

***Welcome***

***Greg Patterson C.C.A.***

***President A&L Canada Laboratories***



# ***“Compost Quality”***



# Consumer of the Future

- Population dynamics - more and more people involved in use of compost
- Better educated on what is expected of organic materials
- Success of industry will be determined on the ability to deliver expected quality to the end user.



# Consumer Awareness

- Identifying the requirements of the end user
- Environmental quality standards are not the only quality concerns
- Product continuity across the country
- User friendly
- Product developed with the end use in mind



# Compost!!!!!!

What is  
compost?



Is it Potting Soil?



# ??Fertilizer or Soil ??



**OR**



# Typical Mineral Concentrations

● Parameter	● Concentration %
● Total Nitrogen	● 0.6
● Total Phosphorus	● 0.25
● Total Potassium	● 0.20
● Total Calcium	● 3.0
● Total Magnesium	● 0.3



# Quality Parameters for Finished Compost

	DESIRABLE
TOTAL N	0.60%
TOTAL P	0.25%
TOTAL K	0.20%
CALCIUM	3.00%
MAGNESIUM	0.30%
TOTAL OM	?>30%
C/N RATIO	<25
SALTS	<3.5
SAR	<5.0





<b><u>ENVIRONMENTAL HEALTH</u></b>	<b><u>QUALITY</u></b>	<b><u>AGRONOMIC</u></b>
<b>Environmental &amp; Health related Criteria</b>	<b>Product Quality Criteria</b>	<b>non government regulated or Recommended criteria</b>
<b>Tests</b>	<b>Describes the Characteristics of The compost produced</b>	<b>Relates to the plant available nutrients including phytotoxic levels</b>
<b><u>Tests:</u></b>	<b><u>Tests:</u></b>	<b><u>Tests:</u></b>
<b>Environmental analysis</b>	<b>C/N ratio</b>	<b>pH</b>
<b>Organics</b>	<b>Organic matter</b>	<b>Organic matter</b>
<b>Health related analysis: Microbiology Pathogens</b>	<b>Total nutrient elements</b>	<b>Available Nutrients</b>
	<b>Nitrogen</b>	<b>Nitrate Nitrogen</b>
	<b>Moisture</b>	<b>Moisture</b>
	<b>Soluble Salts</b>	<b>Soluble Salts</b>
	<b>PH</b>	<b>CEC</b>
	<b>NBD</b>	<b>Base saturation of cations</b>
	<b>WHC</b>	<b>Proportional equivalent of cations</b>
	<b>Particle size</b>	<b>Cation ratio</b>

# A & L CANADA LABORATORIES EAST, INC.

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100

## Certificate of Analysis

Client: Greg Patterson  
Account#: 67003  
Project: Compost Research

Report#: C99221-005  
Sample Matrix: Compost  
Date of Report: Aug. 30, 1999

Method I.D. Environmental Parameters

PARAMETERS	SAMPLE ID / RESULTS (ppm)	MAC	MDL
	Sample # 3	ug/g	ug/g
<i>Cadmium</i>	< 2.00	3.00	2.00
<i>Chromium</i>	6.40	50.0	1.00
<i>Cobalt</i>	1.90	25.0	1.00
<i>Copper</i>	6.90	60.0	1.00
<i>Lead</i>	4.30	150.0	2.00
<i>Molybdenum</i>	< 2.00	2.00	2.00
<i>Nickel</i>	5.00	60.0	1.00
<i>Zinc</i>	16.3	500.0	1.00

Results Authorized By: \_\_\_\_\_

Robert J. Deakin  
Laboratory Director





# Understanding Plant Nutrient Requirements

Report Date: 19/09/01

## COMPOST REPORT

Page: 4

Sample Number	Lab Number	pH	Lime Index	Total Organic Matter %	Available Organic Matter %	Phosphorus P ppm	Potassium K ppm	Magnesium Mg ppm	Calcium Ca ppm
4	12044	7.7	7.1	39.7	23.82	524	1981	618	10000

Sulfur S ppm	Zinc Zn ppm	Manganese Mn ppm	Iron Fe ppm	Copper Cu ppm	Boron B ppm	Sodium Na ppm	Nitrate-N NO <sub>3</sub> -N ppm	Soluble Salt ms/cm	Moisture %
371	30.6	34	161	2.8	2.1	476	15	3.1	56.1

## INTERPRETATION

CEC meq/100g	Percent Base Saturation % BS					Proportional Equivalents (meq)				Cation Ratio		C/N Ratio
	% K	% Mg	% Ca	% Na	K	Mg	Ca	Na	Mg/K	Ca/Mg		
62.2	100.0	8.16	8.17	80.35	3.33	5.08	5.08	50.00	2.07	1:1	10:1	
<i>Optimum Range:</i>		3 - 5	8 - 20	60 - 80		0.5 - 1.3				7:1	5:1	

\* Crop yield is influenced by a number of factors in addition to soil fertility. No guarantee or warranty concerning crop performance is made by

\* Results reported on a dry weight basis.

\* NO<sub>3</sub>-N as received.

