

Utah State University

DigitalCommons@USU

---

Phytoremediation

Research

---

2000

## Characterization of Root Exudates From Crested Wheatgrass (*Agropyron cristatum*)

A. Henry

*Utah State University*

J. Chard

*Utah State University*

B. Doucette

*Utah State University*

J. Norton

*Utah State University*

Bruce Bugbee

*Utah State University*, [bruce.bugbee@usu.edu](mailto:bruce.bugbee@usu.edu)

R. Hess

*INEEL*

Follow this and additional works at: [https://digitalcommons.usu.edu/cpl\\_phytoremediation](https://digitalcommons.usu.edu/cpl_phytoremediation)



[next page for additional authors](#)  
Part of the [Plant Sciences Commons](#)

---

### Recommended Citation

Henry, A.; Chard, J.; Doucette, B.; Norton, J.; Bugbee, Bruce; Hess, R.; and Palmer, C., "Characterization of Root Exudates From Crested Wheatgrass (*Agropyron cristatum*)" (2000). *Phytoremediation*. Paper 1.

[https://digitalcommons.usu.edu/cpl\\_phytoremediation/1](https://digitalcommons.usu.edu/cpl_phytoremediation/1)

This Presentation is brought to you for free and open access by the Research at DigitalCommons@USU. It has been accepted for inclusion in Phytoremediation by an authorized administrator of DigitalCommons@USU. For more information, please contact [digitalcommons@usu.edu](mailto:digitalcommons@usu.edu).



