.74	1	**47** [ab] **± 6**	**0.19** [b] **± 0.03**	<1	17.5 ± 3.7	nd	-
	Cal	**2980** [b] **± 270**	**3.8** [b] **± 1.0**	<1	369 ± 36	6.68 ± 5.05	2	**45** [b] **± 4**	**0.15** [b] **± 0.03**	<1	17.4 ± 2.2	nd	-

Notes
1 Values presented are means ± standard deviation. Values in bold type indicate a significant difference was noted between treatments within a site. Superscript letters indicate grouping, based on Tukey's Posthoc test.
2 Amendment treatments, as described in Section 2.3. UN = Unamended, 1X = 1X OMAFRA levels, 2X = 2X OMAFRA levels, Cal = Calcareous.
3 Ratios are percentage of total CoC concentration found in plant tissue, to the nearest integer.
4 nd = not detected. Ratios were not calculated for these values.

Table 2 Uptake of CoCs into Toxicological Corn Tissue at C2 and C3 Test Sites During 2001.[1]

Test Site	Amend.[2]	Nickel			Copper			Cobalt			Arsenic		
		Soil (mg/kg)	Tissue (mg/kg)	Ratio[3] (as %)	Soil (mg/kg)	Tissue (mg/kg)	Ratio (as %)	Soil (mg/kg)	Tissue (mg/kg)	Ratio (as %)	Soil (mg/kg)	Tissue (mg/kg)	Ratio (as %)
C2	UN	4950 ± 1200	7.2 ± 1.7	<1	596 ± 126	**5.41** [ab] **± 0.85**	1	75 ± 13	**0.33** [a] **± 0.06**	<1	28.8 ± 3.8	**0.8** [ab] **± 0.3**	3
	1X	4730 ± 930	8.4 ± 4.5	<1	584 ± 94	**6.34** [a] **± 1.94**	1	72 ± 10	**0.42** [b] **± 0.11**	1	28.2 ± 3.3	**1.1** [c] **± 0.3**	4
	2X	5030 ± 1490	7.3 ± 3.0	<1	596 ± 128	**5.64** [ab] **± 1.16**	1	76 ± 18	**0.34** [a] **± 0.06**	<1	28.9 ± 5.1	**0.9** [bc] **± 0.3**	3
	Cal	4020 ± 830	5.1 ± 4.7	<1	490 ± 87	**4.73** [b] **± 1.3**	1	64 ± 10	**0.36** [ab] **± 0.10**	1	25.3 ± 5.0	**0.6** [a] **± 0.3**	2
C3	UN	**3210** [a] **± 350**	**55.4** [a] **± 14.1**	2	388 ± 39	6.13 ± 1.23	2	**48** [a] **± 5**	**0.70** [a] **± 0.18**	1	17.7 ± 2.1	0.5 ± 0.1	3
	1X	**3110** [ab] **± 410**	**16.4** [b] **± 3.8**	1	380 ± 46	6.23 ± 1.13	2	**47** [ab] **± 6**	**0.39** [b] **± 0.11**	1	17.5 ± 3.7	0.4 ± 0.1	2
	Cal	**2980** [b] **± 270**	**10.0** [b] **± 2.7**	<1	369 ± 36	6.66 ± 1.98	2	**45** [b] **± 4**	**0.40** [ab] **± 0.15**	1	17.4 ± 2.2	0.3 ± 0.1	2

Notes
1 Values presented are means ± standard deviation. Values in bold type indicate a significant difference was noted between treatments within a site. Superscript letters indicate grouping, based on Tukey's Posthoc test.
2 Amendment treatments, as described in Section 2.3. UN = Unamended, 1X = 1X OMAFRA levels, 2X = 2X OMAFRA levels, Cal = Calcareous.
3 Ratios are percentage of total CoC concentration found in plant tissue, to the nearest integer.

Table 3 Uptake of CoCs into Corn Crop Yield Tissue at C2 Test Site During 2001.[1]

Test Site	Amend.[2]	Nickel			Copper			Cobalt			Arsenic		
		Soil (mg/kg)	Tissue (mg/kg)	Ratio[3] (as %)	Soil (mg/kg)	Tissue (mg/kg)	Ratio (as %)	Soil (mg/kg)	Tissue (mg/kg)	Ratio (as %)	Soil (mg/kg)	Tissue (mg/kg)	Ratio (as %)
C2	UN	4950 ± 1200	**2.6** [a] **± 0.6**	<1	596 ± 126	**1.42** [a] **± 0.14**	<1	75 ± 13	**0.03** [b] **± 0.01**	<1	28.8 ± 3.8	nd[4]	-
	1X	4730 ± 930	**2.6** [a] **± 0.6**	<1	584 ± 94	**1.43** [a] **± 0.15**	<1	72 ± 10	**0.03** [a] **± 0.01**	<1	28.2 ± 3.3	nd	-
	2X	5030 ± 1490	**2.8** [ab] **± 0.4**	<1	596 ± 128	**1.37** [a] **± 0.10**	<1	76 ± 18	**0.04** [c] **± 0.01**	<1	28.9 ± 5.1	nd	-
	Cal	4020 ± 830	**3.2** [b] **± 1.3**	<1	490 ± 87	**1.98** [b] **± 1.16**	<1	64 ± 10	**0.03** [a] **± 0.00**	<1	25.3 ± 5.0	nd	-

Notes
1 Values presented are means ± standard deviation. Values in bold type indicate a significant difference was noted between treatments within a site. Superscript letters indicate grouping, based on Tukey's Posthoc test.
2 Amendment treatments, as described in Section 2.3. UN = Unamended, 1X = 1X OMAFRA levels, 2X = 2X OMAFRA levels, Cal = Calcareous. Corn cobs were not harvested from the C3 Test Site.
3 Ratios are percentage of total CoC concentration found in plant tissue, to the nearest integer.
4 nd = not detected. Ratios were not calculated for these values.

Table 4 Uptake of CoCs into Agronomic Radish at C2 Test Site During 2001.[1]

Test Site	Amend.[2]	Nickel			Copper			Cobalt			Arsenic		
		Soil (mg/kg)	Tissue (mg/kg)	Ratio[3] (as %)	Soil (mg/kg)	Tissue (mg/kg)	Ratio (as %)	Soil (mg/kg)	Tissue (mg/kg)	Ratio (as %)	Soil (mg/kg)	Tissue (mg/kg)	Ratio (as %)
C2	UN	4950 ± 1200	**71.1** [a] **± 36.8**	1	596 ± 126	**12.8** [a] **± 3.6**	2	75 ± 13	**1.5** [a] **± 0.6**	2	28.8 ± 3.8	**0.4** [a] **± 0.2**	1
	1X	4730 ± 930	**71.5** [a] **± 36.1**	2	584 ± 94	**14.7** [a] **± 3.2**	3	72 ± 10	**1.6** [a] **± 0.6**	2	28.2 ± 3.3	**0.5** [a] **± 0.2**	2
	2X	5030 ± 1490	**64.4** [a] **± 37.9**	1	596 ± 128	**13.3** [a] **± 4.2**	2	76 ± 18	**1.6** [a] **± 0.7**	2	28.9 ± 5.1	**0.5** [a] **± 0.3**	2
	Cal	4020 ± 830	**122** [b] **± 63**	3	490 ± 87	**24.7** [b] **± 7.5**	5	64 ± 10	**2.5** [b] **± 1.0**	4	25.3 ± 5.0	**0.7** [b] **± 0.4**	3

Notes
1 Values presented are means ± standard deviation. Values in bold type indicate a significant difference was noted between treatments within a site. Superscript letters indicate grouping, based on Tukey's Posthoc test.
2 Amendment treatments, as described in Section 2.3. UN = Unamended, 1X = 1X OMAFRA levels, 2X = 2X OMAFRA levels, Cal = Calcareous.
3 Ratios are percentage of total CoC concentration found in plant tissue, to the nearest integer.

Table 5 Uptake of CoCs into Toxicological Radish Tissue at C2 Test Site During 2001.[1]

Test Site	Amend.[2]	Nickel			Copper			Cobalt			Arsenic		
		Soil (mg/kg)	Tissue (mg/kg)	Ratio[3] (as %)	Soil (mg/kg)	Tissue (mg/kg)	Ratio (as %)	Soil (mg/kg)	Tissue (mg/kg)	Ratio (as %)	Soil (mg/kg)	Tissue (mg/kg)	Ratio (as %)
C2	UN	4950 ± 1200	**54.7** [a] **± 16.1**	1	596 ± 126	**11.2** [a] **± 2.9**	2	75 ± 13	**1.1** [a] **± 0.3**	2	28.8 ± 3.8	**0.6** [a] **± 0.1**	2
	1X	4730 ± 930	**55.1** [a] **± 18.7**	1	584 ± 94	**12.3** [a] **± 2.7**	2	72 ± 10	**1.2** [a] **± 0.3**	2	28.2 ± 3.3	**0.6** [a] **± 0.2**	2
	2X	5030 ± 1490	**52.4** [a] **± 26.0**	1	596 ± 128	**11.8** [a] **± 4.4**	2	76 ± 18	**1.2** [a] **± 0.5**	2	28.9 ± 5.1	**0.6** [a] **± 0.2**	2
	Cal	4020 ± 830	**128** [b] **± 39**	3	490 ± 87	**25.9** [b] **±5 .4**	5	64 ± 10	**2.7** [b] **± 0.6**	4	25.3 ± 5.0	**1.0** [b] **± 0.2**	4

Notes
1 Values presented are means ± standard deviation. Values in bold type indicate a significant difference was noted between treatments within a site. Superscript letters indicate grouping, based on Tukey's Posthoc test.
2 Amendment treatments, as described in Section 2.3. UN = Unamended, 1X = 1X OMAFRA levels, 2X = 2X OMAFRA levels, Cal = Calcareous.
3 Ratios are percentage of total CoC concentration found in plant tissue, to the nearest integer.

Table 6 Uptake of CoCs into Radish Globes (Crop Yield Tissue) at C2 Test Site During 2001.[1]

Test Site	Amend.[2]	Nickel Soil (mg/kg)	Nickel Tissue (mg/kg)	Nickel Ratio[3] (as %)	Copper Soil (mg/kg)	Copper Tissue (mg/kg)	Copper Ratio (as %)	Cobalt Soil (mg/kg)	Cobalt Tissue (mg/kg)	Cobalt Ratio (as %)	Arsenic Soil (mg/kg)	Arsenic Tissue (mg/kg)	Arsenic Ratio (as %)
C2	UN	4950 ± 1200	**42.5** [b] **± 10.9**	1	596 ± 126	**8.2** [a] **± 1.7**	1	75 ± 13	**1.0** [ab] **± 0.2**	1	28.8 ± 3.8	**0.3** [a] **± 0.1**	1
	1X	4730 ± 930	**32.0** [a] **± 9.4**	1	584 ± 94	**7.7** [a] **± 1.4**	1	72 ± 10	**0.9** [a] **± 0.2**	1	28.2 ± 3.3	**0.3** [a] **± 0.1**	1
	2X	5030 ± 1490	**34.8** [a] **± 14.3**	1	596 ± 128	**7.9** [a] **± 2.2**	1	76 ± 18	**1.1** [bc] **± 0.4**	1	28.9 ± 5.1	**0.3** [a] **± 0.2**	1
	Cal	4020 ± 830	**43.2** [b] **± 10.2**	1	490 ± 87	**10.0** [b] **± 1.8**	2	64 ± 10	**1.2** [c] **± 0.2**	2	25.3 ± 5.0	**0.6** [b] **± 0.1**	2

Notes
1 Values presented are means ± standard deviation. Values in bold type indicate a significant difference was noted between treatments within a site. Superscript letters indicate grouping, based on Tukey's Posthoc test.
2 Amendment treatments, as described in Section 2.3. UN = Unamended, 1X = 1X OMAFRA levels, 2X = 2X OMAFRA levels, Cal = Calcareous.
3 Ratios are percentage of total CoC concentration found in plant tissue, to the nearest integer.

Table 7 Uptake of CoCs into Agronomic Oat Tissue at C2 And C3 Test Sites During 2001.[1]

Test Site	Amend.[2]	Nickel Soil (mg/kg)	Nickel Tissue (mg/kg)	Nickel Ratio[3] (as %)	Copper Soil (mg/kg)	Copper Tissue (mg/kg)	Copper Ratio (as %)	Cobalt Soil (mg/kg)	Cobalt Tissue (mg/kg)	Cobalt Ratio (as %)	Arsenic Soil (mg/kg)	Arsenic Tissue (mg/kg)	Arsenic Ratio (as %)
C2	UN	4950 ± 1200	**21.8** [a] **± 6.4**	<1	596 ± 126	**9.97** [a] **± 0.65**	2	75 ± 13	**0.32** [a] **± 0.04**	<1	28.8 ± 3.8	**1.3** [a] **± 0.4**	5
	1X	4730 ± 930	**12.2** [b] **± 4.9**	<1	584 ± 94	**10.28** [a] **± 0.86**	2	72 ± 10	**0.29** [a] **± 0.04**	<1	28.2 ± 3.3	**1.0** [b] **± 0.2**	4
	2X	5030 ± 1490	**13.4** [b] **± 4.1**	<1	596 ± 128	**9.79** [a] **± 0.65**	2	76 ± 18	**0.32** [a] **± 0.08**	<1	28.9 ± 5.1	**0.8** [b] **± 0.1**	3
	Cal	4020 ± 830	**14.9** [b] **± 3.3**	<1	490 ± 87	**8.98** [b] **± 0.70**	2	64 ± 10	**0.15** [b] **± 0.04**	<1	25.3 ± 5.0	**0.6** [c] **± 0.4**	2
C3	UN	**3210** [a] **± 350**	**135** [a] **± 15**	4	388 ± 39	**6.06** [a] **± 1.30**	2	**48** [a] **± 5**	**0.69** [a] **± 0.06**	1	17.7 ± 2.1	0.2 ± 0.1	1
	1X	**3110** [ab] **± 410**	**78.1** [b] **± 10.2**	3	380 ± 46	**8.32** [b] **± 1.58**	2	**47** [ab] **± 6**	**0.44** [b] **± 0.06**	1	17.5 ± 3.7	0.3 ± 0.1	2
	Cal	**2980** [b] **± 270**	**62.4** [c] **± 8.8**	2	369 ± 36	**8.99** [b] **± 1.10**	2	**45** [b] **± 4**	**0.41** [b] **± 0.04**	1	17.4 ± 2.2	0.3 ± 0.1	2

Notes
1 Values presented are means ± standard deviation. Values in bold type indicate a significant difference was noted between treatments within a site. Superscript letters indicate grouping, based on Tukey's Posthoc test.
2 Amendment treatments, as described in Section 2.3. UN = Unamended, 1X = 1X OMAFRA levels, 2X = 2X OMAFRA levels, Cal = Calcareous.
3 Ratios are percentage of total CoC concentration found in plant tissue, to the nearest integer.

Table 8 Uptake of CoCs into Toxicological Oat Tissue at C2 and C3 Test Sites During 2001.[1]

Test Site	Amend.[2]	Nickel			Copper			Cobalt			Arsenic		
		Soil (mg/kg)	Tissue (mg/kg)	Ratio[3] (as %)	Soil (mg/kg)	Tissue (mg/kg)	Ratio (as %)	Soil (mg/kg)	Tissue (mg/kg)	Ratio (as %)	Soil (mg/kg)	Tissue (mg/kg)	Ratio (as %)
C2	UN	4950 ± 1200	**20.0** [a] **± 7.3**	<1	596 ± 126	9.53 ± 0.71	2	75 ± 13	**0.34** [a] **± 0.12**	<1	28.8 ± 3.8	**1.7** [a] **± 0.5**	6
	1X	4730 ± 930	**10.9** [b] **± 3.7**	<1	584 ± 94	9.47 ± 1.40	2	72 ± 10	**0.29** [a] **± 0.05**	<1	28.2 ± 3.3	**1.2** [b] **± 0.2**	4
	2X	5030 ± 1490	**13.7** [b] **± 6.8**	<1	596 ± 128	9.46 ± 0.80	2	76 ± 18	**0.35** [a] **± 0.18**	<1	28.9 ± 5.1	**1.1** [bc] **± 0.2**	4
	Cal	4020 ± 830	**13.2** [b] **± 2.5**	<1	490 ± 87	9.43 ± 0.74	2	64 ± 10	**0.20** [b] **± 0.06**	<1	25.3 ± 5.0	**0.9** [c] **± 0.3**	4
C3	UN	**3210** [a] **± 350**	**114** [a] **± 22**	4	388 ± 39	**6.97** [a] **± 1.55**	2	**48** [a] **± 5**	**0.75** [a] **± 0.15**	2	17.7 ± 2.1	**0.4** [a] **± 0.1**	2
	1X	**3110** [ab] **± 410**	**74.2** [b] **± 13.1**	2	380 ± 46	**8.75** [b] **± 1.49**	2	**47** [ab] **± 6**	**0.48** [b] **± 0.06**	1	17.5 ± 3.7	**0.3** [ab] **± 0.1**	2
	Cal	**2980** [b] **± 270**	**61.6** [c] **± 13.2**	2	369 ± 36	**9.52** [c] **± 1.19**	3	**45** [b] **± 4**	**0.44** [b] **± 0.05**	1	17.4 ± 2.2	**0.3** [b] **± 0.1**	2

Notes
1 Values presented are means ± standard deviation. Values in bold type indicate a significant difference was noted between treatments within a site. Superscript letters indicate grouping, based on Tukey's Posthoc test.
2 Amendment treatments, as described in Section 2.3. UN = Unamended, 1X = 1X OMAFRA levels, 2X = 2X OMAFRA levels, Cal = Calcareous.
3 Ratios are percentage of total CoC concentration found in plant tissue, to the nearest integer.

Table 9 Uptake of CoCs into Oat Crop Yield Tissue at C2 Test Site During 2001.[1]

Test Site	Amend.[2]	Nickel			Copper			Cobalt			Arsenic		
		Soil (mg/kg)	Tissue (mg/kg)	Ratio[3] (as %)	Soil (mg/kg)	Tissue (mg/kg)	Ratio (as %)	Soil (mg/kg)	Tissue (mg/kg)	Ratio (as %)	Soil (mg/kg)	Tissue (mg/kg)	Ratio (as %)
C2	UN	4950 ± 1200	**58.1** [a] **± 10.7**	1	596 ± 126	**6.58** [a] **± 0.48**	1	75 ± 13	**0.22** [a] **± 0.03**	<1	28.8 ± 3.8	nd[4]	-
	1X	4730 ± 930	**41.6** [b] **± 12.3**	1	584 ± 94	**6.56** [a] **± 0.52**	1	72 ± 10	**0.16** [b] **± 0.04**	<1	28.2 ± 3.3	nd	-
	2X	5030 ± 1490	**45.5** [b] **± 11.7**	1	596 ± 128	**6.84** [a] **± 0.73**	1	76 ± 18	**0.18** [c] **± 0.04**	<1	28.9 ± 5.1	nd	-
	Cal	4020 ± 830	**34.0** [c] **± 4.5**	1	490 ± 87	**5.91** [b] **± 0.32**	1	64 ± 10	**0.09** [d] **± 0.03**	<1	25.3 ± 5.0	nd	-

Notes
1 Values presented are means ± standard deviation. Values in bold type indicate a significant difference was noted between treatments within a site. Superscript letters indicate grouping, based on Tukey's Posthoc test.
2 Amendment treatments, as described in Section 2.3. UN = Unamended, 1X = 1X OMAFRA levels, 2X = 2X OMAFRA levels, Cal = Calcareous. Corn cobs were not harvested from the C3 Test Site.
3 Ratios are percentage of total CoC concentration found in plant tissue, to the nearest integer.
4 nd = not detected. Ratios were not calculated for these values.

Table 10 Uptake of CoCs into Agronomic Soybean Tissue at C2 and C3 Test Sites During 2001.[1]

Test Site	Amend.[2]	Nickel			Copper			Cobalt			Arsenic		
		Soil (mg/kg)	Tissue (mg/kg)	Ratio[3] (as %)	Soil (mg/kg)	Tissue (mg/kg)	Ratio (as %)	Soil (mg/kg)	Tissue (mg/kg)	Ratio (as %)	Soil (mg/kg)	Tissue (mg/kg)	Ratio (as %)
C2	UN	4950 ± 1200	**52.2 [a] ± 17.5**	1	596 ± 126	9.99 ± 2.63	2	75 ± 13	**1.08 [a] ± 0.59**	1	28.8 ± 3.8	**0.31 [a] ± 0.29**	1
	1X	4730 ± 930	**41.0 [b] ± 7.4**	1	584 ± 94	9.19 ± 1.41	2	72 ± 10	**0.75 [b] ± 0.22**	1	28.2 ± 3.3	**0.16 [b] ± 0.10**	1
	2X	5030 ± 1490	**37.0 [bc] ± 3.9**	1	596 ± 128	9.16 ± 1.05	2	76 ± 18	**0.76 [b] ± 0.17**	1	28.9 ± 5.1	**0.16 [b] ± 0.08**	1
	Cal	4020 ± 830	**29.5 [c] ± 4.4**	1	490 ± 87	9.50 ± 2.54	2	64 ± 10	**0.31 [c] ± 0.07**	<1	25.3 ± 5.0	**0.10 [b] ± 0.00**	<1
C3	UN	**3210 [a] ± 350**	**158 [a] ± 40**	5	388 ± 39	**6.92 [a] ± 0.64**	2	**48 [a] ± 5**	**2.61 [a] ± 0.89**	5	17.7 ± 2.1	0.23 ± 0.08	1
	1X	**3110 [ab] ± 410**	**56.7 [b] ± 9.3**	2	380 ± 46	**5.97 [b] ± 0.73**	2	**47 [ab] ± 6**	**0.81 [b] ± 0.14**	2	17.5 ± 3.7	nd[4]	-
	Cal	**2980 [b] ± 270**	**33.5 [c] ± 5.0**	1	369 ± 36	**5.21 [c] ± 0.62**	1	**45 [b] ± 4**	**0.50 [b] ± 0.16**	1	17.4 ± 2.2	nd	-

Notes
1 Values presented are means ± standard deviation. Values in bold type indicate a significant difference was noted between treatments within a site. Superscript letters indicate grouping, based on Tukey's Posthoc test.
2 Amendment treatments, as described in Section 2.3. UN = Unamended, 1X = 1X OMAFRA levels, 2X = 2X OMAFRA levels, Cal = Calcareous.
3 Ratios are percentage of total CoC concentration found in plant tissue, to the nearest integer.
4 nd = not detected. Ratios were not calculated for these values.

Table 11 Uptake of CoCs into Toxicological Soybean Tissue at C2 and C3 Test Sites During 2001.[1]

Test Site	Amend.[2]	Nickel Soil (mg/kg)	Nickel Tissue (mg/kg)	Nickel Ratio[3] (as %)	Copper Soil (mg/kg)	Copper Tissue (mg/kg)	Copper Ratio (as %)	Cobalt Soil (mg/kg)	Cobalt Tissue (mg/kg)	Cobalt Ratio (as %)	Arsenic Soil (mg/kg)	Arsenic Tissue (mg/kg)	Arsenic Ratio (as %)
C2	UN	4950 ± 1200	66.2 ± 21.6	1	596 ± 126	14.5 ± 3.5	2	75 ± 13	2.00 ± 0.67	3	28.8 ± 3.8	1.19 ± 0.48	4
	1X	4730 ± 930	65.0 ± 28.4	1	584 ± 94	14.6 ± 3.2	3	72 ± 10	1.95 ± 0.68	3	28.2 ± 3.3	1.08 ± 0.36	4
	2X	5030 ± 1490	63.7 ± 26.3	1	596 ± 128	16.4 ± 6.6	3	76 ± 18	1.90 ± 0.77	3	28.9 ± 5.1	1.14 ± 0.45	4
	Cal	4020 ± 830	66.3 ± 34.8	2	490 ± 87	17.0 ± 5.4	3	64 ± 10	1.55 ± 0.84	2	25.3 ± 5.0	0.89 ± 0.34	4
C3	UN	**3210 [a] ± 350**	**162 [a] ± 24**	5	388 ± 39	8.24 ± 1.31	2	**48 [a] ± 5**	**2.64 [a] ± 0.47**	6	17.7 ± 2.1	0.23 ± 0.05	1
	1X	**3110 [ab] ± 410**	**93.9 [b] ± 23.7**	3	380 ± 46	8.56 ± 1.89	2	**47 [ab] ± 6**	**1.95 [a] ± 0.42**	4	17.5 ± 3.7	0.19 ± 0.12	1
	Cal	**2980 [b] ± 270**	**46.7 [c] ± 7.3**	2	369 ± 36	7.35 ± 0.87	2	**45 [b] ± 4**	**1.45 [b] ± 0.23**	3	17.4 ± 2.2	0.17 ± 0.11	1

Notes
1 Values presented are means ± standard deviation. Values in bold type indicate a significant difference was noted between treatments within a site. Superscript letters indicate grouping, based on Tukey's Posthoc test.
2 Amendment treatments, as described in Section 2.3. UN = Unamended, 1X = 1X OMAFRA levels, 2X = 2X OMAFRA levels, Cal = Calcareous.
3 Ratios are percentage of total CoC concentration found in plant tissue, to the nearest integer.

Table 12 Uptake of CoCs into Soybean Crop Yield Tissue at C2 Test Site During 2001.[1]

Test Site	Amend.[2]	Nickel Soil (mg/kg)	Nickel Tissue (mg/kg)	Nickel Ratio[3] (as %)	Copper Soil (mg/kg)	Copper Tissue (mg/kg)	Copper Ratio (as %)	Cobalt Soil (mg/kg)	Cobalt Tissue (mg/kg)	Cobalt Ratio (as %)	Arsenic Soil (mg/kg)	Arsenic Tissue (mg/kg)	Arsenic Ratio (as %)
C2	UN	4950 ± 1200	**37.4 [a] ± 5.8**	1	596 ± 126	**9.78 [a] ± 0.72**	2	75 ± 13	**0.59 [a] ± 0.09**	1	28.8 ± 3.8	nd[4]	-
	1X	4730 ± 930	**36.1 [ab] ± 4.9**	1	584 ± 94	**11.03 [b] ± 1.52**	2	72 ± 10	**0.51 [b] ± 0.09**	1	28.2 ± 3.3	nd	-
	2X	5030 ± 1490	**32.8 [b] ± 4.7**	1	596 ± 128	**10.07 [ab] ± 0.59**	2	76 ± 18	**0.51 [b] ± 0.09**	1	28.9 ± 5.1	nd	-
	Cal	4020 ± 830	**34.7 [ab] ± 6.4**	1	490 ± 87	**12.20 [c] ± 2.81**	2	64 ± 10	**0.31 [c] ± 0.05**	<1	25.3 ± 5.0	nd	-

Notes
1 Values presented are means ± standard deviation. Values in bold type indicate a significant difference was noted between treatments within a site. Superscript letters indicate grouping, based on Tukey's Posthoc test.
2 Amendment treatments, as described in Section 2.3. UN = Unamended, 1X = 1X OMAFRA levels, 2X = 2X OMAFRA levels, Cal = Calcareous. Corn cobs were not harvested from the C3 Test Site.
3 Ratios are percentage of total CoC concentration found in plant tissue, to the nearest integer.
4 nd = not detected. Ratios were not calculated for these values.

APPENDIX F-2

DATA FROM FIELD TRIALS

Preliminary Field Trials
2000 Soil and Plant Data

Plant Tissue

C	Corn
O	Oat
R	Radish (below ground)
RL	Radish leaves
S	Soybean

0-15 cm Soil Samples

A: UNAMENDED SOIL
B: AMENDED SOIL (1X OMAFRA)
C: AMENDED SOIL (2X OMAFRA)

nd: parameter not detected

		Total organic C %	Soil Nickel (mg/kg)	Aqueous Nickel (mg/kg)	DTPA Nickel (mg/kg)	Soil Copper (mg/kg)	Aqueous Copper (mg/kg)	DTPA Copper (mg/kg)	Soil Cobalt (mg/kg)	Aqueous Cobalt (mg/kg)	DTPA Cobalt (mg/kg)
Organic Test Site											
DATE: JULY 24/2000											
sample ID											
O 713 P4 A SS 1		35.3	1750	5.32	263	317	nd	6.1	27.6	nd	2.2
O 713 P4 B SS 1		32.7	1780	2.81	288	294	nd	27.4	26.5	nd	3
O 713 P4 C SS 1		35.1	1900	3.92	293	324	nd	19.3	28.6	nd	2.9
DATE: JULY 24/2000											
sample ID											
O 713 P3A SS 1		37.2	1850	4.88	295	321	nd	16.7	29.8	nd	3
O 713 P3 B SS 1		34.4	2020	3.08	315	326	nd	23.7	29.4	nd	3.3
O 713 P3 C SS 1		26	1550	2.74	376	254	nd	35.3	22.7	nd	1.6
DATE: JULY 24/2000											
sample ID											
O 713 P2 A SS 1		26.7	7360	13.3	1110	993	1.3	14.7	86	nd	0.5
O 713 P2 B SS 1		36.3	2800	4.72	499	422	nd	13.9	39	nd	1.7
O 713 P2 C SS 1		30.3	5650	10.1	1080	738	nd	26.5	69.2	nd	1.4
DATE: JULY 24/2000											
sample ID											
O 713 P1 A SS 1		33.1	3410	7.77	492	475	nd	9.9	45.2	nd	0.9
O 713 P1 B SS 1		38.7	2760	4.16	519	388	nd	19.5	37.9	nd	3.5
O 713 P1 C SS 1		29.30	2080	3.65	362	306	nd	36.1	29.7	nd	3.5
Clay 2 Test Site											
DATE: AUGUST 18/2000											
sample ID											
I804PIA	SS-1	6.20	7140	3.97	237.00	773.00	nd	100.00	100.00	nd	3.60
I804PIB	SS-1	5.6	5550	53.7	3190.0	628.0	nd	119.0	81.8	nd	119.0
I804PIC	SS-1	5.1	4890	nd	2.8	569.0	nd	116.0	71.8	nd	3.0
DATE: AUGUST 24 /2000											
1804P2A	SS-1	6	7420	4.87	ns	865	nd	67.40	89.7	nd	3.10
1804P2B	SS-1	5.8	7210	5.5	3.2	760	nd	75.1	81.7	nd	2.3
1804P2C	SS-1	6.2	7610	nd	286.0	785	nd	68.5	90.7	nd	3.2
DATE: AUGUST 24 /2000											
1804P3A	SS-1	5.3	5140	3.89	198	567	nd	62.5	68.7	nd	3.1
1804P3B	SS-1	5.8	6890	4.2	212	780	nd	78.9	85.5	nd	3.6
1804P3C	SS-1	6.2	5170	3.29	192	575	nd	83.7	72.6	nd	3.3
DATE: AUGUST 24 /2000											
1804P4A	SS-1	4.7	4620	3.08	129	530	nd	93.2	58	nd	3.4
1804P4B	SS-1	5.1	4260	1.95	151	490	nd	92	60.9	nd	3.7
1804P4C	SS-1	7	5030	3.26	183	599	nd	94.1	71	nd	4.6
Clay 1 Test Site											
DATE: AUGUST 11 /2000											
C727P1A	SS-1	5.72	581	1.21	50.1	86	nd	16.5	15.7	nd	0.7
C727P1B	SS-1	4.4	591	0.99	44.8	85.1	nd	15.3	15.3	nd	0.5
C727P1C	SS-1	6.2	557	0.77	38.4	83.7	nd	14.8	13.8	nd	0.3
DATE: AUGUST 11 /2000											
C727P2A	SS-1	5	636	1.34	44.6	104	nd	17.4	14.7	nd	0.5
C727P2B	SS-1	8.44	646	0.81	46.1	113	nd	16.3	16.7	nd	0.8
C727P2C	SS-1	4.6	635	1.14	49.1	112	nd	16.9	15	nd	0.7
DATE: AUGUST 14 /2000											
C727P3A	SS-1	10.2	693	1.02	51.6	146	nd	16.1	14.4	nd	0.7
C727P3B	SS-1	8.4	713	0.95	49	137	nd	25.3	15.2	nd	0.6
C727P3C	SS-1	8	675	1.02	47.3	128	nd	22.5	13.1	nd	0.6
DATE: AUGUST 14 /2000											
C727P4A	SS-1	5.2	633	1.24	51.7	95.9	nd	15.9	15	nd	0.8
C727P4B	SS-1	6.08	617	1.01	46.6	95.5	nd	17.7	14.2	nd	0.6
C727P4C	SS-1	5.6	587	1.13	53.5	93	nd	19	14.6	nd	0.9

Preliminary Field Trials
2000 Plant Data
Organic Test Site

Plot	Amendment	Tissue	Plant Dry Mass	Leaf Dry Mass	Total Dry Mass	Plant Co	Plant Cu	Plant Ni
			(g)	(g)	(g)	mg/kg	mg/kg	mg/kg
1	U	RL	9.933	2.052	11.985	0.9	13.1	127
1	U	R			4.866	nd	10	122
1	U	O	2.824		2.824	nd	7.9	86
1	U	C	164.732	1.355	166.087	nd	12.1	19
1	U	S	1.384	0.375	1.759	nd	5	72
1	1X	RL	11.117	1.390	12.507	nd	3.5	45
1	1X	R			6.263	nd	4.9	43
1	1X	O	8.591		8.591	nd	8.4	20
1	1X	C	45.950	3.117	49.067	nd	8.2	11
1	1X	S	14.673	0.349	15.022	nd	4.6	54
1	2X	RL	7.858	2.980	10.838	nd	5.1	47
1	2X	R			5.599	nd	5.4	72
1	2X	O	9.332		9.332	nd	5.7	29
1	2X	C	66.967	2.010	68.977	nd	11	12
1	2X	S	13.713	0.445	14.158	nd	4.6	54
2	U	RL	7.512	1.679	9.191	nd	2.4	16
2	U	R			6.919	nd	3	32
2	U	O	10.343		10.343	nd	8	15
2	U	C	16.175	0.339	16.514	0.9	17	39
2	U	S	16.922	0.515	17.437	nd	3.9	9
2	1X	RL	9.560	2.314	11.874	nd	2.5	18
2	1X	R			2.314	nd	2.5	27
2	1X	O	18.820		18.820	nd	8.5	14
2	1X	C	16.536	0.882	17.418	0.7	17.3	48
2	1X	S	16.932	0.484	17.416	nd	4.9	19
2	2X	RL	10.228	0.905	11.133	nd	4	19
2	2X	R			9.070	nd	3.6	23
2	2X	O	7.929		7.929	nd	9.9	19
2	2X	C	51.644	2.560	54.204	nd	12.1	9
2	2X	S	19.189	0.517	19.706	nd	3.9	6
3	U	RL	10.460	1.590	12.050	nd	3.2	19
3	U	R			5.358	nd	6.5	33
3	U	O	8.650		8.650	nd	7.1	15
3	U	C	7.378	0.229	7.607	nd	10.1	2
3	U	S	14.695	0.603	15.298	nd	4.7	9
3	1X	RL	6.933	1.604	8.537	nd	3.1	12
3	1X	R			5.854	nd	3.8	21
3	1X	O	11.223		11.223	nd	7	9
3	1X	C	15.139	0.388	15.527	nd	9.3	3
3	1X	S	12.332	0.291	12.623	nd	4.6	10
3	2X	RL	9.196	1.416	10.612	nd	2.8	22
3	2X	R			5.358	nd	2.5	24
3	2X	O	14.819		14.819	nd	4.5	11
3	2X	C	36.414	0.750	37.164	nd	8.3	2
3	2X	S	12.628	0.490	13.118	nd	5.7	12
4	U	RL	8.504	2.985	11.489	nd	3.2	15
4	U	R			4.602	nd	3.5	18
4	U	O	16.897		16.897	nd	9.8	16
4	U	C	63.715	5.339	69.054	nd		
4	U	S	15.405	0.540	15.945	nd	4.2	4
4	1X	RL	12.989	2.825	15.814	nd	3.2	15
4	1X	R			12.358	nd	5.5	20
4	1X	O	17.576		17.576	nd	7.5	12
4	1X	C	50.279	4.768	55.047	nd	8.6	5
4	1X	S	18.884	0.530	19.414	nd	5.7	15
4	2X	RL	16.175	2.881	19.056	nd	4.1	20
4	2X	R			11.382	nd	2.6	15
4	2X	O	9.160		9.160	nd	5.9	5
4	2X	C	35.622	2.847	38.469	nd	5.3	3
4	2X	S	19.003	0.510	19.513	nd	3.8	4

Preliminary Field Trials
2000 Plant Data
Clay 2 (Refinery) Test Site

Plot	Amendment	Tissue	Plant Dry Mass	Leaf Dry Mass	Total Dry Mass	Plant Co	Plant Cu	Plant Ni
			(g)	(g)	(g)	(mg/kg)	(mg/kg)	(mg/kg)
1	U	RL	1.878	0.448	2.326	6.1	53.4	280
1	U	R			1.896	2.8	22.6	108
1	U	O	2.446		2.446	nd	6.2	47
1	U	C	5.645	0.62	6.265	3.3	35.2	141
1	1X	RL	2.703	0.724	3.427	2	29.8	136
1	1X	R			4.792	1.4	13.3	45
1	1X	O	1.575		1.575	0.7	12.1	94
1	1X	C	13.341	1.087	14.428	1.7	19.5	64
1	1X	S	5.047	0.804	5.851	1.5	12.6	67
1	2X	RL	3.578	1.523	5.101	0.9	8	43
1	2X	R			5.441	2	6.4	54
1	2X	O	5.207		5.207	0.7	6.7	59
1	2X	C	17.619	1.099	18.718	1.5	18.8	49
1	2X	S	5.284	0.329	5.613	1.6	14.7	104
2	U	RL	2.782	0.429	3.211	4.9	42.4	241
2	U	R			4.541	1.6	10.1	77
2	U	O	2.112		2.112	0.8	10.1	80
2	U	C	18.966	0.569	19.535	1.1	15.6	45
2	1X	RL	3.301	1.542	4.843	1.2	15.4	66
2	1X	R			7.407	2	4	45
2	1X	O	4.906		4.906	0.7	8.9	44
2	1X	C	14.44	0.907	15.347	0.8	21	59
2	1X	S	5.783	0.309	6.092	1.7	15.5	95
2	2X	RL	3.804	1.306	5.11	1.1	11.5	47
2	2X	R			5.753	1.8	7.9	45
2	2X	O	4.84		4.84	nd	14.7	46
2	2X	C	25.239	1.117	26.356	2.6	36.3	128
2	2X	S	5.168	0.306	5.474	2.4	15.1	133
3	U	RL	5.499	0.952	6.451	4.6	47.6	204
3	U	R			4.184	1.1	5	68
3	U	O	2.564		2.564	0.7	11	37
3	U	C	28.892	1.277	30.169	0.9	18.3	34
3	1X	RL	6.782	0.942	7.724	1.9	25.5	92
3	1X	R			5.757	1.2	2.6	25
3	1X	O	4.294		4.294	nd	8.1	30
3	1X	C	18.064	1.45	19.514	0.6	14.9	22
3	1X	S	6.842	0.805	7.647	3.2	32.3	146
3	2X	RL	6.174	1.497	7.671	11.1	117	578
3	2X	R			4.606	1.7	12.9	40
3	2X	O	5.407		5.407	nd	11.7	37
3	2X	C	32.775	1.951	34.726	0.8	15	22
3	2X	S	7.215	1.121	8.336	1.2	15.5	58
4	U	RL	4.955	1.674	6.629	1.1	12.5	52
4	U	R			6.085	1.6	4.5	45
4	U	O	4.578		4.578	nd	8.2	33
4	U	C	10.123	0.514	10.637	0.9	11	31
4	1X	RL	4.819	1.39	6.209	1.2	19.5	65
4	1X	R			4.225	1	7.9	26
4	1X	O	5.86		5.86	0.8	6.4	49
4	1X	C	11.507	0.725	12.232	0.7	13.7	20
4	2X	RL	4.256	1.696	5.952	nd	8.6	21
4	2X	R			6.877	0.9	8.2	20
4	2X	O	9.177		9.177	nd	6.5	24
4	2X	C	9.716	1.154	10.87	1	19.2	37
4	2X	S	7.616	0.213	7.829	1.4	14.8	56

Preliminary Field Trials
2000 Plant Data
Clay 1 (Rae Farm) Test Site

Plot	Amendment	Tissue	Plant Dry Mass	Leaf Dry Mass	Total Dry Mass	Plant Co	Plant Cu	Plant Ni
			(g)	(g)	(g)	(mg/kg)	(mg/kg)	(mg/kg)
1	U	RL	1.110	0.278	1.388			
1	U	R			0.000			
1	U	O	1.848		0.982			
1	U	S	6.547	0.494	7.041			
1	1X	RL	4.030	1.288	5.318			
1	1X	R			5.297			
1	1X	O	4.989		4.989			
1	1X	S	6.436	0.608	7.044			
1	2X	RL	2.764	1.147	3.911			
1	2X	R			5.166			
1	2X	O	2.996		2.996			
1	2X	S	7.737	0.551	8.288			
2	U	RL	1.908	0.525	2.433			
2	U	R			2.937	nd	4	14
2	U	O	3.840		3.840	nd	5	16
2	U	S	10.861	0.700	11.561			
2	1X	RL	4.314	0.499	4.813	nd	5.1	10
2	1X	R			4.390	nd	4.2	11
2	1X	O	2.332		2.332	nd	7.3	13
2	1X	S	5.106	0.585	5.691	nd	5	nd
2	2X	RL	1.936	0.662	2.598	nd	4.9	8
2	2X	R			2.677	0.8	4.8	8
2	2X	O	3.309		3.309	nd	7.4	16
2	2X	S	6.918	0.523	7.441	nd	5.9	2
3	U	RL	2.299	0.811	3.110	nd	3	6
3	U	R			3.790	nd	3.7	7
3	U	O	4.479		4.479	nd	6.3	6
3	U	S	4.479	0.394	4.873	nd	6.2	3
3	1X	RL	2.364	0.791	3.155	nd	4.2	9
3	1X	R			4.379	nd	2.7	5
3	1X	O	3.402		3.402	nd	6.2	10
3	1X	S	4.064	0.499	4.563	nd	5.5	3
3	2X	RL	1.357	0.405	1.762	nd	3.5	5
3	2X	R			2.418	nd	2.1	3
3	2X	O	4.551		4.551	nd	6.8	8
3	2X	S	3.058	0.392	3.450	nd	6	3
4	U	RL	2.870	0.646	3.516			
4	U	R			3.132			
4	U	O	2.467		2.467			
4	U	C	8.309	0.244	8.553			
4	U	S	5.671	0.304	5.975			
4	1X	RL	4.479	1.006	5.485			
4	1X	R			3.169			
4	1X	O	2.628		2.628			
4	1X	S	4.204	0.456	4.660			
4	2X	RL	3.824	0.722	4.546			
4	2X	R			3.541			
4	2X	O	4.260		4.260			
4	2X	S	7.587	0.640	8.227			

Preliminary Field Trials
2001 Soil and Plant Data

Year 2001 Field Trial Oat Agrinomical Analysis for C2 Site

plot	treat	Sample Dry Weight (g)	As	Co	Cu	Ni	Ca	Fe	Mg	Mn	P	K	Zn
	EQL	0.001	0.2	0.01	0.05	0.1	50	5	5	0.5	5	10	0.5
	Units	g	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
1A	UN	3.773	1.3	0.32	9.83	33.1	6660	68	2110	14.6	4680	27300	19.6
1A	UN	3.205	1.3	0.29	9.41	19	8430	70	2330	17.8	4990	27300	22
1A	UN	3.643	1.1	0.35	10.1	23.3	6770	78	2400	20.7	3490	29400	21
1A	UN	3.457	1.3	0.31	9.38	25	8190	76	2290	19.1	4100	26000	16.6
1A	1X	1.665	0.8	0.29	9.56	11.5	7740	71	2360	31.2	2330	24900	15.3
1A	1X	3.809	0.8	0.3	9.64	11.95	7735	72.5	2290	22.2	2900	25100	16.4
1A	1X	2.888	0.8	0.26	9.64	15.8	8420	75	2230	23.1	2770	23200	17.4
1A	1X	2.897	0.9	0.24	9.18	11.1	8610	66	2110	23	2310	22100	14
1A	2X	3.066	0.5	0.21	9.79	17.1	6070	77	2120	23.4	3160	31300	17.5
1A	2X	3.586	0.9	0.28	10	13.4	7820	76	2380	20.1	2580	26000	15.1
1A	2X	3.958	0.7	0.3	10	11.2	7430	81	2510	26.7	2850	28400	16.6
1A	2X	3.127	0.8	0.31	10.2	15.8	7240	77	2600	23.1	2680	27900	16.1
2A	UN	2.010	1.5	0.36	11.4	25.3	7770	79	2490	15.4	3180	25100	18.1
2A	UN	2.754	1.4	0.38	10.5	21.9	7370	76	2320	15.9	3100	24900	17.4
2A	UN	1.792	0.8	0.25	9.8	22.6	6460	68	1940	18.1	2870	28800	16
2A	UN	1.555	0.9	0.27	10.1	30.3	6950	62	1790	13	3480	23800	16
2A	1X	2.437	1	0.29	12	26.5	6500	66	2140	14.5	2510	24400	18.1
2A	1X	2.844	0.8	0.28	10.8	14.1	6770	76	2160	22.2	2980	27800	16.5
2A	1X	2.917	1.1	0.32	10.4	13.4	7260	83	2180	22	2750	25100	15.7
2A	1X	2.575	1.1	0.28	10.4	10	8040	76	2440	20.6	2440	24100	15.1
2A	2X	1.391	0.8	0.35	9.38	16.8	7290	62	2110	15.3	2380	22200	14.9
2A	2X	1.985	0.9	0.37	10	10.3	7850	77	2490	16.1	2610	25400	16.8
2A	2X	3.139	0.9	0.35	9.76	10.6	8010	82	2390	20.5	2430	21400	19.1
2A	2X	2.038	1	0.33	10.3	17.4	7000	78	2440	17.9	2910	25300	20.2
3A	UN	2.319	1.7	0.37	9.99	22.6	6340	65	2100	13.8	3320	24700	19.8
3A	UN	2.284	2.1	0.31	10.3	23.1	6730	66	2190	11.8	4270	24300	18.4
3A	UN	1.846	1.9	0.33	9.96	28.3	6930	67	2210	14.2	5130	24400	21.4
3A	UN	2.320	1.7	0.32	10.2	22.7	7050	71	2410	11.9	5000	26200	19.6
3A	1X	2.046	1.1	0.28	10.2	12.6	5860	63	2510	11.4	6400	27100	19.4
3A	1X	1.921	1.3	0.3	11.6	13.2	6040	73	2550	12	7100	25100	20.6
3A	1X	2.208	1.2	0.41	11.5	14	6050	68	2295	11.4	6990	23300	20.3
3A	1X	1.758	1.1	0.25	10.6	14.1	5510	68	2340	11.6	6810	25800	19.6
3A	2X	1.397	0.9	0.33	9.3	14.5	5100	67	2130	14.8	7520	26400	18.9
3A	2X	1.764	1	0.33	11.1	13.5	5430	69	2380	14.7	7600	23800	22.7
3A	2X	0.969	0.8	0.37	9.51	14.1	5540	65	2300	14.4	8260	24800	20.4
3A	2X	0.856	1	0.56	8.24	22.8	5630	69	1940	21.5	5480	25100	18
plot	treat	Sample Dry Weight (g)	As	Co	Cu	Ni	Ca	Fe	Mg	Mn	P	K	Zn
	EQL	0.001	0.2	0.01	0.05	0.1	50	5	5	0.5	5	10	0.5
	Units	g	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
4A	UN	1.541	0.9	0.27	10.96	13.5	6640	85	1880	21.95	2350	24550	19.85
4A	UN	2.294	0.9	0.34	9.68	10.2	6160	65	2090	20.6	2320	25900	17.1
4A	UN	1.857	1	0.29	8.72	14.7	7020	65	2150	24.5	2420	24300	16.3
4A	UN	1.926	1	0.36	9.24	13.2	7320	68	2280	24.7	2670	22600	16.5
4A	1X	3.868	0.8	0.28	9.31	6.9	6380	72	1950	18.6	2630	29400	15.1
4A	1X	3.294	0.9	0.29	9.69	6.5	7430	74	2460	26.2	2330	29100	19
4A	1X	3.005	0.8	0.24	9.46	6.2	6470	70	1940	20.7	2130	29400	16.9
4A	1X	2.824	1	0.28	10.6	7.4	6740	89	2400	20.7	2380	28300	17.7
4A	2X	2.268	0.8	0.19	10.1	13	6620	62	2050	12.5	2590	23500	18.4
4A	2X	2.896	0.7	0.28	9.17	6.8	6280	63	2090	19	2490	26900	16.4
4A	2X	2.807	0.8	0.35	10.5	9.6	6400	77	2180	14.8	2320	25600	17.6
4A	2X	2.645	0.8	0.24	9.3	7.7	5730	63	1880	16.5	2810	26200	16.2
1B	CAL	8.016	0.4	0.14	9.11	15.1	5100	63	1600	12.5	2450	26700	19.2
1B	CAL	5.491	0.2	0.09	8.38	17.3	3830	56	1340	15.8	2420	25000	19.8
1B	CAL	5.755	0.5	0.1	8.7	10.9	5200	60	1600	11.5	2210	28200	18.9
1B	CAL	6.503	0.6	0.14	8.62	12	5600	64	1680	10	2190	29900	18.5
2B	CAL	6.241	0.5	0.11	8.65	11.3	5040	58	1520	10.2	2120	26800	17.9
2B	CAL	5.621	0.2	0.1	8.91	22.1	3240	60	1510	18.5	2920	26700	22.8
2B	CAL	8.048	1.3	0.23	9.95	14.1	7840	85	3170	11.5	2510	39600	15.4
2B	CAL	8.355	0.4	0.14	9.52	17.8	4420	69	1790	19.2	2890	28600	22.9
3B	CAL	5.658	0.4	0.14	9.27	19.3	3280	62	1720	21.7	3470	26700	25.2
3B	CAL	8.602	0.6	0.16	10.3	13.8	4280	72	1800	13.8	2810	25300	26
3B	CAL	3.092	1.2	0.18	9.97	11.3	6350	74	2940	10.4	3270	38700	22.3
3B	CAL	3.406	1.3	0.24	9.21	11.15	6645	80.5	2670	8.45	2825	33800	11.55
4B	CAL	5.569	0.4	0.18	8.44	17	4440	73	1790	14.5	4080	24700	19.9
4B	CAL	4.975	0.4	0.18	8.25	15.7	4070	67	1700	16.6	3610	24200	20.6
4B	CAL	7.183	0.4	0.18	8.71	12.9	4500	77	1770	17.4	3540	26100	19.9
4B	CAL	4.025	0.1	0.13	7.73	17.4	3370	57	1520	18.2	3370	25000	23.8

Year 2001 Field Trial Oat Toxilogical Analysis for C2 Site

plot	treat	Sample Dry Weight (g)	As	Co	Cu	Ni	Ca	Fe	Mg	Mn	P	K	Zn
	EQL	0.001	0.2	0.01	0.05	0.1	50	5	5	0.5	5	10	0.5
	Units	g	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
1A	UN	1.937	2	0.31	10.2	22.5	10900	92	3060	8.9	5650	22700	10.4
1A	UN	2.020	1.3	0.23	8.76	20.4	6790	66	2150	13	5390	30200	15.3
1A	UN	2.008	1.6	0.23	9.48	19.2	7010	67	2280	13.2	4060	28500	13.9
1A	UN	1.881	2.3	0.5	11.4	40.5	9640	135	2920	9.4	5900	22300	11.1
1A	1X	1.665	1.1	0.23	8.63	10.8	8370	74	2640	11.8	2660	26700	10.8
1A	1X	2.156	1.2	0.28	9.29	16.8	10700	86	3320	8.9	3080	20300	8.5
1A	1X	1.854	1.1	0.22	7.37	12.3	9640	74	2890	8.1	1840	23100	10.6
1A	1X	1.729	0.7	0.24	8.13	9.9	7070	67	2180	14.2	2600	25500	9.2
1A	2X	1.927	0.9	0.2	9.11	12.9	8430	67.5	2695	12.7	2430	25800	10.95
1A	2X	2.283	0.7	0.26	9.76	16.7	7730	80	2700	14.2	2750	28700	13.2
1A	2X	2.466	0.8	0.34	9.89	14.1	7980	82	2630	13.9	2850	30400	13.5
1A	2X	2.445	1	0.22	9.5	14.3	7890	73	2600	14.3	2850	27600	13.8
2A	UN	1.434	1.6	0.3	9.17	22.2	9265	76	2720	7.35	4190	22000	11.5
2A	UN	1.482	1.5	0.35	9.57	31.5	7570	76	2230	8.5	5150	25100	12.8
2A	UN	1.864	1.2	0.21	8.99	17.8	7390	67	2170	9.2	3210	26300	10.3
2A	UN	1.671	1.1	0.67	8.59	15.8	6920	63	2200	9.1	2750	27500	11.8
2A	1X	2.587	1.2	0.34	9.36	11.9	7950	75	2320	12.6	2910	26200	13.1
2A	1X	1.538	1.1	0.34	12.4	8.9	8120	107	2570	12.5	2250	29900	13.5
2A	1X	1.411	1.1	0.27	8.88	11.5	8030	71	2540	10.3	2330	26500	10.2
2A	1X	2.262	1.3	0.28	9.98	14.9	9920	90	3060	10.5	2340	23600	9.7
2A	2X	2.663	1	0.23	9.12	8.5	7190	77	2400	13.6	2270	27900	14.2
2A	2X	1.642	1	0.31	8.25	9.2	9890	139	3040	7.2	2080	23200	16.4
2A	2X	1.475	0.9	0.26	8.37	10.3	6520	73	2450	10.5	3150	28800	9.8
2A	2X	1.471	1.2	0.24	9.59	10.6	7660	87	2870	9.3	2900	25800	9.9
3A	UN	0.933	2.6	0.34	10.3	15.9	9010	109	2840	7.9	6330	24400	10
3A	UN	1.805	1.9	0.24	9.25	22.5	6300	61	2060	9.2	4970	33000	13.7
3A	UN	0.981	2.6	0.35	9.1	19.2	8410	84	2360	7	6470	24700	10.6
3A	UN	2.343	1.8	0.29	9.97	20.4	6220	70	2050	10.2	4100	32300	12.5
3A	1X	1.412	1.3	0.34	10.3	13.1	6460	89	2620	8.3	8370	30200	10.8
3A	1X	0.985	1.8	0.35	12.1	12.1	9050	108	3390	7.8	10100	23800	9.5
3A	1X	1.128	1.3	0.36	10.7	16.4	6290	77	2680	8.7	9390	31000	12.9
3A	1X	1.254	1.5	0.33	9.83	12.3	8200	109	3040	7.1	9160	26600	9.2
3A	2X	1.215	1.1	0.33	10	12.9	6290	90	2590	10.4	9040	31800	11.7
3A	2X	1.183	1	0.47	9.6	22	5660	105	2450	12.5	8550	31600	15.2
3A	2X	1.111	1.4	0.59	11.2	19.8	7580	151	3180	11.9	9860	28700	12.1
3A	2X	0.632	1.4	0.91	10.6	33.4	8310	213	2860	17.4	7530	23200	10
plot	treat	Sample Dry Weight (g)	As	Co	Cu	Ni	Ca	Fe	Mg	Mn	P	K	Zn
	EQL	0.001	0.2	0.01	0.05	0.1	50	5	5	0.5	5	10	0.5
	Units	g	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
4A	UN	1.378	1.6	0.42	9.75	15.1	10700	103	3250	10.9	4230	24500	9
4A	UN	2.273	1.8	0.34	9.26	12.1	9830	94	2920	9.8	1960	27800	9.5
4A	UN	2.337	1.4	0.36	9.82	14.5	7270	93	2380	16.3	2430	29900	12.1
4A	UN	2.403	1.15	0.29	8.81	11.1	6225	67.5	2165	12.45	2355	34650	12.45
4A	1X	3.363	1.3	0.27	8.74	4.3	7850	80	2710	15.9	1740	31900	9.5
4A	1X	3.361	1.3	0.31	8.65	7.9	8020	89	2720	8.7	1670	24800	9.5
4A	1X	3.260	1.2	0.25	7.84	5.4	9010	94	2860	14.9	1540	28800	8
4A	1X	4.030	1.2	0.28	9.37	6.1	7000	75	2530	12	1900	31900	11.5
4A	2X	2.638	1.3	0.36	9.43	10.5	7850	105	2640	8.2	2310	28200	10.5
4A	2X	3.014	1.2	0.25	8.99	8.3	7840	70	2830	12.8	2750	28900	12.7
4A	2X	2.738	1	0.26	8.25	6.1	7470	66	2760	10.5	2410	31100	10.4
4A	2X	2.631	1.3	0.32	9.75	9.6	8030	92	2630	8.4	2440	27700	9.8
1B	CAL	3.275	0.8	0.19	8.29	11.5	6420	70	2290	8.4	2480	39100	14.6
1B	CAL	4.675	0.9	0.22	8.51	13.1	6890	76	2450	9.7	2760	41000	15.7
1B	CAL	5.004	0.7	0.13	8.88	12.2	5440	66	1960	10.8	2420	33100	14.6
1B	CAL	3.518	0.7	0.14	9.04	12.9	5830	70	2060	9.9	2280	34300	15.8
2B	CAL	4.384	0.7	0.13	9.8	14.3	5910	63	2220	10	2600	38300	18.6
2B	CAL	2.765	1.3	0.22	9.8	13.6	7970	83	3210	11.3	2460	39700	15.4
2B	CAL	2.253	1.3	0.265	9.475	16.6	8070	92	3395	10.2	2475	42100	14.3
2B	CAL	3.335	0.7	0.17	9.44	16.8	6040	61	2360	10.5	2820	41000	16.9
3B	CAL	3.952	1.3	0.18	11	14.3	6160	79	2730	14.5	2880	34500	17.7
3B	CAL	3.650	1.3	0.25	9.99	13.4	6050	93	2920	9.4	2520	34500	13.9
3B	CAL	6.251	0.4	0.14	10.2	17.6	3310	63	1720	16.8	3570	29200	23.1
3B	CAL	5.987	0.5	0.14	9.87	14.3	4260	66	1870	17.7	2820	25100	19.4
4B	CAL	3.390	1.1	0.31	10.2	12.7	6850	129	3070	9.9	6190	32600	11.6
4B	CAL	4.372	0.7	0.26	8.85	9.6	5560	87	2430	13.1	4880	31300	12.6