**C:N 30.7**

# Classification of the essential elements

- Bulk structural elements
  - Carbon (C), hydrogen (H), oxygen (O), phosphorus (P) and sulfur (S)
  - Calcium (Ca), chlorine (Cl), potassium (K), magnesium (Mg), sodium (Na)
  - Copper (Cu), iron (Fe), and zinc (Zn), manganese (Mn), molybdenum (Mo), nickel (Ni)
  - Arsenic (As), boron (B), fluorine (F), iodine (I), and selenium (Se)
  - Cadmium (Cd), chromium (Cr), cobalt (Co), lead (Pb), manganese (Mn), molybdenum (Mo), nickel (Ni), tin (Sn), vanadium (V)
- Macroelements
- Trace elements
- Ultratrace elements
  - Non-metals
- Metals



# Heavy metal vs micro-nutrient

## Heavy metal

- Cadmium
- Chromium
- Mercury
- Lead
- Cobalt
- Selenium

## Micro-nutrient

- Boron
- Copper
- Iron
- Manganese
- Molybdenum
- Nickel
- Zinc



*“The Need!”*



# Quality Assurance and Standardization within the Industry

- **Accreditation and Certification**
  - Provincial
  - Federal
- **Industrial Standardization across**
  - Municipalities
  - Provinces
  - Countries



ALLIANCE DE LA QUALITÉ  
**COMP**  **ST**  
QUALITY ALLIANCE

Composting  
Council of Canada

## Compost Quality Alliance

- **Objective of CQA**

- To introduce a voluntary industry quality & reporting program for compost





ALLIANCE DE LA QUALITÉ  
**COMPOST**  
QUALITY ALLIANCE

Composting  
Council of Canada

## Compost Quality Alliance

- **Purpose** – Improve Customer Confidence in compost selection and utilization, and Enhance Compost’s Position as a mainstream horticultural, agricultural, and retail product.
  - By On-going testing – providing assurance to customers that products are tested on an on-going basis
  - Provide End Use Instructions – providing educational information to customers, via end-use instructions
- **Goal:** Improve “field results” and user confidence.



## Finished Compost Testing

Testing the final product for environmental parameters is mandatory and goes without question. However the final product should be tested for its quality as it applies to end use. In most cases compost is used to support some sort of plant life in many applications from topdressing to soil remediation. A compost may pass all the mandatory criterion for environmental concerns and still be worthless to the end user. A&L has designed a test (S8C) that will assist in the interpretation of the analysis of the finished compost in it's ability to support plant growth.

Routine testing of Compost feed stocks is also a good idea so that recipes for blends can be made, looking at C:N ratio combinations that will work the best and identifying possible contaminants that may be present. Feed stock testing need not be as intensive but again will help to identify materials that work best in the final blend. (see compost fee schedule for descriptions of test and pricing).

ENVIRONMENTAL HEALTH	QUALITY	AGRONOMIC
Environmental & health related Criteria	Product Quality Criteria	Non government regulated or recommended criteria
TESTS	Describes the Characteristics of The Compost produced	Relates to the plant available nutrients including phytotoxic levels
Environmental Analysis	C:N	pH
Organics	Organic Matter	Organic matter
Health related analysis,/ microbiology, pathogens	Total nutrient elements	Plant Available elements and ranges
	Nitrogen	Nitrate Nitrogen
	Moisture	Moisture
	Soluble Salts	Soluble Salts
	pH	C.E.C.
	NBD	Base saturation of cations
	WHC	Proportional equivalent of cations
	Particle size	Cation ratio
		Na and %Na
		C:N
		Lime index



# Product Description

- All products would fall into a category of some description



<b>USE</b>	<b>pH</b>	<b>C/N ratio</b>	<b>Moisture</b>	<b>Particle size</b>	<b>Soluble salts</b>	<b>%Na</b>
<b>Remediation</b>	<b>5.8-8.5</b>	<b>10-40</b>	<b>NA</b>	<b>&lt;2 inch</b>	<b>&lt;20</b>	<b>&lt;3%</b>
<b>Soil Amendment</b>	<b>5.8-8.5</b>	<b>10-30</b>	<b>NA</b>	<b>&lt;1/2 inch</b>	<b>&lt;6</b>	<b>&lt;2%</b>
<b>Landscaping</b>	<b>5.8-8.5</b>	<b>12-22</b>	<b>&lt;50%</b>	<b>&lt;1/2 inch</b>	<b>&lt;5</b>	<b>&lt;2%</b>
<b>Planting Media</b>	<b>5.5-7.8</b>	<b>12-22</b>	<b>&lt;50%</b>	<b>&lt;1/2 inch</b>	<b>&lt;4</b>	<b>&lt;2%</b>
<b>Turf Topdressing &amp; establishment</b>	<b>5.8-7.8</b>	<b>12-22</b>	<b>&lt;50%</b>	<b>&lt;3/8 inch</b>	<b>&lt;3</b>	<b>&lt;1%</b>
<b>Potting Soil</b>	<b>5.5-7.2</b>	<b>12-22</b>	<b>&lt;50%</b>	<b>&lt;1/4 inch</b>	<b>&lt;2</b>	<b>&lt;1%</b>