---

**Authors**

A. Henry, J. Chard, B. Doucette, J. Norton, Bruce Bugbee, R. Hess, and C. Palmer

**A. Henry, J.Chard, B. Doucette,**

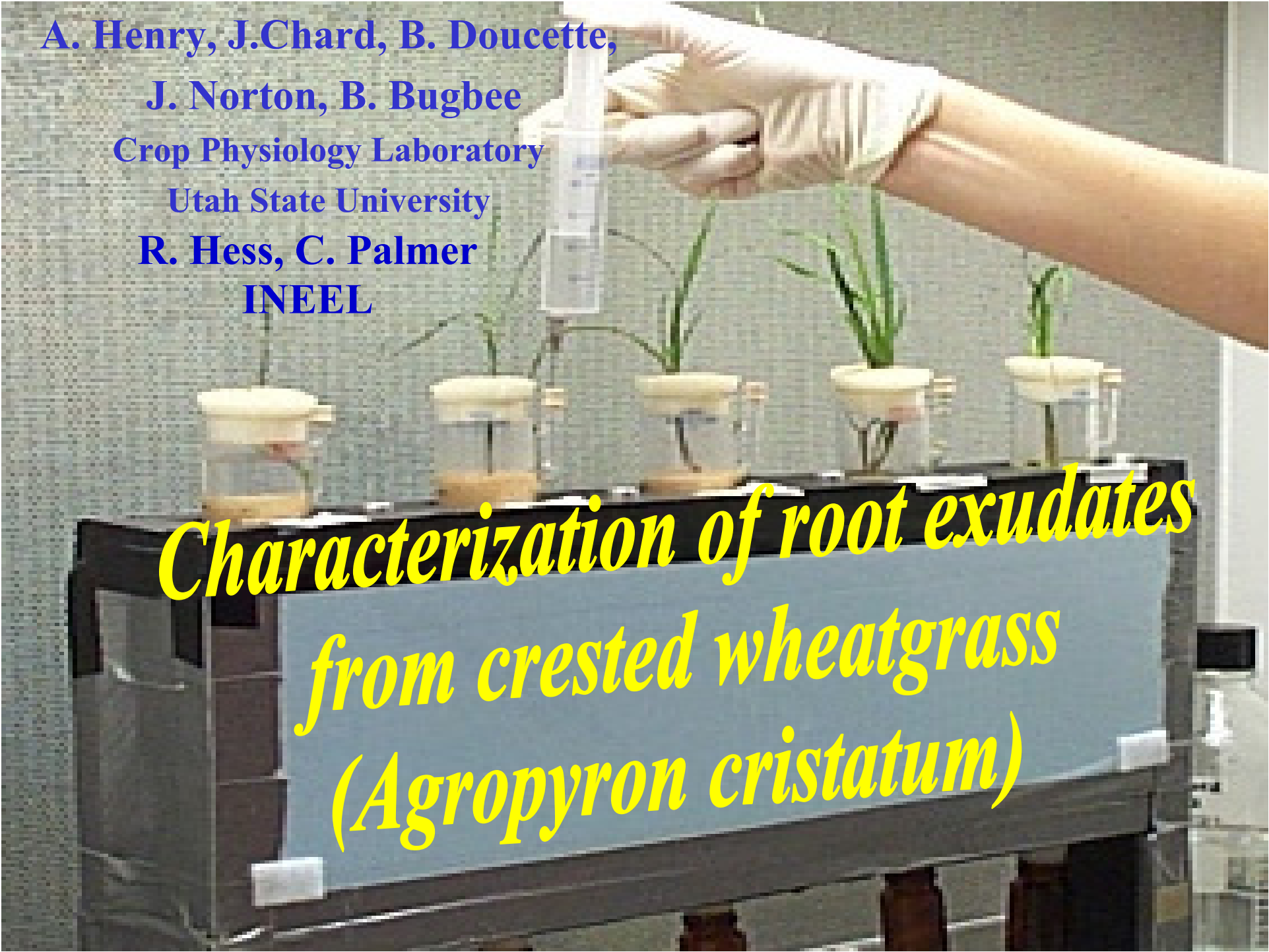
**J. Norton, B. Bugbee**

**Crop Physiology Laboratory**

**Utah State University**

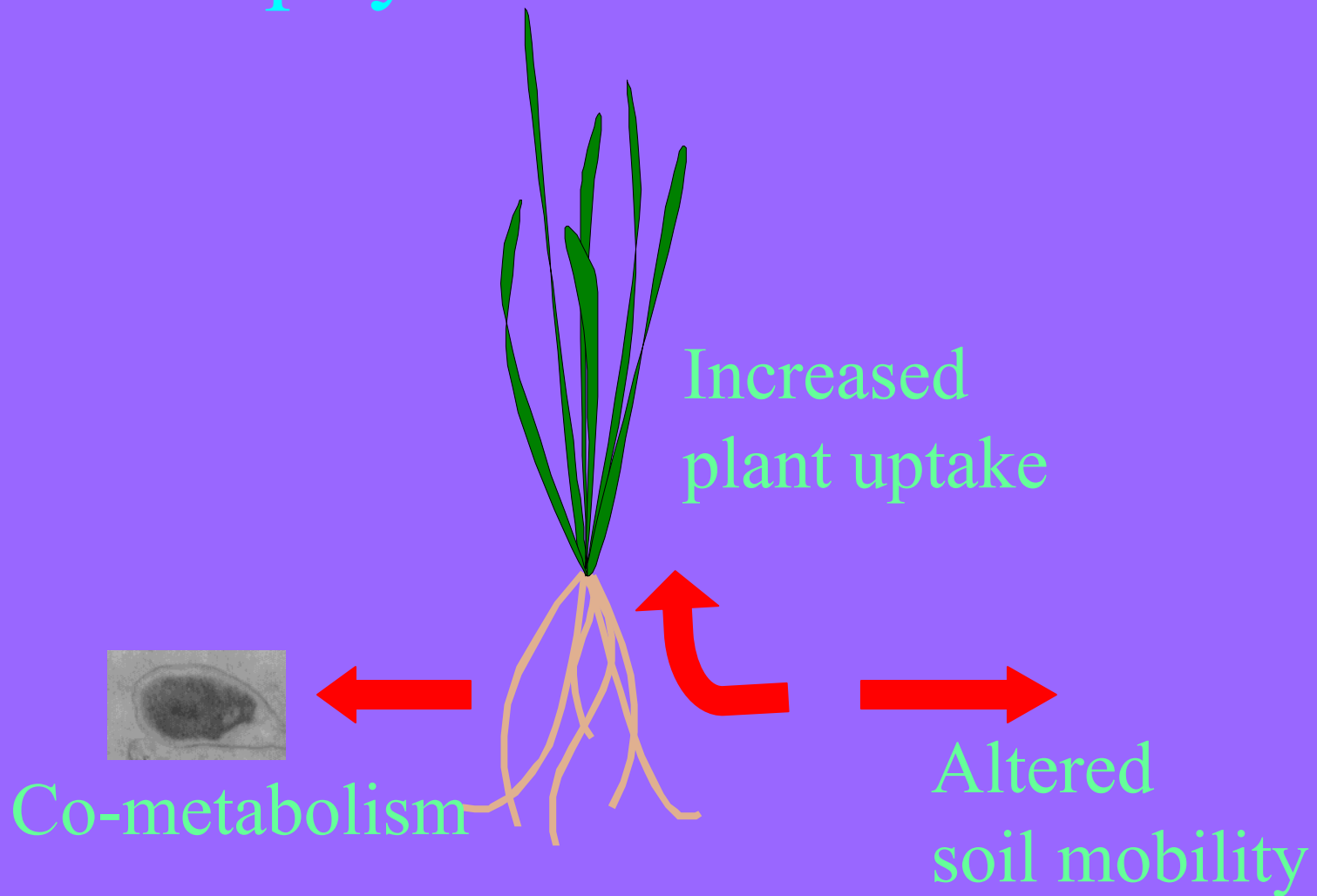