Year 2001 Field Trial Oat Seed Analysis for C2 Site

plot	treat	As	Co	Cu	Ni	Ca	Fe	Mg	Mn	P	K	Zn
1A	UN	0.1	0.26	6.715	72.15	476	40.5	1340	25.3	5460	5345	46.7
1A	UN	0.1	0.23	6.54	71.7	501	37	1420	25.4	5640	5500	46.5
1A	UN	0.1	0.25	6.68	72.8	464	36	1270	24.7	5270	5260	46.5
1A	UN	0.1	0.21	6.74	49.4	492	40	1260	34.7	5200	5220	43.5
1A	UN	0.1	0.21	6.79	54.6	501	44	1350	31	5350	5200	45.8
1A	UN	0.1	0.2	6.83	52.2	503	41	1290	31.6	5410	5210	44.7
1A	1X	0.1	0.15	6.32	40.1	480	36	1280	37	5010	5100	38.3
1A	1X	0.1	0.16	6.3	38.1	485	36	1270	37.8	4890	4950	37.7
1A	1X	0.1	0.15	6.25	41.2	467	36	1280	37.2	5110	5050	38
1A	1X	0.1	0.16	6.33	42.3	479	41	1340	34.7	5290	5070	39.2
1A	1X	0.1	0.16	6.1	38.2	432	36	1220	34.8	4910	4910	37.1
1A	1X	0.1	0.16	6.37	41.2	467	38	1230	35.9	4910	4900	38.5
1A	2X	0.1	0.17	7.41	51.1	498	39	1290	28.4	5180	5100	39.6
1A	2X	0.1	0.17	7.77	53.2	452	44	1370	29.5	5260	5180	41.7
1A	2X	0.1	0.18	7.65	52.4	483	43	1360	30.1	5400	5100	41.7
1A	2X	0.1	0.16	7.89	60.45	479	36.5	1340	23.65	5010	4710	40.7
1A	2X	0.1	0.15	7.77	56.5	474	36	1320	24.3	5180	5050	42.4
1A	2X	0.1	0.17	8.39	61.1	460	38	1370	25.7	5340	4670	45.8
2A	UN	0.1	0.26	6.99	51.5	464	34	1210	29.4	4790	5000	39.8
2A	UN	0.1	0.24	6.99	54.5	445	36	1270	30.1	5050	4980	40
2A	UN	0.1	0.24	6.92	49.7	445	35	1160	31.9	4740	4840	39.6
2A	UN	0.1	0.25	6.97	58.9	461	34	1290	27	5150	4950	43.1
2A	UN	0.1	0.25	6.76	56.6	462	35	1220	27.3	4950	4770	41.2
2A	UN	0.1	0.23	6.84	57.4	469	36	1270	28.1	4970	5030	41.3
2A	1X	0.1	0.17	7.29	43.2	459	39	1250	33	5000	4760	39.1
2A	1X	0.1	0.17	6.94	41.2	452	37	1200	30.9	4770	4690	37
2A	1X	0.1	0.16	7.45	44.7	454	41	1250	31.5	4940	4720	39.3
2A	1X	0.1	0.18	6.48	40.9	482	42	1310	39.9	5130	4900	40.8
2A	1X	0.1	0.11	6.36	25.2	475	44	1190	40.5	4830	4680	39.2
2A	1X	0.1	0.17	6.41	38.8	487	44	1290	39.7	5180	4850	40.5
2A	2X	0.1	0.185	7.41	42.9	437	39.5	1235	31.1	4920	4685	38.1
2A	2X	0.1	0.17	7.23	43.8	442	39	1330	30.9	5320	4980	39.4
2A	2X	0.1	0.17	7.26	41.9	428	36	1260	31.3	5040	4790	37.6
2A	2X	0.1	0.16	6.63	34	396	35	1200	34.7	4830	4620	37.9
2A	2X	0.1	0.17	6.41	33.9	426	37	1220	37.2	4860	4830	39.2
2A	2X	0.1	0.17	6.63	34.3	413	37	1250	38.2	5130	4990	39.5
3A	UN	0.1	0.245	6.47	71.8	499.5	43.5	1480	26.4	5740	5305	45.1
3A	UN	0.1	0.25	6.66	75.5	496	45	1480	26.7	5810	5360	45.7
3A	UN	0.1	0.25	6.63	73.1	481	45	1410	26.3	5550	5100	47
3A	UN	0.1	0.22	7.16	66.6	464	48	1400	22.9	5510	5020	49.4
3A	UN	0.1	0.24	7.23	65.6	484	47	1420	23.2	5630	5300	49.2
3A	UN	0.1	0.22	6.98	63.8	483	46	1380	22.9	5480	5170	48.2
3A	1X	0.1	0.2	7.09	56.2	422	50	1360	16.7	5280	4710	53.5
3A	1X	0.1	0.21	7.25	60.3	445	46	1470	17.5	5790	5060	54.9
3A	1X	0.1	0.2	7.01	56.8	419	44	1430	17.4	5620	4890	54.5
3A	1X	0.1	0.21	7.32	62.2	429	48	1480	20.3	5640	5000	55.1
3A	1X	0.1	0.2	6.97	60.5	437	43	1470	19.3	5690	5000	53.9
3A	1X	0.1	0.21	7.23	61.6	437	44	1460	19	5740	4980	53.3
3A	2X	0.1	0.22	6.84	49.1	472	49	1460	29.3	5750	4940	51.4
3A	2X	0.1	0.23	6.77	48	474	49	1460	29.8	5640	5030	52.7
3A	2X	0.1	0.23	6.88	47.4	485	50	1460	30.7	5600	5020	53.4
3A	2X	0.1	0.245	6.34	60.75	467.5	39.5	1300	31.55	5305	4870	48.7
3A	2X	0.1	0.25	6.6	61.3	483	40	1360	32.2	5450	5010	50.1
3A	2X	0.1	0.26	6.41	62.3	498	40	1380	32.6	5630	5030	50.2
plot	treat	As	Co	Cu	Ni	Ca	Fe	Mg	Mn	P	K	Zn
		0.2	0.01	0.05	0.1	50	5	5	0.5	5	10	0.5
		mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
4A	UN	0.1	0.21	6.18	48.4	438	32	1180	37.2	4730	4750	39.2
4A	UN	0.1	0.22	6.02	47.1	415	33	1110	35.2	4480	4530	37.8
4A	UN	0.1	0.18	5.65	45	392	31	1120	32.2	4470	4330	36.1
4A	UN	0.1	0.17	5.88	46.4	485	34	1230	36.6	4980	4680	36.9
4A	UN	0.1	0.15	5.63	46	480	32	1180	34.3	4770	4610	34.6
4A	UN	0.1	0.17	5.7	43.3	491	31	1220	37.2	4780	4440	35.7
4A	1X	0.1	0.1	5.98	30.5	411	37	1160	23.1	4820	4640	38.7
4A	1X	0.1	0.1	6.23	31.3	460	41	1330	26.7	5200	4820	40.7
4A	1X	0.1	0.11	6.14	31.2	443	39	1180	24.6	4760	4690	39.9
4A	1X	0.1	0.1	5.86	24.6	462	36	1170	24.9	4730	4660	33.4
4A	1X	0.1	0.1	5.95	24.5	463	38	1190	25.6	4750	4610	34
4A	1X	0.1	0.09	5.89	24.7	471	38	1210	24.3	4810	4650	34.2
4A	2X	0.1	0.13	6.11	40.3	460.5	36.5	1210	27.7	4875	4895	36.95
4A	2X	0.1	0.14	6.12	39.7	445	38	1240	29.4	5050	4860	37.3
4A	2X	0.1	0.14	6.1	37.9	443	33	1190	28.9	4730	4770	36.1
4A	2X	0.1	0.11	5.76	26.5	461	40	1250	36.4	5090	4640	37.4
4A	2X	0.1	0.12	5.89	27	463	41	1260	36.8	4880	4660	38.5
4A	2X	0.1	0.11	5.79	25.6	445	38	1190	35.7	4820	4590	37
1B	CAL	0.1	0.06	5.545	39.05	739.5	32.5	1235	31.6	4850	4905	31.7
1B	CAL	0.1	0.06	5.7	40.6	850	34	1490	33.4	5770	5580	34.1
1B	CAL	0.1	0.06	5.55	39	812	33	1340	32.7	5090	5090	33
1B	CAL	0.1	0.07	5.73	40.2	754	36	1280	29.5	5020	4910	32.9
1B	CAL	0.1	0.07	5.49	37.9	701	33	1210	27.7	4620	4710	31.2
1B	CAL	0.1	0.08	5.83	41.9	810	37	1420	30.4	5310	5170	34.7
2B	CAL	0.1	0.12	6.03	31.5	738	36	1250	32.6	4910	4760	32.6
2B	CAL	0.1	0.08	5.7	30.8	726	34	1200	31.5	4660	4700	30.4
2B	CAL	0.1	0.07	5.64	29.7	647	33	1080	27.3	4300	4390	30.3
2B	CAL	0.1	0.14	5.83	37.9	791	36	1240	28.2	4940	5330	34.8
2B	CAL	0.1	0.07	5.6	36.9	741	34	1220	28.3	4760	5200	31.9
2B	CAL	0.1	0.08	5.71	36.4	738	35	1250	28.7	4850	5160	33.4
3B	CAL	0.1	0.12	6.65	29	741	46	1200	30.7	4820	4700	34.6
3B	CAL	0.1	0.08	6.57	30.1	731	45	1160	28.5	4710	4560	33.1
3B	CAL	0.1	0.08	6.47	31.2	778	47	1280	31.3	4990	4940	34.7
3B	CAL	0.1	0.075	6.045	27.35	658	43.5	1170	31.45	4740	4575	33.9
3B	CAL	0.1	0.08	6.2	29.4	720	43	1310	33.2	5220	5040	36.2
3B	CAL	0.1	0.08	6.18	27.3	671	43	1200	31.9	4760	4770	33.6
4B	CAL	0.1	0.11	5.65	34.6	675	44	1270	28.7	5080	5160	36.2
4B	CAL	0.1	0.1	5.75	33.9	629	40	1210	28.7	4760	4950	35.4
4B	CAL	0.1	0.19	5.99	36.2	714	45	1380	32.4	5390	5360	39.2
4B	CAL	0.1	0.1	5.96	30.5	638	42	1200	26.3	4800	5080	38.9
4B	CAL	0.1	0.1	5.89	31.2	660	42	1210	26.7	4780	5200	37.8
4B	CAL	0.1	0.1	6.1	33.8	702	47	1320	27.7	5230	5460	43.1

Year 2001 Field Trial Soybean Agrinomical Analysis for C2 Site

Bag #	plot	treat	Sample Dry Weight (g)	As	Co	Cu	Ni	Ca	Fe	Mg	Mn	P	K	Zn
		EQL	0.001	0.2	0.01	0.05	0.1	50	5	5	0.5	5	10	0.5
		Units	g	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
349	1A	UN	5.786	0.3	0.95	9.28	60.5	17100	118	5110	25.9	5280	22100	33.3
350	1A	UN	7.409	0.5	1.21	9.44	68.5	15600	176	4390	23.1	3980	17100	33.6
351*	1A	UN	6.083	0.4	1.22	11.15	66.6	17050	194	5020	24.95	4370	21650	33.7
352	1A	UN	4.528	0.4	1.1	10.9	65.8	17900	159	5250	24.8	4980	21000	35.3
353	1A	1X	6.355	0.1	0.78	10.8	50	13600	99	4880	16.9	4650	22000	32.1
354	1A	1X	7.575	0.1	0.78	9.89	42.2	14100	108	4920	18.2	4010	21500	33.1
355	1A	1X	7.358	0.2	0.71	9.95	51	16300	94	5540	21.5	4780	22400	34.5
356	1A	1X	7.369	0.4	1.01	8.62	54.8	16700	131	5220	19.8	3980	22000	31.5
357	1A	2X	6.698	0.1	0.66	9.31	33.3	14700	80	4820	20.7	4070	21400	31.9
358	1A	2X	5.054	0.1	0.62	9.81	36.2	13800	95	4620	20	4340	22000	33.9
359	1A	2X	9.411	0.2	0.85	8.79	38.2	14800	147	4500	21.4	3580	22500	31.3
360	1A	2X	8.760	0.1	0.72	9.45	37.8	14800	97	4930	20.3	4100	21200	34.6
373	2A	UN	3.928	0.1	0.54	10.2	39.5	11900	69	4210	15.3	4530	21500	31.9
374	2A	UN	4.363	0.1	0.54	10.3	38.5	11200	79	4320	15.4	4130	21100	33.1
375	2A	UN	5.647	0.1	0.69	9.55	39.1	11900	76	3890	18.5	4200	20400	33.7
376	2A	UN	3.894	0.1	0.58	10.1	39.3	10700	78	4200	15.4	4290	19800	32.3
377	2A	1X	5.859	0.1	0.46	9.22	39.5	9830	79	4110	15.7	4220	20500	26.7
378	2A	1X	5.910	0.1	0.44	9.36	38.6	9570	79	3820	13.8	4140	19600	26
379	2A	1X	5.662	0.2	0.53	10.9	43.4	10800	92	4330	16.1	4310	21200	31.1
380	2A	1X	7.908	0.3	0.62	9.28	40.1	9540	90	3710	14.2	3540	17800	28.6
381	2A	2X	6.537	0.3	0.54	10.7	41.1	10600	83	4370	11.7	3900	20700	26.3
382*	2A	2X	4.723	0.3	0.685	8.93	38.15	10950	91	3885	15.85	3610	19500	29.1
383	2A	2X	6.890	0.1	0.53	9.82	36.2	9900	86	3900	14	4040	19300	26
384	2A	2X	4.346	0.2	0.5	11.2	37.5	10200	85	4070	13.4	3930	16400	28.3
49	3A	UN	8.080	0.3	0.93	6.41	39.5	10200	83	3850	20.4	4530	24500	26.9
50	3A	UN	5.970	0.3	1.04	7.42	37.8	11500	67	4100	20	4510	25600	26.1
51	3A	UN	7.093	0.2	0.83	8.26	44.7	12300	72	4500	21.6	5150	23000	28.3
52	3A	UN	6.509	0.3	1.06	7.54	45.4	11900	84	4600	21.7	5560	25900	30.2
53	3A	1X	9.430	0.1	0.61	6.84	37.8	11100	80	4000	22.6	5190	23800	31.3
54	3A	1X	9.310	0.1	0.59	7.14	33.8	10500	82	4030	20.6	5120	21800	29.8
55	3A	1X	8.250	0.2	0.64	7.5	29.1	9460	91	3380	19.9	4180	26500	28
56	3A	1X	7.951	0.3	0.69	7.27	31	9640	82	3380	20.2	3930	23800	27.6
57	3A	2X	7.235	0.3	0.75	7.84	29.7	11200	105	4050	18.5	3630	23200	27.5
58	3A	2X	5.455	0.1	0.82	7	31.1	10100	79	3900	20.3	4520	24700	27.8
59	3A	2X	7.638	0.2	1.14	9.53	44.3	11400	143	4330	22.4	4650	25600	28.9
60	3A	2X	7.963	0.1	0.78	7.69	39.5	10900	103	4230	22.4	4510	25700	30.1

Bag #	plot	treat	Sample Dry Weight (g)	As	Co	Cu	Ni	Ca	Fe	Mg	Mn	P	K	Zn
		EQL	0.001	0.2	0.01	0.05	0.1	50	5	5	0.5	5	10	0.5
		Units	g	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
85	4A	UN	8.722	1.3	3.08	18.2	103	13400	99	4660	21.2	3750	19400	29.3
74	4A	UN	6.319	0.2	1.06	8.91	41.3	11900	88	4480	20	4090	22600	26.1
75	4A	UN	6.441	0.2	1.25	10.3	55	12900	119	4920	24.1	4690	22500	29
76	4A	UN	4.573	0.1	1.17	11.8	50	13700	113	5190	18.4	4740	20100	35
77*	4A	1X	7.136	0.1	0.86	8.445	32.9	10005	76	3905	15.75	4005	20700	27.5
78	4A	1X	6.950	0.1	1.13	10.5	45.2	10500	88	4320	17.6	5110	24500	30.8
79	4A	1X	5.984	0.1	1.15	10.8	47.8	11300	82	4810	18.3	5490	22700	33.3
80	4A	1X	6.014	0.1	0.97	10.5	39.4	10900	89	4430	18	5070	23100	30.4
81	4A	2X	6.654	0.1	0.81	9.24	33.8	10200	87	4080	15.9	3960	23900	29.6
82	4A	2X	5.993	0.1	0.89	8.69	34.8	10600	80	4040	18.3	4030	23900	26
83	4A	2X	5.201	0.1	0.98	9.24	41.9	11000	78	4680	20.6	5110	24000	30.8
84	4A	2X	6.613	0.1	0.85	9.3	38.2	10200	79	4230	18.1	4770	20400	30.8
413	1B	CAL	9.168	0.1	0.39	6.97	28	9170	95	3560	15.9	3920	22600	23.1
414	1B	CAL	8.104	0.1	0.41	7.3	27.7	9480	96	3620	15.3	3730	21100	23
415	1B	CAL	8.957	0.1	0.37	6.89	23.7	10000	105	3340	16.4	3140	20000	21.8
416	1B	CAL	8.787	0.1	0.39	7.02	28.3	9300	101	3410	18.3	3770	22000	23.5
421	2B	CAL	9.368	0.1	0.29	9.84	30.4	9130	82	3400	9.9	3750	16100	27.2
422	2B	CAL	7.560	0.1	0.23	10.4	28	10500	83	3990	10.3	3850	18000	24.4
423	2B	CAL	7.872	0.1	0.22	10.7	33.3	9450	73	4010	10	4390	19300	25.7
424	2B	CAL	6.908	0.1	0.27	10.9	30.7	10900	90	4230	11	3700	18800	23.8
397*	3B	CAL	11.280	0.1	0.285	13	33.85	11150	103	4095	10.3	4110	20400	29.8
398	3B	CAL	9.208	0.1	0.23	13.5	35.1	9470	89	3840	9.9	5000	21600	32.5
399	3B	CAL	6.883	0.1	0.27	13.5	37.8	9540	99	4050	11.3	4840	21800	34.7
400	3B	CAL	7.089	0.1	0.21	12.2	31.1	12000	91	4440	10.5	4020	20600	26.7
405	4B	CAL	6.851	0.1	0.37	7.46	25.4	10400	97	3350	17.2	3610	19600	23.3
406	4B	CAL	9.700	0.1	0.33	7.5	27.8	10000	78	3460	18.8	4470	20900	26.3
407	4B	CAL	6.636	0.1	0.27	7.15	20.2	10000	79	3210	20.7	3630	19300	22.2
408	4B	CAL	7.583	0.1	0.43	7.67	29.9	8850	96	3370	18.6	4080	20600	24.4

Year 2001 Field Trial Soybean Toxilogical Analysis for C2 Site

Bag #	plot	treat	Sample Dry Weight (g)	As	Co	Cu	Ni	Ca	Fe	Mg	Mn	P	K	Zn
		EQL	0.001	0.2	0.01	0.05	0.1	50	5	5	0.5	5	10	0.5
		Units	g	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
361	1A	UN	7.446	1.4	2.41	15.9	99.2	20300	374	4570	26.2	3710	15500	44.3
362	1A	UN	6.110	1.6	3.03	17.6	97.7	22300	537	5110	26.3	3650	16000	46.1
363	1A	UN	6.146	1.3	2.32	24.9	95.4	20200	389	4540	22.5	3710	13600	48.4
364	1A	UN	7.076	1.3	2.0	14.3	75.5	21200	319	4740	23.7	3600	13000	50.8
365	1A	1X	4.936	1.3	2.72	16.9	102	24700	473	6360	20.7	3770	14600	51.7
366*	1A	1X	5.226	1.2	2.385	17.45	92	20850	427	5580	20.75	3675	13900	41.4
367*	1A	1X	5.341	1.3	2.86	16.5	104	21400	473.5	5305	22.7	3750	15550	52.2
368	1A	1X	4.237	1.1	2.53	19.1	110	20800	519	5440	20.7	3180	14600	48.5
369	1A	2X	5.462	1.2	2.66	16.8	95.6	23600	504	5820	25.1	3170	11700	50.7
370	1A	2X	6.733	1.1	2.53	15	78.6	22400	417	5410	23.7	2980	10900	50.8
371	1A	2X	6.042	0.6	0.51	32.9	2.7	31100	467	8080	413	3870	19400	162
372	1A	2X	6.869	1.2	2.22	13.4	69.9	24100	377	5470	20.7	3050	13500	46.3
385	2A	UN	6.122	0.7	0.9	10.6	32.6	14300	107	4690	11.6	3070	14500	32.7
386	2A	UN	4.297	1.4	1.68	15.7	68.4	20200	260	5180	14.5	2550	10900	40.8
387	2A	UN	4.733	0.8	1.23	11.4	37.9	15500	131	4980	12.4	2980	15200	39.9
388	2A	UN	3.207	0.5	0.92	13	48	11900	131	4190	13.1	3460	17000	35.5
389	2A	1X	4.157	0.6	1.01	12.8	47.6	11300	137	4100	14.2	3530	20200	27.7
390	2A	1X	3.330	0.6	0.9	14.6	52.5	13600	128	4890	15.7	4190	20100	32.4
391	2A	1X	4.144	0.5	0.9	11.4	37.2	11000	132	4010	13.4	3420	17200	28.9
392	2A	1X	4.128	1.4	1.95	15.5	89.9	17700	309	5430	13.5	2730	15000	24.4
393	2A	2X	4.133	0.3	0.7	11.2	46.7	10700	106	4460	12.9	4190	21200	28
394	2A	2X	4.220	0.4	0.78	10.7	46.7	10600	95	4410	14.6	4230	21200	35.6
395	2A	2X	4.767	0.6	1.02	11.9	50.5	11200	156	4350	12.1	3380	19100	28.6
396	2A	2X	5.874	1.8	2.27	30.9	107	19700	450	5510	17.8	2660	13500	35.3
61*	3A	UN	8.423	1.8	2.655	15.8	74.2	20800	484	4440	30.15	3435	15400	41.8
62*	3A	UN	6.372	1.75	1.795	12.45	45.35	20850	310	4540	27.9	3150	14000	37.1
63	3A	UN	8.157	1.6	1.9	12.5	51.5	21000	294	4540	22.4	3190	11200	42.9
64	3A	UN	6.708	1.7	2.6	14	69.8	20800	439	4530	32	3490	14200	40.5
65	3A	1X	6.330	1.6	2.93	20.6	89.6	21100	712	5050	42.1	2400	14500	34.9
66	3A	1X	9.466	1.5	2.35	15.9	62.1	21000	501	4830	36.9	2310	13600	35.2
67	3A	1X	7.939	1.3	2.04	13.8	52.5	23000	467	4930	34.2	2440	15900	33.3
68	3A	1X	9.183	1.4	2.27	15.6	61.2	22900	502	4870	37.6	2520	15200	45.5
69	3A	2X	7.970	1.5	1.77	10.3	39.3	24500	309	5490	29.3	3240	14500	42.9
70	3A	2X	5.662	1.6	1.78	11.5	40.1	24100	407	5090	36.6	2640	14800	40.4
71	3A	2X	8.408	1.5	2.87	18.1	89.4	22300	697	5060	38.6	2540	14300	35.9
72	3A	2X	5.515	1.6	2.77	17.2	78.6	23900	576	5200	31.5	3100	14100	41.3

Bag #	plot	treat	Sample Dry Weight (g)	As	Co	Cu	Ni	Ca	Fe	Mg	Mn	P	K	Zn
		EQL	0.001	0.2	0.01	0.05	0.1	50	5	5	0.5	5	10	0.5
		Units	g	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
73	4A	UN	5.629	0.2	1.13	9.4	40.5	21100	471	4410	23.9	2570	11300	48.4
86	4A	UN	7.912	1.2	2.74	15.2	82.1	20300	377	4300	22.1	2870	10900	49.5
87	4A	UN	4.996	0.9	2.4	13.8	68.5	17700	297	4530	24.8	2630	12400	43.9
88	4A	UN	7.234	0.9	2.34	14.8	71.8	17100	314	4250	23	2580	10600	49.2
89	4A	1X	3.965	1.1	1.66	11.4	34.4	27400	236	6240	14.1	2980	13700	43.1
90	4A	1X	3.750	0.7	1.31	8.92	26.2	18300	191	4980	17.2	2250	13700	32.9
91	4A	1X	3.846	0.7	1.71	11.4	41.3	18600	227	5330	16.7	2660	14700	41.6
92*	4A	1X	4.455	1.05	1.74	10.9	36.95	26150	268	5515	15.9	2285	10500	46.45
93	4A	2X	4.680	1.4	2.38	16.7	79.2	24000	497	5380	19.8	2260	11400	41.6
94	4A	2X	5.497	1.1	1.69	12.2	47.9	23600	333	5380	19.7	2350	13300	38.7
95	4A	2X	5.495	1.1	2.28	18.2	78.9	18100	484	4970	22.5	2510	15300	36.6
96	4A	2X	5.642	1.2	2.1	15.8	68.6	21900	415	5360	19.8	2490	11400	42.2
417	1B	CAL	4.905	0.8	1.5	14.9	56.5	18100	367	5100	18.8	2780	12700	44.5
418	1B	CAL	6.550	0.8	1.33	12.8	47.3	18800	348	5210	26	2540	12900	41.6
419	1B	CAL	5.786	0.7	1.07	11.2	31.1	16900	245	4830	20.3	2490	14100	40.2
420	1B	CAL	8.208	0.6	1.07	11.7	38.2	15200	263	4300	20.7	2470	13500	39.6
425	2B	CAL	4.581	0.6	0.97	12.8	47.7	17900	207	5380	12.2	2540	14200	24.8
426	2B	CAL	5.157	0.6	0.76	13.3	38.8	17100	184	5660	12.4	2610	14900	26
427*	2B	CAL	4.686	1.05	1.475	24.45	71.55	32350	318.5	10200	23.3	5555	30950	52.8
428*	2B	CAL	5.045	0.5	0.69	12.35	36.15	17000	167	5945	11.45	2530	15250	24.85
401	3B	CAL	6.854	0.8	1.07	16.5	54.2	19000	260	5390	15	2340	13300	27.3
402	3B	CAL	4.922	0.9	1.44	19.4	71.6	21500	383	5800	15.7	2380	14600	30.7
403	3B	CAL	6.514	0.8	1.37	17.8	72.8	18800	334	5580	14.6	2390	13900	26.2
404	3B	CAL	8.001	0.7	1.04	15	55.7	17500	251	5160	14.2	2430	15000	29.4
409	4B	CAL	3.908	1.8	3.79	31.1	169	22400	1200	6700	49.7	3150	11500	52.5
410	4B	CAL	5.929	1	1.9	16.9	74.2	20000	561	5880	38.3	3400	13900	51.6
411	4B	CAL	7.191	1.1	2.23	18	79.5	19500	575	5730	36.6	3070	12400	47.9
412*	4B	CAL	5.924	1.45	3.07	23.15	117	20100	804.5	5690	42.5	3515	13300	51.05

Year 2001 Field Trial Soybean Seed Analysis for C2 Site

Bag #	Sample Code	plot	treat	As	Co	Cu	Ni	Ca	Fe	Mg	Mn	P	K	Zn
			EQL	0.2	0.01	0.05	0.1	50	5	5	0.5	5	10	0.5
			Units	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
1279X	X	1A	UN	0.1	0.52	10	50.6	2400	52	2080	18.4	5560	17100	30.5
1279Y	Y	1A	UN	0.1	0.5	9.77	47.1	2480	52	2040	18.5	5420	17000	29.7
1279Z	Z	1A	UN	0.1	0.52	10.3	49.3	2450	56	2090	18.3	5590	17000	30
1280X	X	1A	UN	0.1	0.52	10.6	42.1	2390	48	2040	17.5	5350	15800	30.1
1280Y	Y	1A	UN	0.2	0.81	11.7	45.2	2480	51	2100	17.7	5550	15700	31.4
1280Z	Z	1A	UN	0.1	0.51	11.3	44	2340	59	2050	18.1	5400	15300	31.6
1281X	X	1A	1X	0.1	0.54	10.6	35.3	2540	58	2240	15.1	5120	16000	30.2
1281Y	Y	1A	1X	0.1	0.53	9.97	34.7	2530	56	2160	15.3	5010	16000	29.3
1281Z*	Z	1A	1X	0.1	0.545	10.6	35.7	2595	57.5	2300	15.25	5270	16900	29.75
1281 1X*	1X	1A	1X	0.1	0.38	13.75	39.6	2580	62	2580	15.2	5810	17500	34.5
1281 1Y	1Y	1A	1X	0.1	0.39	13.5	40.6	2640	65	2580	15.8	5820	17600	34.4
1281 1Z	1Z	1A	1X	0.1	0.38	13.8	39.4	2610	65	2630	15.4	5830	17900	35.3
1281 2X	2X	1A	1X	0.1	0.41	13.9	42.3	2690	61	2650	15.3	6070	18500	35
1281 2Y	2Y	1A	1X	0.1	0.4	13.9	40.5	2560	66	2600	15.1	5890	18000	34.3
1281 2Z	2Z	1A	1X	0.1	0.4	13.8	39.9	2470	62	2520	14.9	5740	17400	34.6
1282X	2X	1A	1X	0.1	0.62	10.2	40.4	2520	55	2440	17	5350	17900	30.5
1282Y	2Y	1A	1X	0.1	0.62	9.74	40.9	2520	57	2320	16.7	5510	18400	29.7
1282Z	2Z	1A	1X	0.1	0.61	9.53	40.4	2360	57	2350	17.4	5450	17900	28.8
1283X	X	1A	2X	0.1	0.46	9.8	29.3	2480	62	2400	15	5100	17100	30.2
1283Y	Y	1A	2X	0.1	0.46	10	31.4	2430	61	2340	14.7	5070	17100	30.7
1283Z	Z	1A	2X	0.1	0.45	10	29.6	2580	60	2170	14.9	4770	17600	30.6
1284X	X	1A	2X	0.1	0.51	9.74	31.1	2710	52	2450	14.5	5290	17400	30
1284Y	Y	1A	2X	0.1	0.48	10.4	29.6	2880	61	2570	15.1	5310	17700	30.7
1284Z	Z	1A	2X	0.1	0.44	9.73	29.2	2380	59	2310	14.3	4900	16700	29.8
1285X*	X	2A	UN	0.1	0.55	10.35	32.9	2550	45.5	2335	15.15	5120	17950	30.45
1285Y	Y	2A	UN	0.1	0.5	10.1	30.9	2750	53	2420	14.6	5480	17900	30.4
1285Z	Z	2A	UN	0.1	0.51	9.71	31.5	2790	58	2390	14.2	5490	17700	30.5
1286X	X	2A	UN	0.1	0.54	9.67	32.5	1010	56	2350	15.1	5120	17900	30.3
1286Y	Y	2A	UN	0.1	0.55	10.1	34.1	2580	54	2310	14.8	5170	18100	31.4
1286Z	Z	2A	UN	0.1	0.55	10	34.1	2620	56	2380	14.9	5110	17900	29.9
1287X	X	2A	1X	0.1	0.58	11.5	42.3	2530	55	2420	14.4	5880	17500	30.8
1287Y	Y	2A	1X	0.1	0.56	11.3	41.2	2640	56	2350	14.9	5820	17300	31.3
1287Z	Z	2A	1X	0.1	0.58	11.8	41.6	2560	59	2400	14.7	5920	17400	31.8
1288X	X	2A	1X	0.1	0.52	9.73	37.7	2360	56	2280	14.5	5610	17300	30.2
1288Y	Y	2A	1X	0.1	0.52	9.86	39.4	2410	58	2270	14.8	5680	17800	30.6
1288Z	Z	2A	1X	0.1	0.51	9.91	37.5	2470	55	2300	14.7	5820	17200	30
1289X	X	2A	2X	0.1	0.55	9.38	37.7	2300	61	2280	16.1	5590	18000	29.1
1289Y	Y	2A	2X	0.1	0.54	9.21	37.5	2180	61	2170	16	5460	17100	28.3
1289Z	Z	2A	2X	0.1	0.58	9.46	38.7	2180	63	2170	16.2	5510	17500	29
1290X*	X	2A	2X	0.1	0.67	10.5	41.5	2470	52	2280	16.05	5740	20950	30.4
1290Y	Y	2A	2X	0.1	0.67	10.5	41.3	2560	58	2320	16	5860	21000	30.6
1290Z	Z	2A	2X	0.1	0.68	11.2	40.8	2690	60	2290	16.6	6100	20900	31.5

Bag #	Sample Code	plot	treat	As	Co	Cu	Ni	Ca	Fe	Mg	Mn	P	K	Zn
			EQL	0.2	0.01	0.05	0.1	50	5	5	0.5	5	10	0.5
			Units	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
1291X	X	3A	UN	0.1	0.54	9.07	35.2	2250	62	2130	13.8	5580	19500	31
1291Y	Y	3A	UN	0.1	0.56	9.42	36.4	2220	58	2120	13.6	5490	19000	33.2
1291Z	Z	3A	UN	0.1	0.52	9.19	34.8	2240	58	2100	13.4	5420	18600	30.4
1292X	X	3A	UN	0.1	0.55	8.73	32.4	2000	58	1940	14.9	4840	16900	28.6
1292Y	Y	3A	UN	0.1	0.61	9.01	35.3	2070	63	2050	15.2	5200	18100	31.9
1292Z	Z	3A	UN	0.1	0.59	8.9	33	2050	60	2040	15.6	5050	17500	30.4
1293Z	Z	3A	1X	0.1	0.52	10.8	26.7	2360	65	2160	16.5	5260	18900	33.1
1294X	X	3A	1X	0.1	0.47	9.17	33.4	2050	62	2100	16	5510	21000	31.8
1294Y	Y	3A	1X	0.1	0.51	9.97	34.8	2080	69	2120	17.6	5610	22300	32.6
1294Z	Z	3A	1X	0.1	0.48	9.48	34.5	2060	64	2100	15.8	5630	21200	31.9
1295X*	X	3A	2X	0.1	0.435	10.15	30.35	2080	66.5	2065	14.1	5430	19750	32.25
1295Y	Y	3A	2X	0.1	0.42	10.2	29.4	2120	61	2110	14	5460	19600	32.5
1296Y	Y	3A	2X	0.1	0.4	10.6	27.5	2150	66	2050	11.9	5350	18300	31.9
1296Z	Z	3A	2X	0.1	0.4	10.4	27.5	2140	66	2010	11.5	5270	18700	31.9
1297X	X	4A	UN	0.1	0.72	9.61	36.4	2450	54	2050	14.1	4960	20000	29.7
1297Y	Y	4A	UN	0.1	0.72	9.13	37.4	2420	57	2000	13.9	4700	20000	29.7
1297Z	Z	4A	UN	0.1	0.71	9.25	35.7	2380	58	2050	14.2	4650	20300	29.6
1298X	X	4A	UN	0.1	0.67	9.42	34.8	2480	58	2060	14.8	4650	19300	29.6
1299X	X	4A	1X	0.1	0.61	11.4	33.3	2310	69	2280	11.9	5160	21000	34.1
1299Y	Y	4A	1X	0.1	0.59	10.5	33	2150	65	2240	11.4	5110	20900	33
1299Z	Z	4A	1X	0.1	0.59	10.7	32.3	2260	65	2200	11.4	4970	20700	32.8
1300X*	X	4A	1X	0.1	0.555	10.1	28.9	2365	58	2205	11.5	4745	19550	30.75
1300Y*	Y	4A	1X	0.1	0.61	10.195	31.3	2410	51	2455	12.5	5470	18050	33.4
1300Z	Z	4A	1X	0.1	0.59	10.3	31.3	2440	63	2520	12.7	5640	19000	34.5
1301Z	Z	4A	2X	0.1	0.61	8.85	36.8	2380	65	2450	18.7	5570	20400	30.8
1302X	X	4A	2X	0.1	0.48	10.4	29.6	2460	63	2230	13.3	5660	17300	32.1
1302Y	Y	4A	2X	0.1	0.46	10.9	28.2	2420	66	2260	14.1	5530	16700	32.9
1302Z	Z	4A	2X	0.1	0.48	10.5	29.6	2480	65	2260	14.4	5480	16600	32.9

Year 2001 Field Trial Soybean Seed Analysis for C2 Site

Bag #	Sample Code	plot	treat	As	Co	Cu	Ni	Ca	Fe	Mg	Mn	P	K	Zn
1319X	X	1B	CAL	0.1	0.33	9.4	31.4	2320	56	2110	17.1	5100	16900	31.3
1319Y	Y	1B	CAL	0.1	0.31	9.37	30.2	2330	57	2110	17.1	5030	16700	31.1
1319Z	Z	1B	CAL	0.1	0.31	9.4	30	2240	61	2110	16.5	5010	16200	30.6
1320X	X	1B	CAL	0.1	0.38	10.1	36	2530	62	2290	18.9	5690	19800	33.8
1320Y	Y	1B	CAL	0.1	0.36	9.64	35	2350	55	2260	17.4	5560	19200	33.3
1320Z	Z	1B	CAL	0.1	0.37	9.53	34.2	2390	57	2230	17.4	5580	18900	33.5
1323Y	Y	3B	CAL	0.1	0.26	16.1	40.3	2570	77	2360	15.9	6090	15100	37.8
1324Y	Y	3B	CAL	0.1	0.31	16.1	42.6	2740	71	2440	16.2	6340	18100	36.9
1324Z	Z	3B	CAL	0.1	0.31	16	42.6	2660	69	2400	15.7	6360	17500	37.4
1325X	X	4B	CAL	0.1	0.22	9.45	23.9	2300	58	2110	16.4	5010	16700	30.7
1325Y	Y	4B	CAL	0.1	0.23	9.74	23.8	2270	61	2000	17.2	4780	16400	31.8
1325Z	Z	4B	CAL	0.1	0.23	9.66	23.3	2270	60	2080	16.4	4830	16300	31.5
1326X	X	4B	CAL	0.1	0.34	11.3	31.1	2710	59	2470	16.8	6100	19700	37.1

Year 2001 Field Trial Corn Agrinomical Analysis for C2 Site

Bag #	plot	treat	Sample Dry Weight (g)	As	Co	Cu	Ni	Ca	Fe	Mg	Mn	P	K	Zn
		EQL Units	0.001 g	0.2 mg/kg	0.01 mg/kg	0.05 mg/kg	0.1 mg/kg	50 mg/kg	5 mg/kg	5 mg/kg	0.5 mg/kg	5 mg/kg	10 mg/kg	0.5 mg/kg
237	1A	UN	4.756	0.1	0.08	4.37	1.9	3060	53	1660	9.1	2050	12800	35.1
238	1A	UN	4.766	0.1	0.07	5.27	2.2	2960	54	1760	9.3	1650	12100	34
239	1A	UN	4.967	0.1	0.08	5.30	2.2	1800	42	1410	7.4	1880	15800	22.3
240	1A	UN	6.621	0.1	0.06	5.62	1.7	2590	48	1420	7.4	1640	14900	32.2
241	1A	1X	5.904	0.1	0.08	6.46	1.7	2780	52	1810	13.1	2250	15000	33.3
242	1A	1X	4.933	0.1	0.07	5.92	1.8	2820	54	1870	12.7	2750	15600	36.5
243	1A	1X	4.970	0.1	0.06	5.23	1.6	3050	61	1850	15.2	2480	14500	38.7
244*	1A	1X	4.037	0.1	0.05	5.05	1.8	2960	63	1880	14.4	2570	15200	36.6
245*	1A	2X	4.665	0.1	0.14	4.85	1.8	3670	73	2070	16.5	2760	15300	43.2
246	1A	2X	4.443	0.1	0.07	4.55	1.8	3550	63	2080	17.4	2810	15300	45
247	1A	2X	5.766	0.1	0.09	4.78	1.7	3970	70	2150	17.1	2850	14900	43.3
248	1A	2X	6.224	0.1	0.09	4.83	1.5	2810	62	1870	14.3	2490	15800	44
261	2A	UN	4.298	0.1	0.09	5.76	3.3	1750	40	1460	10.5	2040	14300	26.6
262	2A	UN	4.609	0.1	0.10	5.22	2.8	1410	31	1310	8.2	2130	15500	21.6
263	2A	UN	3.461	0.1	0.10	4.56	2.6	2410	53	1690	12.3	1610	12400	29.3
264	2A	UN	6.522	0.1	0.13	6.24	2.5	1770	40	1560	12.8	2330	17300	23.2
265	2A	1X	7.053	0.1	0.14	6.30	1.9	3890	66	2090	16.7	2870	15400	36.8
266	2A	1X	5.937	0.1	0.10	5.49	2.2	3330	67	2030	15.5	2810	15900	34.2
267	2A	1X	5.101	0.1	0.12	5.74	2.3	3320	57	1830	14	2620	13800	31.5
268	2A	1X	4.403	0.1	0.08	5.07	2.4	2960	54	1850	18	2740	13700	33.9
269	2A	2X	4.414	0.1	0.08	5.31	2.7	3230	60	1970	13.7	2580	13700	41.1
270	2A	2X	3.824	0.1	0.10	5.46	3.2	3090	62	1980	12.3	2730	14300	39.5
271	2A	2X	5.593	0.1	0.09	5.77	2.3	3870	67	2160	13.2	2690	14100	40.9
272	2A	2X	4.721	0.1	0.13	6.56	2.3	4210	74	2130	17.4	2850	14200	47.8
189	3A	UN	3.584	0.1	0.16	5.89	2.8	1830	48	1120	8.2	2180	15100	23.6
190	3A	UN	2.969	0.1	0.19	4.60	2.5	2900	57	1300	15.1	1510	12800	38.8
191	3A	UN	2.803	0.1	0.10	4.59	2.1	2870	74	1335	12.75	1560	12450	38.8
192	3A	UN	2.607	0.1	0.14	27.80	2.5	2960	67	1690	8.9	1930	15500	34.9
193	3A	1X	1.758	0.1	0.10	4.30	2.3	2965	79	1970	11.3	2500	14400	37.65
194	3A	1X	2.422	0.1	0.09	4.14	2.0	2930	55	1890	12.9	2610	14800	34.2
195	3A	1X	2.738	0.1	0.13	4.30	1.9	3130	60	1770	11.3	2420	14400	34.4
196	3A	1X	1.883	0.1	0.09	3.64	2.0	3190	56	1760	10.8	2360	14200	34.6
197	3A	2X	3.232	0.1	0.13	5.37	1.7	2270	65	1350	10	2630	19200	21.7
198	3A	2X	2.833	0.1	0.13	4.46	1.8	2420	60	1410	14.2	2600	18400	18.6
199*	3A	2X	3.787	0.1	0.18	4.71	2.7	2710	56	1610	13.9	2710	17300	33.1
200	3A	2X	2.509	0.1	0.17	4.09	2.1	2710	69	1670	15.4	2440	15300	36.1
Bag #	plot	treat	Sample Dry Weight (g)	As	Co	Cu	Ni	Ca	Fe	Mg	Mn	P	K	Zn
		EQL Units	0.001 g	0.2 mg/kg	0.01 mg/kg	0.05 mg/kg	0.1 mg/kg	50 mg/kg	5 mg/kg	5 mg/kg	0.5 mg/kg	5 mg/kg	10 mg/kg	0.5 mg/kg
213	4A	UN	2.055	0.1	0.20	3.93	3.5	3050	44	1930	9.4	1630	10600	32.3
214	4A	UN	2.072	0.1	0.17	4.08	3.4	2650	47	1960	8.8	1930	12700	27.5
215	4A	UN	2.254	0.1	0.18	4.47	3.0	2920	56	1620	9.1	1810	11200	34.4
216	4A	UN	2.761	0.1	0.12	4.77	3.1	2900	49	1800	7.3	1790	12700	28.5
217	4A	1X	3.522	0.2	0.21	5.52	3.3	3020	59	1680	24.6	2710	14300	40.7
218	4A	1X	2.121	0.1	0.12	4.05	2.3	3470	69	1880	23.7	2820	15000	45.1
219	4A	1X	3.350	0.1	0.18	4.55	2.6	3030	62	1820	18.4	2620	14000	37.8
220	4A	1X	2.631	0.2	0.23	5.51	4.3	4200	92	1890	25.2	2770	13800	53.7
221	4A	2X	2.734	0.1	0.19	4.79	3.6	1860	49	1240	11.4	2480	16500	22.7
222	4A	2X	2.781	0.1	0.19	5.17	3.9	2110	53	1360	11.5	2810	17600	22.2
223	4A	2X	2.504	0.1	0.15	5.39	3.8	1870	46	1210	8.4	2540	17000	21.7
224	4A	2X	3.933	0.1	0.19	5.11	2.8	1730	41	1220	10.3	2550	17600	21.2
961	1B	CAL	2.545	0.2	0.16	3.97	1.1	2440	54	1490	11.7	2330	15600	23.3
962	1B	CAL	2.733	0.3	0.24	4.10	1.3	2510	54	1520	11.4	2520	15900	26.4
963	1B	CAL	1.464	0.1	0.14	3.62	1.2	2555	60.5	1430	11.35	2195	15500	26.75
964	1B	CAL	2.412	0.1	0.18	3.61	1.0	2200	57	1460	11	2500	16000	25.6
965	2B	CAL	1.326	0.1	0.14	3.87	1.2	1810	56	1240	9.1	2120	14400	18.2
966	2B	CAL	1.442	0.1	0.10	3.47	1.4	1440	54	1000	8.6	2130	15000	19.4
967	2B	CAL	2.203	0.1	0.17	3.55	1.2	1760	63	1160	10.7	2380	14900	21.8
968	2B	CAL	1.045	0.1	0.16	3.76	2.0	1500	55	1030	13	2370	15400	26.2
969	3B	CAL	2.608	0.1	0.15	4.13	1.1	2690	74	1350	6.9	1900	12300	25.3
970	3B	CAL	2.700	0.1	0.19	4.52	1.2	2160	53	1210	10.8	1760	12900	25.5
971*	3B	CAL	2.870	0.1	0.20	5.00	1.3	2360	66	1220	7.4	1810	13100	25.3
972	3B	CAL	2.083	0.2	0.24	4.79	1.7	2500	84	1270	8.5	1880	12800	26.3
973	4B	CAL	2.588	0.1	0.12	3.42	0.9	1980	64	1180	9.4	2050	13500	21.2
974	4B	CAL	1.619	0.3	0.16	3.77	0.9	2450	78	1580	10.8	2670	13700	27.6
975	4B	CAL	3.577	0.3	0.24	4.54	1.1	1990	66	1080	11.4	2120	14300	22
976	4B	CAL	1.884	0.2	0.14	3.52	0.9	2420	63	1260	10.1	1990	13100	23.6

Year 2001 Field Trial Corn Toxilogical Analysis for C2 Site

Bag #	plot	treat	Sample Dry Weight (g)	As	Co	Cu	Ni	Ca	Fe	Mg	Mn	P	K	Zn
		EQL Units	0.001 g	0.2 mg/kg	0.01 mg/kg	0.05 mg/kg	0.1 mg/kg	50 mg/kg	5 mg/kg	5 mg/kg	0.5 mg/kg	5 mg/kg	10 mg/kg	0.5 mg/kg
249	1A	UN	5.685	1.2	0.30	6.98	5.3	2790	71	1540	5	1320	16900	9.6
250	1A	UN	6.396	1.2	0.28	5.84	5.3	3050	82	1730	5	1010	17500	8.9
251	1A	UN	6.345	1.1	0.34	6.65	5.7	3090	80	1730	4.5	1230	17900	8.1
252	1A	UN	6.306	1.1	0.31	7.27	6.6	4730	79	1860	6.8	1190	17100	19.3
253	1A	1X	4.451	1.5	0.41	8.95	8.5	6230	92	2110	6.1	1790	29400	10.3
254	1A	1X	3.931	1.4	0.40	8.40	9.5	6020	93	1940	6.4	1580	26300	9.5
255	1A	1X	3.401	1.5	0.68	9.15	19.6	5980	95	1990	6.6	1440	24500	9.9
256	1A	1X	2.855	1.7	0.54	9.40	12.8	6540	101	2190	6.5	1560	26600	11.7
257	1A	2X	7.673	0.6	0.25	4.97	3.2	8410	172	2680	7.1	1730	24100	10.2
258	1A	2X	6.955	0.7	0.31	5.22	5.3	9290	116	2920	7.7	1890	20500	14.8
259	1A	2X	5.747	0.7	0.28	5.21	5.1	7900	151	2550	7.5	1460	24100	11.2
260*	1A	2X	5.921	0.6	0.34	5.49	9.7	6670	105	2510	7.5	1910	23700	13.8
273	2A	UN	4.024	1.1	0.40	5.16	11.8	3930	52	2630	7.4	2550	21700	12.8
274	2A	UN	3.759	0.9	0.28	4.60	7.4	4130	62	2180	5.2	1600	22300	8.8
275*	2A	UN	5.098	1.1	0.27	4.96	7.4	4330	68	2280	6.8	2460	21900	11
276	2A	UN	4.562	1.2	0.27	4.80	8.4	4110	57	2220	5.9	1680	22100	9.3
277	2A	1X	2.838	1.3	0.59	8.07	17.5	9300	148	2950	9.1	1920	24200	10.2
278	2A	1X	4.112	1.3	0.35	7.39	7.8	9580	153	2980	8.1	1650	24900	10.5
279	2A	1X	3.005	1.1	0.38	6.71	7.3	10400	219	3490	9.7	1600	26000	10.3
280	2A	1X	6.383	0.9	0.29	5.33	6.6	12700	169	4390	8.8	1590	22000	10
281	2A	2X	3.415	1.6	0.44	8.49	13.2	10500	153	3370	6.6	2120	22900	13.3
282	2A	2X	4.228	1.1	0.43	5.93	10.4	8260	111	3220	5.9	1710	21400	10
283	2A	2X	3.437	1.1	0.41	6.87	8.6	8260	126	2900	6.2	1980	22900	12
284	2A	2X	4.702	1.3	0.37	7.66	11.7	7640	146	2760	5.9	1650	23200	10.4
201	3A	UN	2.494	0.6	0.33	4.88	5.4	5290	154	2370	8.4	2520	20800	12.9
202	3A	UN	3.734	0.6	0.41	5.53	7.1	4950	97	2050	7.4	2020	18000	14.1
203	3A	UN	3.970	0.5	0.37	5.36	5.7	7150	128	1990	7.7	1480	18600	13.1
204	3A	UN	3.216	0.4	0.43	5.31	7.4	8060	122	2720	6.3	3660	19700	15.5
205	3A	1X	2.290	0.8	0.34	4.55	6.7	4910	83	2440	6.5	1960	23900	9.6
206	3A	1X	3.209	1.0	0.33	4.30	5.4	5620	91	2540	6.1	1600	25700	9.8
207	3A	1X	1.957	1.1	0.54	4.59	6.6	5850	120	2640	6	1460	26000	10.3
208	3A	1X	1.973	0.9	0.45	4.32	6.2	5375	124.5	2635	6.25	2540	25500	14.2
Bag #	plot	treat	Sample Dry Weight (g)	As	Co	Cu	Ni	Ca	Fe	Mg	Mn	P	K	Zn
		EQL Units	0.001 g	0.2 mg/kg	0.01 mg/kg	0.05 mg/kg	0.1 mg/kg	50 mg/kg	5 mg/kg	5 mg/kg	0.5 mg/kg	5 mg/kg	10 mg/kg	0.5 mg/kg
209	3A	2X	4.916	0.8	0.41	5.62	4.7	4260	100	1680	6.7	1600	19600	12.4
210	3A	2X	4.273	1.0	0.32	5.34	5.4	4540	120	1740	7.3	1610	21000	11.1
211	3A	2X	4.202	0.6	0.32	5.12	3.5	4060	99	1870	8.1	2040	23100	12.2
212	3A	2X	3.644	0.7	0.36	4.38	4.7	4450	123	1710	7.1	1490	20600	11.7
225	4A	UN	2.934	0.4	0.37	4.79	8.7	4120	64	2060	4.7	2140	18800	12.7
226	4A	UN	1.726	0.5	0.40	4.86	9.3	4410	63	2190	5.3	2480	16200	14.9
227	4A	UN	2.249	0.6	0.33	4.62	7.6	4870	62	2560	5	2350	19000	8.9
228	4A	UN	3.212	0.6	0.26	4.87	6.6	5370	62	2900	6.1	2890	18400	11.1
229*	4A	1X	2.883	0.7	0.31	4.28	4.4	6820	116	2060	7.5	2960	26500	13.2
230	4A	1X	3.200	0.7	0.39	5.93	5.7	6520	97	2410	7.1	3590	25200	12.7
231	4A	1X	3.830	0.8	0.42	5.36	5.8	6040	94	1930	5.55	2710	26000	11.2
232	4A	1X	4.383	0.6	0.29	4.63	3.7	7350	91	2230	7	2830	24300	12.4
233	4A	2X	1.951	1.0	0.31	6.08	9.3	5450	117	2100	6.3	1580	23800	10.4
234	4A	2X	2.338	0.9	0.35	4.52	7.6	4840	87	2060	4.9	1540	22200	8.4
235	4A	2X	1.871	0.5	0.26	4.48	6.5	5560	96	2400	8.3	2020	24300	9.7
236	4A	2X	1.747	0.9	0.30	4.79	8.0	4970	87	2020	5.6	1380	22600	8.4
1025	1B	CAL	3.238	0.3	0.39	3.64	4.2	5720	97	2150	6.8	1420	21900	11.4
1026	1B	CAL	1.689	0.3	0.47	4.27	5.1	5250	97	2180	5.9	2200	22700	10.6
1027	1B	CAL	3.322	0.3	0.30	3.64	3.1	4030	72	1910	6.6	2220	22200	10.5
1028	1B	CAL	4.727	0.7	0.62	5.92	3.8	4780	83	2020	6.4	1830	24000	10.8
1029	2B	CAL	4.038	0.4	0.20	4.76	2.0	3530	90	1810	5.3	3040	18100	11.8
1030	2B	CAL	2.589	0.4	0.37	3.68	2.9	4010	122	1700	5.3	2370	20900	10.1
1031	2B	CAL	1.884	0.5	0.31	3.91	3.1	4430	111	1970	5.5	1960	21600	10
1032	2B	CAL	3.878	0.4	0.36	3.40	3.0	4400	88	1680	4.9	2390	20700	9.5
1033	3B	CAL	2.969	0.8	0.36	7.14	6.6	4705	73	2500	4.45	2370	27800	12.3
1034	3B	CAL	4.131	0.7	0.33	5.39	4.0	3890	86	2230	4.6	1660	25800	9.6
1035	3B	CAL	4.764	1.2	0.46	7.64	6.7	3880	81	2060	4.7	1410	25300	10.2
1036	3B	CAL	2.977	1.2	0.32	5.86	6.1	3960	64	2180	4	2070	25300	12.2
1037	4B	CAL	6.193	0.6	0.28	3.97	3.3	5570	100	2920	5.1	2730	30200	8.7
1038	4B	CAL	8.078	0.7	0.26	4.55	2.0	5180	102	2590	5.4	2100	26400	10.6
1039	4B	CAL	6.743	0.7	0.34	3.95	22.0	4700	79	3560	6.2	5120	26000	12.3
1040	4B	CAL	6.875	0.7	0.34	3.92	3.8	6370	93	3240	5	3730	26800	10.8