# COMPOST END USE COMMERCIAL

USE	SALT INDEX	PARTICLE SIZE	pH	C/N	Moisture	% Na
Landscaping	<6	<1/2	6-7	12-22	<50%	<1%
Potting Soil	<2	<1/2	6-7	12-22	<25%	<.5%
Greenhouse Soil seeding	<2	<1/4	6-7	12-22	<25%	<.5%
Greenhouse Soil established	2-3.5	<1/2	6-7	12-22	<30%	<.5%
Top dressing	<5	<1/4	6-8	12-22	<30%	<1%
Home owner use Amendment	<6	<1/2	6-7.5	10-30	<40%	<1%
Home owner use Planting media	<3.5	<1/2	6-7	12-22	<30%	<.5%
Field nursery	<3.5	<1/2	5.8-8	10-30	<50%	<1%
Soil amendment	<20	<1/2	5.8-8	10-30		
Bulk	<20	<1/2	5.5-8	10-30		
Agricultural Soil amendment	<20	<1/2	6-8	10-30	<50%	
Remediation	<20	<1/2	5.8-8	10-40		





# 1 Understanding Plant Nutrient Requirements

Report Date: 19/09/01

## COMPOST REPORT

Page: 1

Sample Number	Lab Number	pH	Lime Index	Total Organic Matter %	Available Organic Matter %	Phosphorus P ppm	Potassium K ppm	Magnesium Mg ppm	Calcium Ca ppm
1	12041	6.5	6.7	36.5	21.90	94	326	386	4724

Sulfur S ppm	Zinc Zn ppm	Manganese Mn ppm	Iron Fe ppm	Copper Cu ppm	Boron B ppm	Sodium Na ppm	Nitrate-N NO <sub>3</sub> -N ppm	Soluble Salt ms/cm	Moisture %
182	5.0	10	302	4.1	1.4	10	148	3.0	41.8

## INTERPRETATION

CEC meq/100g	Percent Base Saturation % BS	Percent Base Saturation				% Na	Proportional Equivalents (meq)				Cation Ratio		C/N Ratio
		% K	% Mg	% Ca	% Na		K	Mg	Ca	Na	Mg/K	Ca/Mg	
27.7	100.0	3.02	11.47	85.35	0.16	0.84	3.17	23.62	0.04	4:1	7:1		
<i>Optimum Range:</i>		3 - 5	8 - 20	60 - 80		0.5 - 1.3				7:1	5:1		

\* Crop yield is influenced by a number of factors in addition to soil fertility. No guarantee or warranty concerning crop performance is made by A & L.

\* Results reported on a dry weight basis.

\* NO<sub>3</sub>-N as received.

ALLIANCE DE LA QUALITÉ  
**COMP**  **ST**  
QUALITY ALLIANCE

Composting  
Council of Canada

## Compost Quality Alliance

- **Benefits to the Industry –**

- To develop a category marketing program based on product quality criteria, thereby enhancing the appropriate and trusted use of the compost products offered in the marketplace
- To establish a workable “rule book” that will enable the industry to manage itself and reduce the impact of inappropriate individual facility behavior





- The use of standard methods and protocols for sampling, analysis, reporting, and interpretation of test results will promote production and marketing of quality composts that meet a core set of analytical standards.
- The methods and standards in the TMECC form the basis for the Canadian Compost Council's grant from the C.F.I.A. to develop the Compost Quality Alliance for the commercial composting Industry.





# Quality Assurance and Standardization within the Industry

- **DIFFERENCE IN LABORATORY RESULTS**
  - METHODS
  - LABORATORY PROTOCOL
  - SAMPLE HANDLING IN THE FIELD
- **CAEAL**
- **NAPTA**
- **CAP Compost Analysis Proficiency**



- **A&L Handbook for interpretation of compost quality and intended use**



## COMPOST

### NUTRITIONAL MANAGEMENT PROGRAM



**A & L CANADA LABORATORIES**



- **A&L Handbook for interpretation of compost quality and intended use**

# Compost Management

Compost Analysis for Available Nutrients and Soil Suitability Criteria and Evaluation



Note: The following pages on "Nutrient Identification" analysis, are data conceived and developed by A&L Canada Laboratories and their affiliates: specifically for the Compost Industry.  
The use of this analysis is now available for those wishing not to just maintain, but to advance in the quest for quantifying the value of their compost as a growth media.

## Tests Required to Monitor the Compost Process

### **Basic Monitoring Analysis**

Temperature, Moisture, C:N Ratio, pH

### **Basic Monitoring Analysis Plus**

Total nitrogen, Total Phosphorus, Total Potassium, pH, Organic Matter, C:N, Sodium, Moisture, Ash, Organic Carbon, Bulk Density.

### **Soil Suitability Testing of Compost**

This test is the same one used for finished compost. The information on this test will help in understanding feedstock materials and blending to achieve the desired finished product.