**R. Hess, C. Palmer**

**INEEL**



***Characterization of root exudates  
from crested wheatgrass  
(*Agropyron cristatum*)***

# Exudates are important to phytoremediation

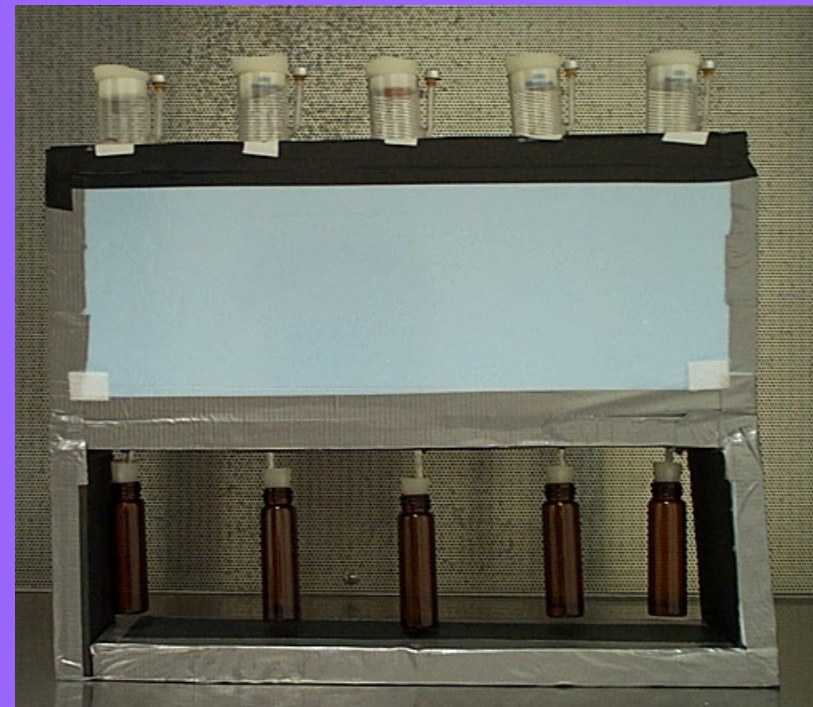
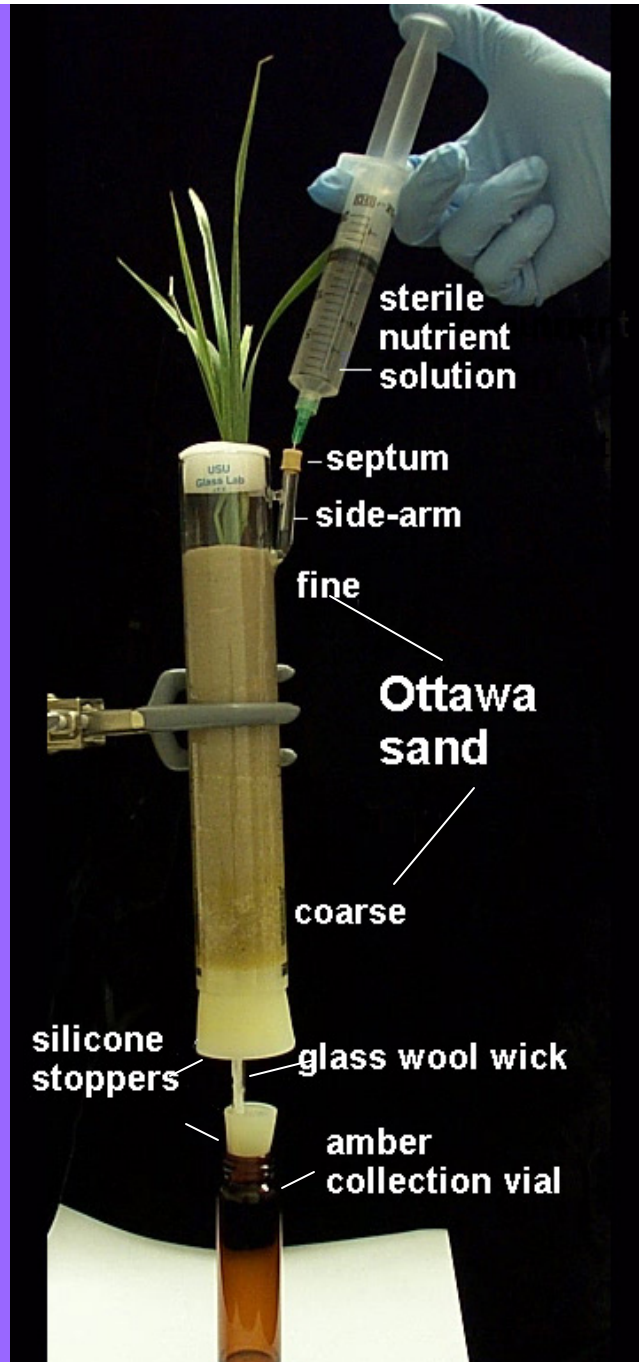