Year 2001 Field Trial Corn Seed Analysis for C2 Site

Bag #	plot	treat	As 0.2 mg/kg	Co 0.01 mg/kg	Cu 0.05 mg/kg	Ni 0.1 mg/kg	Ca 50 mg/kg	Fe 5 mg/kg	Mg 5 mg/kg	Mn 0.5 mg/kg	P 5 mg/kg	K 10 mg/kg	Zn 0.5 mg/kg
1255X	1A	UN	0.1	0.02	1.31	2.1	72	20	830	3.6	2560	4030	18.6
1255Y	1A	UN	0.1	0.02	1.31	2.1	74	21	863	3.7	2560	3960	18.7
1255Z	1A	UN	0.1	0.02	1.11	1.8	70	18	780	3.5	2280	3460	17.2
1256X	1A	UN	0.1	0.03	1.53	2.6	92	20	830	3.8	2450	4260	19
1256Y	1A	UN	0.1	0.03	1.46	2.8	86	22	913	4	2670	4600	20.2
1256Z	1A	UN	0.1	0.03	1.47	2.5	98	22	962	4.4	2660	4200	21.9
1257X	1A	1X	0.1	0.02	1.25	1.7	61	22	883	3.7	2850	4140	20.1
1257Y	1A	1X	0.1	0.02	1.34	1.7	66	18	921	3.5	2980	4280	18.9
1257Z	1A	1X	0.1	0.02	1.25	1.6	77.5	25	1120	4.1	3325	4765	21
1258X	1A	1X	0.1	0.02	1.42	2.3	92	19	1080	4.4	3150	4620	20.9
1258Y	1A	1X	0.1	0.02	1.34	2.2	83	22	1230	4.2	3420	4690	22.2
1258Z*	1A	1X	0.1	0.02	1.26	2.1	80	20	1080	3.9	3100	4430	19.9
1259X	1A	2X	0.1	0.03	1.25	2.5	73	18	953	4	2720	3700	21.5
1259Y	1A	2X	0.1	0.03	1.25	2.3	68	18	943	3.9	2680	3740	20.9
1259Z	1A	2X	0.1	0.03	1.33	2.3	62	19	934	4	2740	3720	21.3
1260X	1A	2X	0.1	0.04	1.64	2.8	84	17	933	3.9	2640	4030	21.7
1260Y	1A	2X	0.1	0.03	1.33	2.5	72	17	922	3.8	2670	4070	20
1260Z	1A	2X	0.1	0.03	1.35	2.5	75	17	953	4	2770	4040	21.3
1261X	2A	UN	0.1	0.03	1.38	3.7	70	20	878	3.8	2510	4010	16.9
1261Y	2A	UN	0.1	0.03	1.45	3.5	72	20	877	3.7	2500	4050	16.9
1261Z	2A	UN	0.1	0.03	1.53	3.8	62	21	890	3.6	2510	3860	16.6
1262X	2A	UN	0.1	0.03	1.36	3.4	82	21	865	3.5	2400	4200	17.6
1262Y	2A	UN	0.1	0.03	1.33	3.4	85	23	917	4	2460	4010	19
1262Z	2A	UN	0.1	0.03	1.29	3.2	91.5	19.5	979	3.85	2475	4155	17
1263X	2A	1X	0.1	0.03	1.32	3.1	72	23	1040	4	3250	4530	21.2
1263Y	2A	1X	0.1	0.03	1.32	3.1	70	25	1030	4.2	3250	4680	21.1
1263Z*	2A	1X	0.1	0.04	1.43	3.2	64	23	998	4	3260	4850	20.5
1264X	2A	1X	0.1	0.03	1.41	3.4	61	20	982	3.8	3120	4960	18.6
1264Y	2A	1X	0.1	0.03	1.43	3.5	67	22	1020	4.2	3290	4900	21.7
1264Z	2A	1X	0.1	0.03	1.41	3.4	80	22	1060	4.4	3390	5250	21.9
1265X	2A	2X	0.1	0.04	1.45	3.2	71	24	879	4.6	2620	3820	23.4
1265Y	2A	2X	0.1	0.04	1.37	3.3	78	21	943	4.9	2700	4070	23.7
1265Z	2A	2X	0.1	0.04	1.33	3.3	80	17	939	4.9	2790	4170	23.3
1266X	2A	2X	0.1	0.03	1.26	3.5	89	21	861.5	4.5	2620	4375	23.25
1266Y	2A	2X	0.1	0.04	1.37	3.3	95	19	892	4.6	2900	5020	23.8
1266Z	2A	2X	0.1	0.04	1.38	3.5	82	19	842	4.1	2710	4610	22.4
1267X	3A	UN	0.1	0.03	1.34	2.2	84	17	1020	3.6	2780	4670	18.7
1267Y	3A	UN	0.1	0.03	1.24	2.1	83	17	977	3.2	2720	4620	16.2
1267Z	3A	UN	0.1	0.03	1.30	2.0	88	19	1020	3.5	2810	4720	18
1268X	3A	UN	0.1	0.03	1.59	2.1	140	26	1020	4.4	2630	4830	21.1
1268Y	3A	UN	0.1	0.02	1.68	2.2	97	18	926	3.7	2480	4490	17.5
1268Z*	3A	UN	0.1	0.03	1.59	2.3	81	20	848	3.6	2390	4110	18.6
1269X*	3A	1X	0.1	0.04	1.61	2.9	77	22	1050	4	3000	4140	21.3
1269Y	3A	1X	0.1	0.03	1.55	2.8	75	23	1050	4.2	3020	4110	22
1269Z	3A	1X	0.1	0.03	1.43	2.9	82	22	1030	4	2920	3910	20.7
1270X	3A	1X	0.1	0.03	1.67	2.9	107	20	1060	4.1	2780	4610	19.7
1270Y	3A	1X	0.1	0.03	1.69	3.1	117	21	1150	4.4	3020	4830	22.1
1270Z	3A	1X	0.1	0.03	1.80	3.0	109	21.5	1105	4.45	2930	4870	21.2
Bag #	plot	treat	As 0.2 mg/kg	Co 0.01 mg/kg	Cu 0.05 mg/kg	Ni 0.1 mg/kg	Ca 50 mg/kg	Fe 5 mg/kg	Mg 5 mg/kg	Mn 0.5 mg/kg	P 5 mg/kg	K 10 mg/kg	Zn 0.5 mg/kg
1271X	3A	2X	0.1	0.04	1.42	2.4	80	15	1040	4.5	2800	3730	23
1271Y	3A	2X	0.1	0.04	1.38	2.3	77	16	946	4.3	2720	3830	22
1271Z	3A	2X	0.1	0.05	1.39	2.3	63	17	927	3.9	2710	3680	21.2
1272X	3A	2X	0.1	0.04	1.29	2.2	72	17	963	4.1	2700	3790	20.1
1272Y	3A	2X	0.1	0.04	1.33	2.5	72	17	907	4	2610	3940	18.9
1272Z	3A	2X	0.1	0.03	1.34	2.3	78	19	976	4.6	2830	4190	20.8
1273X	4A	UN	0.1	0.04	1.41	2.5	64	23	931	4.6	3190	4440	23.9
1273Y	4A	UN	0.1	0.05	1.51	2.4	74	23	997	4.9	3330	4410	25.5
1273Z	4A	UN	0.1	0.04	1.65	2.5	79	23	1010	5.2	3390	4710	25.5
1274X*	4A	UN	0.1	0.05	1.45	2.5	66	20	872	4.3	2940	3980	21.5
1274Y	4A	UN	0.1	0.05	1.48	2.9	72	22	970	4.8	3190	4170	22.9
1274Z	4A	UN	0.1	0.05	1.38	2.7	62	19	862	3.9	2870	3940	21.1
1275X	4A	1X	0.1	0.04	1.52	2.0	102.5	18.5	1045	4.8	2830	4880	21.6
1275Y	4A	1X	0.1	0.04	1.44	2.2	95	17	962	4.3	2720	4830	19.7
1275Z	4A	1X	0.1	0.04	1.37	2.1	88	17	1030	4.8	2830	4730	22.2
1276X	4A	1X	0.1	0.04	1.32	2.3	130	16	1060	4.9	2670	5550	19.1
1276Y	4A	1X	0.1	0.04	1.34	2.2	126	19	1040	4.9	2660	5410	19.6
1276Z	4A	1X	0.1	0.04	1.31	2.3	132	17	1040	5.4	2630	5770	20.9
1277X	4A	2X	0.1	0.05	1.40	2.9	65	22	976	4.4	3040	4360	21.7
1277Y	4A	2X	0.1	0.05	1.44	3.0	70	21	958	4.2	3080	4350	21.3
1277Z	4A	2X	0.1	0.05	1.23	2.7	56	20	846	3.6	2750	3800	19
1278X	4A	2X	0.1	0.05	1.31	3.1	72	19	960	4	3050	4920	19.7
1278Y	4A	2X	0.1	0.05	1.37	3.0	69	21	974	4.2	3060	4690	20.8
1278Z	4A	2X	0.1	0.05	1.61	3.3	85	19	1020	4.3	3160	5140	20.6
1311X*	1B	CAL	0.1	0.03	1.37	2.8	138.5	16	1075	5.2	3210	6415	19.6
1311Y	1B	CAL	0.1	0.02	1.44	2.8	176	14	1080	5.1	3180	6860	19.2
1311Z	1B	CAL	0.1	0.03	1.57	2.8	171	17	1150	5.8	3370	7030	21.5
1312X	1B	CAL	0.1	0.03	1.61	2.8	150	21	1110	5.9	3100	6450	21
1312Y	1B	CAL	0.1	0.03	1.42	2.7	119	21	1010	5.4	2860	6000	19.5
1312Z	1B	CAL	0.1	0.03	1.54	2.9	147	21	1100	5.7	3050	6390	20.4
1313X	2B	CAL	0.1	0.02	1.45	2.3	205	23	1110	7.8	2720	5760	23.8
1313Y	2B	CAL	0.1	0.02	1.60	2.4	232	23	1160	7.9	2850	5990	24.3
1313Z	2B	CAL	0.1	0.02	1.95	2.8	304	23	1210	8.7	2910	7140	27.8
1314X	2B	CAL	0.1	0.03	3.53	6.6	716	22	1450	9.2	3370	13800	36.8
1314Y	2B	CAL	0.1	0.03	3.60	6.0	816	20	1500	9.2	3550	15100	37.6
1314Z	2B	CAL	0.1	0.03	3.71	6.3	782	23	1460	9.3	3430	14300	37.9
1316X	3B	CAL	0.1	0.03	5.70	2.5	158	20	1010	5.8	2770	7420	23.6
1316Y	3B	CAL	0.1	0.03	1.66	2.5	162	20	998	5.9	2720	7390	21
1316Z	3B	CAL	0.1	0.03	1.64	2.4	165	20	989	5.7	2750	7320	20.6
1317X	4B	CAL	0.1	0.03	1.23	2.7	100	19	1010	4.5	2750	5070	20.6
1317Y	4B	CAL	0.1	0.03	1.28	2.7	90	17	952	4.2	2640	4750	19.8
1317Z	4B	CAL	0.1	0.04	1.24	2.6	91	18	927	3.9	2540	4780	19.6
1318X	4B	CAL	0.1	0.03	1.37	2.7	93	17	955	3.9	2660	5380	17.2
1318Y	4B	CAL	0.1	0.03	1.38	2.8	95	18	931	4	2610	5260	18
1318Z	4B	CAL	0.1	0.03	1.28	2.7	88	16	918	3.8	2600	5110	16.8

Year 2001 Field Studies - C2 Site - Parameters in Radish (All Leaves)

Sample Code	plot	treat	Sample Dry Weight (g)	As	Co	Cu	Ni	Ca	Fe	Mg	Mn	P	K	Zn
		EQL	0.001	0.2	0.01	0.05	0.1	50	5	5	0.5	5	10	0.5
		Units	g	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
REF1AUNRAD1AL	1A	UN	1.654	0.3	1.17	12.60	52.4	30000	215	3270	18.5	2260	19200	24.3
REF1AUNRAD2AL	1A	UN	1.426	0.3	1.12	13.10	54.7	26600	221	3280	13.3	2190	24400	19.7
REF1AUNRAD3AL	1A	UN	1.149	0.3	1.12	11.30	60.7	22500	197	3040	15.2	2300	24200	17.7
REF1AUNRAD4AL	1A	UN	1.148	0.3	1.21	9.96	58.5	20600	220	2770	20.1	2150	22200	18.4
REF1AUNRAD5AL	1A	UN	2.216	0.3	1.03	12.65	48.1	26400	200	2830	16	1930	19750	18.65
REF1AUNRAD6AL	1A	UN	1.717	0.3	1.05	10.10	49.8	21900	230	2670	14.2	1720	20000	15.7
REF1AUNRAD7AL	1A	UN	1.530	0.3	1.24	12.20	62.4	25600	245	3040	16.8	2360	19800	19.4
REF1AUNRAD8AL	1A	UN	1.116	0.4	1.29	13.40	61.6	22700	250	2920	14	2330	25000	19.6
REF1A1XRAD1AL	1A	1X	1.490	0.3	1.00	13.30	46.6	27800	187	3450	14.9	2130	22600	18.2
REF1A1XRAD2AL	1A	1X	0.989	0.3	1.03	14.60	43.7	25300	167	2900	15.7	2700	23700	21.6
REF1A1XRAD3AL	1A	1X	1.727	0.3	1.02	13.10	39.1	25800	162	3160	15.6	2390	22700	21
REF1A1XRAD4AL	1A	1X	1.443	0.2	0.80	10.30	30.1	21900	131	2940	14.5	2090	22400	21.8
REF1A1XRAD5AL	1A	1X	1.882	0.2	0.93	10.50	32.7	26100	141	3040	15.7	2100	23500	20.2
REF1A1XRAD6AL	1A	1X	2.149	0.3	0.96	12.30	41.5	27200	171	3090	14	2380	21800	23.1
REF1A1XRAD7AL	1A	1X	2.497	0.5	1.10	11.30	54.0	50600	286	6570	12.8	1240	19700	22.2
REF1A1XRAD8AL	1A	1X	1.812	0.3	0.91	10.50	39.4	30500	187	3520	12	2010	20000	19.1
REF1A2XRAD1AL	1A	2X	1.091	0.4	1.77	16.70	65.8	36800	225	5630	12.9	3370	25600	32.2
REF1A2XRAD2AL	1A	2X	1.138	0.5	1.93	19.10	88.2	32600	304	4680	14.6	2760	21200	25.1
REF1A2XRAD3AL	1A	2X	1.614	0.4	1.47	11.60	46.6	33300	183	4950	13.2	2820	22200	31.9
REF1A2XRAD4AL	1A	2X	1.088	0.3	1.41	17.10	68.3	32700	212	5270	10.8	2650	20700	25.3
REF1A2XRAD5AL	1A	2X	1.568	0.3	1.28	15.40	43.0	32700	184	5060	10.9	2760	23200	28.2
REF1A2XRAD6AL	1A	2X	1.549	0.3	1.44	14.30	54.1	28300	208	4280	14.2	2960	22600	28.2
REF1A2XRAD7AL	1A	2X	1.269	0.3	1.38	13.80	50.9	24700	184	3820	11.7	3010	22800	27.1
REF1A2XRAD8AL	1A	2X	1.533	0.3	1.40	12.70	48.4	30400	214	5000	14.4	2830	20700	26.5
REF2AUNRAD1AL	2A	UN	0.791	0.3	1.35	10.80	63.0	25600	248	2760	18	2450	21400	17.9
REF2AUNRAD2AL	2A	UN	1.441	0.3	1.28	10.90	60.1	24700	218	2910	19.1	1930	15800	17.4
REF2AUNRAD3AL	2A	UN	1.034	0.3	1.37	10.70	64.4	27500	212	3400	16.6	2210	20100	19.1
REF2AUNRAD4AL	2A	UN	1.467	0.4	1.39	13.50	69.3	28900	268	2780	20.7	1790	20400	19.2
REF2AUNRAD5AL	2A	UN	0.936	0.5	1.72	13.90	82.5	23700	348	3010	19.6	2210	15600	20.8
REF2AUNRAD6AL	2A	UN	1.438	0.3	1.26	9.48	60.9	30800	233	3070	22.1	1860	20000	20.5
REF2AUNRAD7AL	2A	UN	1.514	0.3	1.15	11.10	52.6	27800	197	3170	18.1	2310	22000	19.7
REF2AUNRAD8AL	2A	UN	0.893	0.3	1.29	10.10	55.8	25800	202	2850	17.2	2210	15900	20.2
REF2A1XRAD1AL	2A	1X	1.805	1.2	3.05	21.80	154.0	31400	658	4160	13.6	2960	16900	29.2
REF2A1XRAD2AL	2A	1X	1.741	0.4	1.69	19.00	84.3	32600	207	3810	16.9	2490	20300	28
REF2A1XRAD3AL	2A	1X	1.586	0.4	1.93	15.40	87.4	34600	337	3980	17.2	2360	18700	28.5
REF2A1XRAD4AL	2A	1X	1.798	0.5	1.68	16.00	69.2	37200	226	4700	17	2490	20000	28.6
REF2A1XRAD5AL	2A	1X	1.729	0.4	1.65	14.10	67.3	34100	197	4250	19.1	2680	22900	24.9
REF2A1XRAD6AL	2A	1X	1.361	0.3	1.45	15.30	56.8	30300	164	4310	16.8	2950	20100	28.7
REF2A1XRAD7AL	2A	1X	1.724	0.3	1.59	17.40	69.7	30900	205	4140	16.8	2580	21200	25
REF2A1XRAD8AL	2A	1X	1.595	0.3	1.48	11.80	60.0	32100	262	3570	15.5	2000	19500	21.4
REF2A2XRAD1AL	2A	2X	1.055	0.2	1.08	9.83	36.5	23400	205	3310	13.4	2190	17800	17.3
REF2A2XRAD2AL	2A	2X	1.265	0.3	0.99	9.09	40.8	23800	257	3290	11.9	1750	19200	12.6
REF2A2XRAD3AL	2A	2X	0.665	0.3	1.17	10.20	53.4	20400	252	3220	15.3	2290	20400	16.9
REF2A2XRAD4AL	2A	2X	1.104	0.2	1.16	8.65	42.4	24900	219	3470	11.5	2080	20400	20.3
REF2A2XRAD5AL	2A	2X	1.260	0.3	1.00	8.50	48.4	17200	264	2920	11	1800	18900	14.4
REF2A2XRAD6AL	2A	2X	1.114	0.3	1.17	8.74	42.8	21600	265	3500	11.8	2020	20400	17.9
REF2A2XRAD7AL	2A	2X	1.195	0.3	1.13	10.50	40.6	18200	255	2970	11	2140	19500	21
REF2A2XRAD8AL	2A	2X	-	0.3	1.16	8.88	42.4	22300	246	3320	13	2085	17100	19.75

Year 2001 Field Studies - C2 Site - Parameters in Radish (All Leaves)

Sample Code	plot	treat	Sample Dry Weight (g)	As	Co	Cu	Ni	Ca	Fe	Mg	Mn	P	K	Zn
		EQL	0.001	0.2	0.01	0.05	0.1	50	5	5	0.5	5	10	0.5
		Units	g	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
REF3AUNRAD1AL	3A	UN	1.517	0.5	1.67	13.80	70.8	25300	303	3300	11.5	2940	20300	20.8
REF3AUNRAD2AL	3A	UN	2.157	0.9	2.41	19.30	124.0	25300	561	3340	14.3	2660	20400	29.4
REF3AUNRAD3AL	3A	UN	2.603	0.6	1.80	11.90	95.2	24200	395	2990	12.7	2420	23600	22.2
REF3AUNRAD4AL	3A	UN	1.999	0.9	2.92	19.20	146.0	33500	611	3920	15.9	2860	23900	31.5
REF3AUNRAD5AL	3A	UN	2.235	0.8	2.54	16.20	128.0	33500	548	4350	16.6	2680	18900	20.5
REF3AUNRAD6AL	3A	UN	3.176	1.3	3.78	26.80	213.0	41900	920	5190	19	3000	27300	29.6
REF3AUNRAD7AL	3A	UN	1.875	0.6	1.87	13.80	93.1	26500	408	3430	11.5	2760	25200	20.6
REF3AUNRAD8AL	3A	UN	2.672	0.6	1.84	13.00	84.1	27100	336	3370	11.7	2640	25100	23.8
REF3A1XRAD1AL	3A	1X	2.253	0.8	2.14	15.40	102.0	23900	514	4320	10.8	3100	20800	23
REF3A1XRAD2AL	3A	1X	0.685	0.6	1.88	14.40	82.1	18500	374	3470	11.2	3620	21600	35
REF3A1XRAD3AL	3A	1X	2.188	1.0	2.82	21.00	148.0	25800	642	4310	12.8	3640	20700	22.3
REF3A1XRAD4AL	3A	1X	2.099	1.0	3.30	22.00	178.0	32300	658	4230	14.5	2520	13800	32.7
REF3A1XRAD5AL	3A	1X	3.002	0.7	2.08	16.80	107.0	23500	441	3550	10.6	3280	16300	25
REF3A1XRAD6AL	3A	1X	2.032	0.7	2.11	15.20	107.0	21000	462	3320	11.1	2740	19200	30.9
REF3A1XRAD7AL	3A	1X	1.300	0.6	1.84	17.70	83.3	25700	390	4920	11.8	3860	22700	29.5
REF3A1XRAD8AL	3A	1X	1.930	0.8	1.91	19.10	89.3	22500	410	3580	10.8	3150	17000	36.7
REF3A2XRAD1AL	3A	2X	1.959	0.4	1.78	14.80	68.9	29800	215	3810	14.4	2660	19100	29.9
REF3A2XRAD2AL	3A	2X	1.339	1.0	3.14	20.70	152.0	33300	646	4240	14	2740	15000	33.2
REF3A2XRAD3AL	3A	2X	1.595	1.0	2.76	18.60	142.0	38100	552	5180	13.1	3330	18700	31.3
REF3A2XRAD4AL	3A	2X	3.367	1.0	2.79	20.40	140.0	22500	629	3520	12.4	3360	17300	29.1
REF3A2XRAD5AL	3A	2X	1.219	1.1	2.56	18.90	110.0	33300	523	4570	14.1	2860	16500	28.6
REF3A2XRAD6AL	3A	2X	1.359	1.2	3.14	22.30	152.0	29000	626	4030	14.8	2750	15500	32.2
REF3A2XRAD7AL	3A	2X	1.551	1.1	2.25	17.30	112.0	43400	496	5950	11.2	1710	11500	28.9
REF3A2XRAD8AL	3A	2X	1.291	0.9	1.75	14.90	87.8	41600	403	5320	9.9	1790	13000	23
REF4AUNRAD1AL	4A	UN	1.295	0.3	1.28	11.10	41.8	27400	206	4050	10.9	3500	22700	24.8
REF4AUNRAD2AL	4A	UN	0.803	0.4	1.60	15.20	68.0	22400	256	3150	13.8	2930	23200	22.6
REF4AUNRAD3AL	4A	UN	1.564	0.3	1.23	9.71	48.3	27500	193	3750	13.1	2590	20500	22.8
REF4AUNRAD4AL	4A	UN	1.593	0.3	1.20	9.52	42.2	26300	201.5	3575	13.15	2420	22800	19.35
REF4AUNRAD5AL	4A	UN	2.150	0.3	1.39	12.00	44.2	25700	201	3800	13.5	2830	24300	24.8
REF4AUNRAD6AL	4A	UN	1.621	0.3	1.10	9.36	36.7	23100	173	3740	12.5	2850	20400	21.2
REF4AUNRAD7AL	4A	UN	1.077	0.2	1.21	11.10	37.6	20800	178	2970	11.6	2770	19200	22
REF4AUNRAD8AL	4A	UN	2.028	0.3	1.16	10.90	45.8	31100	210	3750	13.3	2580	22200	22.1
REF4A1XRAD1AL	4A	1X	2.492	0.4	1.37	13.40	66.5	31300	306	4810	13	3070	26800	30.8
REF4A1XRAD2AL	4A	1X	1.620	0.4	1.31	13.70	50.6	21900	241	3690	12.2	3720	28200	30.9
REF4A1XRAD3AL	4A	1X	2.172	0.4	1.33	13.05	51.2	24700	256	4100	11.1	3445	28550	29.6
REF4A1XRAD4AL	4A	1X	2.100	0.4	1.37	12.60	53.6	23300	246	3820	14.9	3220	28600	27.1
REF4A1XRAD5AL	4A	1X	2.167	0.4	1.15	11.80	36.5	25600	176	4460	11	2860	26400	21.2
REF4A1XRAD6AL	4A	1X	1.380	0.4	1.61	11.90	55.2	23600	260	3950	11.3	3420	24000	27.8
REF4A1XRAD7AL	4A	1X	2.134	0.4	1.18	12.10	44.7	30000	244	4440	12.1	3280	25700	24.2
REF4A1XRAD8AL	4A	1X	2.261	0.4	1.46	13.50	55.9	27200	257	4850	14.5	2930	28900	23.8
REF4A2XRAD1AL	4A	2X	1.500	0.3	0.97	8.94	32.7	24200	206	4010	10.7	2540	21400	17.4
REF4A2XRAD2AL	4A	2X	1.333	0.3	1.12	10.80	35.7	22200	190	3680	11.3	2900	22000	21.5
REF4A2XRAD3AL	4A	2X	1.097	0.3	1.09	10.80	30.5	27000	173	3650	13.5	2520	20000	16.1
REF4A2XRAD4AL	4A	2X	1.289	0.3	1.17	10.30	33.5	29000	180	4230	10.8	2530	17500	27.4
REF4A2XRAD5AL	4A	2X	1.544	0.3	1.04	10.10	27.4	26400	192	4290	13.4	2820	22000	27.7
REF4A2XRAD6AL	4A	2X	1.581	0.2	0.99	8.69	35.8	21300	223	3620	9.9	2670	21500	25.1
REF4A2XRAD7AL	4A	2X	1.885	0.4	1.17	11.10	41.8	20700	241	3650	10.9	2990	22200	24.9
REF4A2XRAD8AL	4A	2X	1.187	0.3	1.17	11.00	46.6	21200	291	4090	9.9	2520	21400	19.1

Year 2001 Field Studies - C2 Site - Parameters in Radish (All Leaves)

Sample Code	plot	treat	Sample Dry Weight (g)	As	Co	Cu	Ni	Ca	Fe	Mg	Mn	P	K	Zn
		EQL	0.001	0.2	0.01	0.05	0.1	50	5	5	0.5	5	10	0.5
		Units	g	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
REF1BCALRAD1AL	1B	CAL	1.481	0.4	1.56	19.3	79	27400	358	5880	15.7	3990	29000	49.9
REF1BCALRAD2AL	1B	CAL	2.120	0.5	1.95	20	75.6	29700	379	5990	16.8	4620	32600	58
REF1BCALRAD3AL	1B	CAL	2.919	0.4	1.92	21.9	94.6	32300	401	6190	16	4220	31700	44.7
REF1BCALRAD4AL	1B	CAL	2.295	0.6	1.87	21.8	94.7	31000	416	6870	14.5	4590	31300	46.8
REF1BCALRAD5AL	1B	CAL	2.309	0.7	2.31	21.4	114	24700	497	5350	15.9	4510	29600	45.2
REF1BCALRAD6AL	1B	CAL	1.837	0.8	2.77	26	148	29900	633	7030	19.9	4330	23900	54.1
REF1BCALRAD7AL	1B	CAL	2.494	0.7	2.24	23.1	110	28900	473	6440	18.1	3920	28000	46
REF2BCALRAD1AL	2B	CAL	3.766	1.1	3.42	28.1	178	34900	982	6930	24.4	4160	27600	55.4
REF2BCALRAD2AL	2B	CAL	2.345	1.8	5.34	44.2	309	28500	1590	6570	32.2	4360	29300	53.7
REF2BCALRAD3AL	2B	CAL	2.341	1.3	4.08	38.7	216	29800	1150	7110	29.4	4450	26700	67
REF2BCALRAD4AL	2B	CAL	2.832	1.2	4.26	31.3	222	34100	1190	6560	27.7	3950	25400	56.6
REF2BCALRAD5AL	2B	CAL	3.348	1.1	3.87	37.3	198	29500	1020	6900	27.2	4490	31700	61.8
REF2BCALRAD6AL	2B	CAL	2.478	1.2	3.91	37.1	198	27400	1090	6680	27.9	4630	27900	55
REF2BCALRAD7AL	2B	CAL	4.466	1.1	3.89	34.6	210	32100	1090	6460	28.3	4510	30900	60.2
REF3BCALRAD1AL	3B	CAL	9.138	0.5	2.07	24.5	92	35900	401	6760	19.4	5290	30200	59
REF3BCALRAD2AL	3B	CAL	4.308	0.5	1.87	20.7	85.3	31500	350	5680	15.1	4500	26800	58.8
REF3BCALRAD3AL	3B	CAL	3.152	0.4	1.74	20.8	88.9	31200	341	5490	14.9	4830	30700	47.2
REF3BCALRAD4AL	3B	CAL	7.294	0.6	1.99	23.3	101	34100	414	6320	15.6	4940	30800	58.8
REF3BCALRAD5AL*	3B	CAL	5.880	0.4	1.705	20.45	82.7	28750	319	5865	17.75	5040	33150	55.1
REF3BCALRAD6AL	3B	CAL	10.163	0.4	1.67	19.8	78.7	36800	323	6410	14.7	4780	28300	50.9
REF3BCALRAD7AL	3B	CAL	9.549	0.5	2.14	21.5	115	36000	454	6820	18.4	4960	27500	64.1
REF4BCALRAD1AL	4B	CAL	1.644	0.7	2.17	21.9	89.8	26700	644	6770	21.3	4650	27500	54.7
REF4BCALRAD2AL	4B	CAL	3.015	0.6	2.01	19	75.8	30500	615	7000	20.9	4470	22300	58
REF4BCALRAD3AL*	4B	CAL	3.094	0.8	2.605	26.25	108.5	32250	791.5	7235	25.3	4425	25250	52.75
REF4BCALRAD4AL	4B	CAL	2.538	0.5	1.76	17.8	69.3	30000	539	6390	21.1	4280	23800	46
REF4BCALRAD5AL	4B	CAL	3.654	0.5	1.87	17	67.4	28700	577	6520	20.3	4270	27100	63.6
REF4BCALRAD6AL	4B	CAL	3.422	0.6	1.71	18.2	63	31000	501	6730	21.6	4240	26000	45.3
REF4BCALRAD7AL	4B	CAL	2.183	0.5	1.75	14.3	51.5	24400	457	5990	19.6	4630	28900	61.6

Year 2001 Field Studies - C2 Site - Parameters in Radish (Basal Leaves)

Sample Code	plot	treat	Sample Dry Weight (g)	As	Co	Cu	Ni	Ca	Fe	Mg	Mn	P	K	Zn
		Units	g	0.2	0.01	0.05	0.1	50	5	5	0.5	5	10	0.5
REF1AUNRAD1AL	1A	UN	1.616	0.6	1.00	11.40	53.6	49400	265	6010	11.6	1010	16800	22.4
REF1AUNRAD2AL	1A	UN	1.436	0.5	0.84	12.20	47.6	45300	251	5960	9.7	874	17000	17.9
REF1AUNRAD3AL	1A	UN	1.858	0.6	0.84	10.10	51.4	38000	211	5350	13.4	1060	24400	18.1
REF1AUNRAD4AL	1A	UN	2.458	0.6	0.96	8.06	50.2	41300	225	5490	17.9	1100	17600	18
REF1AUNRAD5AL	1A	UN	1.841	0.5	0.93	16.00	52.1	46600	227	4965	13.15	1020	16100	16.3
REF1AUNRAD6AL	1A	UN	2.020	0.5	0.90	9.89	50.6	43600	226	5010	11.3	984	17300	18.4
REF1AUNRAD7AL	1A	UN	1.967	0.6	1.06	11.70	56.6	42800	259	5070	11.9	1150	15100	18.6
REF1AUNRAD8AL	1A	UN	1.440	0.5	1.02	11.40	50.7	42900	248	5200	11.4	1060	20200	16.3
REF1A1XRAD1AL	1A	1X	1.406	0.5	0.83	13.10	46.6	48000	242	6140	8.4	1050	19000	18.9
REF1A1XRAD2AL	1A	1X	1.532	0.4	0.75	11.60	37.5	43400	177	4800	10.2	1210	19100	19.9
REF1A1XRAD3AL	1A	1X	2.043	0.5	0.94	12.20	49.0	41400	220	5450	9.8	1150	20700	16.8
REF1A1XRAD4AL	1A	1X	2.043	0.4	0.79	8.87	34.9	38400	185	5500	9.5	1010	22900	20.4
REF1A1XRAD5AL	1A	1X	2.371	0.5	0.91	11.60	44.5	45600	230	5850	12.4	1100	20000	20.1
REF1A1XRAD6AL	1A	1X	2.059	0.4	0.97	12.50	50.2	48600	251	6530	10.4	1240	17000	22.9
REF1A1XRAD7AL	1A	1X	2.893	0.3	1.08	11.70	44.1	31500	204	3870	15.3	2150	21000	25.1
REF1A1XRAD8AL	1A	1X	1.703	0.4	0.81	9.46	38.9	45900	201	5910	8.3	1030	15000	19.3
REF1A2XRAD1AL	1A	2X	1.185	0.6	1.23	14.90	53.4	59700	234	10100	10.8	1470	14300	27.9
REF1A2XRAD2AL	1A	2X	1.400	0.6	1.33	15.20	59.2	51100	264	8320	10.5	1180	13100	23.5
REF1A2XRAD3AL	1A	2X	1.698	0.6	1.10	9.84	44.8	52400	227	7720	9.9	1340	16700	22.9
REF1A2XRAD4AL	1A	2X	0.785	0.6	1.23	18.20	59.3	55700	242	9380	9.3	1190	10500	28.6
REF1A2XRAD5AL	1A	2X	1.461	0.5	1.14	12.50	48.6	48800	266	7760	8.5	1320	18600	19.5
REF1A2XRAD6AL	1A	2X	1.389	0.6	1.05	20.20	48.0	50700	245	7670	10	1090	15500	19.7
REF1A2XRAD7AL	1A	2X	1.720	0.5	1.07	12.00	51.4	47900	241	7390	8.3	1130	15100	22
REF1A2XRAD8AL	1A	2X	1.740	0.6	1.07	12.00	44.0	48300	255	9080	9.4	1260	14700	21.1
REF2AUNRAD1AL	2A	UN	1.562	0.5	0.88	8.27	51.4	41600	220	4870	11.2	1130	15700	18.4
REF2AUNRAD2AL	2A	UN	2.390	0.5	1.00	10.10	51.2	43600	215	5250	13.6	1200	13500	19.6
REF2AUNRAD3AL	2A	UN	1.804	0.5	1.03	8.95	57.8	42800	199	4970	10.8	1070	19000	17.1
REF2AUNRAD4AL	2A	UN	1.975	0.5	1.01	11.30	57.0	40200	262	3880	14.6	1120	17400	20.3
REF2AUNRAD5AL	2A	UN	1.476	0.5	0.97	8.63	52.7	41100	221	5040	15.4	1150	15100	21.3
REF2AUNRAD6AL	2A	UN	2.176	0.7	1.56	12.60	86.6	55600	369	5960	24.2	1220	17200	22.4
REF2AUNRAD7AL	2A	UN	1.767	0.5	0.87	8.98	43.9	38900	236	4700	10.9	1130	16800	18.3
REF2AUNRAD8AL	2A	UN	1.374	0.5	0.98	8.87	49.2	43300	245	4670	12.7	1100	12900	19.8
REF2A1XRAD1AL	2A	1X	1.843	0.6	1.32	13.50	66.8	51300	230	6360	11.4	1140	15700	28.5
REF2A1XRAD2AL	2A	1X	1.607	0.6	1.56	17.80	68.2	54500	204	6110	13	1290	16800	28.1
REF2A1XRAD3AL	2A	1X	1.040	0.6	1.62	14.80	83.5	59400	303	7040	13.3	1170	12100	28.4
REF2A1XRAD4AL	2A	1X	1.747	0.6	1.11	12.90	55.0	50300	199	6610	10.3	1230	15500	22.8
REF2A1XRAD5AL	2A	1X	1.748	0.5	1.26	11.10	54.2	52200	188	6280	12.6	1300	18400	21.4
REF2A1XRAD6AL	2A	1X	1.856	0.6	1.27	12.30	60.7	51500	232	7065	9.5	1410	17100	24.75
REF2A1XRAD7AL	2A	1X	1.633	0.6	1.31	16.20	74.9	50100	248	6870	12.5	1230	17100	22
REF2A1XRAD8AL	2A	1X	1.495	0.4	1.28	11.30	61.9	53500	227	6440	12.8	1160	13900	23
REF2A2XRAD1AL	2A	2X	2.009	0.4	0.77	7.58	31.8	43500	234	6590	8.5	923	11900	13.5
REF2A2XRAD2AL	2A	2X	1.554	0.5	0.94	9.57	45.1	48500	291	7820	8.7	850	14800	16.5
REF2A2XRAD3AL	2A	2X	1.583	0.4	0.72	7.44	34.8	34700	239	5690	10.4	1150	16300	17.6
REF2A2XRAD4AL	2A	2X	1.611	0.5	1.20	9.10	55.5	44000	368	7070	9.5	1120	16900	21.1
REF2A2XRAD5AL	2A	2X	1.880	0.4	0.89	7.94	43.8	32800	287	5400	9.3	1010	16900	17.6
REF2A2XRAD6AL	2A	2X	1.266	0.5	1.00	7.19	42.2	39900	321	7320	8.5	1040	16900	16.8
REF2A2XRAD7AL	2A	2X	1.681	0.5	0.88	7.92	37.1	38600	302	6340	8.4	1060	13600	16.6
REF2A2XRAD8AL	2A	2X	1.719	0.5	0.98	7.38	37.4	40600	306	6660	9.8	1030	14000	17.4

Year 2001 Field Studies - C2 Site - Parameters in Radish (Basal Leaves)

Sample Code	plot	treat	Sample Dry Weight (g)	As	Co	Cu	Ni	Ca	Fe	Mg	Mn	P	K	Zn
		Units	g	0.2	0.01	0.05	0.1	50	5	5	0.5	5	10	0.5
REF3AUNRAD1AL	3A	UN	1.608	0.6	1.46	12.90	58.9	40900	277	4510	10.4	1680	14700	20.7
REF3AUNRAD2AL	3A	UN	1.547	0.8	1.59	16.50	70.6	38500	349	5350	10.6	1800	15700	26.9
REF3AUNRAD3AL	3A	UN	2.165	0.7	1.65	9.87	63.9	37600	325	4560	12.7	1830	20500	25.3
REF3AUNRAD4AL	3A	UN	1.519	0.7	1.63	15.60	77.2	42700	343	5090	12.7	2050	17800	28.6
REF3AUNRAD5AL	3A	UN	1.690	0.5	1.34	11.30	60.9	47600	306	5630	12.9	1790	16600	16.6
REF3AUNRAD6AL	3A	UN	1.442	0.9	2.23	18.30	110.0	43400	598	5320	14.5	2390	20300	24.7
REF3AUNRAD7AL	3A	UN	1.387	0.6	1.34	11.00	60.5	33500	299	4370	10.9	1980	21300	15.9
REF3AUNRAD8AL	3A	UN	1.381	0.8	1.77	13.70	71.7	44000	379	5620	12.3	1870	22200	26.5
REF3A1XRAD1AL	3A	1X	1.656	0.9	1.47	12.80	64.5	38500	391	5950	10.6	2430	17900	21.9
REF3A1XRAD2AL	3A	1X	1.782	0.8	1.62	13.50	73.5	39800	401	6120	9.5	2200	17000	30.6
REF3A1XRAD3AL	3A	1X	2.360	0.9	1.86	14.70	98.4	44400	444	6430	9.9	1720	12600	19.7
REF3A1XRAD4AL	3A	1X	2.984	1.0	1.99	16.20	94.2	41700	481	5870	9.4	1900	12500	26.6
REF3A1XRAD5AL	3A	1X	2.335	0.8	1.49	16.30	79.1	44900	378	6240	8.6	1750	11200	31.7
REF3A1XRAD6AL	3A	1X	1.279	0.8	1.46	14.10	58.3	36600	358	5660	9.8	2050	14900	24
REF3A1XRAD7AL	3A	1X	1.604	0.6	1.18	14.90	52.0	38800	248	6820	8.8	2340	22900	31.9
REF3A1XRAD8AL	3A	1X	1.805	1.0	1.51	16.90	80.4	41900	345	5760	9.3	1750	11000	37.5
REF3A2XRAD1AL	3A	2X	1.125	1.1	2.07	16.60	100.0	45000	509	6420	11.3	2040	12900	28.1
REF3A2XRAD2AL	3A	2X	1.108	1.0	2.10	17.90	88.2	47800	440	5480	12.1	1870	8180	30.1
REF3A2XRAD3AL	3A	2X	1.313	1.1	2.25	17.10	99.6	54300	480	6880	13.2	2360	11200	31.8
REF3A2XRAD4AL	3A	2X	1.372	0.8	1.62	12.90	68.3	35900	325	4570	9.5	1470	7960	20.6
REF3A2XRAD5AL	3A	2X	0.734	1.0	1.69	15.40	60.8	40400	366	5470	12.1	2070	11200	28.2
REF3A2XRAD6AL	3A	2X	0.923	1.1	2.01	18.80	77.8	41600	401	5000	11.4	1760	12300	27.7
REF3A2XRAD7AL	3A	2X	1.352	0.9	2.60	18.50	121.0	22600	525	3430	12.8	3190	18600	29.6
REF3A2XRAD8AL	3A	2X	0.628	0.8	2.20	18.00	105.0	17400	411	3330	10.9	3630	24400	26.9
REF4AUNRAD1AL	4A	UN	1.597	0.3	0.76	8.38	27.9	40800	174	5390	8.3	1660	18500	22.9
REF4AUNRAD2AL	4A	UN	1.165	0.6	1.13	17.00	56.7	33700	241	4270	9.2	1550	22500	28.5
REF4AUNRAD3AL	4A	UN	1.798	0.5	0.98	8.09	45.1	41400	223	5410	8.6	1560	18600	24.4
REF4AUNRAD4AL	4A	UN	1.597	0.5	0.89	7.38	34.9	43500	206	6140	8.7	1550	24700	25.7
REF4AUNRAD5AL	4A	UN	2.046	0.5	1.20	11.00	43.4	41800	253	5630	8.8	1640	21200	25.6
REF4AUNRAD6AL	4A	UN	1.960	0.4	0.88	9.21	35.4	40200	218	5840	8.6	1680	18500	23.7
REF4AUNRAD7AL	4A	UN	1.912	0.4	0.94	9.80	35.2	39000	203	5380	9.2	1710	20800	22.4
REF4AUNRAD8AL	4A	UN	1.648	0.5	0.79	8.61	36.7	44500	209	5710	9.2	1540	19900	26.9
REF4A1XRAD1AL	4A	1X	1.966	0.5	0.99	10.50	41.1	49900	273	6870	8.7	1810	22400	26.9
REF4A1XRAD2AL	4A	1X	2.107	0.5	0.90	10.20	37.5	39700	245	5400	7.8	2100	27900	24.5
REF4A1XRAD3AL	4A	1X	2.032	0.4	0.81	9.04	31.3	41200	233	6630	7.8	2310	30600	26.5
REF4A1XRAD4AL	4A	1X	2.273	0.5	1.00	9.28	41.3	44400	280	6580	8	1820	25800	27.3
REF4A1XRAD5AL	4A	1X	2.210	0.4	0.91	8.54	31.1	41900	178.5	6150	8.45	1755	22350	27.3
REF4A1XRAD6AL	4A	1X	1.343	0.5	0.81	8.65	38.1	38200	242	6250	7.4	1720	23100	22.3
REF4A1XRAD7AL	4A	1X	1.688	0.6	0.78	8.34	35.3	46000	249	6610	7.8	1730	23200	21
REF4A1XRAD8AL	4A	1X	1.549	0.5	1.06	9.60	37.5	42900	226	7040	9.6	1460	21700	23.1
REF4A2XRAD1AL	4A	2X	1.409	0.4	0.84	7.79	30.0	40100	244	5800	8.4	1320	19900	16.3
REF4A2XRAD2AL	4A	2X	1.709	0.4	0.78	8.36	24.2	38300	181	5620	7.7	1580	20400	20.4
REF4A2XRAD3AL	4A	2X	1.626	0.4	0.83	9.91	24.8	41900	200	5510	10.3	1550	16200	18.7
REF4A2XRAD4AL	4A	2X	1.299	0.4	0.80	7.66	26.5	39700	176	6170	7.4	1380	11600	21.4
REF4A2XRAD5AL	4A	2X	1.594	0.4	0.89	8.01	25.6	42300	235	7000	8.9	1690	21400	30.5
REF4A2XRAD6AL	4A	2X	1.744	0.4	0.77	6.86	26.1	35800	255	6040	7.6	1530	23400	26.4
REF4A2XRAD7AL	4A	2X	2.058	0.4	0.69	6.68	26.6	34300	193	5550	6.8	1410	17300	25.9
REF4A2XRAD8AL	4A	2X	1.460	0.4	0.79	9.23	34.6	36600	287	6410	7	1410	24100	19.5

Year 2001 Field Studies - C2 Site - Parameters in Radish (Basal Leaves)

Sample Code	plot	treat	Sample Dry Weight (g)	As	Co	Cu	Ni	Ca	Fe	Mg	Mn	P	K	Zn
		Units	g	0.2	0.01	0.05	0.1	50	5	5	0.5	5	10	0.5
REF1BCALRAD1AL	1B	CAL	1.253	0.7	1.89	25.4	94.4	40900	494	6910	14.5	2250	22900	31.8
REF1BCALRAD2AL	1B	CAL	1.815	0.8	2.53	21.4	121	48600	671	7750	17.2	2590	21000	40.8
REF1BCALRAD3AL	1B	CAL	2.362	0.8	2.4	25.45	125.5	51800	589	7950	14.65	2560	21450	28.65
REF1BCALRAD4AL	1B	CAL	1.591	1.1	2.82	28.2	141	47000	699	8790	15.8	2310	18200	32.5
REF1BCALRAD5AL	1B	CAL	2.155	1	3.01	26.3	159	40600	823	7080	18	2410	21900	34.4
REF1BCALRAD6AL	1B	CAL	1.008	1.2	2.75	25.8	131	49400	767	8420	18.5	2080	12500	37.7
REF1BCALRAD7AL	1B	CAL	1.514	1.3	3.02	32.8	171	44600	826	8240	20.1	2070	19100	31.9
REF2BCALRAD1AL	2B	CAL	1.594	1.2	2.98	23.6	149	48200	924	8070	22.7	2240	17900	36.6
REF2BCALRAD2AL	2B	CAL	1.417	1.1	3.03	31.3	149	38200	917	7750	21.6	2760	25400	43.2
REF2BCALRAD3AL	2B	CAL	1.165	1.1	2.9	32.2	140	44900	911	9440	23	2890	18700	51.9
REF2BCALRAD4AL	2B	CAL	1.157	1.4	3.47	29.9	173	49200	1080	8710	23.6	2170	18200	37.3
REF2BCALRAD5AL	2B	CAL	2.038	1.2	3.35	30.6	164	46000	1030	8410	24	2450	21200	42.9
REF2BCALRAD6AL	2B	CAL	1.727	1.35	3.81	35.45	190.5	40600	1155	8725	26.3	3320	22950	47.6
REF2BCALRAD7AL	2B	CAL	2.436	1.5	4.44	38.3	228	50400	1380	8190	30.3	2190	20200	43.7
REF3BCALRAD1AL	3B	CAL	4.594	0.7	2.41	21.8	114	52100	542	8580	17.6	2820	18000	37.5
REF3BCALRAD2AL	3B	CAL	1.855	0.8	2.27	23.9	100	57600	476	7370	15.5	2340	14300	48
REF3BCALRAD3AL	3B	CAL	2.005	0.8	2.32	23.3	116	48300	542	6800	15.2	2330	17000	35.5
REF3BCALRAD4AL	3B	CAL	4.422	0.8	2.58	23.7	132	54900	629	7900	15.9	2330	16500	40.2
REF3BCALRAD5AL*	3B	CAL	3.045	0.8	2.21	22.9	106	50900	525	7470	17.6	2400	18200	41.9
REF3BCALRAD6AL	3B	CAL	3.533	0.8	2.07	20.1	106	60200	519	7960	14	1830	11600	32.8
REF3BCALRAD7AL	3B	CAL	3.761	0.9	2.82	23	152	59800	732	8990	17.6	2130	16000	39.3
REF4BCALRAD1AL	4B	CAL	0.641	1	2.24	27.6	88.8	38900	801	8910	21.1	3140	25000	44.7
REF4BCALRAD2AL	4B	CAL	1.165	0.9	2.33	23.7	87.3	47500	898	9150	22.8	2740	15300	40.7
REF4BCALRAD3AL*	4B	CAL	1.195	1.2	3.47	32.5	148	46900	1240	8540	29	2180	15500	41.1
REF4BCALRAD4AL	4B	CAL	0.985	0.8	1.86	20.2	66.1	50900	746	9200	20.7	2010	15900	27.9
REF4BCALRAD5AL	4B	CAL	1.928	0.8	2.22	18.1	77.2	43400	856	8620	22.4	2270	19700	38.8
REF4BCALRAD6AL	4B	CAL	1.627	0.9	2.01	20.3	74.5	47000	741	8720	23.2	2240	17100	34.1
REF4BCALRAD7AL	4B	CAL	1.521	0.8	1.91	16.2	68.5	46100	776	9260	20.7	2440	19300	48.1

Year 2001 Field Studies - C2 Site - Parameters in Radish (Globes)

Sample Code	plot	treat	Sample Dry Weight (g)	As	Co	Cu	Ni	Ca	Fe	Mg	Mn	P	K	Zn
		Units	g	0.2	0.01	0.05	0.1	50	5	5	0.5	5	10	0.5
REF1AUNRAD1AL	1A	UN	4.868	0.4	1.05	8.65	45.4	8990	79	3030	7.85	3265	51650	27.2
REF1AUNRAD2AL	1A	UN	4.157	0.4	1.02	10.70	46.9	8530	68	3010	7.4	3170	59000	25
REF1AUNRAD3AL	1A	UN	4.798	0.4	0.92	8.51	54.4	8210	64	2670	6	3780	51100	24.5
REF1AUNRAD4AL	1A	UN	7.513	0.3	0.86	6.40	42.7	7350	52	2250	7.3	3560	54800	23
REF1AUNRAD5AL	1A	UN	6.584	0.3	0.77	9.27	40.6	7570	64	2580	6.2	2880	49200	23.4
REF1AUNRAD6AL	1A	UN	7.254	0.3	0.78	7.76	44.3	7110	67	2080	6.2	3150	43800	19.9
REF1AUNRAD7AL	1A	UN	5.362	0.3	0.85	6.88	43.0	8460	59	2710	5.9	3080	47800	21.8
REF1AUNRAD8AL	1A	UN	4.270	0.3	0.74	8.93	35.8	7850	60.5	2620	5.75	2735	45450	16.95
REF1A1XRAD1AL	1A	1X	5.251	0.3	0.80	7.50	29.9	7810	63	2480	5.7	3200	50600	21.9
REF1A1XRAD2AL	1A	1X	4.650	0.3	0.81	8.32	34.8	7880	77	2770	5.7	3060	46200	24.1
REF1A1XRAD3AL	1A	1X	7.391	0.3	0.69	8.23	27.4	7080	53	2410	5.3	3060	42700	21.7
REF1A1XRAD4AL	1A	1X	6.785	0.2	0.64	7.31	22.9	6615	56.5	2240	5.3	2930	41800	21.9
REF1A1XRAD5AL	1A	1X	8.993	0.2	0.75	5.83	24.1	7880	57	2570	6.4	2900	48500	20.8
REF1A1XRAD6AL	1A	1X	8.085	0.2	0.70	6.28	22.1	7460	51	2575	5.25	3160	49550	22.4
REF1A1XRAD7AL	1A	1X	12.309	0.2	0.56	5.77	20.4	7010	53	2320	4.5	2620	49600	20.7
REF1A1XRAD8AL	1A	1X	7.539	0.2	0.62	7.06	24.8	7170	52	2290	5	3000	43200	19.6
REF1A2XRAD1AL	1A	2X	2.918	0.3	1.16	8.78	38.3	8080	59	3500	5.1	3940	54100	27.6
REF1A2XRAD2AL	1A	2X	3.245	0.3	1.07	8.20	40.6	7670	52	3230	4.9	3240	54600	27.8
REF1A2XRAD3AL	1A	2X	5.996	0.3	0.99	5.98	32.1	7300	56	3150	4.2	3470	57100	27.3
REF1A2XRAD4AL	1A	2X	2.063	0.4	1.37	11.20	54.0	9360	81	4770	6	4080	59300	32.6
REF1A2XRAD5AL	1A	2X	4.090	0.3	0.93	8.39	27.8	7300	53	3490	4.7	3550	63300	27.9
REF1A2XRAD6AL	1A	2X	4.327	0.2	0.79	6.93	32.6	6820	44	2950	4	3330	50800	24
REF1A2XRAD7AL	1A	2X	3.996	0.3	0.99	6.90	33.1	7030	52.5	3115	4.35	3210	50200	28.95
REF1A2XRAD8AL	1A	2X	5.506	0.2	0.90	5.97	25.7	6300	43	3010	4.1	3240	56200	25.6
REF2AUNRAD1AL	2A	UN	3.873	0.3	0.93	7.50	43.0	6730	60	2340	5.1	3040	45700	20.7
REF2AUNRAD2AL	2A	UN	7.889	0.3	0.91	8.24	46.6	6550	52.5	2050	5.8	3110	49050	22.45
REF2AUNRAD3AL	2A	UN	4.464	0.3	1.17	7.98	57.3	8430	57	2680	5.3	2860	47100	22.7
REF2AUNRAD4AL	2A	UN	7.989	0.2	0.81	7.83	41.7	6130	51	2030	5.4	2710	45800	20.5
REF2AUNRAD5AL	2A	UN	3.553	0.2	0.85	7.33	43.5	6000	59.5	2065	5.05	2580	36300	20.15
REF2AUNRAD6AL	2A	UN	15.540	0.3	1.10	7.58	56.9	7770	57	2280	7.8	2970	54700	27.8
REF2AUNRAD7AL	2A	UN	7.383	0.3	0.90	8.66	45.1	7150	59	2480	5.7	3860	50700	22.9
REF2AUNRAD8AL	2A	UN	4.686	0.2	0.78	6.38	40.2	6560	51	2160	4.5	2390	42300	19.4
REF2A1XRAD1AL	2A	1X	5.234	0.3	1.02	6.53	37.3	6550	60	2640	4.1	2740	43500	25.4
REF2A1XRAD2AL	2A	1X	5.791	0.2	0.84	7.51	32.8	5890	50	2140	3.8	2340	38700	19.7
REF2A1XRAD3AL	2A	1X	4.430	0.3	1.32	7.18	58.0	8380	76	3070	5.6	3260	43900	26.6
REF2A1XRAD4AL	2A	1X	6.775	0.3	1.06	9.19	44.5	7630	72	2680	4.7	3010	39900	24.8
REF2A1XRAD5AL	2A	1X	5.620	0.3	1.14	7.73	41.6	7090	58	3050	4.8	3330	48300	30.1
REF2A1XRAD6AL	2A	1X	5.723	0.2	0.91	7.53	35.9	6120	49	2420	4	2830	38800	23.6
REF2A1XRAD7AL	2A	1X	5.284	0.3	1.10	10.10	41.1	7810	62	2860	4.9	2720	42300	27.7
REF2A1XRAD8AL	2A	1X	5.775	0.2	1.07	7.00	44.3	7290	60	2840	4.8	2770	49100	24.3
REF2A2XRAD1AL	2A	2X	6.058	0.3	0.91	6.51	30.8	7660	76	2720	5.6	2660	43100	18
REF2A2XRAD2AL	2A	2X	4.358	0.3	1.04	8.35	35.4	8920	89	3200	7.1	3290	47100	20.1
REF2A2XRAD3AL	2A	2X	4.282	0.2	0.87	7.37	33.4	6850	69	2335	5.45	3295	39600	18.65
REF2A2XRAD4AL	2A	2X	4.930	0.1	0.78	5.16	25.6	6820	53	2380	4.8	2890	39400	19.7
REF2A2XRAD5AL	2A	2X	5.799	0.1	0.76	6.50	27.4	6310	49	2360	4.9	3220	42900	21.1
REF2A2XRAD6AL	2A	2X	4.121	0.1	0.95	4.90	24.5	6750	60	2590	6	3300	39900	20
REF2A2XRAD7AL	2A	2X	5.069	0.3	1.11	7.65	32.5	8665	76.5	2865	6.55	3425	44500	23.7
REF2A2XRAD8AL	2A	2X	5.237	0.3	0.93	6.13	26.8	7585	134.5	2705	6.05	4225	44650	28.5