### **Sampling Procedure See appendix D**

## CQA Product Quality Test Requirements

USE	pH	C/N ratio	Moisture	Particle size	Soluble salts	%Na
Remediation	5.8-8.5	10-40	NA	<2 inch	<20	<3%
Soil Amendment	5.8-8.5	10-30	NA	<1/2 inch	<6	<2%
Landscaping	5.8-8.5	12-22	<50%	<1/2 inch	<5	<2%
Planting Media	5.5-7.8	12-22	<50%	<1/2 inch	<4	<2%
Turf Topdressing & establishment	5.8-7.8	12-22	<50%	<3/8 inch	<3	<1%
Potting Soil	5.5-7.2	12-22	<50%	<1/4 inch	<2	<1%

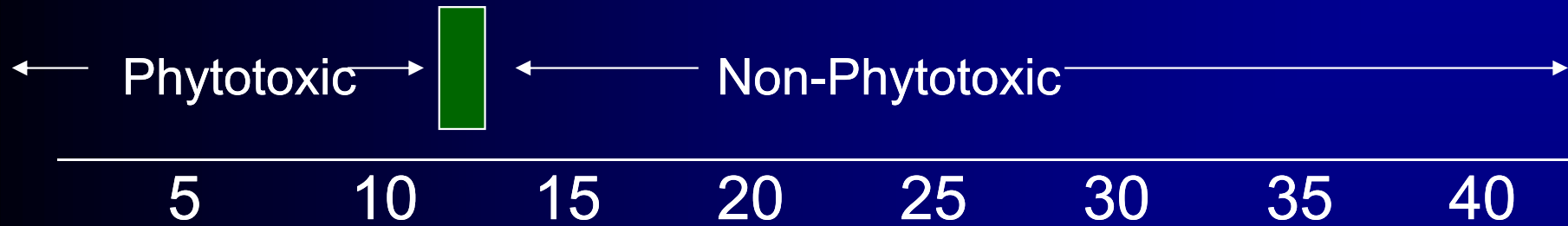
*(table 3a)*

addition will proceed at a slow rate.

(table 1b)

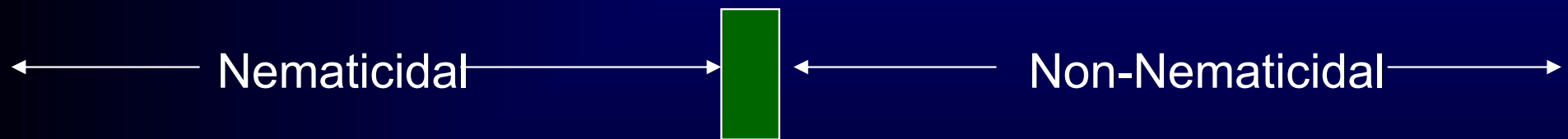
<b>Material High in Carbon</b>	<b>C/N Ratio</b>
autumn leaves	30-80:1
straw	40-100:1
wood chips or sawdust	100-500:1
bark	100-130:1
mixed paper	150-200:1
newspaper or corrugated cardboard	560:1
<b>Materials High in Nitrogen</b>	
vegetable scraps	15-20:1
coffee grounds	20:1
grass clippings	15-25:1
manure	5-25:1

# CARBON:NITROGEN RATIO



C:N ratio

**Carbon to Nitrogen ration must be  $\leq 25$  and  $> 12$**



Schematic representation of the relationship between the C:N ratio of an organic amendment, nematocidal activity and phytotoxicity. (From Rodriguez-Kabana et al, 1987)



### Soluble Salt (EC)

<b>Very low</b>	<b>0-.75</b>	May be used as a planting media directly, will require some nutrient addition for plant growth.
<b>Acceptable</b>	<b>.75-2.0</b>	May be used directly as a media for small plants and seeding.
<b>Medium</b>	<b>2.0-3.5</b>	May be used for transplanting potted plants and mature plants with high nutrient demand. In applications with tender plants may need to be diluted with 25 to 50% soil.
<b>Medium high</b>	<b>3.5 - 5</b>	Can be used for topdressing established plants or blended in as a soil amendment to gardens or soils 2-1 to 5-1.
<b>High</b>	<b>5 - 10</b>	Used as a soil amendment and will require diluting with existing soil depending on the use 4-1 up to 10-1 for more sensitive plantings.
<b>Very high</b>	<b>&gt;10</b>	Use only at low application rates in areas of plantings that do not have salt sensitivity.



# Sodium

## *Sodium cont'd*

Only a few plant species can tolerate high sodium levels and for the most part sodium levels greater than 1% saturation in media are toxic to root systems. Sodium competes with calcium and potassium uptake and damages root tissue when in excess. A reading of greater than 1% saturation of sodium on the exchange complex causes germination and emergence problems for a number of plants. This indication of sodium availability will suggest possible damage to plant growth long before a calculated SAR may suggest problems.