# Objectives

1. Develop cultural system to grow healthy plants
2. Develop procedures for aseptic culture of:
  - a. Seeds
  - b. Plants
3. Develop procedures to manipulate exudation with:  
 $K^+$ ,  $NH_4^+$ ,  $O_2$ ,  $H_2O$
4. Develop procedures to quantify exudates
  - a. TOC
  - b. GC-MS, HPLC, ion chromatography



# Plant Growth Containers



# Growing healthy plants: Materials and Methods

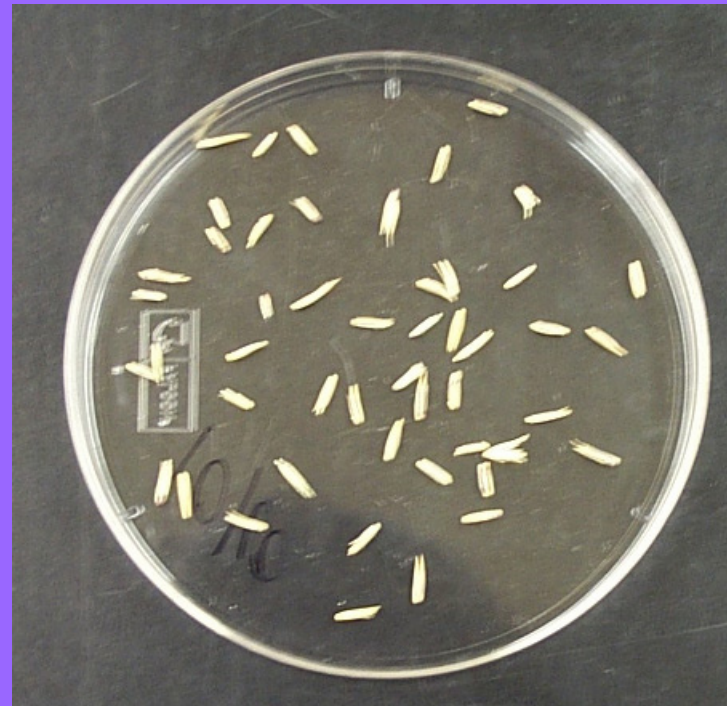
- Nutrient solution: standard hydroponic solution, no chelate
- Growth medium: Ottawa sand
- Photoperiod: 16 hours