Year 2001 Field Studies - C2 Site - Parameters in Radish (Globes)

Sample Code	plot	treat	Sample Dry Weight (g)	As	Co	Cu	Ni	Ca	Fe	Mg	Mn	P	K	Zn
		Units	g	0.2	0.01	0.05	0.1	50	5	5	0.5	5	10	0.5
REF3AUNRAD1AL	3A	UN	5.396	0.3	1.04	9.29	42.6	6340	68.5	2160	3.85	3585	39500	28.85
REF3AUNRAD2AL	3A	UN	5.795	0.4	1.11	9.74	46.9	5700	96	1830	4.5	3480	42400	26.3
REF3AUNRAD3AL	3A	UN	7.196	0.4	1.09	6.78	46.4	6310	85	2020	4.8	3700	51800	25.7
REF3AUNRAD4AL	3A	UN	5.683	0.4	1.14	9.34	48.6	7180	69.5	2420	4.25	3875	49800	29.1
REF3AUNRAD5AL	3A	UN	5.679	0.4	1.53	9.11	63.6	8500	112	3320	6.9	5850	50900	30
REF3AUNRAD6AL	3A	UN	6.045	0.6	1.75	12.60	67.5	8760	126	3030	6.2	5090	55900	34
REF3AUNRAD7AL	3A	UN	4.421	0.4	1.14	8.40	49.0	6440	76	2260	4.1	4210	51600	23.7
REF3AUNRAD8AL	3A	UN	7.056	0.3	1.00	6.80	43.9	5680	69	1940	4.2	4000	45800	24.7
REF3A1XRAD1AL	3A	1X	7.340	0.4	1.19	7.32	36.2	6310	81	2250	3.9	4910	48100	34.4
REF3A1XRAD2AL	3A	1X	4.812	0.5	1.31	10.50	46.4	7340	124	2810	4.4	5290	44100	31.5
REF3A1XRAD3AL	3A	1X	8.249	0.4	1.17	9.18	35.4	6270	90	2300	3.7	4520	47600	30
REF3A1XRAD4AL	3A	1X	10.897	0.5	1.35	9.48	41.0	6050	92	2240	4.1	4480	48600	34.4
REF3A1XRAD5AL	3A	1X	9.167	0.4	1.16	9.56	36.2	5570	79	2260	3.7	4100	45900	30.2
REF3A1XRAD6AL	3A	1X	5.860	0.4	1.18	8.69	34.0	5760	103	2100	3.8	4030	38200	30.3
REF3A1XRAD7AL	3A	1X	5.407	0.3	1.01	9.74	32.5	5885	61	2160	3.4	4165	37850	24.7
REF3A1XRAD8AL	3A	1X	7.104	0.5	1.10	10.30	35.9	6010	77	2300	4.1	4460	46200	31.9
REF3A2XRAD1AL	3A	2X	3.732	0.8	1.97	12.90	71.4	9860	135	4080	5.5	5130	53400	42.1
REF3A2XRAD2AL	3A	2X	2.366	0.7	1.93	11.10	54.8	8290	122	3240	4.8	5580	50200	36
REF3A2XRAD3AL	3A	2X	3.999	0.6	1.84	9.53	55.9	7450	99	2490	4.4	4540	45600	31.3
REF3A2XRAD4AL	3A	2X	5.709	0.5	1.30	9.36	45.2	7350	106	2650	4.5	4850	43500	30.5
REF3A2XRAD5AL	3A	2X	2.238	0.6	1.75	10.12	45.1	7700	119.5	3060	4.95	4750	49450	36.95
REF3A2XRAD6AL	3A	2X	2.233	0.7	2.08	13.40	62.9	7800	119	2570	4.4	5130	50400	37.8
REF3A2XRAD7AL	3A	2X	4.024	0.6	1.54	10.10	49.1	6480	109	2590	4.1	4130	42900	29.8
REF3A2XRAD8AL	3A	2X	2.194	0.6	1.46	10.08	50.8	6690	128	2620	4.4	4340	44800	30.8
REF4AUNRAD1AL	4A	UN	3.353	0.1	0.81	7.10	23.3	6520	54	2640	3.5	3570	42500	22.6
REF4AUNRAD2AL	4A	UN	2.882	0.2	1.00	8.41	37.5	6110	56	2230	4.5	3440	37100	23.3
REF4AUNRAD3AL	4A	UN	5.408	0.2	1.03	4.75	33.1	5830	56	2090	4.2	3280	41100	22.8
REF4AUNRAD4AL	4A	UN	5.073	0.2	0.77	5.69	26.2	5610	55	2140	3.7	2620	34800	19.4
REF4AUNRAD5AL	4A	UN	7.496	0.2	0.83	7.35	24.8	5030	53	2120	4	3150	39100	21.7
REF4AUNRAD6AL	4A	UN	5.075	0.2	0.78	6.87	26.5	5910	59	2240	4.1	3130	41100	22
REF4AUNRAD7AL	4A	UN	4.329	0.1	0.75	7.37	22.5	6160	64	2180	3.9	3030	34300	22.3
REF4AUNRAD8AL	4A	UN	4.128	0.3	0.94	13.00	31.9	7370	91	2870	5	3300	45900	26.3
REF4A1XRAD1AL	4A	1X	7.752	0.2	0.52	5.53	19.1	5180	55	2230	3.2	2810	38000	23.2
REF4A1XRAD2AL	4A	1X	5.047	0.3	0.69	6.67	23.3	5310	61	2230	3.7	3300	39300	23.9
REF4A1XRAD3AL	4A	1X	5.290	0.3	0.74	6.26	21.8	6340	70	2330	3.6	3440	44100	25.2
REF4A1XRAD4AL	4A	1X	6.621	0.2	0.67	6.14	22.4	5390	69	2240	4.2	3570	42800	22.4
REF4A1XRAD5AL	4A	1X	5.987	0.2	0.76	6.37	22.7	5300	58	2300	3.2	3760	42400	25.8
REF4A1XRAD6AL	4A	1X	2.769	0.3	0.86	7.92	26.6	6240	93	2620	4.4	4080	40600	25.7
REF4A1XRAD7AL	4A	1X	5.390	0.3	0.72	6.53	21.1	5750	60	2730	3.7	3600	47200	22
REF4A1XRAD8AL	4A	1X	4.742	0.3	0.78	8.25	26.6	5270	76	1950	4.4	3040	47700	19.8
REF4A2XRAD1AL	4A	2X	2.762	0.3	0.68	6.15	20.8	6370	70	2570	4.8	2920	45400	17.4
REF4A2XRAD2AL	4A	2X	5.055	0.2	0.66	6.00	16.3	5690	41	2110	3.4	2880	39200	16.9
REF4A2XRAD3AL	4A	2X	4.935	0.2	0.70	7.26	21.2	5290	70	2140	4.1	2940	37900	15.7
REF4A2XRAD4AL	4A	2X	3.099	0.2	0.69	6.22	19.3	6740	51	2690	4.1	2990	40400	25
REF4A2XRAD5AL	4A	2X	4.525	0.2	0.69	5.44	15.6	5760	61	2530	4.1	3110	42100	22.7
REF4A2XRAD6AL	4A	2X	3.489	0.3	0.70	5.09	21.9	5720	106	2730	4	3280	35300	24.9
REF4A2XRAD7AL	4A	2X	3.720	0.3	0.73	7.13	21.7	5175	73	2335	4.2	3020	37450	21.1
REF4A2XRAD8AL	4A	2X	2.793	0.2	0.68	6.63	22.1	5680	59	2620	3.3	2780	34900	17.2

Year 2001 Field Studies - C2 Site - Parameters in Radish (Globes)

Sample Code	plot	treat	Sample Dry Weight (g)	As	Co	Cu	Ni	Ca	Fe	Mg	Mn	P	K	Zn
		Units	g	0.2	0.01	0.05	0.1	50	5	5	0.5	5	10	0.5
REF1BCALRAD1AL	1B	CAL	2.553	0.4	0.8	10.3	36.9	9300	58	4010	5.9	3350	52100	47.7
REF1BCALRAD2AL	1B	CAL	5.235	0.4	0.95	6.77	28.5	8410	61	3230	5.8	3730	54000	38.7
REF1BCALRAD3AL	1B	CAL	5.323	0.4	0.95	8.63	36.3	9140	76	3140	5.4	3680	61400	42.9
REF1BCALRAD4AL	1B	CAL	4.195	0.6	0.96	9.79	39.4	9350	96	2760	5.7	3910	61200	46.1
REF1BCALRAD5AL	1B	CAL	5.497	0.5	1.06	8.95	42.4	9620	104	3480	6.5	3930	51300	38.6
REF1BCALRAD6AL	1B	CAL	2.874	0.6	1.01	7.18	38.5	8500	88	3230	6.4	4080	55500	43.8
REF1BCALRAD7AL	1B	CAL	4.379	0.5	1.07	9.93	46.8	10300	98	3550	7.9	3560	60200	40
REF2BCALRAD1AL	2B	CAL	3.386	0.6	1.18	7.78	39.5	9790	105	3930	8.1	3970	57500	54
REF2BCALRAD2AL	2B	CAL	2.911	0.7	1.35	10.7	49	10300	121	3990	8.6	4570	65300	51.2
REF2BCALRAD3AL	2B	CAL	2.378	0.6	1.39	10.9	51	9160	104	3450	8.6	4490	66100	61.5
REF2BCALRAD4AL	2B	CAL	2.321	0.7	1.31	7.87	51.1	9120	130	3940	8.1	3490	64600	42.9
REF2BCALRAD5AL	2B	CAL	3.747	0.6	1.44	12.3	51.2	10600	138	4540	9.6	4140	63200	58.8
REF2BCALRAD6AL	2B	CAL	2.706	0.75	1.59	12.15	54.85	10850	130.5	3770	11.05	4530	70500	56.75
REF2BCALRAD7AL	2B	CAL	5.510	0.5	1.36	10.5	48.9	9910	94	3870	8.8	3730	74000	60.2
REF3BCALRAD1AL	3B	CAL	11.882	0.6	1.22	11.1	48	11700	106	4690	8.5	3500	76200	50.2
REF3BCALRAD2AL	3B	CAL	6.165	0.6	1.22	12.5	57.5	13100	119	4360	9.1	4030	66300	51.3
REF3BCALRAD3AL	3B	CAL	5.063	0.6	1.51	13.6	64.2	14600	163	4480	9.5	3630	67400	48.3
REF3BCALRAD4AL	3B	CAL	8.891	0.6	1.305	12.25	59.3	11300	151	4335	8.2	3165	63750	49.85
REF3BCALRAD5AL*	3B	CAL	8.950	0.5	1.05	10.8	43.2	12200	102	4390	7.3	3260	60900	47.8
REF3BCALRAD6AL	3B	CAL	9.048	0.5	0.89	9.81	43.1	12500	91	4490	6.4	3200	64600	39.9
REF3BCALRAD7AL	3B	CAL	10.675	0.6	1.2	10.3	52.9	12200	112	4910	8	3820	70100	52.8
REF4BCALRAD1AL	4B	CAL	2.060	0.6	1.1	10.1	31.4	7970	141	2790	7.8	4660	57100	47.7
REF4BCALRAD2AL	4B	CAL	3.021	0.6	1.14	10.7	33.6	6350	171	2810	8.8	5360	45700	57.3
REF4BCALRAD3AL*	4B	CAL	3.372	0.6	1.26	10.3	43.2	8070	181	3500	10	4040	54700	46.2
REF4BCALRAD4AL	4B	CAL	2.753	0.5	1.06	9.28	30.4	8200	162	3350	9	4460	48700	36.6
REF4BCALRAD5AL	4B	CAL	4.839	0.5	0.97	7.23	25.1	7000	114	2930	7.3	4030	55700	48
REF4BCALRAD6AL	4B	CAL	4.263	0.5	1.04	9.25	32.6	6560	137	2540	7.7	4460	56700	40.1
REF4BCALRAD7AL	4B	CAL	2.935	0.6	1.14	7.82	30	7330	162	3290	8.1	4610	63500	48

Year 2001 Field Trials Soil Characteristics for C2 Site

Sample Code	Plot	Treatment	OATS	SOYBEAN	RADISH	CORN
			pH (H2O)	pH (H2O)	pH (H2O)	pH (H2O)
		EQL	0.01	0.01	0.01	0.01
		Units	Units	Units	Units	Units
REF1AUN1	1A	UN	6.36	6.36	6.36	6.36
REF1AUN2	1A	UN	6	6	6	6
REF1AUN3	1A	UN	5.96	5.96	5.96	5.96
REF1AUN4	1A	UN	6.125	6.125	6.125	6.125
REF1AUN5	1A	UN	6.21	6.21	6.21	6.21
REF1AUN6	1A	UN	6.11	6.11	6.11	6.11
REF1A1X1	1A	1X	6.315	6.315	6.315	6.315
REF1A1X2	1A	1X	6.58	6.58	6.58	6.58
REF1A1X3	1A	1X	6.57	6.57	6.57	6.57
REF1A1X4	1A	1X	6.64	6.64	6.64	6.64
REF1A1X5	1A	1X	6.77	6.77	6.77	6.77
REF1A1X6	1A	1X	6.8	6.8	6.8	6.8
REF1A2X1	1A	2X	6.6	6.6	6.6	6.6
REF1A2X2	1A	2X	6.61	6.61	6.61	6.61
REF1A2X3	1A	2X	6.87	6.87	6.87	6.87
REF1A2X4	1A	2X	7.11	7.11	7.11	7.11
REF1A2X5	1A	2X	6.88	6.88	6.88	6.88
REF1A2X6	1A	2X	6.9	6.9	6.9	6.9
REF2AUN1	2A	UN	6.53	6.53	6.53	6.53
REF2AUN2	2A	UN	5.88	5.88	5.88	5.88
REF2AUN3	2A	UN	6	6	6	6
REF2AUN4	2A	UN	6.63	6.63	6.63	6.63
REF2AUN5	2A	UN	6.13	6.13	6.13	6.13
REF2AUN6	2A	UN	6.64	6.64	6.64	6.64
REF2A1X1	2A	1X	6.64	6.64	6.64	6.64
REF2A1X2	2A	1X	6.49	6.49	6.49	6.49
REF2A1X3	2A	1X	6.66	6.66	6.66	6.66
REF2A1X4	2A	1X	6.68	6.68	6.68	6.68
REF2A1X5	2A	1X	6.71	6.71	6.71	6.71
REF2A1X6	2A	1X	6.7	6.7	6.7	6.7
REF2A2X1	2A	2X	6.84	6.84	6.84	6.84
REF2A2X2	2A	2X	6.89	6.89	6.89	6.89
REF2A2X3	2A	2X	6.87	6.87	6.87	6.87
REF2A2X4	2A	2X	7.005	7.005	7.005	7.005
REF2A2X5	2A	2X	6.97	6.97	6.97	6.97
REF2A2X6	2A	2X	7.05	7.05	7.05	7.05
REF3AUN1	3A	UN	6.28	6.28	6.28	6.28
REF3AUN2	3A	UN	6.35	6.35	6.35	6.35
REF3AUN3	3A	UN	6.36	6.36	6.36	6.36
REF3AUN4	3A	UN	6.22	6.22	6.22	6.22
REF3AUN5	3A	UN	6.16	6.16	6.16	6.16
REF3AUN6	3A	UN	6.74	6.74	6.74	6.74
REF3A1X1	3A	1X	6.67	6.67	6.67	6.67
REF3A1X2	3A	1X	6.71	6.71	6.71	6.71
REF3A1X3	3A	1X	6.7	6.7	6.7	6.7
REF3A1X4	3A	1X	6.66	6.66	6.66	6.66
REF3A1X5	3A	1X	6.71	6.71	6.71	6.71
REF3A1X6	3A	1X	7.08	7.08	7.08	7.08
REF3A2X1	3A	2X	7.02	7.02	7.02	7.02
REF3A2X2	3A	2X	6.97	6.97	6.97	6.97
REF3A2X3	3A	2X	6.88	6.88	6.88	6.88
REF3A2X4	3A	2X	7.05	7.05	7.05	7.05
REF3A2X5	3A	2X	6.87	6.87	6.87	6.87
REF3A2X6	3A	2X	6.87	6.87	6.87	6.87

Year 2001 Field Trials Soil Characteristics for C2 Site

Sample Code	Plot	Treatment	OATS	SOYBEAN	RADISH	CORN
			pH (H2O)	pH (H2O)	pH (H2O)	pH (H2O)
		EQL	0.01	0.01	0.01	0.01
		Units	Units	Units	Units	Units
REF4AUN1	4A	UN	7.05	7.05	7.05	7.05
REF4AUN2	4A	UN	6.37	6.37	6.37	6.37
REF4AUN3	4A	UN	6.71	6.71	6.71	6.71
REF4AUN4	4A	UN	6.62	6.62	6.62	6.62
REF4AUN5	4A	UN	6.48	6.48	6.48	6.48
REF4AUN6	4A	UN	6.52	6.52	6.52	6.52
REF4A1X1	4A	1X	6.88	6.88	6.88	6.88
REF4A1X2	4A	1X	6.83	6.83	6.83	6.83
REF4A1X3	4A	1X	6.8	6.8	6.8	6.8
REF4A1X4	4A	1X	6.77	6.77	6.77	6.77
REF4A1X5	4A	1X	6.82	6.82	6.82	6.82
REF4A1X6	4A	1X	6.79	6.79	6.79	6.79
REF4A2X1	4A	2X	6.98	6.98	6.98	6.98
REF4A2X2	4A	2X	6.82	6.82	6.82	6.82
REF4A2X3	4A	2X	7.02	7.02	7.02	7.02
REF4A2X4	4A	2X	6.83	6.83	6.83	6.83
REF4A2X5	4A	2X	6.82	6.82	6.82	6.82
REF4A2X6	4A	2X	6.95	6.95	6.95	6.95
REF1BCAL1	1B	CAL	6.92	6.92	6.92	6.92
REF1BCAL2	1B	CAL	6.82	6.82	6.82	6.82
REF1BCAL3	1B	CAL	7.01	7.01	7.01	7.01
REF1BCAL4	1B	CAL	7.04	7.04	7.04	7.04
REF1BCAL5	1B	CAL	7.035	7.035	7.035	7.035
REF1BCAL6	1B	CAL	7.02	7.02	7.02	7.02
REF2BCAL1	2B	CAL	7.15	7.15	7.15	7.15
REF2BCAL2	2B	CAL	6.99	6.99	6.99	6.99
REF2BCAL3	2B	CAL	6.84	6.84	6.84	6.84
REF2BCAL4	2B	CAL	6.85	6.85	6.85	6.85
REF2BCAL5	2B	CAL	7.07	7.07	7.07	7.07
REF2BCAL6	2B	CAL	6.93	6.93	6.93	6.93
REF3BCAL1	3B	CAL	6.98	6.98	6.98	6.98
REF3BCAL2	3B	CAL	6.93	6.93	6.93	6.93
REF3BCAL3	3B	CAL	7.09	7.09	7.09	7.09
REF3BCAL4	3B	CAL	7.03	7.03	7.03	7.03
REF3BCAL5	3B	CAL	6.795	6.795	6.795	6.795
REF3BCAL6	3B	CAL	7.1	7.1	7.1	7.1
REF4BCAL1	4B	CAL	7.15	7.15	7.15	7.15
REF4BCAL2	4B	CAL	7.04	7.04	7.04	7.04
REF4BCAL3	4B	CAL	6.98	6.98	6.98	6.98
REF4BCAL4	4B	CAL	6.89	6.89	6.89	6.89
REF4BCAL5	4B	CAL	6.92	6.92	6.92	6.92
REF4BCAL6	4B	CAL	6.96	6.96		6.96

Year 2001 Field Trials Soil Characteristics for C2 Site

Sample Code	Plot	Treatment	Antimony	Arsenic	Selenium	Aluminum	Barium	Beryllium	Cadmium	Chromium	Cobalt	Copper	Iron	Lead	Manganese	Molybdenum
		EQL	0.2	0.2	0.2	20	5	0.2	0.5	1	2	1	50	5	1	3
		Units	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
REF1AUN1	1A	UN	0.7	27.8	5.65	25300	181	1.3	1.3	32	82.5	657	24000	42	260	1.5
REF1AUN2	1A	UN	0.4	25.4	6.1	24300	171	1.2	1.1	31	82	636	23100	37	225	1.5
REF1AUN3	1A	UN	0.7	33.1	6.3	25000	191	1.4	1.4	32	96	797	25700	44	272	1.5
REF1AUN4	1A	UN	0.7	27.3	7.2	24500	174	1.2	1.2	31	83	639	23300	40	244	1.5
REF1AUN5	1A	UN	0.7	27.3	6.1	24900	175	1.2	1.5	32	88	679	23300	38	258	1.5
REF1AUN6	1A	UN	0.8	36.1	7.4	24900	189	1.4	1.5	34	108	952	25300	54	245	1.5
REF1A1X1	1A	1X	0.6	31.15	6.25	24400	186.5	1.25	1.3	32	80.5	680	22900	40	229	1.5
REF1A1X2	1A	1X	0.6	26.4	5.4	24000	175	1.2	1	30	80	639	22000	34	232	1.5
REF1A1X3	1A	1X	0.6	26.4	5.7	23700	172	1.2	0.8	32	79	611	22300	45	224	1.5
REF1A1X4	1A	1X	0.7	31.2	6.6	24200	176	1.3	1.4	31	90	704	22600	40	220	1.5
REF1A1X5	1A	1X	0.7	32.1	5.6	26000	184	1.3	1.4	33	89	714	25500	43	286	1.5
REF1A1X6	1A	1X	0.9	32.1	6.4	28100	197	1.4	1.6	35	93	794	26100	40	277	1.5
REF1A2X1	1A	2X	0.7	36.1	6.9	24400	182	1.3	1.5	32	108	850	24200	46	267	1.5
REF1A2X2	1A	2X	0.9	47.2	9.2	26200	192	1.4	2.3	35	133	1010	25500	53	244	1.5
REF1A2X3	1A	2X	0.7	29.2	6.9	25400	175	1.3	1.5	33	93	682	23800	46	264	1.5
REF1A2X4	1A	2X	0.7	30.2	6.5	23700	170	1.2	1.3	30.5	92	688	22750	41	236.5	1.5
REF1A2X5	1A	2X	0.6	23.5	6.1	24400	170	1.2	0.6	32	75	557	21900	31	215	1.5
REF1A2X6	1A	2X	0.7	27.3	7.2	24400	174	1.2	1.3	31	90	637	23000	40	234	1.5
REF2AUN1	2A	UN	1	32.45	6.45	25050	178.5	1.25	1.1	31.5	87.5	674	23050	41.5	241.5	1.5
REF2AUN2	2A	UN	0.8	24.9	6	24000	161	1.1	1.2	31	72	504	21600	43	212	1.5
REF2AUN3	2A	UN	1	27	6.9	24000	166	1.2	0.9	30	79	592	22600	33	213	1.5
REF2AUN4	2A	UN	1.1	32.4	6.1	26600	186	1.3	1.1	32	84	659	23400	39	244	1.5
REF2AUN5	2A	UN	1	30.3	6.3	25500	179	1.2	0.9	32	80	625	23000	41	238	1.5
REF2AUN6	2A	UN	1	31.4	6.1	26300	183	1.3	1.3	32	86	707	24000	39	254	1.5
REF2A1X1	2A	1X	0.8	26	6.1	23700	166	1.1	1	30	71	550	22200	38	221	1.5
REF2A1X2	2A	1X	0.9	32.9	6.15	25950	194	1.35	1.25	31.5	76.5	680	24500	42	240.5	1.5
REF2A1X3	2A	1X	0.9	28.1	5.9	24000	171	1.2	1.1	31	75	563	22500	38	242	1.5
REF2A1X4	2A	1X	1	32.4	6.4	25000	179	1.2	1.2	31	76	650	23200	36	240	1.5
REF2A1X5	2A	1X	0.8	26	5.8	23900	165	1.1	1	30	68	546	22100	37	209	1.5
REF2A1X6	2A	1X	1.1	28.1	6	24700	172	1.2	1.1	30	77	586	22900	33	247	1.5
REF2A2X1	2A	2X	1	30.3	6.7	25400	179	1.2	1.2	32	84	622	24300	40	260	1.5
REF2A2X2	2A	2X	1	32.4	6.1	25400	176	1.2	0.8	31	77	629	22300	39	221	1.5
REF2A2X3	2A	2X	1	32.4	6	23900	171	1.2	1.2	31	87	641	21900	45	224	1.5
REF2A2X4	2A	2X	0.8	27.55	5.9	24650	174.5	1.25	1.2	31.5	79	610.5	22250	41.5	222	1.5
REF2A2X5	2A	2X	0.8	26	5.9	24300	165	1.2	0.7	30	72	547	21800	34	210	1.5
REF2A2X6	2A	2X	0.8	27	6.1	25500	174	1.2	0.7	32	76	544	23900	38	245	1.5
REF3AUN1	3A	UN	0.75	30.3	5.3	23650	173.5	1.15	1.55	30	71.5	558	22250	40.5	237	1.5
REF3AUN2	3A	UN	0.6	23	4.3	22100	153	1.1	1.7	30	58	422	21700	39	217	1.5
REF3AUN3	3A	UN	0.5	21.9	4	22100	151	1	1.2	29	58	422	21300	36	208	1.5
REF3AUN4	3A	UN	0.4	20.9	3.8	22000	150	1	1.2	29	53	390	20800	33	200	1.5
REF3AUN5	3A	UN	0.7	28.2	4.7	23100	166	1.1	1.1	30	69	514	21800	38	227	1.5
REF3AUN6	3A	UN	0.6	26.1	3.9	20700	146	1	1.1	28	58	445	19900	37	219	1.5
REF3A1X1	3A	1X	0.8	30.3	4.7	22700	167	1.2	1.8	30	67	531	22100	41	216	1.5
REF3A1X2	3A	1X	0.6	25.2	4.95	22350	162	1.1	1	29	65	495	21850	37	209	1.5
REF3A1X3	3A	1X	0.7	33.4	4.8	23100	171	1.2	1.5	30	71	576	22000	42	224	1.5
REF3A1X4	3A	1X	0.7	29.2	4	20900	155	1.1	1.3	29	63	478	20700	37	215	1.5
REF3A1X5	3A	1X	0.6	21.9	4	22500	151	1	0.9	30	58	417	22100	38	225	1.5
REF3A1X6	3A	1X	0.6	23	4	22100	156	1	1.5	29	62	471	21700	36	237	1.5
REF3A2X1	3A	2X	0.5	21.9	4	22700	153	1.1	0.9	32	54	384	23000	36	203	1.5
REF3A2X2	3A	2X	0.8	31.3	4.6	24800	177	1.2	1.6	32	73	593	24500	41	246	1.5
REF3A2X3	3A	2X	0.9	31.3	4.5	23700	173	1.2	1.2	31	67	558	22200	36	232	1.5
REF3A2X4	3A	2X	0.7	26.6	4.9	22500	156.5	1.1	1.15	30	60	450	22650	37	225	1.5
REF3A2X5	3A	2X	0.8	31.3	4.5	22700	164	1.2	1.5	30	67	512	20500	42	221	1.5
REF3A2X6	3A	2X	0.7	25.1	4.3	23400	156	1.1	1.1	32	60	441	22300	37	212	1.5

Year 2001 Field Trials Soil Characteristics for C2 Site

Sample Code	Plot	Treatment	Antimony	Arsenic	Selenium	Aluminum	Barium	Beryllium	Cadmium	Chromium	Cobalt	Copper	Iron	Lead	Manganese	Molybdenum
		EQL	0.2	0.2	0.2	20	5	0.2	0.5	1	2	1	50	5	1	3
		Units	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
REF4AUN1	4A	UN	0.7	31.95	5.6	23150	179	1.2	1.4	30	74.5	642.5	24800	45	270.5	1.5
REF4AUN2	4A	UN	0.5	28.2	4.8	20900	151	1.1	1.4	28	63	509	21400	40	211	1.5
REF4AUN3	4A	UN	0.5	33.3	5.7	22900	167	1.1	1.2	29	69	530	23900	34	308	1.5
REF4AUN4	4A	UN	0.7	30.2	4.9	22400	170	1.2	1.4	29	68	551	23400	38	252	1.5
REF4AUN5	4A	UN	0.5	29.2	5.7	21800	164	1.2	1.3	29	69	611	22800	44	215	1.5
REF4AUN6	4A	UN	0.5	32.2	4.9	22300	168	1.2	0.9	29	71	582	23800	39	239	1.5
REF4A1X1	4A	1X	0.7	27.3	4.9	24900	187	1.3	1.5	33	82	704	25600	47	261	1.5
REF4A1X2	4A	1X	0.5	25.3	4.8	22300	163	1.1	1.1	28	60	499	21900	38	230	1.5
REF4A1X3	4A	1X	0.5	24.3	4.4	23800	167	1.2	1	29	62	532	22300	33	232	1.5
REF4A1X4	4A	1X	0.5	30.2	4.4	23000	161	1.1	1	29	58	504	22400	36	228	1.5
REF4A1X5	4A	1X	0.725	26.75	5.35	23275	174.25	1.175	0.975	30.25	70.5	573	23675	39.5	235.5	1.5
REF4A1X6	4A	1X	0.6	26.3	4	21800	152	1.1	1	28	60	510	20700	38	221	1.5
REF4A2X1	4A	2X	0.7	25.3	4.8	21900	159	1.1	1.2	28	66	520	22900	39	224	1.5
REF4A2X2	4A	2X	0.5	25.3	4	21600	155	1.1	1.3	27	60	530	21300	36	225	1.5
REF4A2X3	4A	2X	0.6	24.3	4.1	22900	160	1.1	0.7	28	60	533	22500	31	227	1.5
REF4A2X4	4A	2X	0.65	28.8	5.35	22400	163	1.2	1.15	29	64	582.5	22700	42.5	205.5	1.5
REF4A2X5	4A	2X	0.7	25.3	5.1	21700	156	1.1	1.3	28	65	557	21900	42	220	1.5
REF4A2X6	4A	2X	0.8	28.2	5.6	23200	170	1.2	1	29	73	624	24300	36	236	1.5
REF1BCAL1	1B	CAL	0.7	28.3	6.1	22100	159	1.1	1.1	28	81	654	21400	45	265	1.5
REF1BCAL2	1B	CAL	0.6	22.6	4.9	21000	150	1	1.1	28	68	487	19700	36	240	1.5
REF1BCAL3	1B	CAL	0.7	20.7	4.8	21100	151	1	0.6	27	64	467	20900	33	272	1.5
REF1BCAL4	1B	CAL	0.5	19.7	4.1	20400	143	1	0.8	27	61	420	19900	38	257	1.5
REF1BCAL5	1B	CAL	0.65	31.2	5.4	22550	169	1.1	1.2	29	78	641	23600	43	292.5	1.5
REF1BCAL6	1B	CAL	0.5	20.7	4.6	20700	145	1	1	27	64	452	20200	39	274	1.5
REF2BCAL1	2B	CAL	0.6	18.5	4.1	23100	153	1.1	0.6	29	57	396	20900	34	236	1.5
REF2BCAL2	2B	CAL	1	30.3	5.9	25900	181	1.2	1.4	32	79	615	23600	38	269	1.5
REF2BCAL3	2B	CAL	0.6	18.6	3.7	22900	155.5	1.05	0.6	28.5	46	321.5	21050	30.5	202	1.5
REF2BCAL4	2B	CAL	1	30.2	5.3	25000	175	1.2	1.3	31	74	595	23100	42	278	1.5
REF2BCAL5	2B	CAL	0.6	18.4	3.8	22800	151	1	0.7	29	52	368	20800	32	220	1.5
REF2BCAL6	2B	CAL	0.8	24.9	5	25200	172	1.2	0.8	31	64	476	22800	35	247	1.5
REF3BCAL1	3B	CAL	0.7	27.1	3.9	22900	158	1.1	1.3	30	64	477	21500	40	257	1.5
REF3BCAL2	3B	CAL	0.8	32.4	4.9	23700	163	1.1	1.3	30	71	524	22400	43	280	1.5
REF3BCAL3	3B	CAL	0.7	26.1	4	23100	157	1.1	1.5	30	58	418	21700	39	262	1.5
REF3BCAL4	3B	CAL	0.8	34.5	4.9	24300	169	1.2	1.9	32	78	584	23500	45	274	1.5
REF3BCAL5	3B	CAL	0.75	32.35	4.35	24950	176	1.2	1.45	30	69.5	595	22850	37	259.5	1.5
REF3BCAL6	3B	CAL	0.8	29.2	4.4	22900	159	1.1	1.7	31	69	526	21600	44	278	1.5
REF4BCAL1	4B	CAL	0.75	27.25	4.5	24050	176.5	1.25	1	31.5	61.5	517	24700	38.5	278.5	1.5
REF4BCAL2	4B	CAL	0.6	24.3	4.2	24800	178	1.2	1	30	54	454	23600	30	240	1.5
REF4BCAL3	4B	CAL	0.7	21.3	4.3	23500	171	1.1	0.6	29	54	449	23400	31	224	1.5
REF4BCAL4	4B	CAL	0.6	20.4	4.4	23700	173	1.1	0.8	30	54	434	23800	35	230	1.5
REF4BCAL5	4B	CAL	0.5	25.3	4.8	23700	169	1.1	0.6	29	53	446	24000	33	229	1.5
REF4BCAL6	4B	CAL	0.5	23.3	5	23500	172	1.1	1.2	29	54	448	23500	34	238	1.5

Year 2001 Field Trials Soil Characteristics for C2 Site

Sample Code	Plot	Treatment	Nickel	Phosphorus	Silver	Titanium	Vanadium	Zinc	Conductivity - @25øC	Loss on Ignition	Cation Exchange Capacity(as Na)	Moisture Content	Total Inorganic Carbon(as C)	Total Carbon(as C)	Total Organic Carbon
		EQL	2	20	1	5	1	5	0.01	0.01	0.01	0.01	0.05	0.05	0.05
		Units	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mS/cm	%	meq100	%	%	%	%
REF1AUN1	1A	UN	5755	1475	1	124.5	43.5	160.5	0.34	11.5	37.5	17.4	0.32	4.8	4.48
REF1AUN2	1A	UN	5570	1330	1	125	40	148	0.44	13.8	40	17.4	0.56	6	5.44
REF1AUN3	1A	UN	7110	1610	1	133	45	170	0.56	14.5	47	15.6	0.32	6.8	6.48
REF1AUN4	1A	UN	5660	1380	1	122	41	150	0.47	13	39	18.8	1.2	5.84	4.64
REF1AUN5	1A	UN	6030	1440	2	130	42	156	0.44	11.9	39	19	0.4	5.2	4.8
REF1AUN6	1A	UN	8100	1530	2	130	43	175	0.38	16.4	45	14.6	0.4	6.8	6.4
REF1A1X1	1A	1X	5470	1450	2	105.5	39.5	152.5	0.57	14.35	44.5	18.75	0.32	6.62	6.56
REF1A1X2	1A	1X	5370	1350	1	121	40	147	0.74	13.2	41	22.2	0.28	5.52	5.24
REF1A1X3	1A	1X	5390	1280	1	122	40	146	0.57	11.5	35	17.5	0.2	4.88	4.68
REF1A1X4	1A	1X	6450	1430	2	109	39	159	0.45	15.3	42	19.8	1.32	7.52	6.2
REF1A1X5	1A	1X	6170	1430	2	130	46	166	0.55	12.1	35	20.4	0.64	5.04	4.4
REF1A1X6	1A	1X	6790	1580	1	141	47	175	0.39	11.8	38	21	0.16	5.04	4.88
REF1A2X1	1A	2X	7750	1480	2	131	41	174	0.59	16.2	45	14.9	0.8	7.32	6.52
REF1A2X2	1A	2X	9860	1600	3	135	44	199	0.48	14.5	41	19.8	0.84	6.2	5.36
REF1A2X3	1A	2X	6260	1450	2	130	44	159	0.43	12.5	38	16.2	0.12	5.72	5.6
REF1A2X4	1A	2X	6225	1435	2	121	40	155.5	0.43	13.75	41	12.1	0.025	5.52	5.66
REF1A2X5	1A	2X	5040	1190	1	122	40	140	0.57	12.7	39	20.9	0.025	5.4	5.48
REF1A2X6	1A	2X	6050	1300	1	125	40	153	0.41	13	39	16.4	0.025	5.44	5.32
REF2AUN1	2A	UN	5910	1455	1.5	121.5	42	163.5	0.45	12.9	397	14.35	0.025	5.62	5.84
REF2AUN2	2A	UN	4510	1210	1	118	41	152	0.42	14.4	397	15.2	0.025	5.92	6.04
REF2AUN3	2A	UN	5400	1300	1	123	40	150	0.37	13.3	381	17.6	0.025	5.56	5.64
REF2AUN4	2A	UN	5520	1440	1	122	42	163	0.45	13	385	16.6	0.48	5.68	5.2
REF2AUN5	2A	UN	5140	1470	1	129	42	155	0.51	13.2	432	14.7	0.025	5.96	5.96
REF2AUN6	2A	UN	5860	1640	1	140	44	167	0.74	12.5	479	16.7	0.025	5.12	5.16
REF2A1X1	2A	1X	4580	1220	1	115	40	138	0.47	12.8	494	18.8	0.025	5.8	5.64
REF2A1X2	2A	1X	5115	1565	1	125.5	42.5	158	0.43	14.35	249.5	18.55	0.025	6.58	6.48
REF2A1X3	2A	1X	4700	1330	1	111	41	143	0.43	13.3	422	12.7	0.025	6.4	6.24
REF2A1X4	2A	1X	5090	1430	1	117	42	150	0.45	14.2	600	13.3	0.025	6.08	6.2
REF2A1X5	2A	1X	4440	1230	1	112	41	137	0.42	15.1	488	15.6	0.025	5.96	6.08
REF2A1X6	2A	1X	5140	1350	1	117	41	149	0.41	14.9	555	18.6	0.025	6.28	6.56
REF2A2X1	2A	2X	5570	1480	2	124	44	158	0.49	13.6	508	16.4	0.025	6.24	6.28
REF2A2X2	2A	2X	5080	1550	1	122	41	156	0.5	15.3	471	18.7	0.025	6.48	6.48
REF2A2X3	2A	2X	5830	1560	2	126	41	160	0.45	12.7	417	16.1	0.025	5.92	6.12
REF2A2X4	2A	2X	5205	1525	1	116.5	41.5	154	0.485	15.5	55	15.95	0.24	6.4	6.2
REF2A2X5	2A	2X	4700	1330	1	118	41	143	0.49	14	677	19.1	0.025	6.16	6.32
REF2A2X6	2A	2X	4850	1270	1	124	46	147	0.46	13.6	515	20.6	0.025	5.76	5.76
REF3AUN1	3A	UN	4510	1210	2	115	41	143	0.32	11.3	38.5	17.6	0.025	4.9	4.76
REF3AUN2	3A	UN	3390	1050	2	123	40	126	0.42	10.9	43	13.4	0.025	4.4	4.48
REF3AUN3	3A	UN	3460	1010	2	120	39	127	0.44	10.4	35	20.5	0.025	4.24	4.16
REF3AUN4	3A	UN	3050	1000	2	115	38	122	0.47	11.7	43	16.7	0.32	5.2	4.88
REF3AUN5	3A	UN	4380	1170	2	117	40	139	0.3	11.5	42	20.3	0.025	4.92	5.16
REF3AUN6	3A	UN	3630	1010	2	111	36	128	0.41	10.1	40	11.8	0.025	4.72	4.64
REF3A1X1	3A	1X	4320	1360	3	120	41	138	0.37	13	46	10.4	0.025	5.36	5.4
REF3A1X2	3A	1X	4095	1145	1.5	120.5	39.5	131.5	0.465	12.15	35.5	21.6	0.2	4.94	4.92
REF3A1X3	3A	1X	4600	1320	2	122	41	143	0.47	12.9	47	20.7	0.025	5.36	5.36
REF3A1X4	3A	1X	3910	1180	2	116	38	131	0.48	12	38	17.8	0.025	5.24	5.28
REF3A1X5	3A	1X	3350	1050	1	130	41	127	0.49	11.4	45	17.4	0.025	4.76	4.6
REF3A1X6	3A	1X	3880	1080	2	116	38	138	0.52	11.4	38	16.3	0.24	5.44	5.2
REF3A2X1	3A	2X	3050	903	2	133	41	122	0.43	11.1	35	13	0.025	4.68	4.84
REF3A2X2	3A	2X	4790	1350	2	133	44	154	0.42	12.1	46	16.7	0.025	5.48	5.4
REF3A2X3	3A	2X	4290	1280	2	122	41	139	0.43	14	42	15.9	0.025	5.8	5.84
REF3A2X4	3A	2X	3635	1030	2	125	42	129.5	0.25	11.25	40	8.4	0.025	4.58	4.48
REF3A2X5	3A	2X	4360	1160	2	117	40	137	0.32	13.8	44	15.7	0.025	5.76	5.6
REF3A2X6	3A	2X	3500	990	2	134	42	132	0.42	11.1	40	14.4	0.025	4.76	4.76

Year 2001 Field Trials Soil Characteristics for C2 Site

Sample Code	Plot	Treatment	Nickel	Phosphorus	Silver	Titanium	Vanadium	Zinc	Conductivity - @25oC	Loss on Ignition	Cation Exchange Capacity(as Na)	Moisture Content	Total Inorganic Carbon(as C)	Total Carbon(as C)	Total Organic Carbon
		EQL	2	20	1	5	1	5	0.01	0.01	0.01	0.01	0.05	0.05	0.05
		Units	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mS/cm	%	meq100	%	%	%	%
REF4AUN1	4A	UN	4630	1450	2	120.5	43	155.5	0.36	12.8	37.5	9.7	0.025	5.3	5.52
REF4AUN2	4A	UN	3930	1190	2	114	37	137	0.45	12.8	36	13	0.025	5.56	5.6
REF4AUN3	4A	UN	4170	1320	2	124	41	148	0.63	12.9	37	15.7	0.025	5.08	5.32
REF4AUN4	4A	UN	4080	1380	2	122	40	143	0.34	12.9	38	11.5	0.025	5.4	5.64
REF4AUN5	4A	UN	4450	1410	1	125	39	146	0.51	13.5	38	14	0.025	6	6.04
REF4AUN6	4A	UN	4510	1320	1	128	40	148	0.44	12.4	39	14	0.025	5.2	5.32
REF4A1X1	4A	1X	5390	1510	2	135	43	169	0.38	13.5	42	13.1	0.025	5.4	5.64
REF4A1X2	4A	1X	3570	1190	1	107	39	134	0.43	12.6	37	15.2	0.24	5.4	5.16
REF4A1X3	4A	1X	3940	1260	1	125	39	143	0.4	12.5	36	13.4	0.025	4.88	4.96
REF4A1X4	4A	1X	3580	1200	2	117	38	154	0.44	12.5	38	11.2	0.025	5.6	5.56
REF4A1X5	4A	1X	4350	1322.5	1	121.75	39.75	144.75	0.53	12.525	38	15.55	0.025	5.36	5.37
REF4A1X6	4A	1X	3720	1180	2	107	37	136	0.48	12	37	14	0.28	5.36	5.08
REF4A2X1	4A	2X	4120	1250	1	122	38	139	0.39	12.1	35	13.7	0.025	4.88	4.88
REF4A2X2	4A	2X	3720	1310	1	114	37	140	0.54	13.1	40	15.8	0.025	5.88	6
REF4A2X3	4A	2X	3780	1300	1	123	39	140	0.4	13.5	38	14.6	0.025	5.72	5.56
REF4A2X4	4A	2X	4065	1430	2	115.5	39.5	142	0.53	13.85	42.5	15.8	0.025	6.46	6.64
REF4A2X5	4A	2X	4130	1220	1	121	38	138	0.51	13.5	39	15.1	0.025	5.6	5.68
REF4A2X6	4A	2X	4760	1310	1	125	40	152	0.4	11.8	37	14.3	0.025	4.92	5.08
REF1BCAL1	1B	CAL	5690	1290	1	110	36	161	0.46	12.4	36	12.2	0.025	5.52	5.36
REF1BCAL2	1B	CAL	4290	1200	1	118	34	143	0.52	13.7	36	16.3	0.025	5.64	5.52
REF1BCAL3	1B	CAL	4080	1080	1	119	36	146	0.53	10.2	32	13	0.025	4.4	4.68
REF1BCAL4	1B	CAL	3780	964	1	105	35	135	0.49	10.7	32	10.4	0.025	4.44	4.56
REF1BCAL5	1B	CAL	5235	1410	1	115	39	166.5	0.49	11.25	33.5	12.2	0.2	4.72	4.76
REF1BCAL6	1B	CAL	4140	1040	1	106	35	143	0.53	11.5	32	10.7	0.025	4.88	4.88
REF2BCAL1	2B	CAL	3400	981	1	122	40	138	0.47	11.8	432	11.9	0.025	4.96	5
REF2BCAL2	2B	CAL	5320	1340	2	123	44	167	0.45	13.3	414	14.6	0.48	5.72	5.24
REF2BCAL3	2B	CAL	2550	933	1	105.5	37	126	0.515	11.25	184.5	12.1	0.3	4.86	4.56
REF2BCAL4	2B	CAL	4910	1330	1	118	43	161	0.43	12.9	433	12.7	0.025	5.84	5.68
REF2BCAL5	2B	CAL	3000	938	1	109	39	130	0.49	11.5	389	10.8	0.28	4.88	4.6
REF2BCAL6	2B	CAL	3920	1130	1	117	42	151	0.44	10.3	357	11.9	0.025	5	4.96
REF3BCAL1	3B	CAL	4110	1150	1	112	38	146	0.49	11.6	35	13.8	0.025	5	5.12
REF3BCAL2	3B	CAL	4340	1180	2	120	41	147	0.48	11.5	46	11	0.025	4.8	4.64
REF3BCAL3	3B	CAL	3570	1180	2	117	38	140	0.42	11.5	39	10	0.025	5.4	5.24
REF3BCAL4	3B	CAL	5150	1210	3	120	42	159	0.37	11.8	40	13.5	0.025	4.8	4.88
REF3BCAL5	3B	CAL	4640	1380	1.5	105.5	39.5	153	0.55	12.4	41.5	16.95	0.24	5.24	5.16
REF3BCAL6	3B	CAL	4490	1260	2	98	39	159	0.53	11.6	37	12.4	0.025	5.28	5.32
REF4BCAL1	4B	CAL	3725	1220	1.5	127	42	151	0.47	11.4	36	15.4	0.4	4.76	4.56
REF4BCAL2	4B	CAL	3280	1130	1	115	40	155	0.46	11.6	37	11	0.32	4.96	4.64
REF4BCAL3	4B	CAL	3290	983	1	114	40	134	0.46	11.3	37	12.1	0.025	4.32	4.52
REF4BCAL4	4B	CAL	3200	1050	1	117	40	132	0.45	11.4	35	12.5	0.28	4.64	4.36
REF4BCAL5	4B	CAL	3160	1060	1	118	41	134	0.46	11.1	37	10.2	0.025	4.64	4.64
REF4BCAL6	4B	CAL	3250	1040	1	119	41	137	0.49	10.8	35	11.7	0.32	4.6	4.28