Report Number: C01106-012  
 Account Number: 67003

# A & L CANADA LABORATORIES EAST, INC.

2136 Jetstream Road • London, Ontario N5V 3P5 • Tel: 519/457-2575 Fax: 519/457-2664



To: GREG PATTERSON  
 2136 JETSTREAM ROAD  
 LONDON, ON N5V 3P5

For:

Report Date: 20/04/01

## COMPOST REPORT

Page: 1

Sample Number	Lab Number	pH	Lime Index	Total Organic Matter %	Available Organic Matter %	Phosphorus P ppm	Potassium K ppm	Magnesium Mg ppm	Calcium Ca ppm
1	13042	6.0	6.2	16.8	10.08	184	459	331	2392

Sulfur S ppm	Zinc Zn ppm	Manganese Mn ppm	Iron Fe ppm	Copper Cu ppm	Boron B ppm	Sodium Na ppm	Nitrate-N NO <sub>3</sub> -N ppm	Soluble Salt ms/cm	Moisture %
36	5.0	68	210	1.5	1.0	65	80	1.6	34.2

## INTERPRETATION

CEC meq/100g	Percent Base Saturation % BS					Proportional Equivalents (meq)					Cation Ratio		C/N Ratio
	% BS	% K	% Mg	% Ca	% Na	K	Mg	Ca	Na	Mg/K	Ca/Mg		
17.7	91.0	6.63	15.34	67.41	1.59	1.18	2.72	11.96	0.28	2:1	4:1	21.7	
<i>Optimum Range:</i>		3 - 5	8 - 20	60 - 80		0.5 - 1.3				7:1	5:1		

\* Crop yield is influenced by a number of factors in addition to soil fertility. No guarantee or warranty concerning crop performance is made by A & L.

\* Results reported on a dry weight basis.

\* NO<sub>3</sub>-N as received.

A&L Canada is a laboratory accredited by Standards Council of Canada / CAEAL and OMAFRA.







# Sodium Research on Compost

*“Understanding Sodium Levels in Compost”*



E21 – 4.5% Na

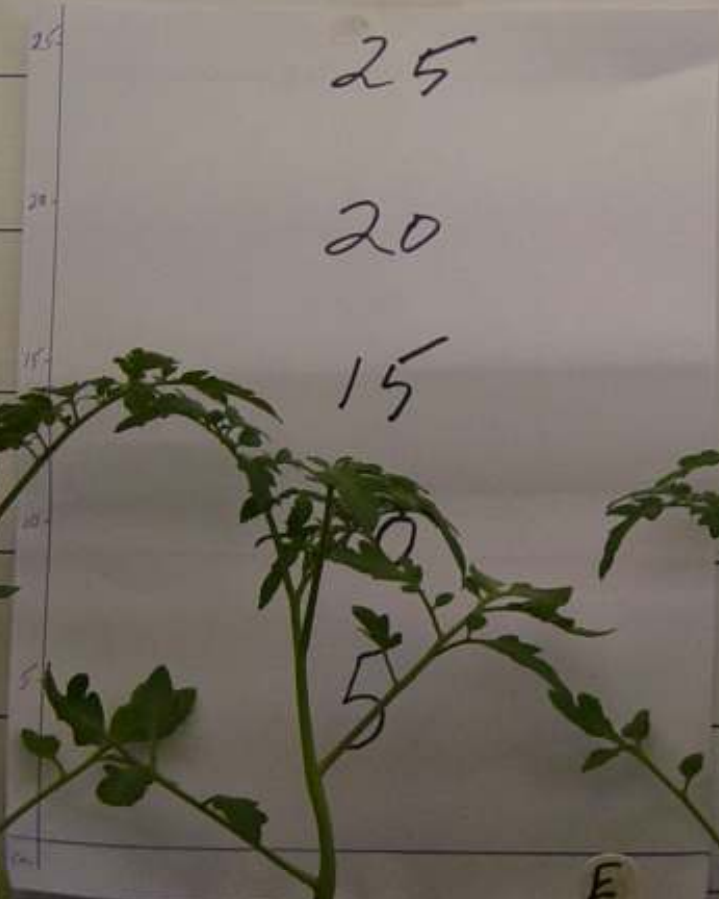
vs.