Species	Plot	Treatment	Replicate	Sample	Sample Dry Weight	Al	Sb	As	Ba	Be	Bi	Cd	Ca	Cr	Co	Cu	Fe	Pb	Mg	Mn	Mo	Ni	P	K	Se	Ag	Sr	Tm	Ti	U	Vd	Zn
					(g)	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
Soy	1	UN	1	Agronomic	1.520	168	nd	0.2	11.7	nd	nd	0.15	11800	nd	1.61	7.29	195	0.63	3810	26	1.8	111	2060	16800	0.2	nd	41	nd	2	nd	0.26	17.8
Soy	1	UN	1	Agronomic	n/a	176	nd	0.2	12.9	nd	nd	0.19	11700	nd	1.57	7.38	196	1.51	3910	25.4	1.7	109	2010	17500	nd	nd	44	nd	3	nd	0.29	18.4
Soy	1	UN	2	Agronomic	2.133	125	nd	nd	13.8	nd	nd	0.15	11200	nd	1.51	7.28	169	0.76	3910	25.5	2.3	111	2350	17800	nd	nd	44.1	nd	2	0.01	0.19	17.6
Soy	1	1X	1	Agronomic	4.157	97.9	nd	nd	13.5	nd	nd	0.17	12400	nd	0.81	6.65	105	0.86	4760	21.7	4.9	65	2830	17400	nd	nd	44.1	nd	2	nd	0.13	15.2
Soy	1	1X	2	Agronomic	6.228	146	nd	nd	13.3	nd	nd	0.19	13000	nd	0.88	7.11	127	0.98	4920	21.9	6.3	68.9	2770	16400	nd	nd	43.2	0.005	2	nd	0.21	16.9
Soy	1	1X	3	Agronomic	5.295	142	nd	nd	12	nd	nd	0.16	11900	nd	0.86	6.87	136	0.61	4850	22.3	5.3	66.8	2850	16600	nd	nd	40	nd	2	nd	0.19	15.1
Soy	1	Calcareous	1	Agronomic	6.537	8.8	nd	nd	8.2	nd	nd	0.19	11500	nd	0.34	5.09	66	0.47	4820	27.6	8.8	28.6	3780	17800	nd	nd	38.3	nd	nd	nd	nd	19.3
Soy	1	Calcareous	2	Agronomic	6.516	5	nd	nd	9.4	nd	nd	0.22	11600	nd	0.36	5.49	59	0.44	5150	25	8.3	33.8	3980	17700	nd	nd	40.4	nd	nd	nd	nd	20
Soy	1	Calcareous	3	Agronomic	6.539	8.7	nd	nd	8.4	nd	nd	0.19	12200	nd	0.34	6.38	65	0.59	5030	25.8	9.3	27	3480	19300	nd	nd	37	nd	nd	nd	nd	18.6
Soy	2	1X	1	Agronomic	3.935	7.6	nd	nd	9.1	nd	nd	0.29	10900	nd	0.79	4.97	59	0.37	4480	18.5	4.4	46.5	4040	18800	nd	nd	36.6	nd	nd	nd	nd	21
Soy	2	1X	2	Agronomic	5.497	11.7	nd	nd	9.3	nd	nd	0.24	10500	nd	0.82	5.17	68	0.44	4230	19.3	4	45.2	3830	19000	nd	nd	34.5	nd	nd	nd	nd	19
Soy	2	1X	3	Agronomic	5.419	6.4	nd	nd	8.6	nd	nd	0.27	11000	nd	0.72	4.94	59	0.35	4690	20.5	5.1	45.8	4300	17900	nd	nd	36.5	nd	nd	nd	nd	20.7
Soy	2	Calcareous	1	Agronomic	9.453	10.6	nd	nd	8.6	nd	nd	0.33	13200	nd	0.48	5.21	63	0.42	5010	16.1	6.7	32.1	4410	21300	nd	nd	41.2	nd	nd	nd	nd	24.9
Soy	2	Calcareous	2	Agronomic	7.646	9.6	nd	nd	8.3	nd	nd	0.31	13200	nd	0.42	5.06	69	0.29	5350	13.7	7.5	33.1	4380	18700	nd	nd	41.7	nd	nd	nd	nd	25.9
Soy	2	Calcareous	3	Agronomic	7.504	10.2	nd	nd	8.4	nd	nd	0.32	12700	nd	0.44	5.33	71	0.43	4800	14.5	6.7	32.4	4080	18500	nd	nd	41.2	nd	nd	nd	nd	28.6
Soy	3	UN	1	Agronomic	1.389	176	nd	0.3	12.4	nd	nd	0.13	10200	nd	3.69	6.46	381	0.9	2770	47.9	0.7	184	1890	15400	0.3	nd	36.7	0.006	2	0.01	0.26	21
Soy	3	UN	2	Agronomic	1.333	193	nd	0.3	13.1	nd	nd	0.13	10500	nd	3.12	7.4	315	0.98	2790	36	0.7	205	2090	16000	0.3	nd	40.2	0.005	3	0.01	0.29	21.9
Soy	3	UN	2	Agronomic	n/a	183	nd	0.3	12.5	nd	nd	0.13	10400	nd	3.16	7.6	297	0.89	2830	36.3	0.8	203	2090	16400	0.3	nd	39.5	0.005	3	0.01	0.27	21
Soy	3	1X	1	Agronomic	7.299	39.9	nd	nd	10.4	nd	nd	0.19	12400	nd	0.6	5.78	70	0.45	5080	16.3	7.8	46.4	4210	17500	nd	nd	40.6	nd	nd	nd	nd	20
Soy	3	1X	2	Agronomic	5.109	42.3	nd	nd	12.8	nd	nd	0.22	13400	nd	0.67	6.12	67	0.6	5410	17.7	9.2	53.1	4580	20200	nd	0.01	46	nd	nd	nd	nd	22.5
Soy	3	1X	3	Agronomic	5.992	53.8	nd	nd	10.7	nd	nd	0.17	12400	nd	0.66	5.59	80	0.32	5040	18.1	6	55.1	4210	19300	nd	nd	42.2	nd	2	nd	0.06	17.6
Soy	3	Calcareous	1	Agronomic	6.401	18.5	nd	nd	9.4	nd	nd	0.29	12000	nd	0.56	4.86	64	1.55	4710	21.8	7.4	32	3580	18700	nd	nd	36.3	nd	nd	nd	nd	19.1
Soy	3	Calcareous	2	Agronomic	6.539	13.3	nd	nd	8.3	nd	nd	0.24	11000	nd	0.47	4.58	71	0.65	4390	22.8	7.2	32.4	4070	20200	nd	nd	34.2	nd	nd	nd	nd	20.7
Soy	3	Calcareous	3	Agronomic	6.652	15.9	nd	nd	8.2	nd	nd	0.22	12400	nd	0.48	4.16	60	0.32	4770	21.8	5.8	29.9	4140	19900	nd	nd	37	nd	nd	nd	nd	19.8
Soy	4	UN	1	Agronomic	1.303	185	nd	0.3	15	nd	nd	0.14	13400	nd	3.15	7.11	271	0.72	4390	51.1	1.9	182	2710	21000	0.2	nd	49.3	nd	2	0.01	0.28	18.2
Soy	4	UN	2	Agronomic	2.067	139	nd	0.2	16	nd	nd	0.14	12800	nd	2.56	5.83	203	0.69	4320	43.2	1.6	159	2510	20000	0.2	nd	50	nd	2	nd	0.19	16.4
Soy	4	1X	1	Agronomic	3.832	19.1	nd	nd	11.4	nd	nd	0.24	12900	nd	0.82	5.8	58	0.46	5330	22.4	7.4	57.2	5480	21300	nd	nd	47.1	nd	nd	nd	nd	26
Soy	4	1X	2	Agronomic	4.083	21.7	nd	nd	12.5	nd	nd	0.23	13200	nd	1.05	6.23	64	0.35	5090	24.5	6.8	63.5	5170	22500	nd	nd	46.9	nd	nd	nd	nd	25.7
Soy	4	1X	3	Agronomic	3.250	20.4	nd	nd	11.4	nd	nd	0.25	13100	nd	1.05	6.44	64	0.32	5500	26.1	9.7	67.2	5960	22200	0.2	nd	45.3	nd	nd	nd	nd	25.4
Soy	4	Calcareous	1	Agronomic	9.239	35.8	nd	nd	9.2	nd	nd	0.29	12700	nd	0.67	6.25	103	3.08	5060	25.2	5.9	38.5	4500	19900	nd	nd	45.4	0.015	1	0.01	0.07	25.1
Soy	4	Calcareous	2	Agronomic	5.980	9.9	nd	nd	8.6	nd	nd	0.26	13000	nd	0.57	5.12	53	0.44	5210	18.8	6.2	36.2	4720	19900	nd	nd	41.8	nd	nd	nd	nd	70.8
Soy	4	Calcareous	3	Agronomic	6.640	8	nd	nd	9	nd	nd	0.29	12900	nd	0.88	4.94	64	0.23	4740	32.2	4.9	46.1	4520	21700	nd	nd	44.5	nd	nd	nd	nd	23.1
Oat	1	UN	1	Agronomic	0.974	56.7	nd	nd	5	nd	nd	0.21	6180	nd	0.58	8.73	67	0.44	1720	16.8	2.8	148	2240	20900	0.2	0.03	27.5	nd	1	nd	0.15	15.5
Oat	1	UN	2	Agronomic	1.162	55.4	nd	nd	6.5	nd	nd	0.12	6190	nd	0.68	5.7	71	0.32	1410	20.2	1.7	156	1810	18000	nd	0.05	27.3	nd	1	nd	0.15	11.8
Oat	1	UN	3	Agronomic	1.373	68.7	nd	0.2	5.3	nd	nd	0.16	6400	0.6	0.69	7.34	83	0.62	1450	19.3	2.3	152	1670	16400	0.3	0.02	28.7	nd	1	nd	0.2	12.6
Oat	1	1X	1	Agronomic	2.284	29.4	nd	0.3	4.4	nd	nd	0.09	6010	0.5	0.54	10.5	71	0.24	2430	20.3	10	87.5	5380	25700	0.3	0.03	24.9	0.009	nd	nd	0.13	18.2
Oat	1	1X	2	Agronomic	1.680	27	nd	0.3	4.7	nd	nd	0.09	5780	0.5	0.48	10.2	62	0.46	2260	18.3	8.8	82.6	5150	27500	0.4	0.03	23.9	0.011	nd	nd	0.12	17.5
Oat	1	1X	3	Agronomic	2.046	20.9	nd	0.3	4.4	nd	nd	0.08	6190	0.5	0.43	11.2	69	0.39	2440	16.6	10.8	77.1	4100	24000	0.3	nd	25.1	0.006	nd	nd	0.1	20.6
Oat	1	1X	3	Agronomic	n/a	24.8	nd	0.3	4.4	nd	nd	0.08	6500	0.5	0.47	11.6	73	0.25	2520	17.5	10.9	83.3	4160	24400	0.3	nd	25.8	0.006	nd	nd	0.11	21.2
Oat	1	1X	4	Agronomic	2.428	28.4	nd	0.3	6.2	nd	nd	0.08	6820	nd	0.53	9.37	63	0.25	3120	20.5	9.7	83.1	5740	32700	0.4	0.01	21.4	0.006	nd	nd	nd	21.2
Oat	1	1X	4	Agronomic	n/a	26.5	nd	0.3	6.3	nd	nd	0.08	6800	nd	0.53	9.8	68	0.31	3100	21.4	9.7	85.7	5810	31600	0.4	0.02	22	nd	nd	nd	nd	22.2
Oat	1	Calcareous	1	Agronomic	1.487	42.4	nd	0.3	6.8	nd	nd	0.14	5530	nd	0.43	10.3	74	0.33	2630	18.9	11.5	68.8	7740	38200	0.3	0.05	21.2	0.008	nd	nd	0.09	17.5
Oat	1	Calcareous	2	Agronomic	2.061	44.6	nd	0.3	5.7	nd	nd	0.15	5770	nd	0.4	9.89	80	0.37	2610	17.3	11	67.5	5900	36500	0.3	0.02	20.8	0.008	nd	nd	0.08	16.6
Oat	1	Calcareous	3	Agronomic	1.502	38.5	nd	0.3	6	nd	nd	0.11	6320	nd	0.43	10.1	78	0.33	2910	20.4	11.6	76.2	7760	38400	0.3	0.02	20.8	0.006	nd	nd	0.07	17.9
Oat	1	Calcareous	4	Agronomic	1.554	24.6	nd	0.3	5.9	nd	nd	0.09	6020	nd	0.42	10.3	67	0.24	2990	19.4	10.5	70.2	6170	36500	0.3	0.02	21	nd	nd	nd	nd	20.4
Oat	2	1X	1	Agronomic	1.963	21.6	nd	0.2	7.3	nd	nd	0.07	6880	nd	0.44	7.95	60	0.35	2730	17.7	8.8	93.8	7080	31200	0.3	0.01	24.1	nd	nd	nd	nd	17.9
Oat	2	1X	2	Agronomic	1.666	20.9	nd	0.2	7.7	nd	nd	0.06	6620	nd	0.42	7.49	58	0.2	2840	17.8	8.7	85.9	6780	29300	0.3	0.02	23.4	nd	nd	nd	nd	13.4
Oat	2	1X	3	Agronomic	1.998	25.6	nd	0.2	7.1	nd	nd	0.06	7420	nd	0.47	7.47	63	0.26	2860	19	9.1	89.1	6160	28100	0.3	0.01	24	nd	nd	nd	nd	14.8
Oat	2	Calcareous	1	Agronomic	1.884	18	nd	nd	5.1	nd	nd	0.05	4500	nd	0.31	6.31	49	0.37	1820	11.5	8.4	53.7	3770	19200	0.2	0.03	16.3	nd	nd	nd	nd	10.1
Oat	2	Calcareous	2	Agronomic	1.675	25	nd	0.2	8.3	nd	nd	0.07	6490	nd	0.41	8.62	66	0.41	2660	17.7	12.3	75	5400	28800	0.4	0.05	23.5	nd	nd	nd	nd	16.5
Oat	2	Calcareous	3	Agronomic	2.460	27.7	nd	0.3	7	nd	nd	0.1	5810	nd	0.43	9.11	73	0.3	2570	16.3	13.2	71.2	6410	32100	0.3	0.03	21.1	nd	nd	nd	0.05	14.1
Oat	3	UN	1	Agronomic	1.368	82.9	nd	0.3	6.5	nd	nd	0.11	7080	nd	0.71	5.69	77	0.36	2010	21.5	2.5	128	5090	22200	0.3	0.03	27.1	nd	1	nd	0.12	9.3
Oat	3	UN	2	Agronomic	1.427	56.9	nd	0.3	5.9	nd	nd	0.11	6320	nd	0.65	5.38	67	0.34	1940	21.3	2.7	118	5130	21800	0.3	0.03	25.9	nd	nd	nd	0.09	8.7
Oat	3	UN	3	Agronomic	1.459	56.9	nd	0.3	5.8	nd	nd	0.1	6680	nd	0.71	4.97	63	0.42	1870	24.2	2.6	129	4990	21900	0.2	0.04	26.4	nd	nd	nd	0.09	7.9
Oat	3	1X	1	Agronomic	1.532	30	nd	0.3	5.2	nd	nd	0.08	5160	nd	0.44	6.95	55	0.26	2580	19.3	7.1	77.2	9350	37800	0.3	0.03	20	nd	nd	nd	nd	11.8
Oat	3	1X	2	Agronomic	2.158	37.2	nd	0.4	5.4	nd	nd	0.09	5870	nd	0.36	8.39	59	0.37	2570	13.3	7.5	71.6	7740	37600	0.3	0.02	22.6	0.011	nd	nd	0.07	12.7
Oat	3	1X	2	Agronomic	n/a	37	nd	0.3	5.4	nd	nd	0.08	5780	nd	0.35	8.41	63	0.35	2600	13.6	7.5	72.4	7600	37400	0.3	0.03	22.7	0.005	nd	nd	0.06	13
Oat	3	1X	3	Agronomic	1.830	38.8	nd	0.3	5.2	nd	nd	0.07	5680	nd	0.35	8.38	57	0.27	2480	14.4	7.8	75.5	8340	39700	0.3	0.02	20.7	nd	nd	nd	0.06	12.9
Oat	3	Calcareous	1	Agronomic	2.347	22.6	nd	0.3	8.4	nd	nd	0.05	6490	nd	0.4	7.68	62	0.28	2850	22	8.1	61.6	7380	29000	0.4	0.02	24.7	0.005	nd	nd	nd	14.2
Oat	3	Calcareous	2	Agronomic	1.850	31.4	nd	0.4	5.8	nd	nd	0.04	7160	nd	0.45	9.01	80	0.24	2670	25.4	9.6	56.7	6030	27700	0.3	0.01	24.7	0.005	nd	nd	0.05	14.4
Oat	3	Calcareous	3	Agronomic	2.715	34.1	nd	0.4	7.2	nd	nd	0.05	7140	nd	0.46	8.25	74	0.29	2800	27.8	8.5	55.2	6260	26300	0.4	nd	26	0.006	nd	nd	0.07	15.1
Oat	4	UN	1	Agronomic	0.810	112	nd	0.3	6.1	nd	nd	0.14	5600	nd	0.8	5.3	103	0.5	1630	26.4	1.9	125	3030	17700	0.2	nd	23.9	nd	2	nd	0.16	11
Oat	4	UN	2	Agronomic	0.664	81.6	nd	0.3	5.8	nd	nd	0.15	5460	nd	0.73	5.34	90	0.41	1570	29.9	1.9	120	3480	18700	0.2	0.02	23.8	nd	1	nd	0.13	9
Oat	4	1X	1	Agronomic	1.340	26.3	nd	0.3	7.7	nd	nd	0.1	5670	0.5	0.49	8.22	62	0.3	2680	14.7	10.8	76	7540	34600	0.3	nd	24.1	0.006	nd	nd	0.05	13.7
Oat	4	1X	2	Agronomic	1.077	19.8	nd	0.2	9	nd	nd	0.1	4700	nd	0.43	6.4	51	0.23	2240	17.7	9.7	59.9	7330	33900	0.3	nd	21	0.005	nd	nd	nd	10.5
Oat	4	1X	3	Agronomic	1.251	42	nd	0.3	7	nd	nd	0.09	5360	nd	0.38	6.06	55	0.35	2130	14.6	8.4	59.9	6330	35700	0.3	0.02	20.2	nd	nd	nd	0.06	9.4
Oat	4	1X	4	Agronomic	1.424	22	nd	0.3	7.9	nd	nd	0.09	5070	nd	0.39	7.44	49	0.36	2500	15.1	9.9	69.7	7530	36800	0.3	0.01	21	0.005	nd	nd	nd	12.5
Oat	4	Calcareous	1	Agronomic	1.821	29.5	nd	0.3	4.4	nd	nd	0.1	5720	nd	0.41	9.34	84	0.36	2420	17.5	10.2	55.5	4220	24600	0.3	nd	24.2	0.011	nd	nd	nd	12.1
Oat	4	Calcareous	2	Agronomic	1.750	34.6	nd	0.3	7.9	nd	nd	0.1	5490	nd	0.35	8.63	69	0.36	2750	18.5	10.4	51.3	6200	31200	0.3	nd	24.6	0.01	nd	nd	0.07	13.4
Oat	4	Calcareous	3	Agronomic	1.606	40	nd	0.3	8.2	nd	nd	0.09	6050	nd	0.41	8.79	77	0.3	2770	19.8	11.1	57.2	6120	31000	0.3	nd	25.7	0.009	nd	nd	0.07	13.2
Oat	4	Calcareous	4	Agronomic	1.746	34.6	nd	0.3	6.5	nd	nd	0.12	5960	nd	0.42	9.47	71	0.34	2740	18.8	10.6	53.1	5190	25700	0.3	0.01	26	0.009	nd	nd	0.07	14.9
Corn	1	UN	1	Agronomic	1.438	13.4	nd	nd	1.6	nd	nd	0.04	2720	nd	0.23	5.49	72	0.38	1120	23.8	0.8	13.2	1380	12700	0.4	0.01	12	nd	nd	nd	nd	25.2
Corn	1	UN	1	Agronomic	n/a	15.2	nd	nd	1.6	nd	nd	0.05	2800	nd	0.25	5.58	78	0.35	1210	24.1	0.8	13.5	1410	13100	0.3	0.02	12	nd	nd	nd	0.05	24.5

Species	Plot	Treatment	Replicate	Sample	Sample Dry Weight	Al	Sb	As	Ba	Be	Bi	Cd	Ca	Cr	Co	Cu	Fe	Pb	Mg	Mn	Mo	Ni	P	K	Se	Ag	Sr	Tm	Ti	U	Vd	Zn
					(g)	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
Corn	1	UN	2	Agronomic	1.597	7.4	nd	nd	1.4	nd	nd	0.03	2450	nd	0.18	4.73	69	0.22	1270	22.8	0.4	9.1	1980	14600	0.3	nd	9.7	nd	nd	nd	nd	22.5
Corn	1	UN	3	Agronomic	1.127	7.8	nd	nd	1.1	nd	nd	0.02	2360	nd	0.17	4.56	58	0.36	1380	25.6	0.4	9.4	1990	14800	0.2	nd	9.2	nd	nd	nd	nd	18.6
Corn	1	UN	4	Agronomic	1.315	8.8	nd	nd	1.2	nd	nd	0.03	2400	nd	0.17	4.83	59	0.33	1270	25.9	0.5	11.3	1450	13800	0.3	nd	10.4	nd	nd	nd	0.05	22
Corn	1	1X	1	Agronomic	1.529	13.5	nd	nd	1.3	nd	nd	0.07	3460	nd	0.2	5.93	81	1.06	1850	13.7	0.7	6	2230	13500	nd	0.01	12.3	nd	nd	nd	0.07	28.7
Corn	1	1X	2	Agronomic	1.753	10.2	nd	nd	1.5	nd	nd	0.04	3030	nd	0.19	5.74	74	0.34	1860	14.1	0.7	5.9	2540	14900	0.2	nd	11.6	nd	nd	nd	0.05	27.2
Corn	1	1X	3	Agronomic	2.090	12.1	nd	nd	1.6	nd	nd	0.03	2840	nd	0.17	5.24	68	0.44	1710	10.5	0.6	6.3	2300	15400	0.2	nd	11	nd	nd	nd	0.08	29.9
Corn	1	1X	4	Agronomic	1.228	10.6	nd	nd	1.2	nd	nd	0.05	2930	nd	0.2	5.76	75	0.48	1900	20.1	0.4	7	2490	14600	0.3	0.01	11.1	nd	nd	nd	0.09	24.2
Corn	1	Calcareous	1	Agronomic	2.617	7.9	nd	nd	1.5	nd	nd	0.05	3060	nd	0.15	5.35	67	0.29	1980	12.5	0.8	3.3	2330	14300	nd	nd	11.7	nd	nd	nd	0.07	27.4
Corn	1	Calcareous	2	Agronomic	2.080	6.8	nd	nd	1.3	nd	nd	0.05	2470	nd	0.14	4.92	61	0.33	1740	15	0.7	4.2	2160	15200	nd	nd	9.6	nd	nd	nd	0.08	20.2
Corn	1	Calcareous	3	Agronomic	1.789	5.3	nd	nd	1	nd	nd	0.04	2780	nd	0.13	5.74	64	0.28	1790	15.4	0.7	3.2	2320	14400	nd	nd	10	nd	nd	nd	0.08	28.7
Corn	1	Calcareous	4	Agronomic	2.426	7	nd	nd	1.3	nd	nd	0.06	2770	nd	0.14	4.73	55	0.38	1750	13.2	0.6	4.3	2130	13300	nd	nd	11.4	nd	nd	nd	0.08	27.4
Corn	2	UN	1	Agronomic	0.455	12.5	nd	nd	1.5	nd	nd	0.03	2710	nd	0.71	5.01	67	0.51	1360	25.5	0.8	28.7	1880	12600	0.2	0.01	13.2	nd	nd	nd	0.1	15.8
Corn	2	UN	2	Agronomic	0.737	9.9	nd	nd	1.4	nd	nd	0.03	2480	nd	0.62	5.24	60	0.36	1250	28	1	22.4	2230	13700	0.3	nd	11.7	nd	nd	nd	0.09	15.1
Corn	2	UN	3	Agronomic	0.830	13.6	nd	nd	1.4	nd	nd	0.02	2380	nd	0.55	5.05	69	0.33	1060	25.8	0.9	23	2100	13300	0.2	nd	11.3	nd	nd	nd	0.1	14.8
Corn	2	UN	4	Agronomic	0.836	13.1	nd	nd	1.8	nd	nd	0.04	2670	nd	0.47	5.29	70	0.47	1250	27.8	0.5	23.9	2280	15100	0.3	nd	12.5	nd	nd	nd	0.09	17
Corn	2	UN	4	Agronomic	n/a	11.7	nd	nd	1.8	nd	nd	0.03	2670	nd	0.41	5.44	72	0.3	1240	28	0.5	23.9	2340	14900	0.3	nd	13.1	nd	nd	nd	0.1	15.9
Corn	2	1X	1	Agronomic	1.731	10	nd	nd	1.3	nd	nd	0.03	3360	nd	0.23	4.95	57	0.32	1870	24.4	0.3	6.5	1970	12200	0.2	nd	14.2	nd	nd	nd	0.06	26.4
Corn	2	1X	2	Agronomic	1.621	10.8	nd	nd	1.1	nd	nd	0.03	3450	nd	0.25	5.85	80	0.32	1990	26	0.5	5.6	1950	11500	0.2	nd	12.8	nd	nd	nd	0.07	33.6
Corn	2	1X	3	Agronomic	1.808	10.5	0.05	nd	1.1	nd	nd	0.03	3160	nd	0.24	5.87	74	0.29	1970	23	0.6	5.3	1940	12900	0.2	nd	11.7	nd	nd	nd	0.09	41.6
Corn	2	1X	4	Agronomic	1.417	8.6	0.16	nd	1	nd	nd	0.06	2450	nd	0.2	4.71	56	0.35	1580	19.9	0.3	6.8	1910	13400	0.2	nd	10.8	0.008	nd	nd	0.08	26.3
Corn	2	Calcareous	1	Agronomic	1.540	8.2	nd	nd	1.1	nd	nd	0.06	3510	nd	0.22	7.05	72	0.3	1780	17.9	1.2	5.6	2220	12800	nd	nd	13.8	nd	nd	nd	0.08	40.7
Corn	2	Calcareous	2	Agronomic	1.844	6.9	nd	nd	0.8	nd	nd	0.04	3390	0.6	0.17	7.89	76	0.33	1780	16	1.2	6.6	2100	12100	nd	nd	12.9	nd	nd	nd	0.08	38.6
Corn	2	Calcareous	3	Agronomic	1.313	6.3	nd	nd	1.1	nd	nd	0.05	2520	nd	0.13	5.44	56	0.27	2150	13.3	0.5	4	2030	14500	nd	nd	11.5	nd	nd	nd	0.1	25.3
Corn	2	Calcareous	4	Agronomic	1.953	8.3	nd	nd	0.9	nd	nd	0.05	3430	nd	0.18	7.08	71	0.32	2000	12.8	0.9	4.3	2150	12300	nd	nd	14.2	nd	nd	nd	0.08	45.8
Corn	3	UN	1	Agronomic	0.286	12.9	nd	nd	1.5	nd	nd	0.02	1510	nd	0.39	3.91	41	0.28	823	15.3	0.2	20.3	1110	11800	nd	nd	8.2	nd	nd	nd	0.08	9.1
Corn	3	UN	2	Agronomic	0.334	24.5	nd	nd	1.4	nd	nd	0.02	1510	nd	0.39	4.32	64	0.27	865	17.9	0.3	23.6	1820	17200	nd	nd	8.1	nd	nd	nd	0.12	13
Corn	3	UN	3	Agronomic	0.260	26.9	nd	nd	1.2	nd	nd	0.02	1740	nd	0.37	4.68	72	0.55	838	26	0.3	25.9	2250	16900	nd	nd	7.7	nd	nd	nd	0.13	13.8
Corn	3	UN	4	Agronomic	0.687	15.4	nd	nd	1.7	nd	nd	0.02	1820	nd	0.33	7.96	49	0.43	990	20.6	0.3	22.9	2220	16300	nd	nd	9.8	nd	nd	nd	0.1	11
Corn	3	1X	1	Agronomic	2.346	7.6	nd	nd	1.1	nd	nd	0.03	2140	nd	0.17	4.76	53	0.28	1620	13.2	0.3	7.1	2320	14600	nd	nd	9.6	nd	nd	nd	0.08	21.3
Corn	3	1X	2	Agronomic	3.368	8.6	nd	nd	1.4	nd	nd	0.04	3370	nd	0.16	6.02	69	0.28	2030	19.3	0.5	6.1	2620	14300	nd	nd	14.8	nd	nd	nd	0.08	35.1
Corn	3	1X	3	Agronomic	1.682	5	nd	nd	1.1	nd	nd	0.02	2230	nd	0.2	4.2	45	0.22	1460	17.1	0.3	7.3	2290	13200	0.2	nd	9.9	nd	nd	nd	nd	24.9
Corn	3	1X	4	Agronomic	1.952	6	nd	nd	0.9	nd	nd	0.03	2260	nd	0.12	4.76	48	0.45	1610	15.9	0.3	5.7	2300	14700	nd	nd	9.4	nd	nd	nd	nd	25.4
Corn	3	Calcareous	1	Agronomic	1.795	10.3	nd	nd	1	nd	nd	0.04	2470	nd	0.15	4.53	60	0.81	1690	24	0.4	3.5	2180	14200	nd	nd	9.2	nd	nd	nd	0.08	21.7
Corn	3	Calcareous	2	Agronomic	1.597	9.2	nd	nd	0.8	nd	nd	0.03	2470	nd	0.18	4.5	51	0.51	1770	22.4	0.4	3.7	2330	13800	nd	nd	8.8	nd	nd	nd	0.07	24.6
Corn	3	Calcareous	3	Agronomic	2.311	9.1	nd	nd	1	nd	nd	0.04	2460	0.7	0.15	25.2	51	1.76	1700	16.8	0.4	3.4	2070	13400	nd	nd	9.7	nd	nd	nd	0.07	34.7
Corn	3	Calcareous	4	Agronomic	2.031	8	nd	nd	0.8	nd	nd	0.03	1700	nd	0.13	4.2	55	0.49	1470	16.2	0.4	3.3	2420	15100	nd	nd	6.9	nd	nd	nd	0.08	22.3
Corn	4	UN	1	Agronomic	0.931	10.2	nd	nd	1.2	nd	nd	0.03	1940	nd	0.36	6.02	63	0.32	1110	35.5	0.3	14	2340	15700	0.3	nd	9.2	nd	nd	nd	0.08	20.7
Corn	4	UN	2	Agronomic	1.573	9.4	nd	nd	1.8	nd	nd	0.03	2560	nd	0.37	5.29	73	0.42	1150	32.2	0.5	20.2	2080	14500	0.3	nd	14.4	nd	nd	nd	0.09	15.1
Corn	4	UN	3	Agronomic	0.910	9.8	nd	nd	1.3	nd	nd	0.02	2240	nd	0.44	5.14	72	0.4	1050	26	0.4	24.2	2330	13900	0.3	nd	11.7	nd	nd	nd	0.09	14.4
Corn	4	UN	4	Agronomic	0.722	7.1	nd	nd	1.2	nd	nd	0.03	2620	nd	0.4	5.4	67	0.8	1410	35.8	0.6	20.6	2300	13400	0.3	nd	12.6	nd	nd	nd	0.09	15.7
Corn	4	1X	1	Agronomic	1.604	7.8	nd	nd	1.1	nd	nd	0.03	2410	nd	0.21	7.18	54	0.29	1970	16	0.3	5.4	2220	13000	nd	nd	12	nd	nd	nd	0.09	23.7
Corn	4	1X	2	Agronomic	1.239	6.9	nd	nd	0.8	nd	nd	0.03	2130	nd	0.15	4.61	49	0.25	1910	19	0.4	5.1	1840	11900	0.2	nd	10.5	nd	nd	nd	0.06	22.6
Corn	4	1X	3	Agronomic	2.084	9.1	nd	nd	0.9	nd	nd	0.03	2500	nd	0.19	5.26	68	0.41	2060	17.9	0.4	4.7	2220	12400	nd	nd	10.9	nd	nd	nd	0.08	30.8
Corn	4	1X	4	Agronomic	1.968	9.9	nd	nd	1	nd	nd	0.03	2750	nd	0.21	4.9	63	0.41	1690	14.7	0.4	6.3	2060	12400	nd	nd	12.2	nd	nd	nd	nd	29.2
Corn	4	1X	4	Agronomic	n/a	8.7	nd	nd	1	nd	nd	0.03	2790	nd	0.17	5.16	68	0.35	1720	14.9	0.4	6.2	2120	12600	nd	nd	12.9	0.006	nd	nd	nd	29.8
Corn	4	Calcareous	1	Agronomic	1.030	7.5	nd	nd	0.7	nd	nd	0.04	2790	nd	0.13	5	56	0.36	2110	19.7	0.3	3.5	2520	14400	nd	nd	12.2	nd	nd	nd	nd	27.2
Corn	4	Calcareous	2	Agronomic	1.554	8	nd	nd	0.9	nd	nd	0.04	2720	nd	0.12	4.78	55	0.43	2200	15.1	0.4	2.4	2180	13900	nd	nd	12.1	nd	nd	nd	nd	24.4
Corn	4	Calcareous	3	Agronomic	2.168	9	nd	nd	1.1	nd	nd	0.04	3100	nd	0.17	5.49	75	0.5	2230	17	0.6	2.8	2330	13000	nd	nd	13.8	nd	nd	nd	nd	31.1
Corn	4	Calcareous	4	Agronomic	1.370	7.9	nd	nd	0.7	nd	nd	0.04	2570	nd	0.17	4.93	60	0.37	1910	20.4	0.4	3.6	2480	13800	nd	nd	10.6	nd	nd	nd	nd	30.1
Soy	1	UN	1	Toxicological	1.122	422	nd	0.3	17.9	nd	nd	0.2	10500	0.7	2.77	9.84	306	1.01	3220	30.4	1.2	176	2000	14900	0.3	0.02	45	0.009	6	0.02	0.76	18.1
Soy	1	UN	1	Toxicological	n/a	439	nd	0.3	17.4	nd	nd	0.21	10300	0.8	2.74	9.79	309	0.9	3310	30.5	1.2	173	2010	15400	0.2	0.02	44.5	0.009	6	0.02	0.75	17.5
Soy	1	UN	2	Toxicological	1.662	214	nd	0.2	15	nd	nd	0.15	10500	0.5	1.97	8.77	220	0.72	3240	26	1.1	128	1750	14900	0.3	nd	45.3	0.006	3	0.02	0.41	17
Soy	1	1X	1	Toxicological	4.309	323	nd	0.3	16.2	nd	nd	0.19	13500	0.6	1.99	10	259	0.93	4320	25.4	1.7	115	2500	12400	0.2	0.02	51.4	0.01	4	0.02	0.58	22.5
Soy	1	1X	2	Toxicological	3.538	486	nd	0.4	18.4	nd	nd	0.22	12700	0.9	2.33	12.5	340	1.13	4020	29.5	1.1	135	1950	12900	0.3	0.02	52.8	0.014	6	0.02	0.83	21.7
Soy	1	1X	3	Toxicological	3.597	434	0.1	0.4	16.8	nd	nd	0.18	11600	0.8	2.14	11.7	301	0.97	3890	27.2	2.4	130	1980	12800	0.3	0.02	47.3	0.013	6	0.02	0.75	20.2
Soy	1	Calcareous	1	Toxicological	4.636	109	0.19	0.3	14.2	nd	nd	0.31	15700	nd	1.58	8.95	218	0.78	4790	36.6	1.8	48.5	2770	10600	nd	nd	61.5	0.01	2	0.01	0.24	30
Soy	1	Calcareous	2	Toxicological	4.771	111	nd	0.3	13	nd	nd	0.33	14700	nd	1.41	8.22	191	0.92	4400	39.8	2.2	42.9	2410	12400	nd	0.01	56.5	0.01	2	nd	0.24	26.6
Soy	1	Calcareous	3	Toxicological	5.969	143	nd	0.4	14.8	nd	nd	0.38	16500	nd	1.79	8.88	246	1.41	4920	39.3	1.6	54.1	2870	11800	nd	0.02	63.4	0.011	2	0.01	0.3	30.5
Soy	2	1X	1	Toxicological	2.072	56	nd	0.2	16.3	nd	nd	0.32	15400	nd	2.21	8.75	115	0.86	4390	22.6	1.9	94.6	4080	14800	0.2	nd	59.9	0.005	2	nd	0.15	34.3
Soy	2	1X	2	Toxicological	3.524	63.9	nd	nd	14.5	nd	nd	0.28	14300	nd	2.15	8.65	136	0.73	4090	21	1.4	101	3800	13900	nd	nd	52.1	0.005	1	nd	0.17	32.4
Soy	2	1X	3	Toxicological	3.067	59.9	nd	0.2	15.9	nd	nd	0.33	16100	nd	2.71	7.71	137	5.18	4890	27.4	2	97.9	4390	15300	nd	nd	60.4	0.006	1	nd	0.15	36.8
Soy	2	Calcareous	1	Toxicological	7.516	57.4	nd	nd	12.5	nd	nd	0.44	16700	nd	1.39	7.3	120	0.85	4970	20.1	2.4	49.1	3670	13000	nd	0.01	59.4	0.007	1	nd	0.14	40.1
Soy	2	Calcareous	2	Toxicological	3.653	55.2	nd	nd	12.5	nd	nd	0.41	16000	nd	1.27	6.87	113	0.77	4740	17.6	3.8	46.6	3750	13900	nd	nd	58.3	0.008	1	nd	0.14	37.3
Soy	2	Calcareous	3	Toxicological	3.780	58.7	nd	nd	12.4	nd	nd	0.45	16600	nd	1.18	6.82	108	0.5	5070	17.3	4	49.4	3840	15000	nd	nd	59	0.007	1	nd	0.14	38
Soy	3	1X	1	Toxicological	4.897	95.9	nd	nd	14	nd	nd	0.24	13400	nd	1.25	6.96	129	0.5	4200	19.3	3.6	65.7	3830	12400	0.2	0.01	52.1	0.008	2	nd	0.21	28.7
Soy	3	1X	2	Toxicological	4.529	119	nd	nd	13.5	nd	nd	0.24	13300	nd	1.35	7.15	138	0.73	4470	20.6	3.6	66.9	3680	11600	nd	0.03	53.7	0.009	2	nd	0.25	27.6
Soy	3	1X	2	Toxicological	n/a	116	nd	nd	14.2	nd	nd	0.24	13400	nd	1.26	6.88	134	0.74	4330	19.6	3.6	63.8	3630	11300	nd	0.02	53.4	0.009	2	nd	0.25	26.9
Soy	3	1X	3	Toxicological	5.809	121	nd	0.2	14.4	nd	nd	0.26	14000	nd	1.58	7.74	154	1.16	4390	21.5	4.3	74.2	4250	10800	0.2	nd	56.4	0.008	2	0.01	0.27	33
Soy	3	Calcareous	1	Toxicological	3.989	70.1	nd	nd	14	nd	nd	0.49	14400	nd	1.25	7.22	156	2.38	4630	27	5.6	35.9	3460	11600	nd	nd	55.7	0.01	1	nd	0.17	36.1
Soy	3	Calcareous	2	Toxicological	5.714	88.8	nd	0.2	13.8	nd	nd	0.47	15500	nd	1.65	7.13	197	0.68	5030	37.4	3	40.7	3460	12100	nd	0.02	59	0.011	1	0.01	0.2	38.2
Soy	3	Calcareous	3	Toxicological	3.120	82.6	nd	nd	11.8	nd	nd	0.38	13800	nd	1.05	6.49	160	0.86	4520	24.3	1.9	33.3	3120	12500	nd	0.01	52.1	0.01	1	nd	0.17	28.9
Soy	4	UN	1	Toxicological	1.627	203	nd	0.2	14.8	nd	nd	0.16	10700	nd	2.75	6.93	235	0.95	3280	44.5	1.5	164	2180	16000	nd	0.04	47.5	0.005	3	0.01	0.4	16.6
Soy	4	UN	2	Toxicological	2.069	199	nd	0.2	14.2	nd	nd	0.15	10100	nd	3.07	7.43	247	0.79	2980	41.1	1.5	181	2180	16800	nd	0.02	42.6	0.006	3	0.01	0.39	19

Species	Plot	Treatment	Replicate	Sample	Sample Dry Weight	Al	Sb	As	Ba	Be	Bi	Cd	Ca	Cr	Co	Cu	Fe	Pb	Mg	Mn	Mo	Ni	P	K	Se	Ag	Sr	Tm	Ti	U	Vd	Zn
					(g)	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
Soy	4	1X	1	Toxicological	3.154	66.2	nd	nd	13	nd	nd	0.3	12700	nd	1.81	7	116	0.52	4030	28.3	4.8	71.9	4700	14100	0.2	0.02	53.2	0.007	1	nd	0.16	39
Soy	4	1X	2	Toxicological	4.294	105	nd	nd	14.5	nd	nd	0.28	14000	nd	1.91	7.15	145	0.78	4160	26.8	4.3	81.2	4750	13600	0.2	0.02	56.6	0.008	2	0.01	0.23	37.3
Soy	4	1X	3	Toxicological	3.405	118	nd	nd	14.4	nd	nd	0.26	14000	nd	2.02	7.57	159	0.72	4230	23.1	6.2	95.3	5210	13800	0.2	0.01	56.1	0.007	2	nd	0.26	39.2
Soy	4	Calcareous	1	Toxicological	5.508	96.2	nd	nd	12.7	nd	nd	0.41	15600	nd	1.54	7.28	136	0.79	5090	26.5	3.5	51.7	4460	10700	nd	0.03	64.2	0.01	2	0.01	0.22	40.7
Soy	4	Calcareous	2	Toxicological	5.280	89	0.1	nd	12.6	nd	nd	0.42	14900	nd	1.77	6.74	152	0.53	4740	30	2.8	57.9	4260	12500	nd	0.02	60.9	0.01	1	nd	0.2	38.1
Soy	4	Calcareous	3	Toxicological	5.563	84.7	nd	nd	12.3	nd	nd	0.4	15300	nd	1.53	6.34	141	0.66	4600	25.1	2	50.3	4070	11000	nd	0.03	60.4	0.01	1	nd	0.19	35.9
Oat	1	UN	1	Toxicological	1.333	55.9	nd	0.3	5.1	nd	nd	0.12	6770	nd	0.59	8.83	58	0.6	2210	15.7	2.7	130	2400	22600	nd	nd	26.6	0.006	nd	nd	0.07	18
Oat	1	UN	1	Toxicological	n/a	57.3	nd	0.3	5	nd	nd	0.11	6810	nd	0.59	8.84	62	2.02	2220	16.3	2.7	126	2370	22700	0.2	nd	26.2	0.006	1	nd	0.09	18.2
Oat	1	UN	2	Toxicological	0.858	225	nd	0.4	8.6	nd	nd	0.16	8400	nd	0.89	9.42	157	2.31	2070	17.5	2.2	150	1800	18500	0.3	0.03	34.2	0.006	3	0.01	0.31	14.9
Oat	1	UN	3	Toxicological	0.943	193	nd	0.4	9.1	nd	nd	0.18	7860	nd	0.98	8.46	167	1.82	1880	21.5	1.6	143	1410	13900	0.3	0.03	35.7	0.005	3	nd	0.26	12.3
Oat	1	1X	1	Toxicological	1.329	46.1	nd	0.3	5.9	nd	nd	0.12	5200	nd	0.55	11.3	73	1.47	2530	15.9	9.1	91.2	5730	36300	0.3	0.04	19.4	0.007	nd	nd	0.07	26
Oat	1	1X	2	Toxicological	1.980	57.4	nd	0.4	5.5	nd	nd	0.37	6440	nd	0.54	11.3	73	2.08	2830	14.2	9.4	88.4	7100	37400	0.3	0.01	23.4	0.009	1	nd	0.1	21.9
Oat	1	1X	3	Toxicological	1.747	34.5	nd	0.3	5.9	nd	nd	0.12	6340	nd	0.47	10.3	60	1.76	2800	16.2	8.3	91.2	6780	35800	0.3	0.01	22.8	0.007	nd	nd	0.06	21.8
Oat	1	1X	4	Toxicological	1.356	34.4	nd	0.3	5.3	nd	nd	0.11	5090	nd	0.49	10.1	64	0.48	2480	16	8.3	87.1	5500	32700	0.3	0.01	19.2	0.006	nd	nd	0.05	22.5
Oat	1	Calcareous	1	Toxicological	1.008	56.9	nd	0.4	5.7	nd	nd	0.11	5140	nd	0.5	11.5	92	1.24	2270	18	12.6	78.6	6540	32700	0.3	0.01	21.3	0.007	1	nd	0.09	16.4
Oat	1	Calcareous	2	Toxicological	1.112	34.4	nd	0.3	6.8	nd	nd	2.92	5040	nd	0.47	10.4	71	1.23	2140	16.6	11.3	70.7	6070	30500	0.4	0.02	21.1	0.006	nd	nd	0.06	20.9
Oat	1	Calcareous	3	Toxicological	1.071	32.1	nd	0.3	6.2	nd	nd	0.55	4760	nd	0.47	10.8	74	1.87	2490	16.3	10.9	80.3	6590	40400	0.3	0.02	18.4	0.007	1	nd	0.05	20.6
Oat	1	Calcareous	4	Toxicological	1.374	26.2	nd	0.3	6	nd	nd	0.21	5280	nd	0.42	11.7	68	1.71	2520	18.8	11.8	77.5	5590	36400	0.4	0.02	20.3	0.007	nd	nd	nd	20.6
Oat	2	UN	1	Toxicological	0.586	109	nd	0.3	5.6	nd	nd	0.16	6360	nd	0.73	7.13	123	1.96	1800	19.8	3.4	122	2890	15600	0.3	0.02	27.9	0.008	2	nd	0.18	13.7
Oat	2	1X	1	Toxicological	1.786	24.6	nd	0.3	5.2	nd	nd	0.07	6170	nd	0.37	8	54	1.87	2420	12.6	9.1	65.7	5850	27800	0.2	0.02	24.6	0.006	nd	nd	nd	11.3
Oat	2	1X	2	Toxicological	1.421	25.9	nd	0.3	7	nd	nd	0.08	6280	nd	0.51	7.2	44	1.93	2460	16	9.7	75.5	6870	34400	0.4	nd	23.3	0.005	nd	nd	nd	12.3
Oat	2	1X	3	Toxicological	1.551	33.8	nd	0.3	5.7	nd	nd	0.07	6250	nd	0.39	7.81	54	1.84	2460	12.2	9.6	71.6	7230	33200	0.3	nd	22.7	0.006	nd	nd	0.06	11.5
Oat	2	Calcareous	1	Toxicological	1.899	25.1	nd	0.3	5.5	nd	nd	0.1	5530	nd	0.37	9.52	66	2.52	2410	16.1	12.8	65.9	6790	31600	0.3	nd	21.8	0.006	nd	nd	nd	16.3
Oat	2	Calcareous	1	Toxicological	n/a	24	nd	0.3	5.6	nd	nd	0.09	5720	nd	0.37	9.63	63	0.88	2450	15	13.2	67	7040	33600	0.4	0.02	21.9	0.006	nd	nd	0.06	16.7
Oat	2	Calcareous	2	Toxicological	2.282	26.6	nd	0.2	6.8	nd	nd	0.1	5710	nd	0.41	8.98	62	2.77	2520	13.2	11.7	69.8	5950	29700	0.3	nd	22.1	0.007	nd	nd	0.05	15.1
Oat	2	Calcareous	3	Toxicological	2.042	24.7	nd	0.3	6.1	nd	nd	0.09	5660	nd	0.4	8.95	64	2.23	2380	14	12.1	72.8	5960	29500	0.4	nd	22.2	0.007	nd	nd	nd	15
Oat	2	Calcareous	4	Toxicological	2.242	30	nd	0.3	5.3	nd	nd	0.08	5820	nd	0.37	8.86	70	2.34	2380	11.4	12.9	62.2	4660	27200	0.2	nd	23.2	0.007	nd	nd	0.05	12.9
Oat	3	UN	1	Toxicological	1.419	51.2	nd	0.4	5.6	nd	nd	0.12	7150	nd	0.63	5.84	60	2.44	2080	18.4	3.3	95.8	5870	22200	0.2	0.02	29.7	nd	nd	nd	0.09	9.5
Oat	3	UN	2	Toxicological	1.159	56	nd	0.3	5.4	nd	nd	0.16	6800	nd	0.58	5.64	56	2.6	2020	17.1	3.2	97.3	5770	22900	0.3	0.01	27.3	nd	1	nd	0.09	9.9
Oat	3	UN	3	Toxicological	1.174	88.8	nd	0.4	6.8	nd	nd	0.15	7400	nd	0.73	6.07	86	2.17	1890	19.7	2.5	99.2	3930	14300	0.3	0.02	33.6	0.006	2	nd	0.15	9.2
Oat	3	1X	1	Toxicological	2.198	38.3	nd	0.4	4.7	nd	nd	0.1	5900	nd	0.39	7.29	52	1.72	2410	14.9	7	62.6	7030	34400	0.3	nd	23	0.005	nd	nd	0.07	10.4
Oat	3	1X	2	Toxicological	1.590	28.2	nd	0.4	5.6	nd	nd	0.16	5770	nd	0.45	8.27	51	3.3	2580	17.5	7.7	73.3	8220	35900	0.3	0.03	23.2	0.005	nd	nd	0.06	14.2
Oat	3	1X	3	Toxicological	1.471	37.6	nd	0.4	5.7	nd	nd	0.15	5810	nd	0.46	9.35	54	2.21	2480	16.3	6.8	90.9	7560	35100	0.4	0.01	24.7	0.008	nd	nd	0.07	12.1
Oat	3	Calcareous	1	Toxicological	1.480	31.3	nd	0.3	6.4	nd	nd	0.1	5160	nd	0.41	7.9	62	2.42	2340	21.9	7.4	52.6	6500	29000	0.4	0.03	20.8	0.007	nd	nd	0.05	14.3
Oat	3	Calcareous	2	Toxicological	2.051	58.8	nd	0.4	5.8	nd	nd	0.11	5500	nd	0.5	9.44	79	2.88	2280	22.8	8.4	57.9	6390	34700	0.4	nd	22.4	0.009	1	nd	0.1	14.7
Oat	3	Calcareous	3	Toxicological	1.649	30.9	0.12	0.4	6.5	nd	nd	0.08	5330	nd	0.4	7.88	60	1.94	2310	22.9	7.4	48.3	6430	27600	0.4	0.01	21.9	0.007	nd	nd	0.05	14
Oat	4	UN	1	Toxicological	1.289	138	nd	0.4	7.4	nd	nd	0.23	6340	nd	0.92	5.93	101	2.48	1860	20.5	1.9	96.2	2750	11600	0.3	nd	30	0.008	2	nd	0.21	10.7
Oat	4	UN	2	Toxicological	1.130	115	nd	0.3	6.6	nd	nd	0.18	6440	nd	0.66	5.41	84	2.41	1760	18.1	1.8	97.2	2660	12500	0.2	0.01	29.2	0.006	2	nd	0.17	8.7
Oat	4	1X	1	Toxicological	0.777	49	nd	0.3	7.4	nd	nd	0.23	6100	nd	0.59	7.28	62	0.41	2270	14.8	7.9	59.4	5100	26000	0.3	0.02	26.8	0.008	1	nd	0.08	11.1
Oat	4	1X	2	Toxicological	0.887	53.8	0.13	0.4	8.2	nd	nd	0.18	7520	nd	0.48	8.94	68	0.71	3210	11.6	12.2	59.7	7080	30100	0.3	0.03	31.5	0.014	1	nd	0.1	11.7
Oat	4	1X	3	Toxicological	0.923	41.4	nd	0.3	8.9	nd	nd	0.14	5600	nd	0.46	7.14	62	0.34	2500	15	9.8	60.8	7150	31800	0.4	nd	25.9	0.008	nd	nd	0.06	10.7
Oat	4	1X	4	Toxicological	1.265	43.3	nd	0.4	8.2	nd	nd	0.16	7870	nd	0.51	8.17	62	0.34	3150	12	11.6	60.9	7470	29300	0.3	nd	34.7	0.014	nd	nd	0.07	11.6
Oat	4	Calcareous	1	Toxicological	1.626	67.1	nd	0.3	5.4	nd	nd	0.23	6940	nd	0.51	10.2	97	0.51	2960	14.6	10.7	45.3	4410	24700	0.3	0.02	29.4	0.017	1	nd	0.12	13.2
Oat	4	Calcareous	2	Toxicological	1.367	38.5	nd	0.3	4.9	nd	nd	0.13	5460	nd	0.46	8.82	87	0.42	2210	15.4	11	38.8	3920	22100	0.2	0.02	26.3	0.015	nd	nd	0.07	16.4
Oat	4	Calcareous	3	Toxicological	1.325	45.9	nd	0.3	8.2	nd	nd	0.16	5730	nd	0.44	9.51	88	0.66	2580	18.1	11.9	51.8	5760	26300	0.3	nd	25.1	0.012	nd	nd	0.1	18.7
Oat	4	Calcareous	4	Toxicological	1.328	21.2	nd	0.2	10.6	nd	nd	0.11	4360	nd	0.41	8.29	60	0.28	2260	25.6	9.7	51.5	5680	25700	0.2	0.01	24.2	0.009	nd	nd	nd	14.4
Corn	1	UN	1	Toxicological	1.491	70.5	nd	0.5	4	nd	nd	0.11	5680	nd	0.41	5.43	109	0.4	2510	14.8	1.3	32.2	1160	17900	nd	nd	25.5	nd	1	nd	0.15	10.2
Corn	1	UN	2	Toxicological	1.664	87.8	nd	0.5	4	nd	nd	0.15	5880	nd	0.42	6.19	121	0.43	2670	14.5	1.2	34.6	1360	16600	nd	nd	26.3	0.005	1	nd	0.18	9.6
Corn	1	UN	3	Toxicological	1.137	143	nd	0.6	5.2	nd	nd	0.18	6580	nd	0.71	7.49	162	0.71	2910	22.6	1.2	53.8	824	15600	nd	0.01	28.7	0.008	2	nd	0.25	11.3
Corn	1	UN	4	Toxicological	1.510	122	0.06	0.5	4.8	nd	nd	0.17	6610	nd	0.65	8.1	156	0.51	3120	23.6	1.4	50.9	785	11800	nd	nd	28.3	0.009	2	nd	0.23	12.1
Corn	1	1X	1	Toxicological	1.071	50.1	0.06	0.5	4.4	nd	nd	0.17	8240	nd	0.54	7.65	121	0.66	4240	8.2	2.2	21.2	1510	14500	nd	0.02	31.3	0.007	nd	nd	0.13	11.5
Corn	1	1X	2	Toxicological	1.726	51.5	nd	0.4	4.3	nd	nd	0.17	7490	nd	0.47	6.23	95	0.68	4640	7.9	2.3	17	1190	10900	nd	0.01	31	0.01	nd	nd	0.1	11.2
Corn	1	1X	3	Toxicological	1.576	65.2	0.08	0.5	4.9	nd	nd	0.16	8700	nd	0.63	7.65	126	0.57	4740	8.9	2.2	21.7	1390	11800	nd	0.01	32.7	0.011	1	nd	0.14	12.6
Corn	1	1X	4	Toxicological	1.547	41.6	nd	0.3	3.5	nd	nd	0.13	7010	nd	0.38	7.12	104	0.42	4050	10.1	1.7	19.5	1390	8930	nd	nd	29.1	0.008	nd	nd	0.09	10.2
Corn	1	Calcareous	1	Toxicological	1.978	31.5	nd	0.4	2.5	nd	nd	0.12	7880	nd	0.35	7.02	94	0.39	4980	11.6	2.8	10.5	1300	8230	nd	0.01	28.9	0.007	nd	nd	0.07	10
Corn	1	Calcareous	2	Toxicological	1.833	51.1	nd	0.4	3.8	nd	nd	0.19	8520	nd	0.43	7.87	118	0.65	4800	10.3	3.2	12.8	1340	11300	nd	nd	32.3	0.011	nd	nd	0.1	12.9
Corn	1	Calcareous	2	Toxicological	n/a	52.2	nd	0.5	3.5	nd	nd	0.18	8470	nd	0.47	8.3	127	0.61	4710	10.8	3.5	13.7	1410	10300	nd	0.01	31.2	0.009	nd	nd	0.11	15.6
Corn	1	Calcareous	3	Toxicological	1.616	32.6	nd	0.3	2.5	nd	nd	0.12	6880	nd	0.29	7.07	100	0.61	4490	9.3	2.3	10.2	1350	10400	nd	0.02	25.7	0.006	nd	nd	0.06	9.8
Corn	1	Calcareous	4	Toxicological	1.837	60.2	nd	0.4	3.4	nd	nd	0.18	8000	nd	0.45	8.41	144	0.86	5010	9.9	2.9	12.5	1070	8990	nd	0.01	28.8	0.01	1	nd	0.12	10.7
Corn	2	UN	1	Toxicological	0.567	180	nd	0.8	4.8	nd	nd	0.11	7360	nd	1.17	8.62	250	0.77	2810	19.5	3.1	89	1820	10900	0.3	nd	29.7	0.014	3	0.01	0.34	12.3
Corn	2	UN	2	Toxicological	0.859	133	nd	0.4	3.4	nd	nd	0.04	4190	nd	0.78	5.27	171	0.46	1940	18.8	2.1	64.5	1400	11400	nd	nd	20.7	0.006	2	nd	0.25	7.9
Corn	2	UN	3	Toxicological	0.800	87.4	nd	0.5	3.7	nd	nd	0.04	4250	nd	0.83	5.16	151	0.49	1900	21.8	2.7	47.9	1520	11200	nd	nd	22.7	0.005	1	nd	0.17	10.1
Corn	2	UN	4	Toxicological	0.904	142	nd	0.7	5	nd	nd	0.06	8030	nd	0.84	6.6	163	0.42	2440	32.8	3.3	71.8	2790	16000	nd	nd	36.9	0.006	2	nd	0.26	12.6
Corn	2	1X	1	Toxicological	2.466	45.1	nd	0.4	3.8	nd	nd	0.12	6270	nd	0.37	4.38	81	0.87	4030	8.9	1	17.9	1100	10400	nd	nd	27.1	0.009	nd	nd	0.1	8.2
Corn	2	1X	2	Toxicological	3.342	40.8	0.09	0.4	3.5	nd	nd	0.1	6580	nd	0.43	5.09	98	0.47	3910	8.6	1.2	21.3	1420	12200	nd	nd	28	0.007	nd	nd	0.11	9.7
Corn	2	1X	3	Toxicological	2.711	36	nd	0.3	3.1	nd	nd	0.13	6030	nd	0.46	5.9	118	1.88	4190	9.5	1.5	13.9	969	7960	nd	nd	24.4	0.006	nd	nd	0.12	10.9
Corn	2	1X	4	Toxicological	3.527	32.5	nd	0.4	3.2	nd	nd	0.14	8300	nd	0.49	8.36	126	1.14	4810	10.8	2	17.4	1080	8280	nd	0.02	30.2	0.008	nd	nd	0.08	14.7
Corn	2	Calcareous	1	Toxicological	1.108	54	nd	0.4	3.4	nd	nd	0.29	9620	nd	0.71	10.2	132	0.6	4610	12.6	3	14.3	1410	14300	nd	nd	34.3	0.012	nd	nd	0.12	14.3
Corn	2	Calcareous	2	Toxicological	1.679	60.9	nd	0.5	3.8	nd	nd	0.27	10200	nd	0.75	9.8	144	0.51	4640	16.4	2.9	14.8	1380	13000	nd	0.01	35.2	0.01	1	nd	0.13	14.2
Corn	2	Calcareous	3	Toxicological	1.048	39	nd	0.3	3.4	nd	nd	0.28	8930	nd	0.46	8.61	103	0.54	5480	11.4	2.5	9	1030	7180	nd	0.01	36.5	0.014	nd	nd	0.08	12.5
Corn	2	Calcareous	3	Toxicological	n/a	37.9	nd	0.3	3.6	nd	nd	0.24	9140	nd	0.57	9.08	103	0.57	5460	11.2	2.5	9.4	1030	7260	nd	0.02	37.2	0.014	nd	nd	0.07	12.4
Corn	2	Calcareous	4	Toxicological	1.683	26.3	nd	0.2	2.7	nd	nd	0.15	6770	nd	0.32	7.11	86	0.52	4530	9.4	2	6.5	896	7100	nd	0.02	28.7	0.006	nd	nd	0.07	9.4
Corn	3	UN	1	Toxicological	0.908	83.2	nd	0.4	4.5	nd	nd	0.08	4730	nd	0.63	5.15	105	0.4	2340	14.3	0.9	58.4	1710	11900	nd	nd	29.3	0.009	1	nd	0.15	7.5