Check - 1.7% Na

Day

1

Tomato



25

20

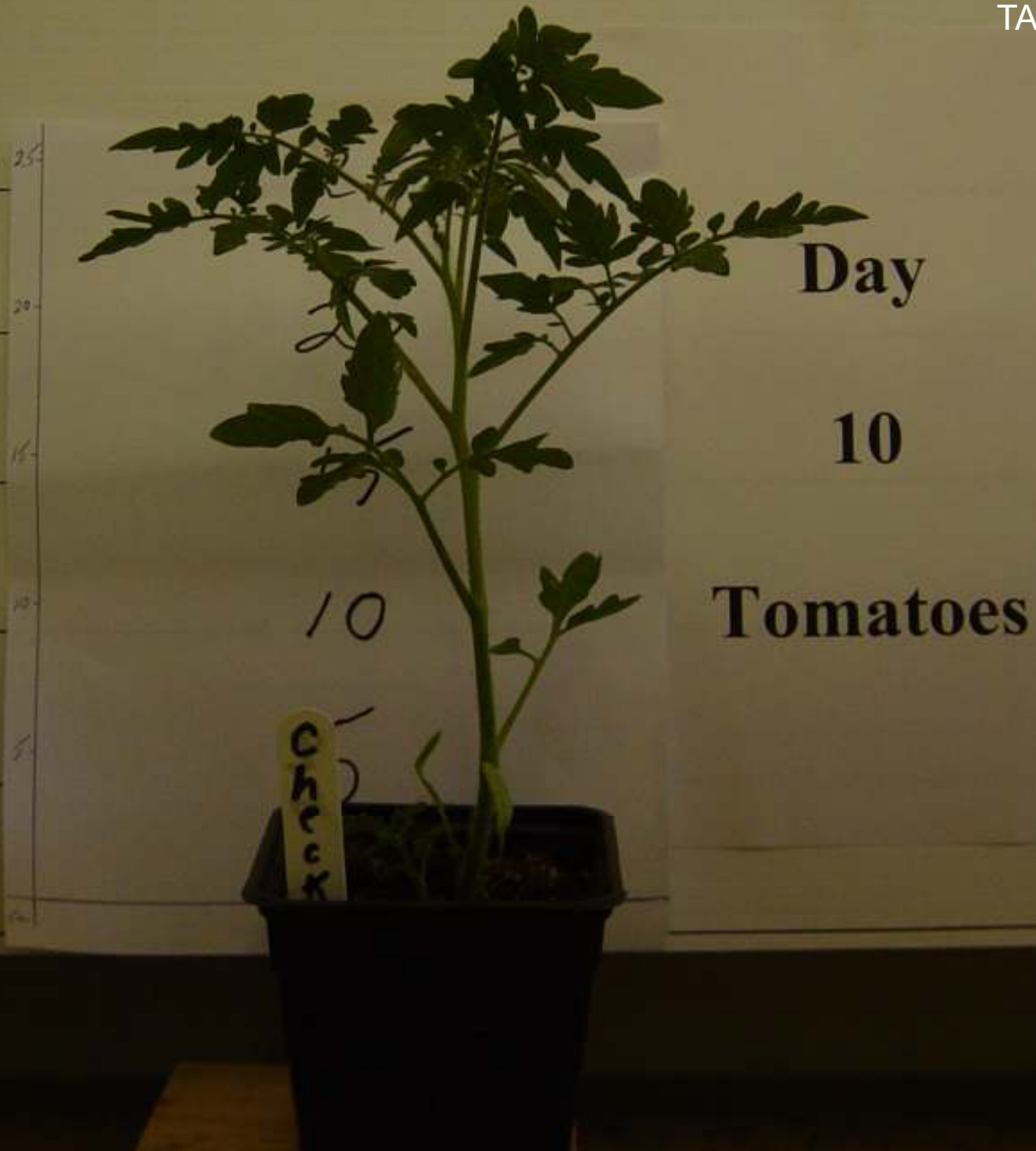
15

10

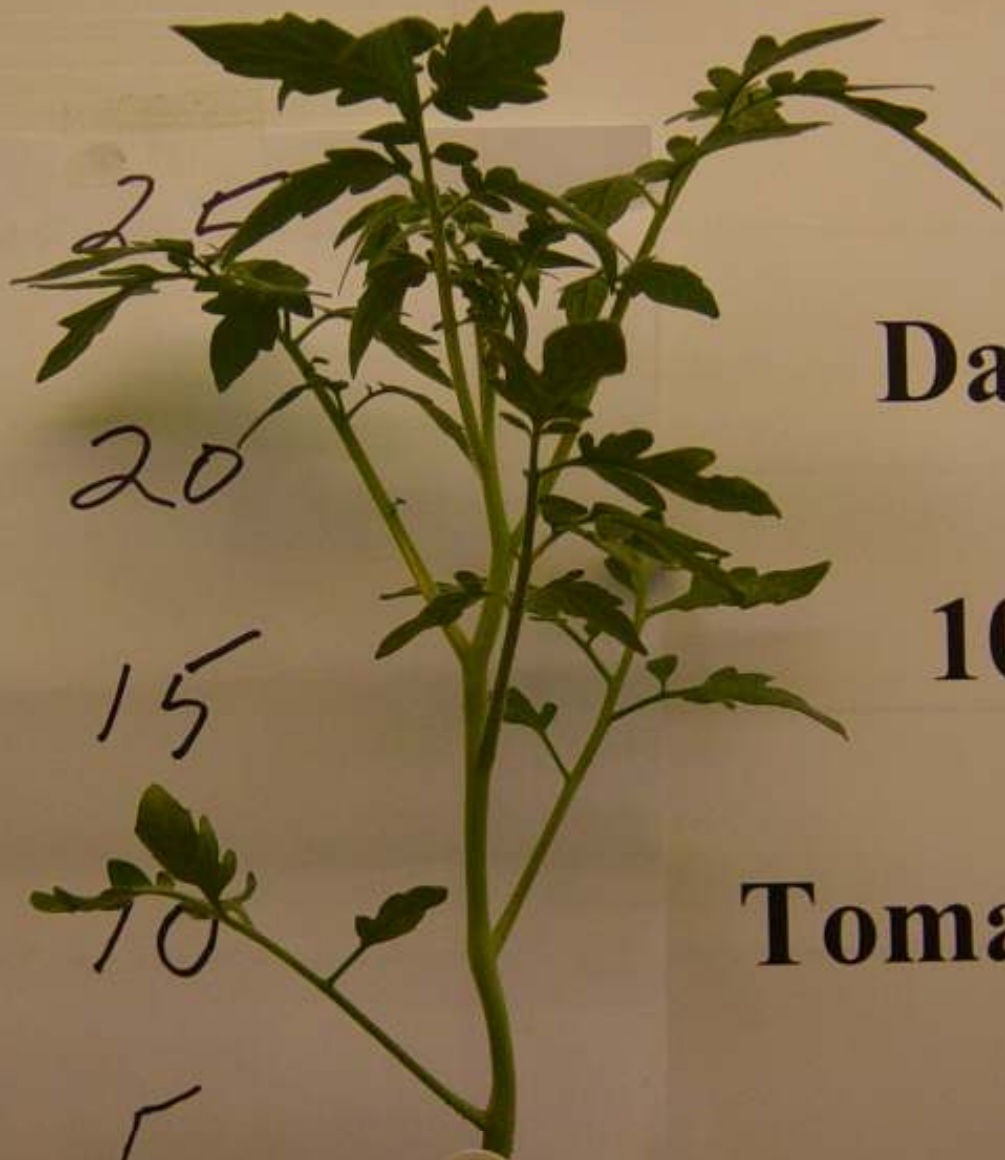
5



Check - 1.7% Na  
TALL



C21 - 2.7% Na



25  
20  
15  
10  
5

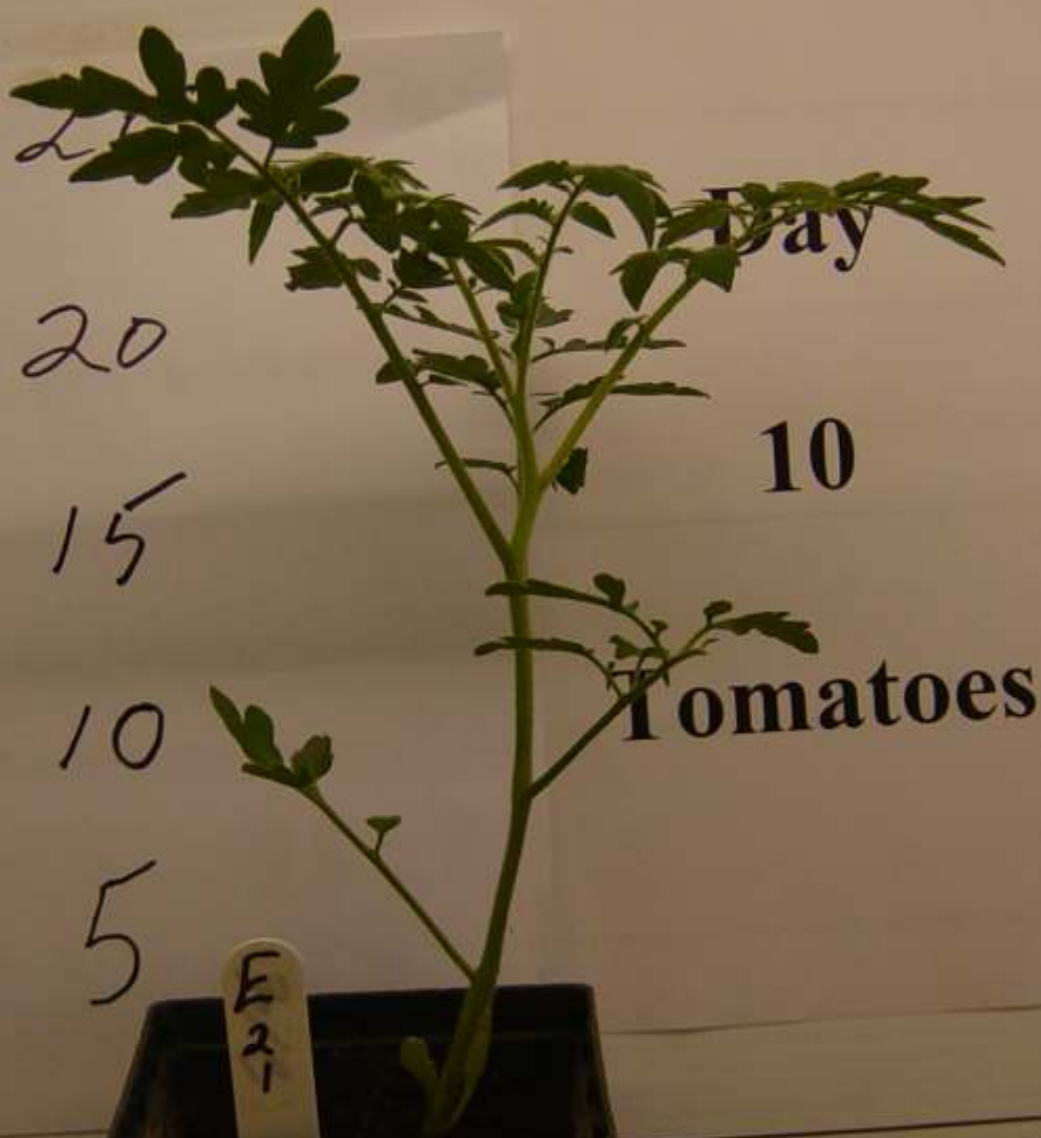
**Day**

**10**

**Tomatoes**

C21





E21 – 4.5% Na

No big difference yet  
after 10 days

Check – 1.7% Na vs. E21 – 4.5% Na

Check

Tomato

- Shorter 40cm.
- Chlorotic
- Thin



E21

Tomato

- Tall 50cm.
- Dark Green
- Fuller



25

20

15

10

5

## Check – 1.7% Na vs. E21 – 4.5% Na



### 120 DAYS

**Check** – Shorter, chlorotic and thin, but the root is bigger than **E21**

**E21** – Taller by 50cm, dark green and fuller, however the root is very small.