2001 Field Trials
Plant Data
C3 Test Site

Species	Plot	Treatment	Replicate	Sample	Sample Dry Weight	Al	Sb	As	Ba	Be	Bi	Cd	Ca	Cr	Co	Cu	Fe	Pb	Mg	Mn	Mo	Ni	P	K	Se	Ag	Sr	Tm	Ti	U	Vd	Zn
					(g)	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
Corn	3	UN	2	Toxicological	0.638	98.8	0.07	0.4	4.6	nd	nd	0.08	4930	nd	0.63	5.13	106	0.47	2230	19.3	0.7	55.9	1780	11700	nd	nd	31.3	0.009	2	0.01	0.17	7.6
Corn	3	UN	3	Toxicological	0.276	82.2	nd	0.3	3.2	nd	nd	0.03	2700	nd	0.68	4.65	127	0.42	1350	17.2	0.6	45	940	11400	0.2	nd	18.2	0.005	1	nd	0.17	8
Corn	3	UN	4	Toxicological	0.368	57.8	nd	0.3	3.3	nd	nd	0.04	3430	nd	0.73	5.26	100	0.54	1750	17.4	0.6	58.7	1190	12400	nd	0.01	20.3	0.005	1	nd	0.12	10.7
Corn	3	1X	1	Toxicological	1.921	52.9	nd	0.4	3	nd	nd	0.12	5320	nd	0.36	5.21	86	0.48	2930	9.4	1.2	20.8	2620	15500	nd	0.02	26.3	nd	nd	nd	0.14	9.1
Corn	3	1X	2	Toxicological	2.719	22.9	nd	0.4	3.3	nd	nd	0.2	6690	nd	0.26	5.45	69	0.46	3980	7.2	1.6	15.9	1920	12800	nd	nd	33.2	0.007	nd	nd	0.07	10.7
Corn	3	1X	3	Toxicological	2.813	19.7	nd	0.3	3	nd	nd	0.15	5160	nd	0.3	5.46	74	0.34	3380	11.2	1.5	12.5	1420	12300	nd	nd	26.6	0.006	nd	nd	0.06	9
Corn	3	1X	4	Toxicological	2.47	29.3	nd	0.3	3.1	nd	nd	0.18	5560	nd	0.3	6.8	91	0.42	3790	11.1	1.7	12.7	1000	8010	nd	0.01	28.7	0.008	nd	nd	0.08	9.7
Corn	3	Calcareous	1	Toxicological	2.092	36.1	nd	0.3	3.5	nd	nd	0.23	6060	nd	0.37	4.05	74	0.77	3800	14.2	1.7	11	2200	16800	nd	0.02	29.8	0.008	nd	nd	0.09	7.9
Corn	3	Calcareous	2	Toxicological	3.155	34.3	nd	0.2	2.9	nd	nd	0.14	4810	nd	0.27	4.29	77	0.7	3110	10.3	1.1	8.5	1820	13700	nd	0.03	23.4	nd	nd	nd	0.09	8.6
Corn	3	Calcareous	3	Toxicological	2.968	31.9	nd	0.3	2.4	nd	nd	0.14	4510	nd	0.23	4.82	87	0.64	2960	10.5	1.1	7.8	2110	13100	nd	0.02	22	nd	nd	nd	0.09	8.9
Corn	3	Calcareous	4	Toxicological	2.476	36.8	nd	0.3	2.9	nd	nd	0.2	5890	nd	0.26	4.28	72	0.46	3680	12.9	1.6	8.2	2030	13000	nd	0.03	28.5	0.006	nd	nd	0.1	8.5
Corn	4	UN	1	Toxicological	0.473	83.2	nd	0.4	3.4	nd	nd	0.05	4520	nd	0.67	5.31	129	0.57	2030	17.3	1.7	48.8	1940	11700	nd	nd	25.8	0.007	1	nd	0.19	10.1
Corn	4	UN	2	Toxicological	0.983	77.7	nd	0.5	4.2	nd	nd	0.1	5260	0.5	0.63	7.15	120	0.89	2080	24.9	1.5	46.2	2240	14600	0.3	0.01	30.2	nd	1	nd	0.19	10.8
Corn	4	UN	2	Toxicological	n/a	80.8	nd	0.5	4.5	nd	nd	0.11	5130	nd	0.62	7.08	120	0.64	2090	24.3	1.5	44	2260	15500	0.3	nd	31.2	0.005	2	nd	0.19	10.8
Corn	4	UN	4	Toxicological	0.978	58.5	nd	0.5	4	nd	nd	0.06	5460	nd	0.65	6.51	111	0.89	2100	14.8	1.4	64.8	2210	15100	0.3	nd	29.4	0.006	nd	nd	0.14	9.3
Corn	4	1X	1	Toxicological	1.575	39.2	nd	0.3	4	nd	nd	0.19	7580	nd	0.36	7.1	87	0.45	5370	8.1	1.3	15.9	1760	8050	nd	0.02	38.4	0.015	nd	nd	0.08	9.2
Corn	4	1X	2	Toxicological	3.146	27.2	nd	0.2	3.4	nd	nd	0.14	5890	nd	0.25	5.84	93	0.83	4080	8.2	1.4	10.8	1790	6700	nd	0.01	31	0.008	nd	nd	0.05	9.8
Corn	4	1X	3	Toxicological	2.537	30	nd	0.2	3	nd	nd	0.13	5010	nd	0.29	4.99	79	1.23	3860	7.4	1.2	10.8	2090	10100	nd	0.02	26.4	0.008	nd	nd	0.07	10.9
Corn	4	1X	4	Toxicological	3.005	30.4	nd	0.3	3.2	nd	nd	0.13	6610	nd	0.32	6.37	92	0.61	4030	7.3	1.6	13.3	1280	8050	nd	0.01	31.1	0.009	nd	nd	0.06	11.1
Corn	4	Calcareous	1	Toxicological	2.705	30.1	nd	nd	3.1	nd	nd	0.16	6840	nd	0.25	5.33	79	0.5	5310	8.1	1.2	5.7	1450	5090	nd	0.03	36.3	0.01	nd	nd	0.07	8.2
Corn	4	Calcareous	2	Toxicological	2.547	52.4	nd	0.3	3.7	nd	nd	0.28	6630	nd	0.48	6.32	107	0.6	4430	13.7	1.6	9.3	1820	7710	nd	0.03	35.1	0.011	nd	nd	0.13	12
Corn	4	Calcareous	3	Toxicological	1.975	31.1	nd	0.2	3.6	nd	nd	0.21	7640	nd	0.36	5.45	67	0.52	5340	8.7	1.7	8.2	2250	7930	nd	0.02	39.6	0.011	nd	nd	0.07	8.3
Corn	4	Calcareous	4	Toxicological	1.345	47	nd	nd	3.6	nd	nd	0.22	7280	nd	0.35	5.43	85	0.58	5290	10.4	1.2	9.3	1580	5300	nd	0.02	40.1	0.012	nd	nd	0.08	10.4

Year 2001 Field Trials;Soil Characteristics for C3 Test Site

Sample Code	Dupl	Site	Plot	Treat	Repl	Sb	As	Se	Al	Ba	Be	Cd	Cr	Co	Cu	Fe	Pb	Mn	Mo	Ni	P	Ag	Ti	Vd	Zn
						0.2 mg/kg	0.2 mg/kg	0.2 mg/kg	20 mg/kg	5 mg/kg	0.2 mg/kg	0.5 mg/kg	1 mg/kg	2 mg/kg	1 mg/kg	50 mg/kg	5 mg/kg	1 mg/kg	3 mg/kg	2 mg/kg	20 mg/kg	1 mg/kg	5 mg/kg	1 mg/kg	5 mg/kg
HRU1UN1		HRU	1	UN	1	0.3	15.3	5.1	23500	162	1.1	1.00	28	57	460	20500	31	177	1.5	3880	987	2.0	75	33	128
HRU1UN2		HRU	1	UN	2	0.3	17.6	5.3	23900	164	1.2	0.80	29	52	424	21300	31	181	1.5	3430	1010	1.0	79	35	124
HRU1UN3	n=2	HRU	1	UN	3	0.4	17.9	5.45	23150	157	1.15	1.00	29	55	437	21550	33	176	1.5	3645	972	2.0	84	34	127
HRU1UN4		HRU	1	UN	4	0.3	17.1	5.1	22100	152	1.1	0.90	27	51	414	19600	32	176	1.5	3350	970	2.0	70	32	121
HRU1UN5	n=3	HRU	1	UN	5	0.3	18.3	4.5	21333	152	1.1	0.73	26	45	365	20033	34	173	1.5	2847	877	1.0	77	35	116
HRU1UN6	n=2	HRU	1	UN	6	0.5	18.75	5.25	24650	167.5	1.25	1.00	30.5	54.5	438	22750	55	176.5	1.5	3710	1050	1.5	76	37	132
HRU1UN7		HRU	1	UN	7	0.4	15.3	5.2	22600	155	1.1	0.80	27	51	424	20100	29	173	1.5	3440	956	1.0	72	32	123
HRU1UN8		HRU	1	UN	8	0.3	15.9	5.2	22800	152	1.1	0.70	28	51	416	20900	27	164	1.5	3560	883	1.0	76	34	121
HRU1UN9		HRU	1	UN	9	0.3	18.2	4.5	22700	149	1.1	0.60	27	44	357	21100	28	165	1.5	3000	850	1.0	74	35	117
HRU1UN10		HRU	1	UN	10	0.3	17.1	5.3	22700	161	1.2	0.90	27	54	451	20400	33	181	1.5	3490	1040	2.0	68	34	125
HRU2UN1		HRU	2	UN	1	0.5	21.1	4.2	22000	153	1.2	0.50	27	45	354	20500	33	159	1.5	2810	843	1.0	60	37	115
HRU2UN2	n=2	HRU	2	UN	2	0.45	18.9	4.25	22050	156.5	1.25	0.80	27.5	44	387	19300	29.5	164	1.5	3045	973	1.3	70.5	33.5	112
HRU2UN3		HRU	2	UN	3	0.4	16.7	3.8	21900	155	1.2	0.25	27	45	364	19500	26	154	1.5	2940	840	1.0	59	34	110
HRU2UN4		HRU	2	UN	4	0.4	18.3	4.1	22000	160	1.2	0.60	27	47	386	19300	30	161	1.5	3240	916	1.0	56	33	112
HRU2UN5		HRU	2	UN	5	0.4	17.2	3.8	23500	162	1.3	0.50	29	43	333	20400	27	164	1.5	2810	893	1.0	59	37	113
HRU2UN6	n=2	HRU	2	UN	6	0.4	22.0	5.1	22100	161	1.25	0.70	28	52.5	433.5	19650	35	162.5	1.5	3525	982	1.5	61.5	35	114
HRU2UN7		HRU	2	UN	7	0.4	20	5.2	23000	164	1.3	0.80	29	58	454	20100	37	169	1.5	3670	1010	2.0	63	36	124
HRU2UN8		HRU	2	UN	8	0.4	18.3	3.9	23700	163	1.3	0.25	28	46	374	20200	30	167	1.5	3070	937	1.0	61	38	113
HRU2UN9		HRU	2	UN	9	0.4	18.3	4.1	24000	165	1.3	0.60	29	51	399	20300	33	162	1.5	3160	964	1.0	64	37	121
HRU2UN10		HRU	2	UN	10	0.4	18.3	3.9	20600	150	1.2	0.25	25	41	366	18500	30	151	1.5	2890	945	1.0	57	33	103
HRU3UN1		HRU	3	UN	1	0.4	21.2	4.6	22900	159	1.2	0.80	28	49	420	20700	37	170	1.5	3400	1050	0.5	73	35	117
HRU3UN2		HRU	3	UN	2	0.4	15.1	4.5	20700	152	1.1	0.70	26	44	369	18500	32	159	1.5	3000	966	0.5	72	32	106
HRU3UN3		HRU	3	UN	3	0.7	18.9	4	20800	146	1.1	0.70	26	45	368	19200	35	158	1.5	3130	1030	0.5	67	32	118
HRU3UN4		HRU	3	UN	4	0.4	16.7	4.2	21900	154	1.1	1.00	27	47	369	19500	34	170	1.5	3060	1030	1.0	67	33	123
HRU3UN5		HRU	3	UN	5	0.6	17.8	4.8	22600	156	1.2	0.80	28	54	445	19700	39	170	1.5	3690	1010	1.0	74	34	123
HRU3UN6	n=2	HRU	3	UN	6	0.45	17.85	3.95	22400	154	1.15	0.80	27.5	44.5	375.5	20600	32	166.5	1.5	3050	1025.5	0.5	72.5	34.5	111.5
HRU3UN7	n=2	HRU	3	UN	7	0.5	20.6	5.8	21950	157.5	1.2	0.90	27.5	56	438	20700	42.5	185	1.5	3715	1150	1.0	70.5	35	130
HRU3UN8		HRU	3	UN	8	0.6	17.3	4.4	23200	159	1.2	0.90	28	47	391	19600	35	167	1.5	3140	1100	1.0	73	35	124
HRU3UN9		HRU	3	UN	9	0.4	14.5	3.5	23200	159	1.2	0.80	27	41	341	19200	26	148	1.5	2780	922	0.5	74	35	110
HRU3UN10		HRU	3	UN	10	0.3	13.4	3.7	22500	157	1.2	0.70	27	43	355	18800	28	156	1.5	2890	949	0.5	77	33	111
HRU4UN1		HRU	4	UN	1	0.4	15.3	4.2	23000	170	1.4	0.25	29	47	360	19200	29	162	1.5	3210	1010	0.5	69	34	111
HRU4UN2		HRU	4	UN	2	0.6	16.3	5.7	21200	164	1.3	0.70	28	58	410	17800	34	153	1.5	3870	1150	2.0	61	32	119
HRU4UN3		HRU	4	UN	3	0.5	14.2	4.8	19100	144	1.2	0.50	26	51	391	16400	30	144	1.5	3550	980	2.0	59	29	104
HRU4UN4		HRU	4	UN	4	0.6	21.4	4.5	22200	157	1.3	0.25	28	45	341	20200	37	159	1.5	2940	1220	1.0	70	35	119
HRU4UN5		HRU	4	UN	5	0.5	20.9	4.4	20800	152	1.2	0.25	27	42	364	18900	34	168	1.5	2810	1110	0.5	66	35	104
HRU4UN6		HRU	4	UN	6	0.5	18.3	4	22500	159	1.4	0.25	28	39	309	18900	33	162	1.5	2510	1070	0.5	66	35	108
HRU4UN7		HRU	4	UN	7	0.3	17.9	4.4	19600	153	1.1	1.00	25	48	376	17500	32	162	1.5	3160	1100	0.5	62	28	114
HRU4UN8		HRU	4	UN	8	0.4	16.1	4.5	17600	139	1	0.25	23	46	382	15800	30	153	1.5	3180	939	0.5	61	26	101
HRU4UN9		HRU	4	UN	9	0.4	19.4	4.3	19700	150	1.1	0.60	26	47	382	18200	33	151	1.5	3210	957	0.5	63	29	111
HRU4UN10	n=2	HRU	4	UN	10	0.35	14.6	3.45	18600	136.5	1	0.50	23.5	37	313.5	15800	25	141.5	1.5	2570	868	0.5	65.5	27.5	95.5

Year 2001 Field Trials;Soil Characteristics for C3 Test Site

Sample Code	Dupl	Site	Plot	Treat	Repl	Sb	As	Se	Al	Ba	Be	Cd	Cr	Co	Cu	Fe	Pb	Mn	Mo	Ni	P	Ag	Ti	Vd	Zn
						0.2 mg/kg	0.2 mg/kg	0.2 mg/kg	20 mg/kg	5 mg/kg	0.2 mg/kg	0.5 mg/kg	1 mg/kg	2 mg/kg	1 mg/kg	50 mg/kg	5 mg/kg	1 mg/kg	3 mg/kg	2 mg/kg	20 mg/kg	1 mg/kg	5 mg/kg	1 mg/kg	5 mg/kg
HRU11X1		HRU	1	1X	1																				
HRU11X2		HRU	1	1X	2	0.4	17.6	5.1	22700	155	1.2	1.00	28	54	421	18900	32	174	1.5	3510	969	2.0	71	31	123
HRU11X3		HRU	1	1X	3	0.2	15.3	4.4	23500	152	1.1	0.80	28	47	349	21200	25	178	1.5	3000	826	2.0	73	36	122
HRU11X4	n=2	HRU	1	1X	4	0.35	19.05	5.05	21700	150.5	1.1	0.80	26.5	52.5	408.5	19700	32.5	180	1.5	3495	933	1.0	69.5	32.5	125
HRU11X5		HRU	1	1X	5	0.3	14.2	4.1	22900	148	1.1	0.50	28	46	333	21000	27	177	1.5	2940	816	1.0	70	35	119
HRU11X6		HRU	1	1X	6	0.4	15.9	4.8	24200	165	1.2	1.00	29	53	432	19600	32	175	1.5	3460	1010	2.0	75	34	125
HRU11X7		HRU	1	1X	7	0.2	14.8	4.7	23100	157	1.1	0.80	28	53	431	19100	31	168	1.5	3560	930	1.0	73	32	121
HRU11X8		HRU	1	1X	8	0.3	18.2	4.2	23800	157	1.2	1.00	28	48	407	20000	31	178	1.5	3320	974	1.0	72	33	126
HRU11X9		HRU	1	1X	9	0.4	18.2	4.7	24200	163	1.2	0.90	29	52	407	20300	31	183	1.5	3510	990	2.0	70	34	126
HRU11X10		HRU	1	1X	10	0.4	16.5	4.3	24400	162	1.2	1.00	29	52	413	19700	32	173	1.5	3510	971	2.0	78	33	125
HRU21X1	n=2	HRU	2	1X	1	0.5	21.75	4.5	22450	157	1.15	0.53	28	52.5	420.5	20350	33.5	174.5	1.5	3585	947.5	1.0	70.5	36	119.5
HRU21X2		HRU	2	1X	2	0.4	23.9	3.4	23000	168	1.3	0.60	28	51	434	20000	35	172	1.5	3400	1080	1.0	58	36	119
HRU21X3		HRU	2	1X	3	0.4	18.3	3.6	23100	157	1.2	0.25	29	48	365	19800	29	164	1.5	3070	838	1.0	61	37	110
HRU21X4		HRU	2	1X	4	0.4	21.1	4.5	22600	157	1.2	0.60	28	53	437	19900	33	169	1.5	3570	1050	2.0	55	36	116
HRU21X5		HRU	2	1X	5	0.4	20	3.9	22600	174	1.3	0.60	28	54	445	19200	32	158	1.5	3640	1160	1.0	61	35	118
HRU21X6		HRU	2	1X	6	0.4	22.8	3.9	21100	158	1.2	0.25	28	58	442	19900	35	165	1.5	3640	970	2.0	57	34	114
HRU21X7		HRU	2	1X	7	0.4	22.8	3.9	22100	159	1.2	0.25	28	50	421	20200	34	167	1.5	3350	1010	1.0	48	36	114
HRU21X8		HRU	2	1X	8	0.4	21.1	4.7	21100	155	1.2	0.50	27	53	429	19600	35	168	1.5	3500	972	1.0	56	34	112
HRU21X9		HRU	2	1X	9	0.6	16.7	4.6	21200	150	1.2	0.80	27	47	379	20100	33	177	1.5	2970	947	1.0	76	35	114
HRU21X10		HRU	2	1X	10	0.3	15.6	4.8	22100	157	1.2	0.90	28	49	402	21200	33	179	1.5	3210	953	1.0	79	37	118
HRU31X1		HRU	3	1X	1	0.6	19.5	4.9	22800	158	1.2	0.90	27	53	432	19900	38	174	1.5	3580	1110	1.0	77	34	132
HRU31X2		HRU	3	1X	2	0.6	14	3.9	21400	147	1.1	0.80	25	41	339	18000	27	149	1.5	2730	903	0.5	73	32	104
HRU31X3	n=2	HRU	3	1X	3	0.45	18.35	4.45	19950	147	1.15	0.70	25	42.5	359.5	17450	31.5	151	1.5	2950	983	0.8	66.5	31	103.5
HRU31X4		HRU	3	1X	4	0.4	16.3	3.8	19300	148	1.2	0.25	24	38	320	17700	31	154	1.5	2540	994	1.0	65	30	101
HRU31X5	n=2	HRU	3	1X	5	0.4	20.3	4	19650	148	1.2	0.43	25	38.5	326.5	20050	37.5	164.5	1.5	2480	1090	0.8	64.5	32	101.5
HRU31X6		HRU	3	1X	6	0.3	15.3	4	19600	149	1.1	0.25	25	40	316	18000	29	157	1.5	2570	930	0.5	64	30	97
HRU31X7		HRU	3	1X	7	0.5	18.8	4.7	19400	150	1.1	0.25	25	48	391	18000	33	166	1.5	3150	1070	1.0	61	30	110
HRU31X8		HRU	3	1X	8	0.4	20.3	3.8	20100	153	1.3	0.25	25	35	314	19100	35	157	1.5	2280	1150	0.5	62	33	100
HRU31X9		HRU	3	1X	9	0.4	3.3	3.8	19500	146	1.2	0.25	25	41	344	18000	27	145	1.5	2770	879	0.5	69	31	95
HRU31X10		HRU	3	1X	10	0.4	18.3	4	20200	150	1.2	0.60	25	38	347	18700	31	134	1.5	2600	913	0.5	69	33	96
HRU41X1		HRU	4	1X	1	0.5	19.4	4.2	18300	145	1	0.70	24	45	359	17300	34	153	1.5	2950	1050	1.0	63	28	109
HRU41X2		HRU	4	1X	2	0.3	14.6	3.1	18500	143	1	0.25	23	36	304	15900	26	145	1.5	2430	896	0.5	64	27	91
HRU41X3	n=2	HRU	4	1X	3	0.5	21.25	4.6	19800	155	1.1	0.75	26	48	401	18850	37.5	165	1.5	3275	1080	1.0	66.5	30.5	114
HRU41X4		HRU	4	1X	4	0.5	19.4	4.6	20800	157	1.2	1.00	26	45	398	18700	35	150	1.5	3190	1010	1.0	65	31	112
HRU41X5		HRU	4	1X	5	0.3	13.7	4.1	18500	144	1	0.70	23	44	348	16000	25	147	1.5	2890	897	0.5	64	26	98
HRU41X6	n=2	HRU	4	1X	6	0.35	14.35	3.65	19500	143	1	0.55	24.5	38.5	319.5	15900	27.5	141	1.5	2600	867	0.5	69	28.5	97.5
HRU41X7		HRU	4	1X	7	0.2	13.2	3.4	17900	134	0.9	0.60	22	38	296	14600	26	139	1.5	2440	833	0.5	64	26	92
HRU41X8		HRU	4	1X	8	0.5	17.9	4.3	20300	152	1.1	0.70	25	46	389	18400	30	152	1.5	3250	945	0.5	61	30	114
HRU41X9		HRU	4	1X	9	0.3	14.2	3.7	20300	152	1.1	0.70	25	42	334	17100	29	155	1.5	2870	995	0.5	63	29	108
HRU41X10		HRU	4	1X	10	0.5	15.1	5.2	20000	153	1.1	0.70	26	50	420	18000	34	149	1.5	3530	1000	1.0	64	30	113

Year 2001 Field Trials;Soil Characteristics for C3 Test Site

Sample Code	Dupl	Site	Plot	Treat	Repl	Sb	As	Se	Al	Ba	Be	Cd	Cr	Co	Cu	Fe	Pb	Mn	Mo	Ni	P	Ag	Ti	Vd	Zn
						0.2 mg/kg	0.2 mg/kg	0.2 mg/kg	20 mg/kg	5 mg/kg	0.2 mg/kg	0.5 mg/kg	1 mg/kg	2 mg/kg	1 mg/kg	50 mg/kg	5 mg/kg	1 mg/kg	3 mg/kg	2 mg/kg	20 mg/kg	1 mg/kg	5 mg/kg	1 mg/kg	5 mg/kg
HRU1CAL1		HRU	1	CAL	1	0.2	15.3	4.1	21300	141	1	0.80	26	45	340	19900	27	175	1.5	2870	804	1.0	74	33	116
HRU1CAL2		HRU	1	CAL	2	0.4	16.5	4.7	22300	156	1.1	0.80	26	53	436	18800	32	166	1.5	3460	982	1.0	73	31	121
HRU1CAL3		HRU	1	CAL	3	0.3	14.2	3.9	22400	146	1	0.60	26	43	326	20300	25	168	1.5	2720	789	1.0	78	33	118
HRU1CAL4		HRU	1	CAL	4	0.2	18.2	4.1	23100	156	1.1	0.90	26	44	366	19900	25	166	1.5	2990	871	1.0	74	33	116
HRU1CAL5	n=2	HRU	1	CAL	5	0.35	18.65	4.65	21200	150	1.05	0.80	26.5	51.5	412	19000	31.5	166.5	1.5	3320	855	1.0	68.5	32	123
HRU1CAL6		HRU	1	CAL	6	0.4	21.7	4.1	22200	158	1.2	0.60	26	47	392	19300	30	172	1.5	3080	1050	1.0	63	33	113
HRU1CAL7	n=2	HRU	1	CAL	7	0.4	18.05	4.2	21200	154	1.15	0.75	26	49.5	401	19000	32	178	1.5	3230	1010	1.0	64	31	118.5
HRU1CAL8		HRU	1	CAL	8	0.4	17.2	4	22200	158	1.2	0.70	27	45	376	19000	28	156	1.5	3050	917	1.0	65	32	113
HRU1CAL9		HRU	1	CAL	9	0.4	18.3	4.2	23300	162	1.2	0.70	27	46	382	19600	29	171	1.5	3030	988	1.0	68	34	116
HRU1CAL10		HRU	1	CAL	10	0.4	17.8	4	23900	167	1.3	0.70	28	46	394	19300	30	161	1.5	3090	1020	1.0	66	35	114
HRU2CAL1		HRU	2	CAL	1	0.4	18.9	4.6	23100	164	1.3	0.90	27	41	361	20300	33	163	1.5	2850	1080	1.0	75	36	115
HRU2CAL2		HRU	2	CAL	2	0.4	15.6	4.4	21600	150	1.1	0.25	27	42	342	21400	28	170	1.5	2690	811	0.5	77	36	107
HRU2CAL3	n=2	HRU	2	CAL	3	0.4	21.8	4.7	20900	147	1.1	0.75	26	44.5	400	19850	36.5	167.5	1.5	2975	983.5	0.8	70.5	34.5	111
HRU2CAL4		HRU	2	CAL	4	0.4	15.6	4.4	21300	145	1.1	0.60	26	42	319	20300	26	169	1.5	2710	763	1.0	70	34	108
HRU2CAL5		HRU	2	CAL	5	0.3	17.8	4.6	21700	150	1.2	0.70	27	48	373	19500	34	162	1.5	3070	924	1.0	70	34	114
HRU2CAL6		HRU	2	CAL	6	0.6	16.7	4.6	22100	152	1.2	0.60	28	50	403	20400	33	170	1.5	3210	928	1.0	69	36	116
HRU2CAL7		HRU	2	CAL	7	0.6	17.8	4.8	21100	143	1.1	0.80	27	45	362	20100	30	162	1.5	3010	788	1.0	70	34	111
HRU2CAL8	n=2	HRU	2	CAL	8	0.6	18.35	4.8	21750	155.5	1.1	0.60	28	49	395	21200	33.5	171	1.5	3110	855.5	1.0	77	36	113.5
HRU2CAL9		HRU	2	CAL	9	0.6	17.3	4	22000	147	1.1	0.60	27	42	327	20900	30	172	1.5	2650	761	0.5	75	37	108
HRU2CAL10		HRU	2	CAL	10	0.7	17.8	5	22000	154	1.1	1.00	27	53	428	19700	34	165	1.5	3430	964	1.0	72	34	124
HRU3CAL1		HRU	3	CAL	1	0.5	20.3	4.5	21200	158	1.2	0.50	26	43	380	19000	31	150	1.5	3010	978	0.5	67	32	108
HRU3CAL2		HRU	3	CAL	2	0.4	13.2	3.3	20300	150	1.2	0.25	25	40	315	17400	23	146	1.5	2550	895	0.5	70	30	96
HRU3CAL3		HRU	3	CAL	3	0.4	14.8	3.4	21200	154	1.2	0.25	26	38	329	18200	28	146	1.5	2510	915	0.5	74	32	98
HRU3CAL4		HRU	3	CAL	4	0.5	19.3	4.7	20200	156	1.2	0.70	25	50	409	19100	32	172	1.5	3320	1150	1.0	70	31	117
HRU3CAL5		HRU	3	CAL	5	0.5	18.8	4.3	19600	150	1.1	0.25	24	45	367	19900	30	160	1.5	2930	1010	1.0	66	31	103
HRU3CAL6		HRU	3	CAL	6	0.4	17.3	4.4	20000	154	1.2	0.25	25	43	356	19000	32	156	1.5	2880	1060	0.5	69	31	109
HRU3CAL7	n=2	HRU	3	CAL	7	0.5	21.05	4.45	20000	149	1.15	0.48	24.5	42.5	374	18350	34	152.5	1.5	2915	990	0.5	66	31	103.5
HRU3CAL8	n=2	HRU	3	CAL	8	0.45	22.4	4.8	21450	158.5	1.2	0.25	26	43.5	387.5	19950	37	160.5	1.5	3015	1095	0.5	70.5	34.5	106.5
HRU3CAL9		HRU	3	CAL	9	0.6	19.3	4.1	20000	153	1.2	0.25	28	49	387	18400	34	166	1.5	3240	1090	1.0	68	31	113
HRU3CAL10		HRU	3	CAL	10	0.4	17.3	4	22200	165	1.4	0.70	27	41	335	19000	31	169	1.5	2710	1100	1.0	67	34	107
HRU4CAL1	n=3	HRU	4	CAL	1	0.3	13.3	3.3	20300	147	1.1	0.60	25	38	305	15700	28	145	1.5	2540	946	0.5	69	29	102
HRU4CAL2		HRU	4	CAL	2	0.6	15.6	4.4	19300	146	1.1	0.80	24	46	393	16800	32	144	1.5	3270	960	1.0	58	28	105
HRU4CAL3		HRU	4	CAL	3	0.4	15.1	3.3	21100	160	1.3	0.70	27	42	346	16600	34	155	1.5	2810	1030	0.5	74	31	108
HRU4CAL4		HRU	4	CAL	4	0.5	17.9	4.5	19500	150	1.2	0.70	28	49	421	17000	36	154	1.5	3450	958	1.0	65	30	110
HRU4CAL5		HRU	4	CAL	5	0.5	17	4.6	20500	153	1.2	0.60	26	42	325	19000	30	171	1.5	2630	1000	0.5	76	34	119
HRU4CAL6		HRU	4	CAL	6	0.4	16.1	4.2	19200	148	1.1	0.80	25	45	368	16200	33	153	1.5	2990	985	1.0	69	29	106
HRU4CAL7		HRU	4	CAL	7	0.2	14.6	3.5	17900	136	1.1	0.25	24	42	323	16100	30	158	1.5	2660	912	0.5	71	28	109
HRU4CAL8		HRU	4	CAL	8	0.3	15.1	4.4	18000	135	1	0.25	23	45	341	16000	30	150	1.5	2930	886	0.5	72	28	109
HRU4CAL9		HRU	4	CAL	9	0.5	18.9	4.8	20400	155	1.2	0.90	27	52	435	17700	40	155	1.5	3490	1020	1.0	66	31	117
HRU4CAL10		HRU	4	CAL	10	0.4	15.1	3.7	20200	150	1.1	0.60	26	40	333	16700	31	150	1.5	2770	956	0.5	67	30	107

Year 2001 Field Trials;Soil Characteristics for C3 Test Site

Sample Code	Dupl	Site	Plot	Treat	Repl	Conductivity - @25øC	Loss on Ignition	Cation Exchange Capacity (as Na)	pH	Moisture Content	Total Inorganic Carbon (as C)	Total Carbon (as C)	Total Organic Carbon
						0.01 mS/cm	0.01 %	0.01 meq100	0.01 Units	0.01 %	0.05 %	0.05 %	0.05 %
HRU1UN1		HRU	1	UN	1	0.36	16.7	49	5.64	12.9	0.025	7.8	7.8
HRU1UN2		HRU	1	UN	2	0.4	18.7	55	5.68	17.4	0.025	8.76	9
HRU1UN3	n=2	HRU	1	UN	3	0.47	18.25	52	5.66	18.2	0.025	8.66	8.76
HRU1UN4		HRU	1	UN	4	0.39	18.3	53	5.6	12.9	0.025	8.52	8.68
HRU1UN5	n=3	HRU	1	UN	5	0.46	16.1	39	5.775	17.5	0.025	7.37	7.36
HRU1UN6	n=2	HRU	1	UN	6	0.38	18.4	53	6.12	13.65	0.025	8.3	8.3
HRU1UN7		HRU	1	UN	7	0.39	18.2	53	5.58	16.5	0.025	8.28	8.36
HRU1UN8		HRU	1	UN	8	0.35	17.8	45	5.7	12.7	0.025	7.6	7.6
HRU1UN9		HRU	1	UN	9	0.36	17.7	47	5.63	15.8	0.025	7.6	7.88
HRU1UN10		HRU	1	UN	10	0.4	20	54	5.86	14.2	0.025	9	9.16
HRU2UN1		HRU	2	UN	1	0.42	16.4	54	5.67	11.8	0.025	7.64	7.72
HRU2UN2	n=2	HRU	2	UN	2	0.465	17.7	46	5.565	18.75	0.025	7.96	8.24
HRU2UN3		HRU	2	UN	3	0.47	16.3	44	5.6	19	0.025	7.64	7.68
HRU2UN4		HRU	2	UN	4	0.44	17.4	55	5.76	15.2	0.025	7.88	7.72
HRU2UN5		HRU	2	UN	5	0.42	17	55	5.61	15.4	0.025	7.6	7.56
HRU2UN6	n=2	HRU	2	UN	6	0.47	18.1	47	5.59	16.2	0.025	8.66	8.74
HRU2UN7		HRU	2	UN	7	0.54	18.9	55	5.48	18.4	0.025	8.96	8.96
HRU2UN8		HRU	2	UN	8	0.44	17	46	5.57	19.7	0.025	7.64	8
HRU2UN9		HRU	2	UN	9	0.51	17.1	54	5.48	20.5	0.025	8.32	8.36
HRU2UN10		HRU	2	UN	10	0.45	16.8	47	5.63	15.7	0.025	7.64	7.88
HRU3UN1		HRU	3	UN	1	0.38	17.7	49	5.84	15.1	0.025	8.88	8.8
HRU3UN2		HRU	3	UN	2	0.38	17.4	48	5.77	15.6	0.025	8.32	8.44
HRU3UN3		HRU	3	UN	3	0.3	17.3	47	5.6	8.2	0.025	8.28	8.36
HRU3UN4		HRU	3	UN	4	0.37	16.7	46	5.76	13	0.280	8.24	7.96
HRU3UN5		HRU	3	UN	5	0.38	18.2	46	5.88	14.7	0.025	8.2	8.2
HRU3UN6	n=2	HRU	3	UN	6	0.49	17.35	43	5.535	19.35	0.133	7.88	7.78
HRU3UN7	n=2	HRU	3	UN	7	0.32	18.45	49	5.85	11	0.025	8.42	8.52
HRU3UN8		HRU	3	UN	8	0.38	18	47	5.59	13.9	0.025	8.24	8.2
HRU3UN9		HRU	3	UN	9	0.37	15.8	45	5.76	22.8	0.200	7.32	7.12
HRU3UN10		HRU	3	UN	10	0.39	16.4	44	5.68	11.6	0.025	7.24	7.32
HRU4UN1		HRU	4	UN	1	0.45	17.5	38	5.73	16.5	0.025	7.24	7.44
HRU4UN2		HRU	4	UN	2	0.63	19.5	44	5.5	16.3	0.480	8.8	8.32
HRU4UN3		HRU	4	UN	3	0.45	19.3	43	5.61	16.5	0.240	8.48	8.24
HRU4UN4		HRU	4	UN	4	0.58	18.5	45	5.46	18.7	0.025	8.6	8.6
HRU4UN5		HRU	4	UN	5	0.41	18.8	48	5.68	15.5	0.280	7.68	8.4
HRU4UN6		HRU	4	UN	6	0.53	17.1	42	5.54	17.3	0.280	7.56	7.28
HRU4UN7		HRU	4	UN	7	0.55	18.8	45	5.05	15.8	0.480	8.56	8.08
HRU4UN8		HRU	4	UN	8	0.37	19.4	44	5.13	16.5	0.025	8.6	8.76
HRU4UN9		HRU	4	UN	9	0.52	18.8	31	5.09	19.2	0.025	8.28	8.28
HRU4UN10	n=2	HRU	4	UN	10	0.395	16.95	35	5.53	17.35	0.025	7.28	7.32

Year 2001 Field Trials;Soil Characteristics for C3 Test Site

Sample Code	Dupl	Site	Plot	Treat	Repl	Conductivity - @25øC 0.01 mS/cm	Loss on Ignition 0.01 %	Cation Exchange Capacity (as Na) 0.01 meq100	pH 0.01 Units	Moisture Content 0.01 %	Total Inorganic Carbon (as C) 0.05 %	Total Carbon (as C) 0.05 %	Total Organic Carbon 0.05 %
HRU11X1		HRU	1	1X	1								
HRU11X2		HRU	1	1X	2	0.36	15.5	49	6.02	12.8	0.025	7.6	8.04
HRU11X3		HRU	1	1X	3	0.45	16.5	45	6.21	17.9	0.025	7.28	7.52
HRU11X4	n=2	HRU	1	1X	4	0.51	17	43.5	6.215	19.2	0.025	7.82	7.92
HRU11X5		HRU	1	1X	5	0.45	16.2	41	6.35	16.9	0.025	6.68	6.96
HRU11X6		HRU	1	1X	6	0.48	17.2	50	6.25	18.5	0.025	7.44	7.68
HRU11X7		HRU	1	1X	7	0.44	17.9	51	6.17	18.6	0.025	7.6	7.6
HRU11X8		HRU	1	1X	8	0.4	17.3	51	6.53	14.8	0.025	7.16	7.2
HRU11X9		HRU	1	1X	9	0.48	16.8	49	6.32	20.8	0.025	7.6	7.6
HRU11X10		HRU	1	1X	10	0.46	16.9	49	6.8	17.0	0.025	7.28	7.36
HRU21X1	n=2	HRU	2	1X	1	0.43	18.85	46	6.035	13.75	0.025	8.74	8.9
HRU21X2		HRU	2	1X	2	0.45	17.6	49	6.11	17.7	0.025	8.96	8.96
HRU21X3		HRU	2	1X	3	0.52	17.8	47	6.31	17.1	0.025	7.8	8
HRU21X4		HRU	2	1X	4	0.65	20.7	46	6.26	20.9	0.025	9.72	9.6
HRU21X5		HRU	2	1X	5	0.55	19.5	50	6.27	14.7	0.025	9.2	9.2
HRU21X6		HRU	2	1X	6	0.53	19.1	48	6.39	17.4	0.320	9.2	8.88
HRU21X7		HRU	2	1X	7	0.5	19.8	50	6.22	12.3	0.025	9.16	9.44
HRU21X8		HRU	2	1X	8	0.57	19.7	49	6.36	17.6	0.025	9.12	9.12
HRU21X9		HRU	2	1X	9	0.56	18.9	49	6.22	17	0.280	9.12	8.84
HRU21X10		HRU	2	1X	10	0.53	18.2	46	6.23	15.9	0.025	8.68	8.6
HRU31X1		HRU	3	1X	1	0.41	18.3	48	6.49	14.8	0.200	8.44	8.24
HRU31X2		HRU	3	1X	2	0.46	16.9	50	6.45	13.2	0.025	7.4	7.44
HRU31X3	n=2	HRU	3	1X	3	0.465	17.7	31	6.255	15.6	0.133	8.08	7.94
HRU31X4		HRU	3	1X	4	0.48	17.5	39	6.56	16.7	0.025	7.88	7.8
HRU31X5	n=2	HRU	3	1X	5	0.52	17.35	34	6.4	17.75	0.300	8.12	7.82
HRU31X6		HRU	3	1X	6	0.46	17.4	43	6.36	17.9	0.360	8	7.64
HRU31X7		HRU	3	1X	7	0.43	18.4	44	6.28	15.4	0.320	8.52	8.2
HRU31X8		HRU	3	1X	8	0.51	18	46	6.39	17.7	0.400	8.2	7.8
HRU31X9		HRU	3	1X	9	0.3	17	40	6.45	11	0.025	7.24	7.08
HRU31X10		HRU	3	1X	10	0.4	17.4	43	6.28	12.2	0.025	7.28	7.2
HRU41X1		HRU	4	1X	1	0.51	17.6	40	5.98	11.2	0.025	8.24	8.2
HRU41X2		HRU	4	1X	2	0.35	15.9	37	6.03	10.9	0.025	7.36	7.52
HRU41X3	n=2	HRU	4	1X	3	0.54	19.1	48	5.93	16.55	0.460	8.72	8.26
HRU41X4		HRU	4	1X	4	0.38	18.7	41	5.82	14.8	0.025	8.44	8.28
HRU41X5		HRU	4	1X	5	0.41	17.5	40	6.04	13.5	0.025	7.96	8.04
HRU41X6	n=2	HRU	4	1X	6	0.385	16.8	35.5	5.925	13.85	0.025	7.64	7.6
HRU41X7		HRU	4	1X	7	0.47	16.9	36	6.23	15.7	0.480	7.52	7.04
HRU41X8		HRU	4	1X	8	0.5	19.6	45	5.73	17.3	0.025	8.56	8.72
HRU41X9		HRU	4	1X	9	0.6	17.9	44	6	16.2	0.025	8.04	8.32
HRU41X10		HRU	4	1X	10	0.46	19.6	49	5.86	12.8	0.840	10.2	9.4

Year 2001 Field Trials;Soil Characteristics for C3 Test Site

Sample Code	Dupl	Site	Plot	Treat	Repl	Conductivity - @25øC	Loss on Ignition	Cation Exchange Capacity (as Na)	pH	Moisture Content	Total Inorganic Carbon (as C)	Total Carbon (as C)	Total Organic Carbon
						0.01 mS/cm	0.01 %	0.01 meq100	0.01 Units	0.01 %	0.05 %	0.05 %	0.05 %
HRU1CAL1		HRU	1	CAL	1	0.63	16.2	45	6.84	20	0.025	7.16	7.12
HRU1CAL2		HRU	1	CAL	2	0.54	18	54	6.77	19.5	0.200	7.32	8.12
HRU1CAL3		HRU	1	CAL	3	0.55	16.3	45	6.7	20.7	0.360	7.16	6.8
HRU1CAL4		HRU	1	CAL	4	0.58	16.3	47	6.68	20.1	0.600	7.6	7
HRU1CAL5	n=2	HRU	1	CAL	5	0.565	16.35	45	6.645	18.75	0.240	7.84	7.6
HRU1CAL6		HRU	1	CAL	6	0.58	18.4	50	6.99	21.4	0.720	8.92	8.2
HRU1CAL7	n=2	HRU	1	CAL	7	0.69	18	51	6.76	21.8	0.700	8.76	8.06
HRU1CAL8		HRU	1	CAL	8	0.59	13.8	47	6.98	21.6	0.320	8.04	7.72
HRU1CAL9		HRU	1	CAL	9	0.62	17.8	46	7.1	22.1	0.360	8.6	8.24
HRU1CAL10		HRU	1	CAL	10	0.57	18.3	49	6.74	21.2	0.025	8.2	8.36
HRU2CAL1		HRU	2	CAL	1	0.62	17.4	51	6.51	20.6	0.800	8.72	7.92
HRU2CAL2		HRU	2	CAL	2	0.76	15.7	42	6.61	17.7	0.025	7.36	7.28
HRU2CAL3	n=2	HRU	2	CAL	3	0.71	18.3	45.5	6.68	21	0.980	9.16	8.18
HRU2CAL4		HRU	2	CAL	4	0.68	16.5	45	6.62	19.6	0.680	7.88	7.2
HRU2CAL5		HRU	2	CAL	5	0.75	18.7	48	6.56	17.4	0.560	8.84	8.28
HRU2CAL6		HRU	2	CAL	6	0.57	17.6	47	5.85	19.6	0.025	8.72	8.6
HRU2CAL7		HRU	2	CAL	7	0.7	16.2	44	6.68	18.8	0.760	8.32	7.56
HRU2CAL8	n=2	HRU	2	CAL	8	0.62	17.8	45.5	6.34	16.1	0.600	8.82	8.22
HRU2CAL9		HRU	2	CAL	9	0.6	16.3	41	6.64	15.8	0.400	7.6	7.2
HRU2CAL10		HRU	2	CAL	10	0.83	18.8	47	6.64	21.9	0.800	9.2	8.4
HRU3CAL1		HRU	3	CAL	1	0.44	16.4	42	6.86	14.7	0.960	7.92	6.96
HRU3CAL2		HRU	3	CAL	2	0.69	15.5	35	6.93	18.6	1.320	7.68	6.36
HRU3CAL3		HRU	3	CAL	3	0.64	14.3	38	6.04	15.9	1.480	7.52	6.04
HRU3CAL4		HRU	3	CAL	4	0.54	17.6	36	6.88	16.3	0.680	8.36	7.68
HRU3CAL5		HRU	3	CAL	5	0.59	16.9	39	7	18.5	0.720	7.92	7.2
HRU3CAL6		HRU	3	CAL	6	0.6	16.3	40	6.95	15.1	0.760	7.72	6.96
HRU3CAL7	n=2	HRU	3	CAL	7	0.425	17	41.5	6.76	12.9	0.300	7.8	7.5
HRU3CAL8	n=2	HRU	3	CAL	8	0.56	16.9	40	7.14	16.6	0.900	8.16	7.26
HRU3CAL9		HRU	3	CAL	9	0.6	16.7	41	6.95	16.9	0.960	8.04	7.08
HRU3CAL10		HRU	3	CAL	10	0.56	15.2	40	6.96	14.2	0.760	7.24	6.48
HRU4CAL1	n=3	HRU	4	CAL	1	0.56	16.3	46	6.52	17.4	0.502	7.71	7.27
HRU4CAL2		HRU	4	CAL	2	0.66	18.7	35	6.38	18	0.025	9.36	9.32
HRU4CAL3		HRU	4	CAL	3	0.48	15.5	44	6.00	13.5	0.025	7.24	7.36
HRU4CAL4		HRU	4	CAL	4	0.63	8.5	48	6.41	16.4	0.320	9.08	8.76
HRU4CAL5		HRU	4	CAL	5	0.62	15.3	36	6.55	16.2	0.360	7.28	6.92
HRU4CAL6		HRU	4	CAL	6	0.68	17.4	41	6.57	20.4	0.200	7.96	7.76
HRU4CAL7		HRU	4	CAL	7	0.55	15.5	37	6.63	15.9	0.280	7.32	7.04
HRU4CAL8		HRU	4	CAL	8	0.64	15.1	41	6.64	15.3	0.400	6.92	6.52
HRU4CAL9		HRU	4	CAL	9	0.56	19.8	45	6.43	14.1	0.025	8.92	8.76
HRU4CAL10		HRU	4	CAL	10	0.67	16.2	41	6.52	15.2	0.025	7.64	7.48

Year 2001 Field Trials; Soil Characteristics for C3 Test Site

						DTPA Extract			Aqueous Extract			Ammonium Oxalate Extraction			Strontium Nitrate Extract			Dithionate-Citrate-Bicarbonate Extract		
Sample Code	Dupl	Site	Plot	Treat	Repl	Cobalt	Copper	Nickel	Cobalt	Copper	Nickel	Cobalt	Copper	Nickel	Cobalt	Copper	Nickel	Aluminum, Extractable	Iron, Extractable	Manganese, Extractable
						0.2 mg/kg	0.2 mg/kg	0.6 mg/kg	0.2 mg/kg	0.2 mg/kg	0.6 mg/kg	2 mg/kg	2 mg/kg	8 mg/kg	0.1 mg/kg	0.1 mg/kg	0.4 mg/kg	300 mg/kg	100 mg/kg	50 mg/kg
HRU1UN1		HRU	1	UN	1	2.2	124	526	0.1	2.4	16.9	11	256	792	0.10	0.2	15	4660	9960	84
HRU1UN2		HRU	1	UN	2	3.1	129	590	0.2	2.5	20.3	13	258	895	0.20	0.2	15.4	4370	10600	89
HRU1UN3	n=2	HRU	1	UN	3	3.05	138.5	583.5	0.1	2.4	18.6	12.5	262	856	0.15	0.2	16.3	4100	10450	66.5
HRU1UN4		HRU	1	UN	4	2.5	129	570	0.1	2.6	19.1	13	261	869	0.20	0.2	16.2	3970	9570	75
HRU1UN5	n=3	HRU	1	UN	5	2.3	119	497	0.1	2.5	18.5	12	219	744	0.20	0.2	17.6	3250	9857	76
HRU1UN6	n=2	HRU	1	UN	6	2.7	135	565	0.1	2.65	19.7	11	251.5	827	0.15	0.2	16.45	3815	9935	63
HRU1UN7		HRU	1	UN	7	2.4	119	528	0.1	2.5	18.5	11	259	837	0.20	0.2	16.8	4210	10800	98
HRU1UN8		HRU	1	UN	8	2	113	492	0.1	2.4	17.8	11	225	752	0.10	0.2	13.6	3450	10500	91
HRU1UN9		HRU	1	UN	9	2.1	105	489	0.1	2.5	18.3	10	221	761	0.20	0.2	14.6	3140	9890	71
HRU1UN10		HRU	1	UN	10	2.5	129	541	0.1	2.8	19.7	15	279	900	0.10	0.2	13.1	4540	10300	96
HRU2UN1		HRU	2	UN	1	3.2	111	484	0.1	2.6	19.2	11	219	723	0.30	0.2	21.9	3460	10000	61
HRU2UN2	n=2	HRU	2	UN	2	2.8	123	546	0.2	2.7	19.75	12	237.5	781	0.20	0.2	19.9	4215	9680	79.5
HRU2UN3		HRU	2	UN	3	2.6	111	471	0.1	2.5	17.9	10	221	692	0.20	0.2	19.7	3380	8920	61
HRU2UN4		HRU	2	UN	4	2.6	115	502	0.2	2.8	19.6	12	239	768	0.20	0.3	19	3940	9720	67
HRU2UN5		HRU	2	UN	5	2.5	98.2	485	0.1	2.4	18.9	12	210	740	0.20	0.2	17.7	3460	8990	61
HRU2UN6	n=2	HRU	2	UN	6	3.7	134.5	570	0.1	3	20.95	13.5	282.5	881.5	0.35	0.3	22.45	4445	10010	72.5
HRU2UN7		HRU	2	UN	7	4.6	141	621	0.1	3.1	22.9	16	306	990	0.40	0.2	25.7	4010	9890	81
HRU2UN8		HRU	2	UN	8	2.4	113	494	0.1	2.5	18.4	12	240	780	0.20	0.2	18	3910	10400	70
HRU2UN9		HRU	2	UN	9	3.8	126	552	0.1	2.8	21.2	12	239	782	0.30	0.3	22.3	4200	10200	65
HRU2UN10		HRU	2	UN	10	2.6	118	509	0.1	2.8	20.1	12	259	818	0.20	0.2	18.6	3920	10600	83
HRU3UN1		HRU	3	UN	1	2.5	135	568	0.1	3.2	21.2	13	251	871	0.10	0.2	13.9	4130	9830	66
HRU3UN2		HRU	3	UN	2	2.4	125	526	0.1	2.9	20.6	12	217	742	0.10	0.2	13.2	4380	10300	90
HRU3UN3		HRU	3	UN	3	3.3	132	555	0.2	3.2	20.4	13	221	795	0.20	0.2	16.4	4330	11500	86
HRU3UN4		HRU	3	UN	4	0.1	4.2	18.4	0.1	3	21.5	14	227	782	0.20	0.2	17.8	3360	9840	81
HRU3UN5		HRU	3	UN	5	2.8	142	564	0.1	3.5	23.1	14	252	818	0.10	0.2	15.5	3400	8890	65
HRU3UN6	n=2	HRU	3	UN	6	2.7	122	519.5	0.1	2.75	19.7	12	221	750.5	0.15	0.15	18.55	3310	11640	73
HRU3UN7	n=2	HRU	3	UN	7	3.25	149.5	620	0.1	3.65	23.65	15.5	265.5	910.5	0.15	0.25	17.1	4050	12050	106.5
HRU3UN8		HRU	3	UN	8	2.9	128	542	0.1	3	21.7	12	224	761	0.20	0.2	16.7	3980	9790	81
HRU3UN9		HRU	3	UN	9	2.6	103	501	0.1	2.5	19.5	9	190	702	0.20	0.2	15.3	3030	8720	52
HRU3UN10		HRU	3	UN	10	2.3	113	485	0.1	2.7	19.2	11	203	669	0.20	0.3	16	2790	8090	54
HRU4UN1		HRU	4	UN	1	2.4	116	513	0.1	2.6	19.1	13	236	842	0.20	0.2	16.1	6280	9540	71
HRU4UN2		HRU	4	UN	2	4.2	143	671	0.1	2.7	23.9	17	275	1050	0.30	0.2	24.2	5760	9640	85
HRU4UN3		HRU	4	UN	3	3.4	140	609	0.1	3.1	21	15	281	974	0.20	0.3	20.6	5130	8870	82
HRU4UN4		HRU	4	UN	4	3.2	119	592	0.1	2.5	19.7	14	236	909	0.30	0.2	18	5100	12000	76
HRU4UN5		HRU	4	UN	5	3	137	598	0.1	3	19.8	14	253	898	0.20	0.2	17	3830	10600	115
HRU4UN6		HRU	4	UN	6	2.5	117	525	0.1	2.4	19.4	13	206	774	0.20	0.2	17.6	4410	9680	76
HRU4UN7		HRU	4	UN	7	3.1	123	597	0.1	2.3	20.6	14	247	903	0.20	0.2	22.7	5370	10600	93
HRU4UN8		HRU	4	UN	8	3.1	130	557	0.1	2.8	17.9	12	244	824	0.20	0.2	18.7	4620	9160	93
HRU4UN9		HRU	4	UN	9	2.9	122	509	0.1	2.5	18.6	13	241	793	0.20	0.1	19.9	4190	10100	77
HRU4UN10	n=2	HRU	4	UN	10	1.65	104	428.5	0.1	2.4	15.85	9.5	200.5	675.5	0.08	0.15	14.6	2975	8150	64.5

Year 2001 Field Trials; Soil Characteristics for C3 Test Site

						DTPA Extract			Aqueous Extract			Ammonium Oxalate Extraction			Stontium Nitrate Extract			Dithionate-Citrate-Bicarbonate Extract		
Sample Code	**Dupl**	**Site**	**Plot**	**Treat**	**Repl**	**Cobalt**	**Copper**	**Nickel**	**Cobalt**	**Copper**	**Nickel**	**Cobalt**	**Copper**	**Nickel**	**Cobalt**	**Copper**	**Nickel**	**Aluminum, Extractable**	**Iron, Extractable**	**Manganese, Extractable**
						0.2 mg/kg	0.2 mg/kg	0.6 mg/kg	0.2 mg/kg	0.2 mg/kg	0.6 mg/kg	2 mg/kg	2 mg/kg	8 mg/kg	0.1 mg/kg	0.1 mg/kg	0.4 mg/kg	300 mg/kg	100 mg/kg	50 mg/kg
HRU11X1		HRU	1	1X	1															
HRU11X2		HRU	1	1X	2	1.4	112	443	0.1	2.5	17.2	12	234	770	0.05	0.2	7.4	3800	9550	102
HRU11X3		HRU	1	1X	3	1	90.8	371	0.1	2	14.6	9	205	670	0.05	0.2	6.2	3270	9640	75
HRU11X4	n=2	HRU	1	1X	4	1.5	114	414.5	0.1	2.55	16.15	13.5	250	810	0.05	0.2	6.85	3665	10335	92.5
HRU11X5		HRU	1	1X	5	0.8	81.8	348	0.1	1.8	14	9	187	649	0.05	0.1	5.2	3590	10100	82
HRU11X6		HRU	1	1X	6	1.5	126	444	0.1	2.4	15.9	13	261	822	0.05	0.2	6.8	4760	9940	89
HRU11X7		HRU	1	1X	7	1.6	130	486	0.1	2.6	17.1	10	242	748	0.05	0.2	8	3570	9260	86
HRU11X8		HRU	1	1X	8	1.1	113	406	0.1	2.4	15.8	11	243	747	0.05	0.2	4.9	3890	9320	89
HRU11X9		HRU	1	1X	9	1	106	391	0.1	2.4	14.9	12	229	723	0.05	0.2	4.9	3930	9330	80
HRU11X10		HRU	1	1X	10	1.4	114	428	0.1	2.4	15.9	11	227	719	0.05	0.2	6.2	4280	8360	72
HRU21X1	n=2	HRU	2	1X	1	1.55	125	426	0.1	3	18.5	13.5	264.5	858.5	0.05	0.3	8.75	3535	10400	85
HRU21X2		HRU	2	1X	2	2.3	131	514	0.1	2.8	18.4	13	286	887	0.10	0.3	10.2	4360	10600	86
HRU21X3		HRU	2	1X	3	1.3	106	396	0.1	2.3	15.1	13	225	699	0.05	0.3	6.4	3490	10300	79
HRU21X4		HRU	2	1X	4	1.6	132	474	0.1	2.6	16.2	15	291	871	0.05	0.3	6.7	4240	10400	72
HRU21X5		HRU	2	1X	5	2.4	139	533	0.1	2.6	17.6	14	290	922	0.05	0.2	9.8	5460	10500	83
HRU21X6		HRU	2	1X	6	2.1	138	506	0.1	3	17.3	15	285	877	0.10	0.3	7.8	4000	10800	77
HRU21X7		HRU	2	1X	7	1.7	122	465	0.1	2.6	16.1	14	265	803	0.05	0.3	7.2	4210	10300	74
HRU21X8		HRU	2	1X	8	1.7	124	478	0.1	2.5	16.3	13	268	831	0.05	0.3	7.6	3810	9920	81
HRU21X9		HRU	2	1X	9	1.4	125	465	0.1	2.8	18.1	14	229	765	0.05	0.2	6.1	3470	9990	97
HRU21X10		HRU	2	1X	10	1.4	115	422	0.1	2.7	17	12	224	728	0.05	0.2	6	3220	9740	95
HRU31X1		HRU	3	1X	1	1.5	126	456	0.1	3	17.8	13	235	789	0.05	0.2	5.8	4180	9140	77
HRU31X2		HRU	3	1X	2	1.2	94	366	0.1	2.4	14.6	9	187	634	0.05	0.2	4.6	3350	8100	72
HRU31X3	n=2	HRU	3	1X	3	1.4	109.5	438.5	0.1	2.85	17.85	12.5	241	830.5	0.05	0.2	7.25	3400	9395	93.5
HRU31X4		HRU	3	1X	4	1.1	94.1	378	0.1	2.7	16.1	11	221	767	0.05	0.2	4.9	4610	10400	89
HRU31X5	n=2	HRU	3	1X	5	1.55	110.5	443.5	0.1	2.85	18.05	12.5	224.5	799.5	0.08	0.15	7.5	4565	10800	74.5
HRU31X6		HRU	3	1X	6	1.3	94.8	386	0.1	2.9	16.7	13	215	766	0.05	0.2	6.3	4300	9550	82
HRU31X7		HRU	3	1X	7	2.1	126	502	0.1	3.5	19.8	17	276	966	0.05	0.2	8.6	4490	11000	117
HRU31X8		HRU	3	1X	8	1.4	94.1	411	0.1	2.7	17.4	12	203	737	0.05	0.2	6.1	4310	10000	92
HRU31X9		HRU	3	1X	9	1.5	97.8	422	0.1	2.9	17.7	9	177	632	0.05	0.2	6.9	3830	9830	66
HRU31X10		HRU	3	1X	10	1.7	101	440	0.1	2.8	17.9	9	206	706	0.10	0.2	8	3660	10100	53
HRU41X1		HRU	4	1X	1	1.5	111	427	0.1	2.2	15.1	12	232	786	0.05	0.2	6.5	4080	9860	91
HRU41X2		HRU	4	1X	2	1	92	354	0.1	2.1	13.3	10	185	608	0.05	0.1	4.6	2940	7560	68
HRU41X3	n=2	HRU	4	1X	3	2.15	128.5	525.5	0.1	2.4	17.3	13	279	939	0.05	0.2	8.25	4090	10000	73
HRU41X4		HRU	4	1X	4	1.8	119	435	0.1	2.8	17.5	11	248	788	0.05	0.2	7.2	4460	9810	75
HRU41X5		HRU	4	1X	5	1.3	102	367	0.1	2.3	13.7	12	212	680	0.05	0.2	5.1	4060	8490	88
HRU41X6	n=2	HRU	4	1X	6	1.2	98.4	353	0.1	2.4	14.35	10.5	200.5	641	0.05	0.125	6.5	3310	7995	70.5
HRU41X7		HRU	4	1X	7	0.9	92.3	312	0.1	2.1	12.3	10	187	597	0.05	0.1	3.5	3030	7760	75
HRU41X8		HRU	4	1X	8	1.8	119	476	0.1	2.8	18.5	12	248	841	0.05	0.05	9.7	4260	9800	73
HRU41X9		HRU	4	1X	9	1.1	104	389	0.1	2.1	14.5	12	223	764	0.05	0.1	5.5	4120	8880	86
HRU41X10		HRU	4	1X	10	2.1	140	522	0.1	3.1	18.8	13	277	904	0.05	0.2	8.9	4250	10100	84

Year 2001 Field Trials; Soil Characteristics for C3 Test Site

						DTPA Extract			Aqueous Extract			Ammonium Oxalate Extraction			Stontium Nitrate Extract			Dithionate-Citrate-Bicarbonate Extract		
Sample Code	Dupl	Site	Plot	Treat	Repl	Cobalt	Copper	Nickel	Cobalt	Copper	Nickel	Cobalt	Copper	Nickel	Cobalt	Copper	Nickel	Aluminum, Extractable	Iron, Extractable	Manganese, Extractable
						0.2 mg/kg	0.2 mg/kg	0.6 mg/kg	0.2 mg/kg	0.2 mg/kg	0.6 mg/kg	2 mg/kg	2 mg/kg	8 mg/kg	0.1 mg/kg	0.1 mg/kg	0.4 mg/kg	300 mg/kg	100 mg/kg	50 mg/kg
HRU1CAL1		HRU	1	CAL	1	0.6	84.4	285	0.1	2	11.3	9	210	647	0.05	0.2	2.9	2470	9040	71
HRU1CAL2		HRU	1	CAL	2	1.1	101	349	0.1	2.2	13.2	12	247	762	0.05	0.2	2.9	4700	10200	87
HRU1CAL3		HRU	1	CAL	3	0.6	78.1	260	0.1	1.8	10.4	10	205	607	0.05	0.1	2.8	3000	8600	70
HRU1CAL4		HRU	1	CAL	4	0.7	91	304	0.1	1.9	11.8	9	219	674	0.05	0.2	3	3120	8900	71
HRU1CAL5	n=2	HRU	1	CAL	5	1.55	126.5	433	0.1	2.4	13.3	13	252.5	747.5	0.05	0.2	4.35	3305	9390	77
HRU1CAL6		HRU	1	CAL	6	1.2	108	390	0.1	2.1	12.5	11	251	754	0.05	0.3	3.4	4320	9970	94
HRU1CAL7	n=2	HRU	1	CAL	7	1.2	111	383.5	0.1	2.05	11.45	13.5	264.5	775	0.05	0.2	3.2	4180	9735	74
HRU1CAL8		HRU	1	CAL	8	1.1	103	328	0.1	2.1	12	11	223	640	0.05	0.3	3.2	3910	9610	67
HRU1CAL9		HRU	1	CAL	9	1.1	102	333	0.1	2.2	11	12	232	686	0.05	0.2	2.9	3780	9790	79
HRU1CAL10		HRU	1	CAL	10	1.3	108	400	0.1	2.1	13.6	10	234	710	0.05	0.2	4.3	4110	9840	74
HRU2CAL1		HRU	2	CAL	1	1.2	108	374	0.1	2.2	13.9	11	222	736	0.05	0.2	3.6	4260	10900	82
HRU2CAL2		HRU	2	CAL	2	0.8	92.3	302	0.1	1.9	11.2	11	188	557	0.05	0.2	3.2	2640	10200	61
HRU2CAL3	n=2	HRU	2	CAL	3	1	117.5	346.5	0.1	2.45	11.95	12	228	663	0.05	0.2	3.2	3235	9960	78
HRU2CAL4		HRU	2	CAL	4	0.8	89	313	0.1	1.9	12.5	9	179	592	0.05	0.2	3.6	2710	9210	65
HRU2CAL5		HRU	2	CAL	5	1.3	115	390	0.1	2.2	13.6	11	227	715	0.05	0.2	4	3660	9140	68
HRU2CAL6		HRU	2	CAL	6	2.9	136	544	0.1	2.9	20.4	13	249	796	0.10	0.2	13.4	3840	11600	97
HRU2CAL7		HRU	2	CAL	7	0.9	101	328	0.1	2.1	11.7	9	217	647	0.05	0.3	3.3	3110	9980	99
HRU2CAL8	n=2	HRU	2	CAL	8	1.7	117	414.5	0.1	2.45	15.75	10	220	662	0.05	0.2	6.05	3005	10345	63.5
HRU2CAL9		HRU	2	CAL	9	0.9	95	313	0.1	1.9	11.9	10	196	590	0.05	0.1	4	2680	9820	68
HRU2CAL10		HRU	2	CAL	10	1.5	129	394	0.1	2.5	13.8	13	252	761	0.05	0.2	4	3760	9270	63
HRU3CAL1		HRU	3	CAL	1	1	102	338	0.1	2.7	14	10	246	780	0.05	0.2	3.5	3950	9640	71
HRU3CAL2		HRU	3	CAL	2	0.7	79.7	257	0.1	2.2	10.9	11	204	646	0.05	0.1	2.4	3600	8530	87
HRU3CAL3		HRU	3	CAL	3	0.7	85.7	267	0.1	2.2	10.8	11	211	645	0.05	0.2	2.5	3650	9010	59
HRU3CAL4		HRU	3	CAL	4	1.2	114	378	0.1	2.9	14.6	14	266	894	0.05	0.2	3.8	4670	11100	99
HRU3CAL5		HRU	3	CAL	5	0.9	103	322	0.1	2.8	13.7	14	256	837	0.05	0.2	2.8	3750	11400	87
HRU3CAL6		HRU	3	CAL	6	0.9	99.5	317	0.1	2.5	12.9	13	240	792	0.05	0.2	2.9	4330	10500	80
HRU3CAL7	n=2	HRU	3	CAL	7	1.05	110.5	340.5	0.1	2.85	14	12.5	252	788	0.05	0.25	3.45	3370	9840	82.5
HRU3CAL8	n=2	HRU	3	CAL	8	1.1	122	361.5	0.1	2.65	13	10.5	250.5	781.5	0.05	0.15	2.95	4875	10465	79
HRU3CAL9		HRU	3	CAL	9	1.3	124	388	0.1	2.7	14.4	14	241	813	0.10	0.3	3.6	4900	10200	119
HRU3CAL10		HRU	3	CAL	10	0.9	98.6	328	0.1	2.3	12.9	12	209	712	0.05	0.2	3.1	4750	97700	97
HRU4CAL1	n=3	HRU	4	CAL	1	0.8	84	276	0.1	1.9	10.3	9	183	588	0.05	0.1	2.4	3567	7810	75
HRU4CAL2		HRU	4	CAL	2	1.2	123	389	0.1	2.4	13.5	12	259	788	0.05	0.2	3.9	4530	8820	84
HRU4CAL3		HRU	4	CAL	3	1.3	103	362	0.1	2	13.7	9	204	649	0.05	0.1	5.9	3820	7950	72
HRU4CAL4		HRU	4	CAL	4	1.1	119	388	0.1	2.3	13.4	12	254	779	0.05	0.1	3.8	4590	9310	73
HRU4CAL5		HRU	4	CAL	5	0.6	82.2	254	0.1	1.8	10.5	9	187	578	0.05	0.1	2.4	3390	8400	81
HRU4CAL6		HRU	4	CAL	6	0.9	96.8	301	0.1	2.1	10.9	11	217	667	0.05	0.2	2.6	3690	8380	75
HRU4CAL7		HRU	4	CAL	7	0.7	83.1	255	0.1	2.1	10.9	10	192	586	0.05	0.1	2.4	3400	8550	68
HRU4CAL8		HRU	4	CAL	8	0.7	85.7	247	0.1	2.1	10	10	205	610	0.05	0.2	2.4	2910	7860	66
HRU4CAL9		HRU	4	CAL	9	1.5	118	390	0.1	2.6	14.1	11	260	782	0.05	0.2	4.2	3600	8930	75
HRU4CAL10		HRU	4	CAL	10	0.7	85.4	266	0.1	1.9	10.8	10	201	626	0.05	0.1	2.5	3250	8010	75

APPENDIX F-3

FIELD APPLICATION RATES OF AGRICULTURAL LIMESTONE FOR TEST SITES

Field Application Rates of Agricultural Limestone for Test Sites

Treatment	Clay 1 Test Site	Clay 2 Test Site	Clay 3 Test Site	Organic Test Site
Unamended		0 t/ha	0 t/ha	0 t/ha
1X OMAFRA		7.5 t/ha	11 t/ha	15 t/ha
2X OMAFRA		15 t/ha	-	30 t/ha
Calcareous		100 t/ha	100 t/ha	-

APPENDIX F-4A

REPRESENTATIVE PHOTOGRAPHS OF FIELD TRIALS 2000

Figure F4-1 Date taken: July 31, 2000 – Organic site.

Figure F4-2 Date taken: July 31, 2000 – Organic site.

Figure F4-3 Rae Site

Figure F4-4 Rae Site

Figure F4-5 Date taken: August 30, 2000.
Radishes grown on unamended soil on the Rae site.

Figure F4-6 Date taken: August 30, 2000
Radishes grown on clayey soils on the Rae site with 1X OMAFRA amendments

Figure F4-7 Date taken: October 3, 2000
Radishes grown on clayey soils on the Rae site with 2X OMAFRA amendments.

Figure F4-8 Date taken: August 30, 2000
Oats grown on Unamended soil on the Rae site.

Figure F4-9 Date taken August 30, 2000
Oats grown on clayey soils on the Rae site with 1X OMAFRA amendments

Figure F4-10 Date taken: October 3, 2000
Oats grown on clayey soils on the Rae site with 2X OMAFRA amendments.

Figure F4-11 Date taken: August 30, 2000
Soy grown on Unamended soil on the Rae site

Figure F4-12 Date taken: August 30, 2000
Soy grown on clayey soils on the Rae site with 1X OMAFRA amendments.

Figure F4-13 Date taken: October 3, 2000.
Soy grown on clayey soils on the Rae sitre with 2X OMAFRA amendments.

Figure F4-14 Inco Site

Figure F4-15 Inco Site

Figure F4-16 Date taken: September 13, 2000
Corn grown on Unamended soil on the Inco site.

Figure F4-17 Date taken: September 13, 2000
Corn grown on clayey soils on the Inco site with 1X OMAFRA amendments.

Figure F4-18 Date taken: September 13, 2000
Corn grown on clayey soils on the Inco site with 2X OMAFRA amendments.

Figure F4-19 Date taken: September 13, 2000
Radishes grown on Unamended soil on the Inco site

Figure F4-20 Date taken: September 13, 2000
Radishes grown on clayey soils on the Inco site with 1X OMAFRA amendments.

Figure F4-21 Date taken: September 13, 2000
Radishes grown on clayey soils on the Inco site with 2X OMAFRA amendments.

Figure F4-22 Date taken: September 13, 2000
Oats grown on Unamended soil on the Inco site.

Figure F4-23 Date taken: September 13, 2000
Oats grown on clayey soils on the Inco site with 1X OMAFRA amendments.

Figure F4-24 Date taken: September 13, 2000.
Oats grown on clayey soils on the Inco site with 2X OMAFRA amendments.

Figure F4-25 Date taken: September 13, 2000.
Soy grown on Unamended soil on the Inco site.

Figure F4-26 Date taken: September 13, 2000.
Soy grown on clayey soils on the Inco site with 1X OMAFRA amendments.

Figure F4-27 Date taken: September 13, 2000
Soy grown on clayey soils on the Inco site with 2X OMAFRA amendments.

APPENDIX F-4B

REPRESENTATIVE PHOTOGRAPHS OF FIELD TRIALS 2001

Representative Photographs of Field Trials 2001

C2 Soy Bean Crop-Plot 2A Crop

C2 Oat Crop 2X OMAFRA-Plot 4A

C2 Site-Plot 1A-Oats Unamended Prior to Harvest

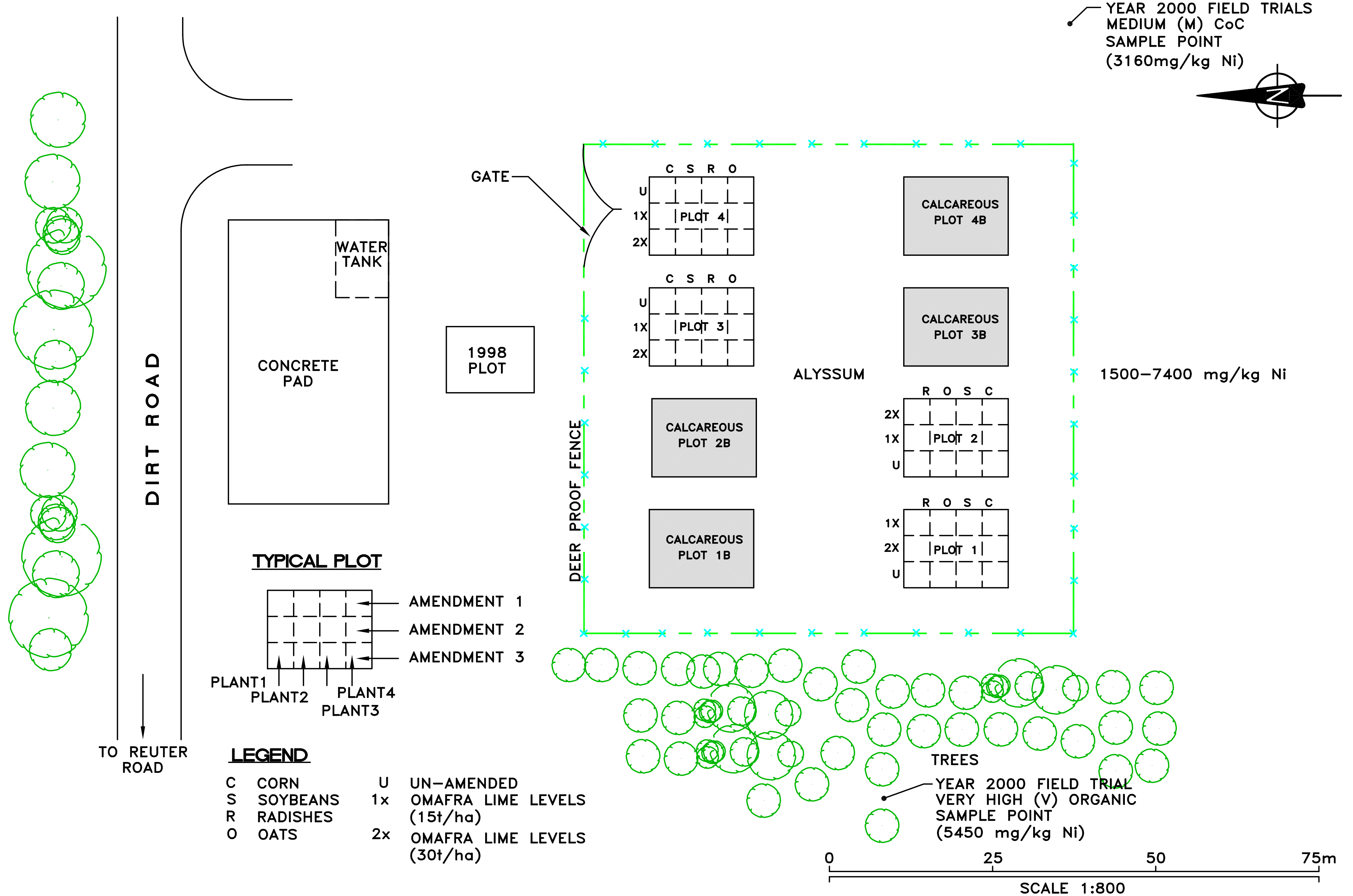
C2 Site – Corn Agronomic Sampling

Field Workers at C2 Site

Harvesting Oats – C2 Site

APPENDIX F-5

LAYOUTS OF FIELD TEST SITES

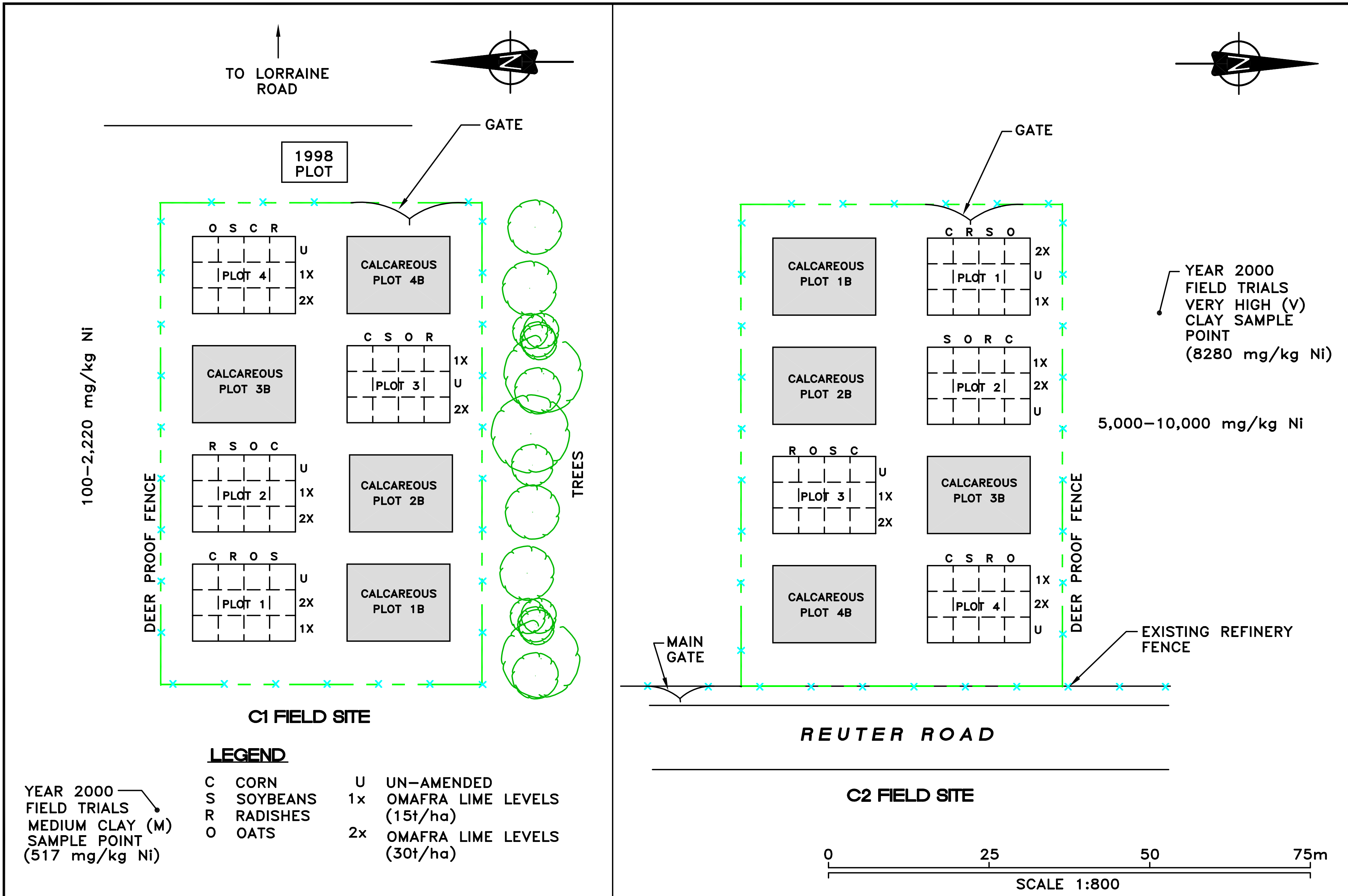


INCO PORT COLBORNE, YEAR 2000 FIELD TRIALS
ORGANIC SOIL SITE LAYOUT

Job No.: ONT34660.3	Figure. No.: 1	
Date: 02/11/20	Dwn. by: RW RW	Appd: JH

Jacques Whitford

34660.3–1



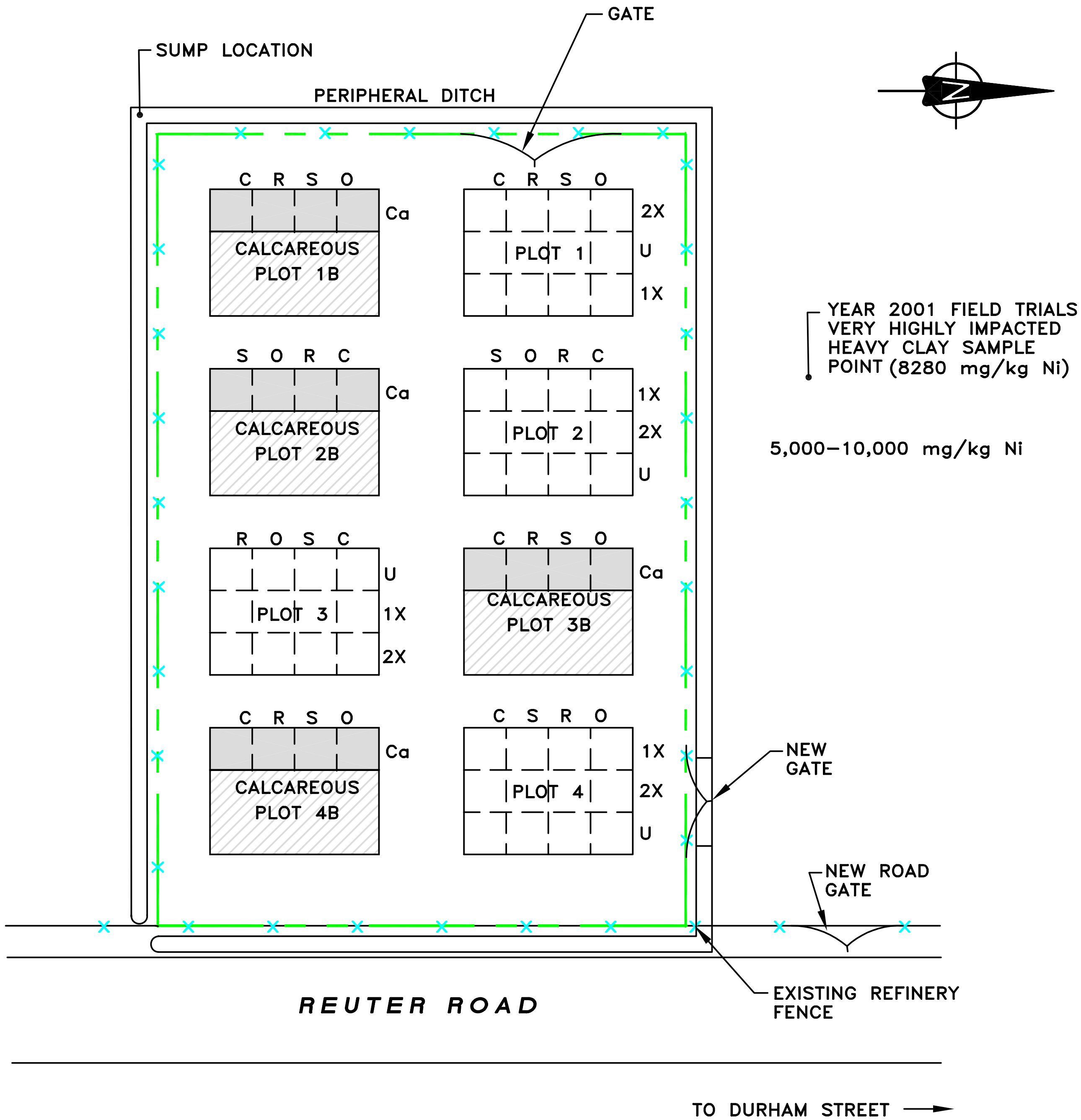
INCO PORT COLBORNE, YEAR 2000 FIELD TRIALS
C1 AND C2 CLAY SOIL TEST SITES

Job No.:	Figure. No.:	
ONT34660	2	
Date: 02/03/06	Dwn. by: RW RW	Appd: JH

Jacques Whitford

34660.3–2

34660.3-3



LEGEND

C	CORN	U	UN–AMENDED
S	SOYBEANS	1x	OMAFRA LIME LEVELS (15t/ha)
R	RADISHES	2x	OMAFRA LIME LEVELS (30t/ha)
O	OATS	Ca	Calcareous (100t/ha)

(hatched box) NOT USED IN FIELD TRIALS

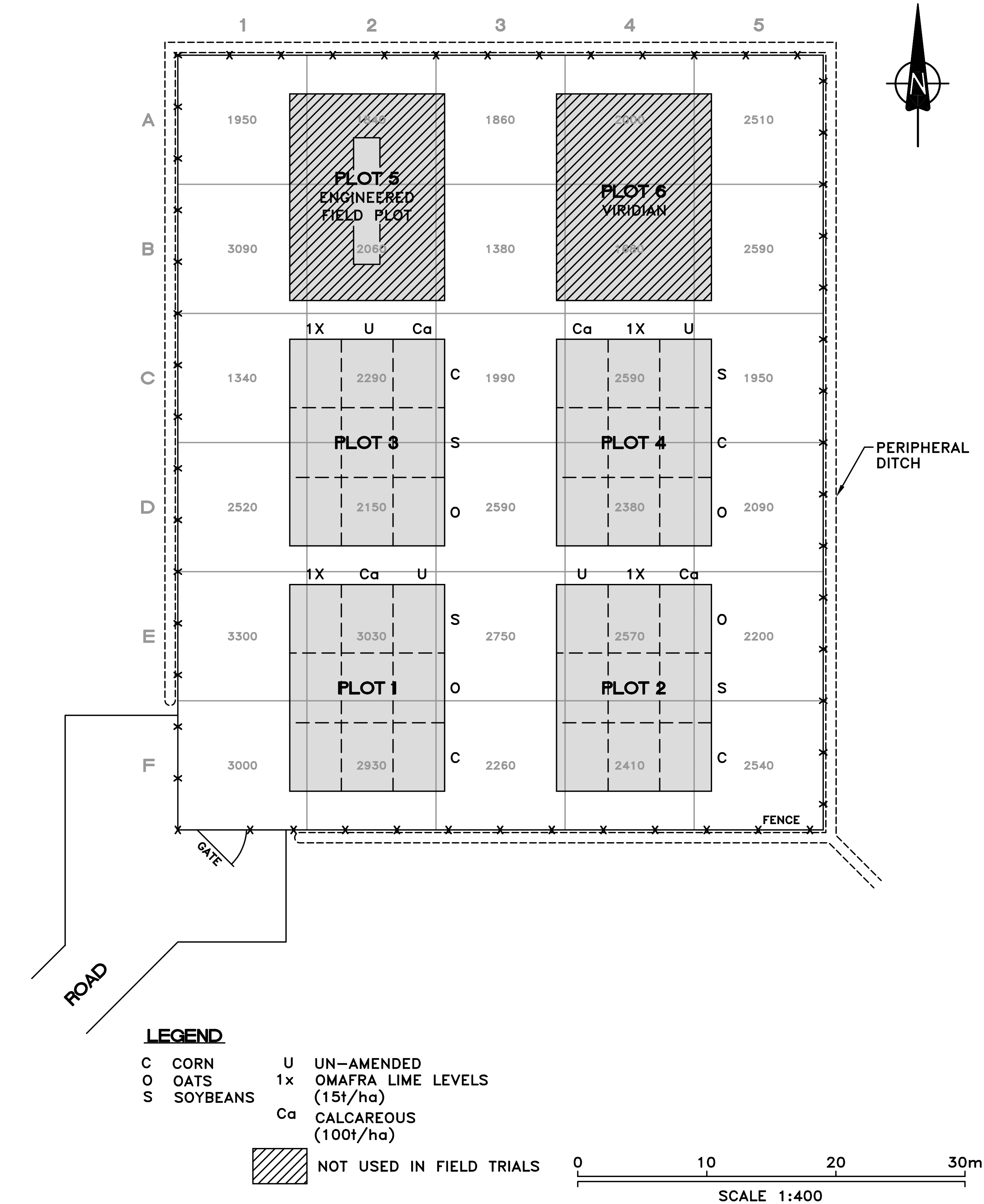
0 10 20 30 40 50m

SCALE 1:600

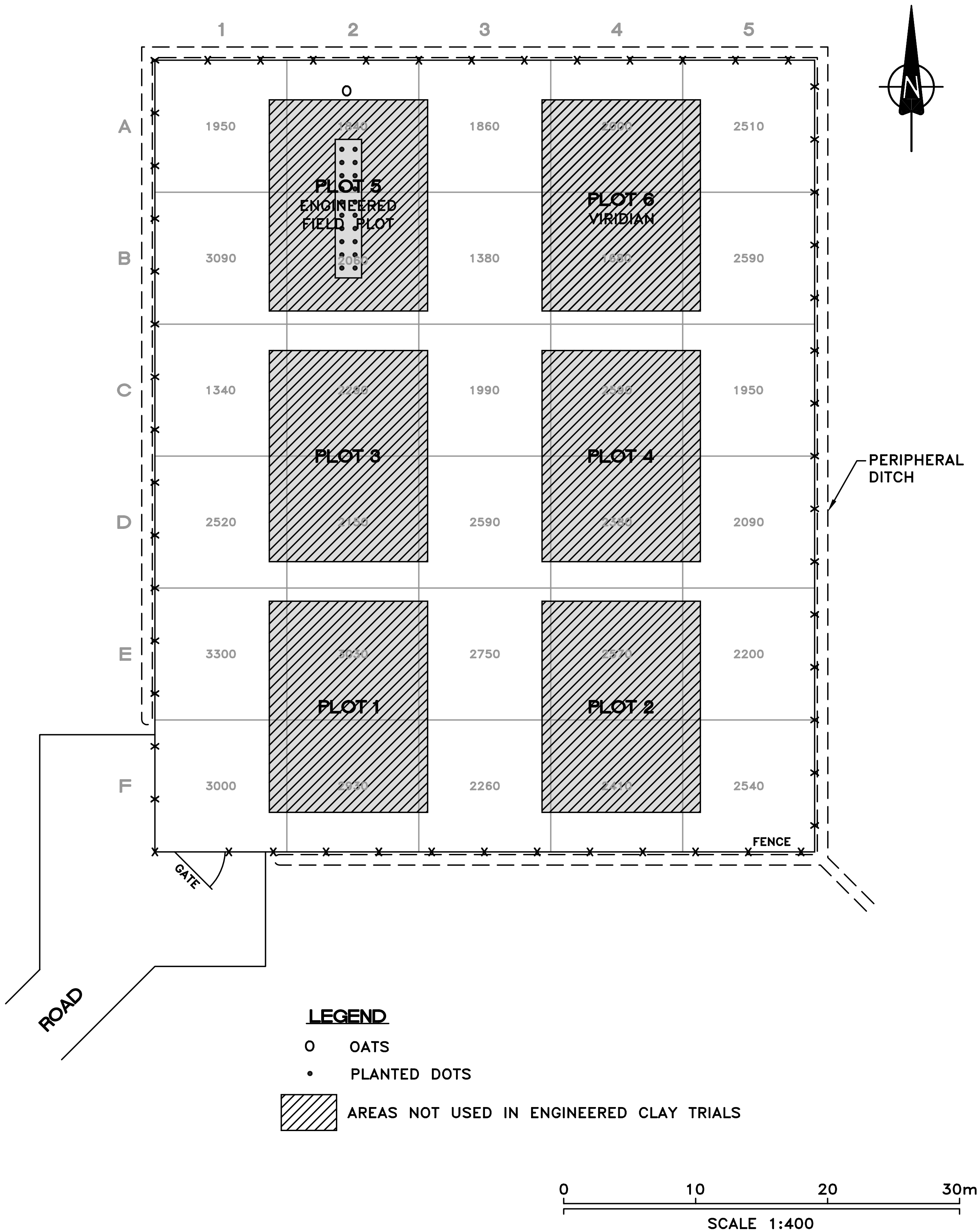
INCO PORT COLBORNE, YEAR 2001 FIELD TRIALS
C2 TEST SITE

Job No.:	Figure. No.:		
ONT34660	3		
Date:	Dwn. by:	Appd.:	
02/03/06	RW RW	JH	

Jacques Whitford



CLAY 3 TEST SITE (CROP TREATMENT PLOTS) **10m GRID NICKEL CONCENTRATIONS, 0-15cm (mg/kg)** **FORMER HRUSKA FARM, PORT COLBORNE, ONTARIO**	Job No.: **ONT34661**	Figure. No.: **4**	Jacques Whitford
	Date: **01/08/16**	Dwn. by: **BJC** RW	Appd.: **JH**



CLAY 3 TEST SITE (ENGINEERED FIELD PLOT) 10m GRID NICKEL CONCENTRATIONS, 0-15cm (mg/kg) FORMER HRUSKA FARM, PORT COLBORNE, ONTARIO	Job No.: ONT34661		Figure. No.: 5	Jacques Whitford
	Date: 01/08/16	Dwn. by: BJC RW	Appd.: JH	

APPENDIX F-6

EXTRACTABLE NICKEL, COPPER AND COBALT OF THE PRELIMINARY FIELD TRIALS (2000) AND FIELD TRIALS (2001)

F6.1 Extractable Nickel, Copper and Cobalt of the Preliminary Field Trials (2000)

Extractions from one plot (Plot 1) within the C2 Test Site were so large compared to all other values (Appendix F-2) that they were excluded as outliers and are not included in the data summary presented in Table 1. Subjecting soils to DTPA extraction provided greater extractable CoCs than the aqueous extraction (Table 1). The Organic Test Site had greater percentages of extractable nickel compared to the clay soils of C1 and C2 Test Sites (Table 1). However, extractable copper was lower in the organic soils, less than half of what was extracted from the clay soils at the C1 and C2 Test Sites (Table 1). Cobalt appears to be extractable at a similar percentage for all soils analysed (Table 1). No clear trend in extractable CoC concentrations was noted across amendment treatments, and none were found to be high enough to likely produce a phytotoxic effect.

Table 1 Total and Extractable CoC Concentrations of Soils from 2000 Field Trials.[1]

Test Site	Amend.[2]	Nickel			Copper			Cobalt		
		Total (mg/kg)	Aqueous (mg/kg)	DTPA (mg/kg)	Total (mg/kg)	Aqueous (mg/kg)	DTPA (mg/kg)	Total (mg/kg)	Aqueous (mg/kg)	DTPA (mg/kg)
C1	UN	636 ± 46	1.2 ± 0.1 (<1%)	50 ± 3 (8%)	108 ± 26	nd[3]	16.5 ± 0.7 (15%)	15 ± 0.6	nd	0.7 ± 0.1 (5%)
	1X	642 ± 53	0.9 ± 0.1 (<1%)	47 ± 2 (7%)	108 ± 23	nd	18.7 ± 4.5 (17%)	15.4 ± 1	nd	0.6 ± 0.1 (4%)
	2X	614 ± 52	1.0 ± 0.2 (<1%)	47 ± 6 (8%)	104 ± 20	nd	18.3 ± 3.3 (18%)	14.1 ± 0.8	nd	0.6 ± 0.3 (4%)
C2	UN	6080 ± 1410	4.0 ± 0.7 (<1%)	188 ± 55 (3%)	684 ± 161	nd	80.8 ± 18.6 (12%)	79.1 ± 19.2	nd	3.3 ± 0.2 (4%)
	1X	6120 ± 1620	3.9 ± 1.8 (<1%)	122 ± 107 (2%)	677 ± 162	nd	82.0 ± 8.9 (12%)	76.0 ± 13.2	nd	3.2 ± 0.8 (4%)
	2X	5680 ± 1300	3.3 ± 0 (<1%)	166 ± 118 (3%)	632 ± 103	nd	90.6 ± 19.9 (14%)	76.5 ± 9.5	nd	3.5 ± 0.7 (5%)
Organic	UN	3590 ± 2620	7.8 ± 3.9 (<1%)	540 ± 393 (15%)	527 ± 320	nd	11.9 ± 4.8 (2%)	47.2 ± 27.1	nd	1.7 ± 1.2 (4%)
	1X	2340 ± 520	3.7 ± 0.9 (<1%)	405 ± 121 (17%)	358 ± 58	nd	21.1 ± 5.8 (6%)	33.2 ± 6.2	nd	2.9 ± 0.8 (9%)
	2X	2800 ± 1920	5.1 ± 3.4 (<1%)	528 ± 370 (19%)	406 ± 224	nd	29.3 ± 8 (7%)	37.6 ± 21.3	nd	2.4 ± 1 (6%)

Notes
1 Values presented are means ± standard deviation. Values in brackets are percentages of total CoC extracted by extraction method.
2 Amendment treatments, as described in Section 2.3. UN = Unamended, 1X = 1X OMAFRA levels, 2X = 2X OMAFRA levels.
3 nd = not detected.
N=4

F6.2 Extractable Nickel, Copper and Cobalt of the Field Trials (2001)

Results from the chemical extractions of nickel, copper and cobalt from soils at the C2 and C3 Test Sites are presented in Tables 2 and 3. These include strontium nitrate ($SrNO_3$) and acid ammonium oxalate extractions in addition to aqueous and DTPA extractions. Table 3 includes concentrations of iron and manganese extracted from the soils using the Dithionate-Citrate-Bicarbonate method (see Volume II).

Results of aqueous extractions present metal concentrations that are most readily available to the plants, while DTPA and $SrNO_3$ extractions reflect what remaining metal concentrations in the soils are available to the plants overall and available to the plants at different pH levels, respectively. Overall, DTPA predicts that roughly 4% of the soil nickel is relatively phytoavailable to plants at the C2 Test Site, while it predicts relative phytoavailability of nickel to be as high as approximately 16% at the C3 Test Site (Table 2).

By far the greatest extraction was done using the acid ammonium oxalate method, which extracted approximately 20% of the nickel, approximately 60% of the copper and 25-30% of the cobalt found in the C2 and C3 soils (Tables 2 & 3). Conversely, very little of the CoCs were extracted using either the aqueous extraction or strontium nitrate method, overall less than 1% of the total CoCs measured in the soil (Tables 2& 3). The DTPA method identified a difference in availability of nickel, copper and cobalt between the two test sites, with more metals extracted from the C3 site than the C2 site (Tables 2 & 3).

Measured concentrations of extracted CoCs from amendment treatments were compared statistically within each site using ANOVA, and grouping of treatments was done using Tukey's Posthoc test. At the C2 Test Site, extraction differed across the treatments for two tests: $SrNO_3$ and DTPA. Strontium nitrate extracted a significantly greater concentration of nickel from unamended soils compared to the Calcareous treatment, although all concentrations were well below 1% of the total nickel found in the soil (Table 2). When comparing DTPA-extracted cobalt across the treatments, soils within the Calcareous treatment had significantly lower concentrations than any of the other treatments (Table 3).

Many of the extractions performed on soils from the C3 Test Site showed a significant difference between treatments. Overall, soils from the Calcareous treatment had significantly lower concentrations of extracted metal compared to the other treatments (Tables 2 & 3). No differences were noted for extractable iron and manganese (Table 3).

Table 2 Nickel and Copper Extractions from Soils at the C2 and C3 Test Sites During 2001.[1]

Test Site	Amend.[2]	Nickel				Copper			
		Aqueous (mg/kg)	DTPA (mg/kg)	$SrNO_3$ (mg/kg)	Ammonium Oxalate (mg/kg)	Aqueous (mg/kg)	DTPA (mg/kg)	$SrNO_3$ (mg/kg)	Ammonium Oxalate (mg/kg)
C2	UN	7.8 ± 1.4 (<1%)	211 ± 59 (4%)	**2.6 [a] ± 1 (<1%)**	1011 ± 183 (20%)	2.2 ± 0.3 (<1%)	108 ± 17 (18%)	0.1 ± 0.1 (<1%)	350 ± 58 (59%)
	1X	6.8 ± 1.4 (<1%)	185 ± 54 (4%)	**1.5 [ab] ± 0.6 (<1%)**	944 ± 171 (20%)	2.2 ± 0.3 (<1%)	105 ± 13 (18%)	0.1 ± 0.1 (<1%)	340 ± 48 (58%)
	2X	6.8 ± 1.0 (<1%)	196 ± 53 (4%)	**1.4 [ab] ± 0.5 (<1%)**	946 ± 229 (19%)	2.1 ± 0.3 (<1%)	110 ± 17 (18%)	0.1 ± 0.1 (<1%)	342 ± 61 (57%)
	Cal	5.4 ± 0.6 (<1%)	134 ± 21 (3%)	**1.0 [b] ± 0.2 (<1%)**	813 ± 140 (20%)	2.0 ± 0.2 (<1%)	93 ± 16 (19%)	0.1 ± 0.1 (<1%)	284 ± 51 (58%)
C3	UN	**19.8 [a] ± 1.7 (<1%)**	**528 [a] ± 96 (16%)**	**17.8 [a] ± 3.0 (<1%)**	**816 [a] ± 86 (25%)**	**2.7 [a] ± 0.3 (<1%)**	**121 [a] ± 96 (31%)**	0.2 ± 0 (<1%)	241 ± 25 (62%)
	1X	**16.4 [b] ± 1.7 (<1%)**	**431 [b] ± 55 (14%)**	**6.8 [b] ± 1.6 (<1%)**	**771 [a] ± 93 (25%)**	**2.6 [a] ± 0.3 (<1%)**	**113 [a] ± 15 (30%)**	0.2 ± 0.1 (<1%)	235 ± 32 (62%)
	Cal	**12.7 [c] ± 1.9 (<1%)**	**340 [c] ± 61 (11%)**	**3.6 [c] ± 1.8 (<1%)**	**702 [b] ± 84 (24%)**	**2.3 [b] ± 0.3 (<1%)**	**103 [b] ± 15 (28%)**	0.2 ± 0.1 (<1%)	226 ± 25 (61%)

Notes

1 Values presented are means ± standard deviation. Values in brackets are percentages of total CoC extracted by extraction method. Values in bold type indicate a significant difference was noted between treatments within a site. Superscript letters indicate grouping, based on Tukey's Posthoc test. Values with similar letters do not differ significantly.

2 Amendment treatments, as described in Section 2.3. UN = Unamended, 1X = 1X OMAFRA levels, 2X = 2X OMAFRA levels, Cal = Calcareous.

Table 3 Cobalt, Iron and Manganese Extractions from Soils at the C2 and C3 Test Sites During 2001.[1]

Test Site	Amend.[2]	Cobalt				Iron	Manganese
		Aqueous (mg/kg)	DTPA (mg/kg)	$SrNO_3$ (mg/kg)	Ammonium Oxalate (mg/kg)	Dithionate-Citrate-Bicarbonate (mg/kg)	Dithionate-Citrate-Bicarbonate (mg/kg)
C2	UN	nd[3]	**0.7** [a] **± 0.2 (1%)**	nd	22 ± 4 (29%)	12000 ± 1500 (53%)	120 ± 24 (50%)
	1X	nd	**0.6** [a] **± 0.2 (1%)**	nd	20 ± 3 (28%)	11800 ± 1300 (52%)	168 ± 196 (72%)
	2X	nd	**0.7** [a] **± 0.2 (1%)**	nd	20 ± 4 (26%)	11900 ± 1300 (52%)	123 ± 29 (54%)
	Cal	nd	**0.4** [b] **± 0.1 (1%)**	nd	17 ± 3 (27%)	10500 ± 1300 (47%)	107 ± 23 (42%)
C3	UN	nd	**2.7** [a] **± 0.7 (6%)**	**0.2** [a] **± 0.1**	**13** [a] **± 2 (27%)**	9980 ± 890 (51%)	77 ± 14 (47%)
	1X	nd	**1.5** [b] **± 0.4 (3%)**	**nd** [b]	**12** [a] **± 2 (26%)**	9680 ± 850 (51%)	82 ± 11 (51%)
	Cal	nd	**1.1** [c] **± 0.4 (2%)**	**nd** [b]	**11** [b] **± 2 (24%)**	11700 ± 14000 (62%)	78 ± 12 (48%)

Notes
1 Values presented are means ± standard deviation. Values in brackets are percentages of total CoC extracted by extraction method. Values in bold type indicate a significant difference was noted between treatments within a site. Superscript letters indicate grouping, based on Tukey's Posthoc test. Values with similar letters do not differ significantly.
2 Amendment treatments, as described in Section 2.3. UN = Unamended, 1X = 1X OMAFRA levels, 2X = 2X OMAFRA levels, Cal = Calcareous.
3 nd = not detected.

BIOMONITORING STUDY

VOLUME 1 – PART 5 – APPENDICES

DECEMBER, 2004

LIST OF APPENDICES

VOLUME 1 - PART 5 – APPENDICES

APPENDIX B-1

DATA FOR BIOMONITORING STUDY

BIOMONITORING STUDY				SOIL											VEGETATION													
EXP. Ni Soil Conc.	**Site**	**Plot**	**Rep**	**Soil pH**	**Soil CEC**	**Soil Conductivity @25°C**	**n**	**As**	**Co**	**Cu**	**Fe**	**Mn**	**Ni**	**P**	**n**	**Al**	**Sb**	**As**	**Ca**	**Co**	**Cu**	**Fe**	**K**	**Mg**	**Mn**	**Ni**	**P**	**Zn**
								mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg		mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
								0.2	0.01	1	50	1	2	20		0.5	0.05	0.2	50	0.01	0.05	5	10	5	0.5	0.1	5	0.5
H	ORG	1	1	5.68	173.50	0.78	n=2	44.4	147.50	1365	23700	403	10650	1105	n=2	12.1	0.025	0.2	7035	1.84	10.75	57	11450	1740	23.7	41.7	974	50.0
H	ORG	1	2	5.40	156.00	0.66		72.2	201.00	1700	27400	517	14300	1340		13.0	0.100	0.2	6980	2.91	12.80	64	12900	2700	25.8	59.4	1360	64.2
H	ORG	1	3	5.35	148.50	0.63	n=2	85.0	216.00	2020	27800	486	15200	1365		13.1	0.080	0.3	6600	2.38	31.00	71	16800	1580	31.1	67.3	1120	66.2
H	ORG	1	4	5.50	135.00	0.51		62.3	167.00	1560	24500	379	11300	1330		12.6	0.025	0.2	7640	1.68	10.60	62	12800	2080	11.0	44.1	1070	39.3
Mean				**5.48**	**153.25**	**0.65**		**66.0**	**182.88**	**1661**	**25850**	**446**	**12863**	**1285**		**12.7**	**0.058**	**0.2**	**7064**	**2.20**	**16.29**	**64**	**13488**	**2025**	**22.9**	**53.1**	**1131**	**54.9**
Std Dev				**0.15**	**16.05**	**0.11**		**17.1**	**31.25**	**276**	**2053**	**66**	**2226**	**121**		**0.5**	**0.038**	**0.1**	**430**	**0.56**	**9.86**	**6**	**2305**	**496**	**8.5**	**12.3**	**164**	**12.7**
H	SND	3	1	5.72	61.20	0.70		3.7	15.00	89	4640	89	600	431		12.0	0.025	0.7	7690	0.55	9.78	59	14600	2510	77.6	28.4	1230	62.8
H	SND	3	2	4.96	160.00	0.57		13.9	47.00	409	11900	280	3440	702		9.9	0.025	0.7	7780	0.55	10.00	51	14100	2470	74.8	28.1	1190	60.0
H	SND	3	3	5.63	125.00	0.62		17.7	82.00	695	12900	404	4690	692		11.1	0.190	0.5	5410	0.54	10.70	44	9540	2670	44.2	15.0	1060	60.3
H	SND	3	4	6.93	32.00	0.44		5.9	12.00	61	4990	151	462	447		8.2	0.080	0.1	9000	0.33	9.13	44	10600	2720	22.7	5.9	1250	37.7
Mean				**5.81**	**94.55**	**0.58**		**10.3**	**39.00**	**314**	**8608**	**231**	**2298**	**568**		**10.3**	**0.080**	**0.5**	**7470**	**0.49**	**9.90**	**50**	**12210**	**2593**	**54.8**	**19.4**	**1183**	**55.2**
Std Dev				**0.82**	**58.41**	**0.11**		**6.6**	**32.75**	**299**	**4401**	**140**	**2104**	**149**		**1.6**	**0.078**	**0.3**	**1498**	**0.11**	**0.65**	**7**	**2517**	**121**	**26.2**	**10.9**	**85**	**11.7**
H	CLY	4	1	6.25	61.33	0.23	n=3	43.2	106.67	897	30133	297	7267	1637		7.1	0.050	0.1	1560	0.77	5.55	38	13400	1330	12.1	8.8	1790	20.6
H	CLY	4	2	6.04	52.33	0.37	n=3	40.2	96.33	787	30633	259	6397	1613	n=2	15.0	0.060	0.1	6220	0.96	6.73	62	14350	1530	21.3	12.7	1665	70.9
H	CLY	4	3	6.13	66.67	0.46	n=3	24.2	57.00	515	23800	184	3583	1053		11.8	0.025	0.1	6930	1.45	6.27	49	15700	1260	22.9	12.4	2430	42.7
H	CLY	4	4	5.99	41.33	0.24	n=3	20.2	51.67	414	22833	200	3200	879		20.4	0.025	0.3	8600	2.82	8.86	78	21300	2150	25.4	17.1	2760	32.6
Mean				**6.10**	**55.42**	**0.32**		**32.0**	**77.92**	**653**	**26850**	**235**	**5112**	**1296**		**13.6**	**0.040**	**0.2**	**5828**	**1.50**	**6.85**	**57**	**16188**	**1567**	**20.4**	**12.7**	**2161**	**41.7**
Std Dev				**0.11**	**11.10**	**0.11**		**11.4**	**27.64**	**227**	**4104**	**53**	**2024**	**387**		**5.6**	**0.018**	**0.1**	**3015**	**0.93**	**1.42**	**17**	**3537**	**405**	**5.8**	**3.4**	**521**	**21.4**
M	SND	5	1	6.96	11.00	0.13		4.7	13.00	103	5690	134	840	349		12.3	0.025	0.1	11700	0.66	5.94	47	10500	3330	36.4	14.7	1500	44.9
M	SND	5	2	6.90	16.00	0.13		10.7	7.00	81	5710	96	520	428		11.7	0.025	0.1	9590	0.27	10.30	52	6520	4510	14.1	9.3	1220	30.8
M	SND	5	3	6.73	14.00	0.15		8.4	9.00	90	7300	127	690	504	n=2	11.3	0.055	0.3	9025	0.43	6.40	58	13000	2535	25.2	30.5	1310	48.6
M	SND	5	4	7.13	11.00	0.14	n=2	9.6	10.00	105	5190	85	835	359		18.0	0.150	0.2	10100	0.50	7.54	83	7480	3670	23.9	19.9	1370	38.3
Mean				**6.93**	**13.00**	**0.14**		**8.4**	**9.75**	**95**	**5973**	**111**	**721**	**410**		**13.3**	**0.064**	**0.2**	**10104**	**0.46**	**7.54**	**60**	**9375**	**3511**	**24.9**	**18.6**	**1350**	**40.7**
Std Dev				**0.17**	**2.45**	**0.01**		**2.6**	**2.50**	**11**	**917**	**24**	**151**	**72**		**3.2**	**0.059**	**0.1**	**1151**	**0.16**	**1.96**	**16**	**2952**	**818**	**9.1**	**9.0**	**117**	**7.8**
M	CLY	6	1	6.49	74.00	0.43		10.6	17.50	147	17850	182	877	1400		11.2	0.070	0.1	8590	0.13	9.62	45	15500	2010	19.9	3.3	1760	22.7
M	CLY	6	2	7.10	74.00	0.50	n=3	5.7	19.00	123	22700	328	694	1410		11.0	0.025	0.1	7980	0.16	9.45	60	16600	1340	14.8	1.9	3000	34.2
M	CLY	6	3	7.38	26.67	0.41	n=3	3.8	10.00	34	27900	452	81	713		8.0	0.025	0.1	7440	0.18	12.50	37	15200	2180	28.9	1.4	1890	31.3
M	CLY	6	4	7.41	29.00	0.43	n=3	3.7	9.00	38	25400	428	83	777		7.9	0.025	0.1	8260	0.12	7.02	32	17500	1930	16.0	1.3	1220	15.8
Mean				**7.10**	**50.92**	**0.44**		**6.0**	**13.88**	**86**	**23463**	**347**	**434**	**1075**		**9.5**	**0.036**	**0.1**	**8068**	**0.15**	**9.65**	**44**	**16200**	**1865**	**19.9**	**2.0**	**1968**	**26.0**
Std Dev				**0.43**	**26.67**	**0.04**		**3.2**	**5.11**	**58**	**4302**	**123**	**413**	**382**		**1.8**	**0.023**	**0.0**	**487**	**0.03**	**2.24**	**12**	**1055**	**365**	**6.4**	**0.9**	**747**	**8.4**
C	ORG	7	1	5.86	135.00	0.37		5.6	4.00	34	13000	205	45	965		11.8	0.250	0.1	6690	0.07	9.09	48	11400	2450	33.2	0.3	1000	32.8
C	ORG	7	2	6.05	126.00	0.45		5.6	4.00	37	12500	204	53	1070		23.0	0.025	0.1	7330	0.04	10.60	66	11800	3020	17.0	0.6	1780	44.1
C	ORG	7	3	5.95	128.00	0.32		8.9	4.00	42	20900	237	62	1260		10.1	0.150	0.1	6360	0.03	8.43	31	10400	2180	28.0	0.3	1590	44.3
Mean				**5.95**	**129.67**	**0.38**		**6.7**	**4.00**	**38**	**15467**	**215**	**53**	**1098**		**15.0**	**0.142**	**0.1**	**6793**	**0.05**	**9.37**	**48**	**11200**	**2550**	**26.1**	**0.4**	**1457**	**40.4**
Std Dev				**0.10**	**4.73**	**0.07**		**1.9**	**0.00**	**4**	**4712**	**19**	**9**	**150**		**7.0**	**0.113**	**0.0**	**493**	**0.02**	**1.11**	**18**	**721**	**429**	**8.3**	**0.2**	**407**	**6.6**
C	SND	8	1	7.01	18.00	0.16		4.2	0.01	14	6050	123	49	1020		13.1	0.070	0.1	7180	0.02	9.25	34	19800	1140	9.6	0.9	2180	68.0
C	SND	8	2	6.68	18.00	0.24		1.9	0.01	8	4670	68	40	596		11.3	0.050	0.1	8890	0.01	11.30	37	14900	1510	9.7	0.9	2190	129.0
C	SND	8	3	6.28	26.50	0.36	n=2	1.6	0.01	14	5605	106	59	781		9.3	0.060	0.1	8560	0.01	17.90	44	11500	2280	11.0	0.7	1620	371.0
C	SND	8	4	7.27	19.00	0.20		1.9	0.01	10	5160	95	41	853		8.3	0.025	0.1	9690	0.01	7.01	38	14600	1160	10.7	0.3	2580	63.2
Mean				**6.81**	**20.38**	**0.24**		**2.4**	**0.01**	**11**	**5371**	**98**	**47**	**813**		**10.5**	**0.051**	**0.1**	**8580**	**0.01**	**11.37**	**38**	**15200**	**1523**	**10.3**	**0.7**	**2143**	**157.8**
Std Dev				**0.43**	**4.11**	**0.09**		**1.2**	**0.00**	**3**	**592**	**23**	**9**	**176**		**2.1**	**0.019**	**0.0**	**1047**	**0.01**	**4.70**	**4**	**3430**	**533**	**0.7**	**0.3**	**395**	**145.3**
C	CLY	9	1	7.27	32.00	0.45	n=3	3.6	10.00	23	30000	394	36	711		17.7	0.025	0.1	8150	0.07	7.23	51	32900	1670	24.1	1.3	1950	24.1
C	CLY	9	2	5.39	44.33	0.37	n=3	2.1	4.00	16	12200	159	28	781		13.7	0.025	0.1	7700	0.11	7.05	44	23800	1560	34.6	0.9	1410	26.3
C	CLY	9	3	7.03	43.33	0.99	n=3	1.8	5.00	31	12133	204	23	842	n=2	17.4	0.080	0.1	7200	0.10	9.20	51	20950	2040	60.4	0.4	1725	32.2
C	CLY	9	4	7.44	28.00	0.38	n=2	2.6	6.00	24	20700	260	26	495		16.0	0.070	0.1	7880	0.06	5.84	44	16500	2380	33.2	0.4	1260	25.2
Mean				**6.78**	**36.92**	**0.55**		**2.6**	**6.25**	**23**	**18758**	**254**	**28**	**707**		**16.2**	**0.050**	**0.1**	**7733**	**0.09**	**7.33**	**48**	**23538**	**1913**	**38.1**	**0.7**	**1586**	**26.9**
Std Dev				**0.94**	**8.16**	**0.30**		**0.8**	**2.63**	**6**	**8506**	**102**	**5**	**151**		**1.8**	**0.029**	**0.0**	**400**	**0.02**	**1.39**	**4**	**6927**	**373**	**15.6**	**0.4**	**310**	**3.6**

Jacques Whitford

APPENDIX B-2

Site Description Summaries

Site description summaries, and Ecological Land Classification (ELC) data sheets for community description, management/disturbance history, and plant species lists for seven biomonitoring sites in and around Port Colborne, Ontario.