#### Tissue Analysis:

%Na **Check** – 0.06%

%Na **E21** – 0.92%

#### Soil Analysis:

**Check** - 1.5% Na

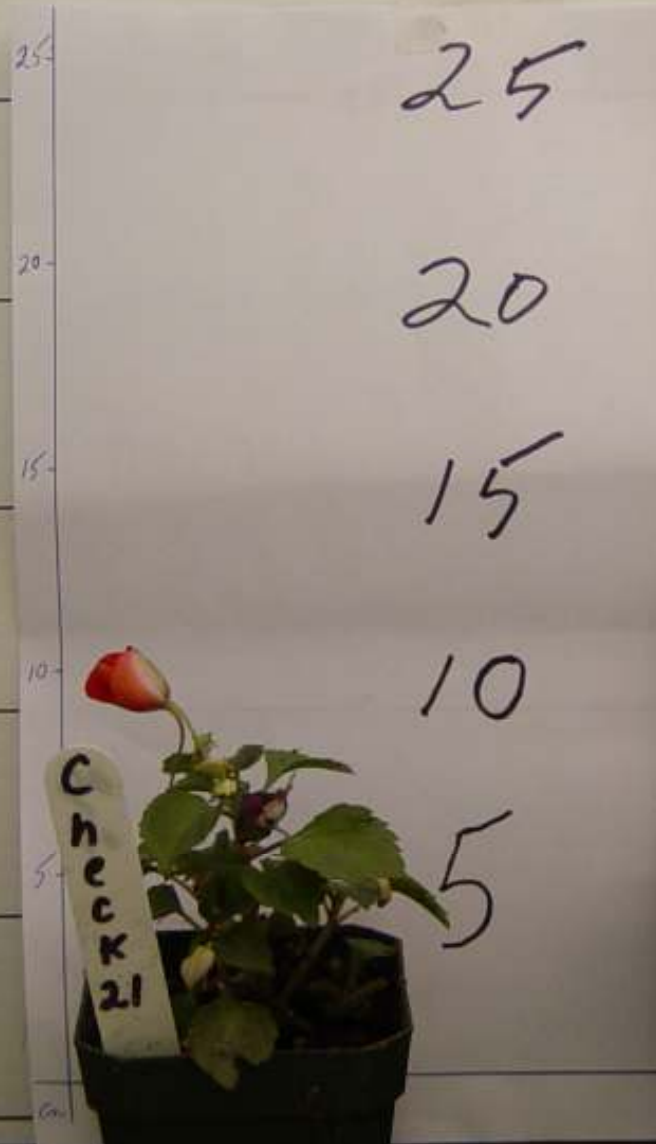
**E21** – 2.4% Na



**E21 – 4.5% Na**

vs.

**Check - 1.7% Na**



**Day**

**1**

**Impatiens**

Check - 1.7% Na

Lots of flowers and buds

25

Day

20

10

15

10

Impatiens

Check  
21



D21Ca – 3.8% Na

Day

10

Impatiens

25

20

15

10

5



20

15

10

5

E  
2  
1



**Day**

**10**

**Impatiens**

**E21 – 4.5% Na**

20

20

**Grass D** – 1.9% Na, 85% Emergence

VS.

**Grass B** – 7.2% Na, 15% Emergence

15

D

10

B

5





## CUCUMBERS

### H vs B

B sample is poor vs H, B is less developed and shorter

**H Soil:** % base sat. sodium 2.1 %.

**B Soil:** % base sat. sodium 7.2 %.



20

15

10

5



## CUCUMBERS

25Comp/75 Soil - very sensitive to compost

Soil: % base sat. sodium  
2.1 %.



# Sodium Trials

7 days after transplanting  
5.53% Na



2.21%Na  
52.58%Ca



1.56%  
62.52%Ca



2.2%Na  
52.58%Ca



1.31%Na  
87.96%Ca



1.05%Na  
49.81% Ca



2.21%Na

2.15%Na

5.53%Na

Sodium Trials



**Thank You**

*Greg Patterson C.C.A.*

*President A&L Canada Laboratories*

*[www.alcanada.com](http://www.alcanada.com)*