Field Site Descriptions – Biomonitoring Study (October 2001)

High/Medium Sand, Reuter Road: This red oak deciduous forest occurs on an old, stabilized dune system. It is remarkable due to the age of many of the trees, the high species diversity at every strata, and the uncommon geomorphology on which they occur. The youngest fore dunes closest to Nickel Beach are colonized by the introduced species silver poplar (*Populus alba*) and the rare to uncommon beach grass *Ammophila breviligulata*. The stable, older back dunes provide microclimates for different species according to their aspect and height. The high dunes include mature, large diameter (ca. 78 cm diameter) red oak (*Quercus rubra*), sugar maple (*Acer saccharum*) hemlock (*Tsuga canadensis*). Scots pine (*Pinus sylvestris*), an introduced conifer, has naturalized here. The size of the larger trees indicates that logging last occurred 100+ years ago, although smaller diameter red oak and black cherry (*Prunus serotina*) on the lower back dunes indicate that logging last occurred there 30-50 years ago. Deadwood and standing snags in all size classes occur which provide habitat and indicate an absence of active management. Shrubs and small trees in the understory include bladdernut (*Staphylea trifolia*), spicebush (*Lindera benzoin*) and purple flowering raspberry (*Rubus odoratus*), and continuous patches of yew (*Taxus canadensis*) on south facing old dunes. Groundcover consists of patchy distributions of various ferns (*Athyrium felix-femina*, *Osumunda cinnamomea*), briers (*Smilax herbacea, S. hispida*) and vines (*Rhus radicans, Parthenocissus sp.*). Light litter occurs throughout the stand, and there is one track leading to a monitoring well. The constant drone of nearby industrial activity is the only other notable disturbance in this stand.

High Organic, Groetlaar Farm: Mature red maple (*Acer rubrum*) and the silver-red hybrid Freeman's maple (*Acer freemanii*) are the dominant tree species of this maple organic deciduous swamp. Standing snags and deadfall of all sizes occur indicating an absence of active management. Blue beech (*Carpinus caroliniana)* and Virginia creeper (*Parthenocissus* sp.) are scattered in the subcanopy. Where there is a break in the canopy, trembling aspen (*Populus tremuloides*) occurs with purple flowering raspberry (*Rubus odoratus*), and spicebush (*Lindera benzoin*). Groundcover largely consists of deciduous leaf litter, although ferns such as sensitive fern (*Onoclea sensibilis)* and wild sarsaparilla (*Aralia nudicaulis)* are found. Light disturbance occurs as domestic garbage dumping at the lane gate and a small excavation for soil extraction. Noise pollution is moderate and widespread due to the nearby industrial plant.

High Clay, Refinery: This fresh-moist poplar deciduous forest consists exclusively of mid-aged trembling aspen (*Populus tremuloides)*. It is an advancing forest edge into the adjacent old field dominated by goldenrod (*Solidago)* species. There is low vegetative diversity at all strata: spice bush (*Lindera benzoin)* is the dominant shrub, and groundcover is dominated by shade-intolerant goldenrod (*Solidago* spp.) and grass species, which is to be expected of woodlands with large canopy breaks such as this. Large diameter aspen snags and deadfalls are abundant. Noise is intensive and widespread from the industrial plant across the road, particularly when the large press is in operation causing below ground vibrations.

Medium Clay, Rae Farm: This site consists of a former property/yard boundary plantings of Norway spruce (*Picea alba*), weeping willow (*Salix babylonica*), and cottonwood (*Populus deltoides*) mixed with volunteer shrub and tree species such as black locust (*Robinia pseudo-acacia)* basswood (*Tilia americana*), sumac (*Rhus typhina*), pussy willow (*Salix discolor*), and red osier dogwood (*Cornus stolonifera*). The surrounding land is an old field dominated by grasses (eg. *Phalaris arundinacea*, *Phleum pratense*), goldenrods (*Solidago* spp.) asters (*Aster* spp.) and teasel (*Dipsacus sylvestris*). Some trees surround two shallow ponds which are possibly of anthropogenic origin. Other than past farming, (including the former fieldplot trials) there is very little ongoing disturbance, and the existing cultural plantings along with the adjoining forest will see this site return to woodland if left undisturbed.

Background Sand, MacDonald Property: This young mixed plantation consists of white spruce (*Picea glauca*), white pine (*Pinus strobus*) cottonwood (*Populus deltoides*, or a hybrid of *P. deltoides*), and black walnut (*Juglans nigra*). Herbaceous groundcover is the native species goldenrod (*Solidago altissima*), joe-pye weed (*Eupatorium maculatum*), and asters (eg. *Aster puniceus, A. novae-angliae*). This herbaceous layer is mowed annually in the fall.

Background Clay, Station Road: There is a high diversity of tree species in this fresh-moist shagbark hickory (*Carya ovata*) deciduous forest. Basswood (*Tilia americana*), ash (*Fraxinus* sp.), red oak (*Quercus rubra*) and red maple (*Acer rubrum*) are equally represented. Other less frequent species include blue beech (*Carpinus caroliniana*), hop hornbeam (*Ostrya virginiana*), yellow birch (*Betula alleghenensis*) black cherry (*Prunus serotina*), beech (*Fagus grandifolia*) and rock elm (*Ulmus thomasii*). Barberry (*Berberis vulgaris),* an escape garden shrub considered a weed, is found in the understory. Wild geranium is abundant in the groundcover, and wild iris (*Iris versicolor*), turtlehead (*Chelone glabra*), sensitive fern (*Onoclea sensibilis*) and various sedges indicate that this understory is normally wet. The ground vegetation was drought-stressed and the soil dehydrated at the time of the survey. There is a historic midden at the center of the woodlot, but there is otherwise very little anthropogenic disturbance.

Background Organic, Dilts Road: Sparsely distributed trembling aspen (*Populus tremuloides*) with thicket forming red osier dogwood (*Cornus stolonifera*) are dominant in this mid-aged, fresh-moist poplar deciduous forest. Jewelweed (*Impatiens* sp.) and the environmental weed garlic mustard (*Alliaria petiolata*) are common groundcover. It is likely this woodland established on abandoned organic cropland. Standing snags and deadfall occur, and there is a track to a small clearing.

Table A1. Ecological Land Classification (ELC) data sheets for community description and classification of Sandy (High-Ni and Medium-Ni) Reuter Road soils.

COMMUNITY DESCRIPTION & CLASSIFICATION	SITE: **Sand High-Medium Reuter Road**			POLYGON: Field #:	Final #:
	SURVEYOR(S): LandSaga Bioge		DATE: October 2/01		UTME:
	START:	END:		UTMZ:	UTMN:

POLYGON DESCRIPTION

SYSTEM	SUBSTRATE	TOPOGRAPHIC FEATURE	HISTORY	PLANT FORM	COMMUNITY
TERRESTRIAL	ORGANIC	LACUSTRINE	*NATURAL*	PLANKTON	POND LAKE
		RIVERINE		SUBMERGED	STREAM RIVER
WETLAND	MINERAL SOIL	BOTTOMLAND	CULTURAL	FLOATING- LVD.	SWAMP MARSH
		TERRACE		GRAMINOID	BOG FEN
AQUATIC	PARENT MIN.	VALLEY SLOPE		FORB	BARREN
		TABLELAND		LICHEN	MEADOW
	ACIDIC BEDRK.	ROLL. UPLAND		BRYOPHYTE	PRAIRIE
		CLIFF		*DECIDUOUS*	THICKET
SITE	BASIC BEDRK.	TALUS	**COVER**	CONIFEROUS	SAVANNAH
OPEN WATER		CREVICE/CAVE	OPEN	MIXED	WOODLAND
SHALLOW WATER	CARB. BEDRK.	ALVAR			FOREST
SURFICIAL DEP.		ROCKLAND	SHRUB		PLANTATION
BEDROCK		BEACH/ BAR			
		SAND DUNE	*TREED*		
		BLUFF			

STAND DESCRIPTION

LAYER		HT	CVR	SPECIES IN ORDER OF DECREASING DOMINANCE (>> MUCH GREATER THAN; > GREATER THAN; = ABOUT EQUAL TO)
1	CANOPY	2		Querubr>>Pruvirg>Tsucana=Pinsylv=Ostvirg
2	SUB-CANOPY	3		Ostvirg
3	UNDERSTOREY	2		Statrif>Rubodor=Linbenz=Parsp=Rhuradi
4	GRD. LAYER	6		see species list - very diverse

HT CODES: 1=>25 m 2=10<HT<25 m 3=2<HT<10 m 4=1<HT<2 m 5=0.5<HT<1 m 6=0.2<HT<0.5 m 7=HT<0.2 m

CVR CODES: 0=NONE 1=0%<CVR<10% 2=10<CVR<25% 3=25<CVR<60% 4=CVR>60%

STAND COMPOSITION:	Querubr	BA:

SIZE CLASS ANALYSIS:	o	< 10 cm	o	10 - 24 cm	a	25 - 50 cm	r	> 50 cm
STANDING SNAGS:	N=	< 10 cm	r	10 - 24 cm	r	25 - 50 cm	r	> 50 cm
DEADFALL/LOGS:	r	< 10 cm	r	10 - 24 cm	r	25 - 50 cm	r	> 50 cm

ABUNDANCE CODES: N=NONE R=RARE O=OCCASIONAL A=ABUNDANT

COMM. AGE:		PIONEER		YOUNG		MID-AGE	x	MATURE		OLD-GROWTH

SOIL ANALYSIS

TEXTURE:	DEPTH TO MOTTLES / GLEY	g =	G =
MOISTURE:	DEPTH OF ORGANICS:		(cm)
HOMOGENEOUS / VARIABLE:	DEPTH TO BEDROCK:		(cm)

COMMUNITY CLASSIFICATION

COMMUNITY CLASS:			
COMMUNITY SERIES:			
ECOSITE:			
VEGETATION TYPE:		Dry -fresh Oak-Hardwood Deciduous Forest	FOD2-4
	INCLUSION		
	COMPLEX		

Notes:

Table A2. Ecological Land Classification (ELC) data sheets for natural vegetation observed at Sandy (High-Ni and Medium-Ni) Reuter Road soils.

ELC PLANT SPECIES LIST	
	SITE: **Sand High-Medium Reuter Rd**
	POLYGON:
	DATE: October 2/01
	SURVEYOR(S): LandSaga Biogeographical

LAYERS: 1 = CANOPY > 10m 2 = SUB-CANOPY 3 = UNDERSTORY 4 = GROUND (GRD.) LAYER
ABUNDANCE CODES: R = RARE O = OCCASIONAL A = ABUNDANT D = DOMINANT

SPECIES CODE	LAYER				COLL.
	1	2	3	4	
Quercus rubra	D				
Aralia nudicaulis				O	
Smilax hispidis				A	
Asarum canadense				R	
Hesperis matronalis				R	
Parthenocissus sp.				O	
Solidago caesia				R	
Alliaria petiolata				R	
Rhus rhydbergii				O	
Maianthemum canadense				R	
Lindera benzoin			O		
Pinus sylvatica	O				
Rubus odoratus			R		
Taxus canadensis			A		
Fagus grandifolia	R				
Smilax herbacea				A	
Menispermum candense			R		
Populus alba	D				
Ammophila breviligulata	D				
Vitis riparia			O		
Viburnum lentago			R		
Tilia americana		R			
Ostrya virginiana		R			
Rubus allegheniensis			R		
Tsuga canadensis	R				
Euonymous obovatus				R	
Prunus serotina	O				
Acer saccharum	R				
Staphylea trifolia		A			
Smilacena racemosa				O	
Athyrium felix-femina				A	
Osmunda cinnamomea				O	

SPECIES CODE	LAYER				COLL.
	1	2	3	4	

Page ____ of ____

Table B1. Ecological Land Classification (ELC) data sheets for community description and classification of Organic (High-Ni) Groetlaar Farm soils.

COMMUNITY DESCRIPTION & CLASSIFICATION	SITE: Organic High - Groetlaar			POLYGON: Field #:	Final #:
	SURVEYOR(S): LandSaga Bioge		DATE: October 3/01		UTME:
	START:	END:		UTMZ:	UTMN:

POLYGON DESCRIPTION

SYSTEM	SUBSTRATE	TOPOGRAPHIC FEATURE	HISTORY	PLANT FORM	COMMUNITY
TERRESTRIAL	*ORGANIC*	LACUSTRINE	*NATURAL*	PLANKTON	POND LAKE
		RIVERINE		SUBMERGED	STREAM RIVER
WETLAND	MINERAL SOIL	BOTTOMLAND	CULTURAL	FLOATING- LVD.	SWAMP MARSH
		TERRACE		GRAMINOID	BOG FEN
AQUATIC	PARENT MIN.	VALLEY SLOPE		FORB	BARREN
		TABLELAND		LICHEN	MEADOW
	ACIDIC BEDRK.	ROLL. UPLAND		BRYOPHYTE	PRAIRIE
		CLIFF		*DECIDUOUS*	THICKET
SITE	BASIC BEDRK.	TALUS	**COVER**	CONIFEROUS	SAVANNAH
OPEN WATER		CREVICE/CAVE	OPEN	MIXED	WOODLAND
SHALLOW WATER	CARB. BEDRK.	ALVAR			*FOREST*
SURFICIAL DEP.		ROCKLAND	SHRUB		PLANTATION
BEDROCK		BEACH/ BAR			
		SAND DUNE	*TREED*		
		BLUFF			

STAND DESCRIPTION

	LAYER	HT	CVR	SPECIES IN ORDER OF DECREASING DOMINANCE (>> MUCH GREATER THAN; > GREATER THAN; = ABOUT EQUAL TO)
1	CANOPY	2		Acefree=Acerubr>>Poptrem>Querubr
2	SUB-CANOPY	3		Carcaro>Parvita
3	UNDERSTOREY	5		Linbenz=Rubodor
4	GRD. LAYER	6		Aranudi=Athefeli

HT CODES: 1=>25 m 2=10<HT<25 m 3=2<HT<10 m 4=1<HT<2 m 5=0.5<HT<1 m 6=0.2<HT<0.5 m 7=HT<0.2 m

CVR CODES: 0=NONE 1=0%<CVR<10% 2=10<CVR<25% 3=25<CVR<60% 4=CVR>60%

STAND COMPOSITION:							BA:	
SIZE CLASS ANALYSIS:	O	< 10 cm	A	10 - 24 cm	A	25 - 50 cm	R	> 50 cm
STANDING SNAGS:	R	< 10 cm	R	10 - 24 cm	R	25 - 50 cm	N	> 50 cm
DEADFALL/LOGS:	O	< 10 cm	A	10 - 24 cm	A	25 - 50 cm	N	> 50 cm

ABUNDANCE CODES: N=NONE R=RARE O=OCCASIONAL A=ABUNDANT

COMM. AGE:		PIONEER		YOUNG		MID-AGE	X	MATURE		OLD-GROWTH

SOIL ANALYSIS

TEXTURE:	DEPTH TO MOTTLES / GLEY	g =	G =
MOISTURE:	DEPTH OF ORGANICS:		(cm)
HOMOGENEOUS / VARIABLE:	DEPTH TO BEDROCK:		(cm)

COMMUNITY CLASSIFICATION

COMMUNITY CLASS:			
COMMUNITY SERIES:			
ECOSITE:			
VEGETATION TYPE:		Maple organic deciduous swamp	SWD6
	INCLUSION		
	COMPLEX		

Notes:

Table B2. Ecological Land Classification (ELC) data sheets for natural vegetation observed at Organic (High-Ni) Groetlaar Farm soils.

ELC PLANT SPECIES LIST	
	SITE: **Organic High Groetlaar**
	POLYGON:
	DATE: October 3/01
	SURVEYOR(S): LandSaga Biogeographical

LAYERS: 1 = CANOPY > 10m 2 = SUB-CANOPY 3 = UNDERSTORY 4 = GROUND (GRD.) LAYER
ABUNDANCE CODES: R = RARE O = OCCASIONAL A = ABUNDANT D = DOMINANT

SPECIES CODE	LAYER 1	2	3	4	COLL.
Rubus idaeus	O				
Rubus odorata	O				
Populus tremuloides	O				
Parthenocissus vitacea	D				
Acer rubrum	A				
Lindera benzoin			O		
Impatiens sp			O		
Solidago altissima			O		
Onoclea sensibilis			O		
Osmunda regalis			R		
Aralia nudicaulis			O		
Osmunda cinnamomea			O		
Carpinus caroliniana			O		
Athyrium felix-femina			O		
Acer freemanii	A				

SPECIES CODE	LAYER 1	2	3	4	COLL.

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Table C1. Ecological Land Classification (ELC) data sheets for community description and classification of Clay (High-Ni) Refinery soils.

COMMUNITY DESCRIPTION & CLASSIFICATION	SITE: Clay -High-Refinery		POLYGON: Field #:	Final #:
	SURVEYOR(S): LandSaga Bioge	DATE: October 3/01		UTME:
	START:	END:	UTMZ:	UTMN:

POLYGON DESCRIPTION

SYSTEM	SUBSTRATE	TOPOGRAPHIC FEATURE	HISTORY	PLANT FORM	COMMUNITY
TERRESTRIAL	ORGANIC	LACUSTRINE	*NATURAL*	PLANKTON	POND LAKE
		RIVERINE		SUBMERGED	STREAM RIVER
WETLAND	*MINERAL SOIL*	BOTTOMLAND	CULTURAL	FLOATING-LVD.	SWAMP MARSH
		TERRACE		GRAMINOID	BOG FEN
AQUATIC	PARENT MIN.	VALLEY SLOPE		FORB	BARREN
		TABLELAND		LICHEN	MEADOW
	ACIDIC BEDRK.	ROLL. UPLAND		BRYOPHYTE	PRAIRIE
		CLIFF		*DECIDUOUS*	THICKET
SITE	BASIC BEDRK.	TALUS	**COVER**	CONIFEROUS	SAVANNAH
OPEN WATER		CREVICE/CAVE	OPEN	MIXED	WOODLAND
SHALLOW WATER	CARB. BEDRK.	ALVAR			*FOREST*
SURFICIAL DEP.		ROCKLAND	SHRUB		PLANTATION
BEDROCK		BEACH/BAR			
		SAND DUNE	*TREED*		
		BLUFF			

STAND DESCRIPTION

	LAYER	HT	CVR	SPECIES IN ORDER OF DECREASING DOMINANCE (>> MUCH GREATER THAN; > GREATER THAN; = ABOUT EQUAL TO)
1	CANOPY	3		Poptre,
2	SUB-CANOPY			
3	UNDERSTOREY	4		Linbenz>>Saldisc
4	GRD. LAYER	6		Solspp=grass sp

HT CODES: 1=>25 m 2=10<HT<25 m 3=2<HT<10 m 4=1<HT<2 m 5=0.5<HT<1 m 6=0.2<HT<0.5 m 7=HT<0.2 m

CVR CODES: 0=NONE 1=0%<CVR<10% 2=10<CVR<25% 3=25<CVR<60% 4=CVR>60%

STAND COMPOSITION: Poptrem								BA:
SIZE CLASS ANALYSIS:	O	< 10 cm	A	10 - 24 cm	A	25 - 50 cm	N	> 50 cm
STANDING SNAGS:	O	< 10 cm	A	10 - 24 cm	O	25 - 50 cm	N	> 50 cm
DEADFALL/LOGS:	O	< 10 cm	A	10 - 24 cm	A	25 - 50 cm	N	> 50 cm

ABUNDANCE CODES: N=NONE R=RARE O=OCCASIONAL A=ABUNDANT

COMM. AGE:		PIONEER		YOUNG	X	MID-AGE		MATURE		OLD-GROWTH

SOIL ANALYSIS

TEXTURE:	DEPTH TO MOTTLES / GLEY	g =	G =
MOISTURE:	DEPTH OF ORGANICS:		(cm)
HOMOGENEOUS / VARIABLE:	DEPTH TO BEDROCK:		(cm)

COMMUNITY CLASSIFICATION

COMMUNITY CLASS:		
COMMUNITY SERIES:		
ECOSITE:		
VEGETATION TYPE:	Fresh-Moist Poplar Deciduous Forest	FOD8-1
☐ INCLUSION		
☐ COMPLEX		

Notes:

Table C2. Ecological Land Classification (ELC) data sheets for natural vegetation observed at Clay (High-Ni) Refinery soils.

ELC PLANT SPECIES LIST	SITE: **Clay High Refinery**
	POLYGON:
	DATE: October 3/01
	SURVEYOR(S): LandSaga Biogeographical

LAYERS: 1 = CANOPY > 10m 2 = SUB-CANOPY 3 = UNDERSTORY 4 = GROUND (GRD.) LAYER
ABUNDANCE CODES: R = RARE O = OCCASIONAL A = ABUNDANT D = DOMINANT

SPECIES CODE	LAYER				COLL.
	1	2	3	4	
Populus tremuloides	D				
Fraxinus pennsylvanica	R				
Leersia oryzoides				O	
Salix discolor			O		
Onoclea sensibilis				O	
Lindera benzoin			D		
Solidago altissima				A	
grass species				A	
Typha latifolia				O	
Quercus rubra				R	

SPECIES CODE	LAYER				COLL.
	1	2	3	4	

Page ____ of ____

Table D1. Ecological Land Classification (ELC) data sheets for community description and classification of Clay (Medium-Ni) Rae Farm soils.

COMMUNITY DESCRIPTION & CLASSIFICATION				
SITE: **Clay-Medium-Rae Farm**			POLYGON: Field #:	Final #:
SURVEYOR(S): LandSaga Bioge		DATE: October 2/01		UTME:
START:	END:		UTMZ:	UTMN:

POLYGON DESCRIPTION

SYSTEM	SUBSTRATE	TOPOGRAPHIC FEATURE	HISTORY	PLANT FORM	COMMUNITY
TERRESTRIAL	ORGANIC	LACUSTRINE	*NATURAL*	PLANKTON	POND LAKE
		RIVERINE		SUBMERGED	STREAM RIVER
WETLAND	*MINERAL SOIL*	BOTTOMLAND	*CULTURAL*	FLOATING- LVD.	SWAMP MARSH
		TERRACE		GRAMINOID	BOG FEN
AQUATIC	PARENT MIN.	VALLEY SLOPE		FORB	BARREN
		TABLELAND		LICHEN	MEADOW
	ACIDIC BEDRK.	ROLL. UPLAND		BRYOPHYTE	PRAIRIE
		CLIFF		*DECIDUOUS*	THICKET
SITE	BASIC BEDRK.	TALUS	**COVER**	CONIFEROUS	*SAVANNAH*
OPEN WATER		CREVICE/CAVE	OPEN	MIXED	WOODLAND
SHALLOW WATER	CARB. BEDRK.	ALVAR			FOREST
SURFICIAL DEP.		ROCKLAND	SHRUB		PLANTATION
BEDROCK		BEACH/ BAR			
		SAND DUNE	*TREED*		
		BLUFF			

STAND DESCRIPTION

LAYER		HT	CVR	SPECIES IN ORDER OF DECREASING DOMINANCE (>> MUCH GREATER THAN; > GREATER THAN; = ABOUT EQUAL TO)
1	CANOPY			
2	SUB-CANOPY	3		Robpseu>Picalb=Salamyg=Rhutuph
3	UNDERSTOREY	2		Soldisc>Corstol
4	GRD. LAYER	5		Solispp=Astspp=grasspp

HT CODES: 1=>25 m 2=10<HT<25 m 3=2<HT<10 m 4=1<HT<2 m 5=0.5<HT<1 m 6=0.2<HT<0.5 m 7=HT<0.2 m

CVR CODES: 0=NONE 1=0%<CVR<10% 2=10<CVR<25% 3=25<CVR<60% 4=CVR>60%

STAND COMPOSITION:	mixed						BA:	
SIZE CLASS ANALYSIS:	R	< 10 cm	A	10 - 24 cm	R	25 - 50 cm	N	> 50 cm
STANDING SNAGS:	N=	< 10 cm	N	10 - 24 cm	N	25 - 50 cm	N	> 50 cm
DEADFALL/LOGS:	N=	< 10 cm	N	10 - 24 cm	N	25 - 50 cm	N	> 50 cm

ABUNDANCE CODES: N=NONE R=RARE O=OCCASIONAL A=ABUNDANT

COMM. AGE:		PIONEER	X	YOUNG		MID-AGE		MATURE		OLD-GROWTH

SOIL ANALYSIS

TEXTURE:	DEPTH TO MOTTLES / GLEY	g =	G =
MOISTURE:	DEPTH OF ORGANICS:		(cm)
HOMOGENEOUS / VARIABLE:	DEPTH TO BEDROCK:		(cm)

COMMUNITY CLASSIFICATION

COMMUNITY CLASS:		
COMMUNITY SERIES:		
ECOSITE:		
VEGETATION TYPE:	Cultural Savannah	CUS
INCLUSION		
COMPLEX		

Notes:

Table D2. Ecological Land Classification (ELC) data sheets for natural vegetation observed at Clay (Medium-Ni) Rae Farm soils.

ELC PLANT SPECIES LIST	
	SITE: **Clay Medium Rae Farm**
	POLYGON:
	DATE: October 2/01
	SURVEYOR(S): LandSaga Biogeographical

LAYERS: 1 = CANOPY > 10m 2 = SUB-CANOPY 3 = UNDERSTORY 4 = GROUND (GRD.) LAYER
ABUNDANCE CODES: R = RARE O = OCCASIONAL A = ABUNDANT D = DOMINANT

SPECIES CODE	LAYER 1	LAYER 2	LAYER 3	LAYER 4	COLL.
Robinia pseudoacacia		O			
Rhus typhina		O			
Picea abies		O			
Salix babylonica	R				
Salix discolor		O			
Populus deltoides		O			
Solidago altissima				D	
Aster novae-angliae				D	
Solanum dulcamara				R	
Linaria vulgaris				R	
Cornus stolonifera				A	
Euthamia graminifolia				O	
Leersia oryzoides				O	
Penthorum sedoides				R	
Vitis riparia				O	
Phalaris arundinacea				O	
Ace Saccharinum				R	
Lythrum salicaria				O	
Tilia americana	R				
Rhus radicans	R				
Aster puniceus				D	
Solidago canadensis				D	

Page ____ of ____

Table E1. Ecological Land Classification (ELC) data sheets for community description and classification of Sandy (Background-Ni) MacDonald Property soils.

COMMUNITY DESCRIPTION & CLASSIFICATION	SITE: Sand-Background-MacDonald		POLYGON: Field #:	Final #:
	SURVEYOR(S): LandSaga Bioge	DATE: October 3/01		UTME:
	START:	END:	UTMZ:	UTMN:

POLYGON DESCRIPTION

SYSTEM	SUBSTRATE	TOPOGRAPHIC FEATURE	HISTORY	PLANT FORM	COMMUNITY
TERRESTRIAL	ORGANIC	LACUSTRINE	NATURAL	PLANKTON	POND LAKE
		RIVERINE		SUBMERGED	STREAM RIVER
WETLAND	*MINERAL SOIL*	BOTTOMLAND	*CULTURAL*	FLOATING- LVD.	SWAMP MARSH
		TERRACE		GRAMINOID	BOG FEN
AQUATIC	PARENT MIN.	VALLEY SLOPE		FORB	BARREN
		TABLELAND		LICHEN	MEADOW
	ACIDIC BEDRK.	ROLL. UPLAND		BRYOPHYTE	PRAIRIE
		CLIFF		DECIDUOUS	THICKET
SITE	BASIC BEDRK.	TALUS	**COVER**	CONIFEROUS	SAVANNAH
OPEN WATER		CREVICE/CAVE	OPEN	*MIXED*	WOODLAND
SHALLOW WATER	CARB. BEDRK.	ALVAR			FOREST
SURFICIAL DEP.		ROCKLAND	SHRUB		*PLANTATION*
BEDROCK		BEACH/ BAR			
		SAND DUNE	*TREED*		
		BLUFF			

STAND DESCRIPTION

LAYER		HT	CVR	SPECIES IN ORDER OF DECREASING DOMINANCE (>> MUCH GREATER THAN; > GREATER THAN; = ABOUT EQUAL TO)
1	CANOPY			
2	SUB-CANOPY	3		Picglau=Pinstrob=Poptrem=Jugnigr
3	UNDERSTOREY			
4	GRD. LAYER	5		Solalti>>Astspp>Eupmacu

HT CODES: 1=>25 m 2=10<HT<25 m 3=2<HT<10 m 4=1<HT<2 m 5=0.5<HT<1 m 6=0.2<HT<0.5 m 7=HT<0.2 m

CVR CODES: 0=NONE 1=0%<CVR<10% 2=10<CVR<25% 3=25<CVR<60% 4=CVR>60%

STAND COMPOSITION:								BA:
SIZE CLASS ANALYSIS:	R	< 10 cm	A	10 - 24 cm	N	25 - 50 cm	N	> 50 cm
STANDING SNAGS:	N=	< 10 cm	N	10 - 24 cm	N	25 - 50 cm	N	> 50 cm
DEADFALL/LOGS:	N=	< 10 cm	N	10 - 24 cm	N	25 - 50 cm	N	> 50 cm

ABUNDANCE CODES: N=NONE R=RARE O=OCCASIONAL A=ABUNDANT

COMM. AGE:		PIONEER	X	YOUNG		MID-AGE		MATURE		OLD-GROWTH

SOIL ANALYSIS

TEXTURE:	DEPTH TO MOTTLES / GLEY	g =	G =
MOISTURE:	DEPTH OF ORGANICS:		(cm)
HOMOGENEOUS / VARIABLE:	DEPTH TO BEDROCK:		(cm)

COMMUNITY CLASSIFICATION

COMMUNITY CLASS:		
COMMUNITY SERIES:		
ECOSITE:		
VEGETATION TYPE:	Mixed plantation	CUP-2
INCLUSION		
COMPLEX		

Notes:

Table E2. Ecological Land Classification (ELC) data sheets for natural vegetation observed at Sandy (Background-Ni) MacDonald Property soils.

ELC PLANT SPECIES LIST	SITE: **Sand Background MacDonald**
	POLYGON:
	DATE: October 2/01
	SURVEYOR(S): LandSaga Biogeographical

LAYERS: 1 = CANOPY > 10m 2 = SUB-CANOPY 3 = UNDERSTORY 4 = GROUND (GRD.) LAYER
ABUNDANCE CODES: R = RARE O = OCCASIONAL A = ABUNDANT D = DOMINANT

SPECIES CODE	LAYER				COLL.	SPECIES CODE	LAYER				COLL.
	1	2	3	4			1	2	3	4	
Picea glauca		A									
Pinus strobus		A									
Juglans nigra		A									
Populus deltoides		A									
Eupatorium maculatum				O							
Solidago altissima				D							
Aster novae angliae				O							
Aster puniceus				O							

Page ____ of ____

Table F1. Ecological Land Classification (ELC) data sheets for community description and classification of Clay (Background-Ni) Station Road soils.

COMMUNITY DESCRIPTION & CLASSIFICATION	SITE: Clay-Background-Station Road			POLYGON: Field #:	Final #:
	SURVEYOR(S): LandSaga Bioge		DATE: Sept 19/01		UTME:
	START:	END:		UTMZ:	UTMN:

POLYGON DESCRIPTION

SYSTEM	SUBSTRATE	TOPOGRAPHIC FEATURE	HISTORY	PLANT FORM	COMMUNITY
TERRESTRIAL	ORGANIC	LACUSTRINE	*NATURAL*	PLANKTON	POND LAKE
		RIVERINE		SUBMERGED	STREAM RIVER
WETLAND	*MINERAL SOIL*	BOTTOMLAND	CULTURAL	FLOATING- LVD.	SWAMP MARSH
		TERRACE		GRAMINOID	BOG FEN
AQUATIC	PARENT MIN.	VALLEY SLOPE		FORB	BARREN
		TABLELAND		LICHEN	MEADOW
	ACIDIC BEDRK.	ROLL. UPLAND		BRYOPHYTE	PRAIRIE
		CLIFF		*DECIDUOUS*	THICKET
SITE	BASIC BEDRK.	TALUS	**COVER**	CONIFEROUS	SAVANNAH
OPEN WATER		CREVICE/CAVE	OPEN	MIXED	WOODLAND
SHALLOW WATER	CARB. BEDRK.	ALVAR			*FOREST*
SURFICIAL DEP.		ROCKLAND	SHRUB		PLANTATION
BEDROCK		BEACH/ BAR			
		SAND DUNE	*TREED*		
		BLUFF			

STAND DESCRIPTION

	LAYER	HT	CVR	SPECIES IN ORDER OF DECREASING DOMINANCE (>> MUCH GREATER THAN; > GREATER THAN; = ABOUT EQUAL TO)
1	CANOPY	2		Carova=Tilamer=Frasp=Querubr
2	SUB-CANOPY			
3	UNDERSTOREY	4		Carcaro
4	GRD. LAYER	6		Germacu>Solrugo

HT CODES: 1=>25 m 2=10<HT<25 m 3=2<HT<10 m 4=1<HT<2 m 5=0.5<HT<1 m 6=0.2<HT<0.5 m 7=HT<0.2 m

CVR CODES: 0=NONE 1=0%<CVR<10% 2=10<CVR<25% 3=25<CVR<60% 4=CVR>60%

STAND COMPOSITION:							BA:	
SIZE CLASS ANALYSIS:	A	< 10 cm	A	10 - 24 cm	A	25 - 50 cm	R	> 50 cm
STANDING SNAGS:	R	< 10 cm	R	10 - 24 cm	A	25 - 50 cm	A	> 50 cm
DEADFALL/LOGS:	A	< 10 cm	O	10 - 24 cm	O	25 - 50 cm	A	> 50 cm

ABUNDANCE CODES: N=NONE R=RARE O=OCCASIONAL A=ABUNDANT

COMM. AGE:		PIONEER		YOUNG	X	MID-AGE		MATURE		OLD-GROWTH

SOIL ANALYSIS

TEXTURE:	DEPTH TO MOTTLES / GLEY	g =	G =
MOISTURE:	DEPTH OF ORGANICS:		(cm)
HOMOGENEOUS / VARIABLE:	DEPTH TO BEDROCK:		(cm)

COMMUNITY CLASSIFICATION

COMMUNITY CLASS:		
COMMUNITY SERIES:		
ECOSITE:		
VEGETATION TYPE:	Fresh-Moist Shagbark Hickory Deciduous Forest	FOD9-4
INCLUSION		
COMPLEX		

Notes:

Table F2. Ecological Land Classification (ELC) data sheets for natural vegetation observed at Clay (Background-Ni) Station Road soils.

ELC PLANT SPECIES LIST	
	SITE: **Clay Background Station Road**
	POLYGON:
	DATE: September 19/01
	SURVEYOR(S): LandSaga Biogeographical

LAYERS: 1 = CANOPY > 10m 2 = SUB-CANOPY 3 = UNDERSTORY 4 = GROUND (GRD.) LAYER
ABUNDANCE CODES: R = RARE O = OCCASIONAL A = ABUNDANT D = DOMINANT

SPECIES CODE	LAYER				COLL.
	1	2	3	4	
Tilia americana	O				
Fraxinus sp	O				
Ostrya virginiana		O			
Fagus grandifolia	R				
Ulmus thomasii		R			
Acer rubrum	A				
Carya ovata	A				
Carpinus caroliniana		O			
Quercus rubrum	O				
Solidago rugosa				O	
Geum sp				A	
Geranium maculatum				A	
Berberis vulgaris			R		
Rhus rhydbergii		O			
Acer saccharum	O				
Prunus virginiana			O		
Onoclea sensibilis				O	
sedges				O	
Betula allegheniensis		R			
Chelone glabra				R	
Iris versicolor				R	

SPECIES CODE	LAYER				COLL.
	1	2	3	4	

Page ____ of ____

Table G1. Ecological Land Classification (ELC) data sheets for community description and classification of Organic (Background-Ni) Dilts Road soils.

COMMUNITY DESCRIPTION & CLASSIFICATION	SITE: Organic Background Dilts Road		POLYGON: Field #:	Final #:
	SURVEYOR(S): LandSaga Bioge	DATE: October 2/01		UTME:
	START:	END:	UTMZ:	UTMN:

POLYGON DESCRIPTION

SYSTEM	SUBSTRATE	TOPOGRAPHIC FEATURE	HISTORY	PLANT FORM	COMMUNITY
TERRESTRIAL	ORGANIC	LACUSTRINE	NATURAL	PLANKTON	POND LAKE
		RIVERINE		SUBMERGED	STREAM RIVER
WETLAND	*MINERAL SOIL*	BOTTOMLAND	*CULTURAL*	FLOATING- LVD.	SWAMP MARSH
		TERRACE		GRAMINOID	BOG FEN
AQUATIC	PARENT MIN.	VALLEY SLOPE		FORB	BARREN
		TABLELAND		LICHEN	MEADOW
	ACIDIC BEDRK.	ROLL. UPLAND		BRYOPHYTE	PRAIRIE
		CLIFF		*DECIDUOUS*	THICKET
SITE	BASIC BEDRK.	TALUS	**COVER**	CONIFEROUS	SAVANNAH
OPEN WATER		CREVICE/CAVE	OPEN	MIXED	WOODLAND
SHALLOW WATER	CARB. BEDRK.	ALVAR			*FOREST*
SURFICIAL DEP.		ROCKLAND	SHRUB		PLANTATION
BEDROCK		BEACH/ BAR			
		SAND DUNE	*TREED*		
		BLUFF			

STAND DESCRIPTION

	LAYER	HT	CVR	SPECIES IN ORDER OF DECREASING DOMINANCE (>> MUCH GREATER THAN; > GREATER THAN; = ABOUT EQUAL TO)
1	CANOPY	2		Poptrem
2	SUB-CANOPY	3		Fraamer
3	UNDERSTOREY	4		Corstol
4	GRD. LAYER	5		Impsp>Allpeti

HT CODES: 1=>25 m 2=10<HT<25 m 3=2<HT<10 m 4=1<HT<2 m 5=0.5<HT<1 m 6=0.2<HT<0.5 m 7=HT<0.2 m

CVR CODES: 0=NONE 1=0%<CVR<10% 2=10<CVR<25% 3=25<CVR<60% 4=CVR>60%

STAND COMPOSITION:							BA:	
SIZE CLASS ANALYSIS:	N	< 10 cm	A	10 - 24 cm	O	25 - 50 cm	N	> 50 cm
STANDING SNAGS:	N=	< 10 cm	N	10 - 24 cm	N	25 - 50 cm	N	> 50 cm
DEADFALL/LOGS:	R	< 10 cm	R	10 - 24 cm	R	25 - 50 cm	N	> 50 cm

ABUNDANCE CODES: N=NONE R=RARE O=OCCASIONAL A=ABUNDANT

COMM. AGE:		PIONEER		YOUNG	X	MID-AGE		MATURE	OLD-GROWTH

SOIL ANALYSIS

TEXTURE:	DEPTH TO MOTTLES / GLEY	g =	G =
MOISTURE:	DEPTH OF ORGANICS:		(cm)
HOMOGENEOUS / VARIABLE:	DEPTH TO BEDROCK:		(cm)

COMMUNITY CLASSIFICATION

COMMUNITY CLASS:		
COMMUNITY SERIES:		
ECOSITE:		
VEGETATION TYPE:	Fresh-Moist Pooplar Deciduous Forest	FOD 8-1
INCLUSION		
COMPLEX		

Notes:

Table G2. Ecological Land Classification (ELC) data sheets for natural vegetation observed at Organic (Background-Ni) Dilts Road soils.

ELC PLANT SPECIES LIST	SITE: **Organic Background Dilts Road**
	POLYGON:
	DATE: October 2/01
	SURVEYOR(S):LandSaga Biogeographical

LAYERS: 1 = CANOPY > 10m 2 = SUB-CANOPY 3 = UNDERSTORY 4 = GROUND (GRD.) LAYER
ABUNDANCE CODES: R = RARE O = OCCASIONAL A = ABUNDANT D = DOMINANT

SPECIES CODE	LAYER				COLL.
	1	2	3	4	
Populus tremuloides	D				
Fraxinus americana	R				
Cornus stolonifera	D				
Rubus idaeus			R		
Acer negundo		R			
Impatiens sp.				A	
Bidens cernua				O	
Alliaria petiolata				A	
Aster oolentangiensis				R	
Eichinocistus lobata				R	
Solidago altissima				R	
Polygonum sp				R	
Urtica dioica				R	

SPECIES CODE	LAYER				COLL.
	1	2	3	4	

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APPENDIX B-3

Statistical Output for *glm*s

ANOVAs and summaries of *glm*s used to assess relationships between soil characteristics and CoC plant: soil ratios.

Nickel Plant: Soil Ratio

Analysis of Deviance Table

```
Gaussian model

Response: asin(sqrt(Ni.Ratio/100))

Terms added sequentially (first to last)
              Df   Deviance Resid. Df Resid. Dev  F Value     Pr(F)
         NULL                       30 0.07472950
         Soil  2 0.01200387        28 0.06272563  6.44589 0.0088464
     Soil.CEC  1 0.02152849        27 0.04119713 23.12093 0.0001930
      Soil.pH  1 0.00090359        26 0.04029354  0.97043 0.3392371
      Soil.Fe  1 0.00108288        25 0.03921066  1.16298 0.2968380
      Soil.Mn  1 0.00270865        24 0.03650201  2.90901 0.1074200
Soil:Soil.CEC  2 0.00902243        22 0.02747958  4.84490 0.0226398
 Soil:Soil.pH  2 0.00506345        20 0.02241613  2.71900 0.0962691
 Soil:Soil.Fe  2 0.00221237        18 0.02020376  1.18801 0.3303311
 Soil:Soil.Mn  2 0.00530575        16 0.01489801  2.84910 0.0874116
```

Summary

```
Call: glm(formula = asin(sqrt(Ni.Ratio/100)) ~ Soil * Soil.CEC + Soil *
Soil.pH + Soil * Soil.Fe + Soil * Soil.Mn, family = gaussian, data =
biomonitoring, na.action = na.omit)

Deviance Residuals:
        Min          1Q       Median          3Q        Max
 -0.03197885 -0.01575893 -0.004322009 0.01352295 0.07758002

Coefficients:
                       Value    Std. Error     t value
  (Intercept)  5.053721e-001 1.639312e-001  3.08283012
        Soil1  1.321695e-001 1.255709e-001  1.05254925
        Soil2  3.268655e-003 1.470287e-001  0.02223141
     Soil.CEC -2.840097e-003 1.051052e-003 -2.70214603
      Soil.pH -4.866551e-002 2.089058e-002 -2.32954375
      Soil.Fe  1.290548e-005 8.051665e-006  1.60283329
      Soil.Mn -3.282895e-004 2.772605e-004 -1.18404695
Soil1Soil.CEC  4.884548e-004 3.854499e-004  1.26723288
Soil2Soil.CEC -1.410112e-003 1.027223e-003 -1.37274202
 Soil1Soil.pH -2.223299e-002 1.864604e-002 -1.19237047
 Soil2Soil.pH -5.699378e-003 1.790320e-002 -0.31834407
 Soil1Soil.Fe  3.043017e-006 1.652374e-006  1.84160324
 Soil2Soil.Fe  1.502872e-005 7.994948e-006  1.87977765
 Soil1Soil.Mn -2.524785e-004 1.233555e-004 -2.04675501
 Soil2Soil.Mn -3.591088e-004 2.679574e-004 -1.34017113

(Dispersion Parameter for Gaussian family taken to be 0.0009311 )

    Null Deviance: 0.0747295 on 30 degrees of freedom

Residual Deviance: 0.014898 on 16 degrees of freedom

Number of Fisher Scoring Iterations: 1
```

Copper Plant: Soil Ratio

Analysis of Deviance Table

```
Gaussian model

Response: asin(sqrt(Cu.Ratio/1000))

Terms added sequentially (first to last)
              Df  Deviance Resid. Df Resid. Dev  F Value     Pr(F)
         NULL                     30  0.2821867
         Soil  2 0.0729417        28  0.2092450 15.75462 0.0001655
     Soil.CEC  1 0.0118787        27  0.1973663  5.13133 0.0377321
      Soil.pH  1 0.0015682        26  0.1957981  0.67745 0.4225650
      Soil.Fe  1 0.0148278        25  0.1809702  6.40531 0.0222465
      Soil.Mn  1 0.0002415        24  0.1807287  0.10433 0.7508774
Soil:Soil.CEC  2 0.1156483        22  0.0650805 24.97877 0.0000120
 Soil:Soil.pH  2 0.0016832        20  0.0633973  0.36354 0.7008047
 Soil:Soil.Fe  2 0.0125605        18  0.0508368  2.71293 0.0967062
 Soil:Soil.Mn  2 0.0137979        16  0.0370389  2.98020 0.0794031
```

Summary

```
Call: glm(formula = asin(sqrt(Cu.Ratio/1000)) ~ Soil * Soil.CEC + Soil *
Soil.pH + Soil * Soil.Fe + Soil * Soil.Mn, family = gaussian, data =
biomonitoring, na.action = na.omit)

Deviance Residuals:
         Min          1Q      Median          3Q        Max
 -0.07998333 -0.01600554 0.001268935 0.02121351 0.08095376

Coefficients:
                       Value    Std. Error    t value
  (Intercept)  1.700710e-001 2.584797e-001  0.6579664
        Soil1 -3.127955e-001 1.979948e-001 -1.5798164
        Soil2  1.117820e-001 2.318285e-001  0.4821755
     Soil.CEC  6.153300e-003 1.657255e-003  3.7129480
      Soil.pH  7.781179e-003 3.293937e-002  0.2362273
      Soil.Fe -2.049343e-005 1.269552e-005 -1.6142255
      Soil.Mn -1.134634e-004 4.371725e-004 -0.2595391
Soil1Soil.CEC  1.214535e-003 6.077609e-004  1.9983763
Soil2Soil.CEC  6.636875e-003 1.619682e-003  4.0976420
 Soil1Soil.pH  3.790818e-002 2.940028e-002  1.2893815
 Soil2Soil.pH -1.605822e-002 2.822900e-002 -0.5688552
 Soil1Soil.Fe  5.608608e-006 2.605392e-006  2.1526923
 Soil2Soil.Fe -1.618565e-005 1.260609e-005 -1.2839548
 Soil1Soil.Mn -4.724508e-004 1.945017e-004 -2.4290319
 Soil2Soil.Mn -1.604964e-004 4.225039e-004 -0.3798696

(Dispersion Parameter for Gaussian family taken to be 0.0023149 )

    Null Deviance: 0.2821867 on 30 degrees of freedom

Residual Deviance: 0.0370389 on 16 degrees of freedom

Number of Fisher Scoring Iterations: 1
```

Cobalt Plant: Soil Ratio

Analysis of Deviance Table

```
Gaussian model

Response: asin(sqrt(Co.Ratio/100))

Terms added sequentially (first to last)
              Df   Deviance Resid. Df Resid. Dev  F Value     Pr(F)
         NULL                      26 0.06597597
         Soil  2 0.03116465        24 0.03481132 11.94924 0.0011352
     Soil.CEC  1 0.00677812        23 0.02803320  5.19777 0.0401292
      Soil.pH  1 0.00808968        22 0.01994352  6.20354 0.0270595
      Soil.Fe  1 0.00074096        21 0.01920257  0.56820 0.4644104
      Soil.Mn  1 0.00004672        20 0.01915584  0.03583 0.8527911
Soil:Soil.CEC  2 0.00137766        18 0.01777819  0.52822 0.6017834
 Soil:Soil.pH  2 0.00023228        16 0.01754591  0.08906 0.9153431
 Soil:Soil.Fe  2 0.00059005        14 0.01695586  0.22624 0.8006033
 Soil:Soil.Mn  1 0.00000330        13 0.01695256  0.00253 0.9606255
```

Summary

```
Call: glm(formula = asin(sqrt(Co.Ratio/100)) ~ Soil * Soil.CEC + Soil *
Soil.pH + Soil * Soil.Fe + Soil * Soil.Mn, family = gaussian, data =
biomonitoring, na.action = na.omit)

Deviance Residuals:
        Min           1Q          Median          3Q        Max
 -0.0320297 -0.02368638 -2.775558e-017 0.01913472 0.07360268

Coefficients: (1 not defined because of singularities)
                      Value    Std. Error     t value
  (Intercept)  4.046597e-001 1.387894e+000  0.29156379
        Soil1 -5.527305e-002 1.486041e-001 -0.37194839
        Soil2 -1.467098e-002 1.387310e+000 -0.01057513
     Soil.CEC -2.863239e-003 4.656080e-003 -0.61494631
      Soil.pH -2.493936e-002 1.719363e-001 -0.14504994
      Soil.Fe  1.359586e-006 2.633004e-005  0.05163630
      Soil.Mn -6.183776e-005 1.459823e-004 -0.42359752
Soil1Soil.CEC  2.930371e-004 4.561521e-004  0.64241090
Soil2Soil.CEC -1.854530e-003 4.633594e-003 -0.40023576
 Soil1Soil.pH  5.429399e-003 2.206624e-002  0.24605001
 Soil2Soil.pH  5.614028e-003 1.720635e-001  0.03262765
 Soil1Soil.Fe  9.904579e-007 1.955465e-006  0.50650757
 Soil2Soil.Fe  1.777692e-006 2.640580e-005  0.06732205
 Soil1Soil.Mn -7.347102e-006 1.459823e-004 -0.05032871
 Soil2Soil.Mn             NA            NA          NA

(Dispersion Parameter for Gaussian family taken to be 0.001304 )

    Null Deviance: 0.065976 on 26 degrees of freedom

Residual Deviance: 0.0169526 on 13 degrees of freedom

Number of Fisher Scoring Iterations: 1
```