# Techniques for sterilizing seeds



20% Clorox for 60  
minutes

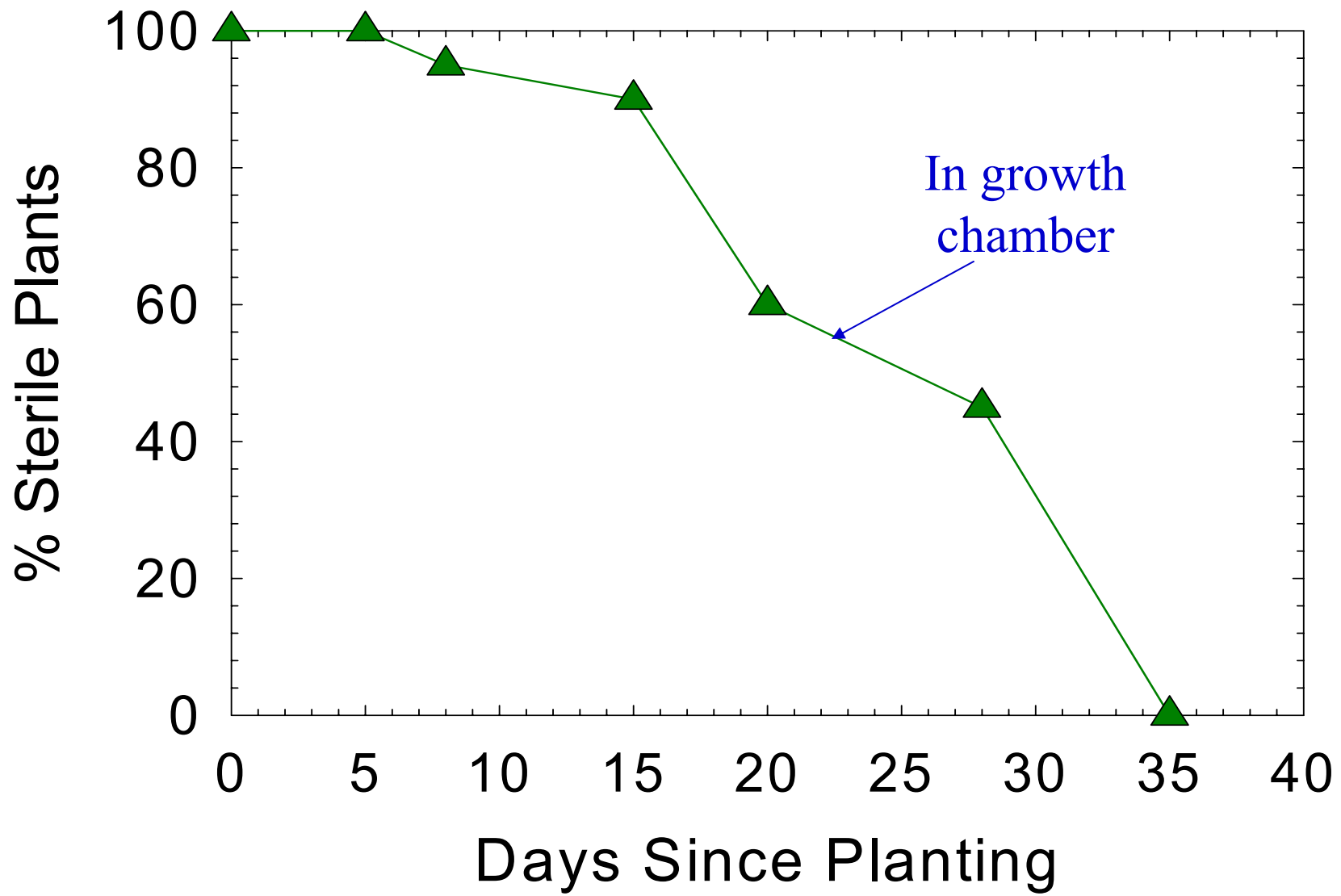


Rinse and plate on media  
for 3-5 days



Assessing microbial contamination in the columns





Plants are now grown in a  
laminar flow hood

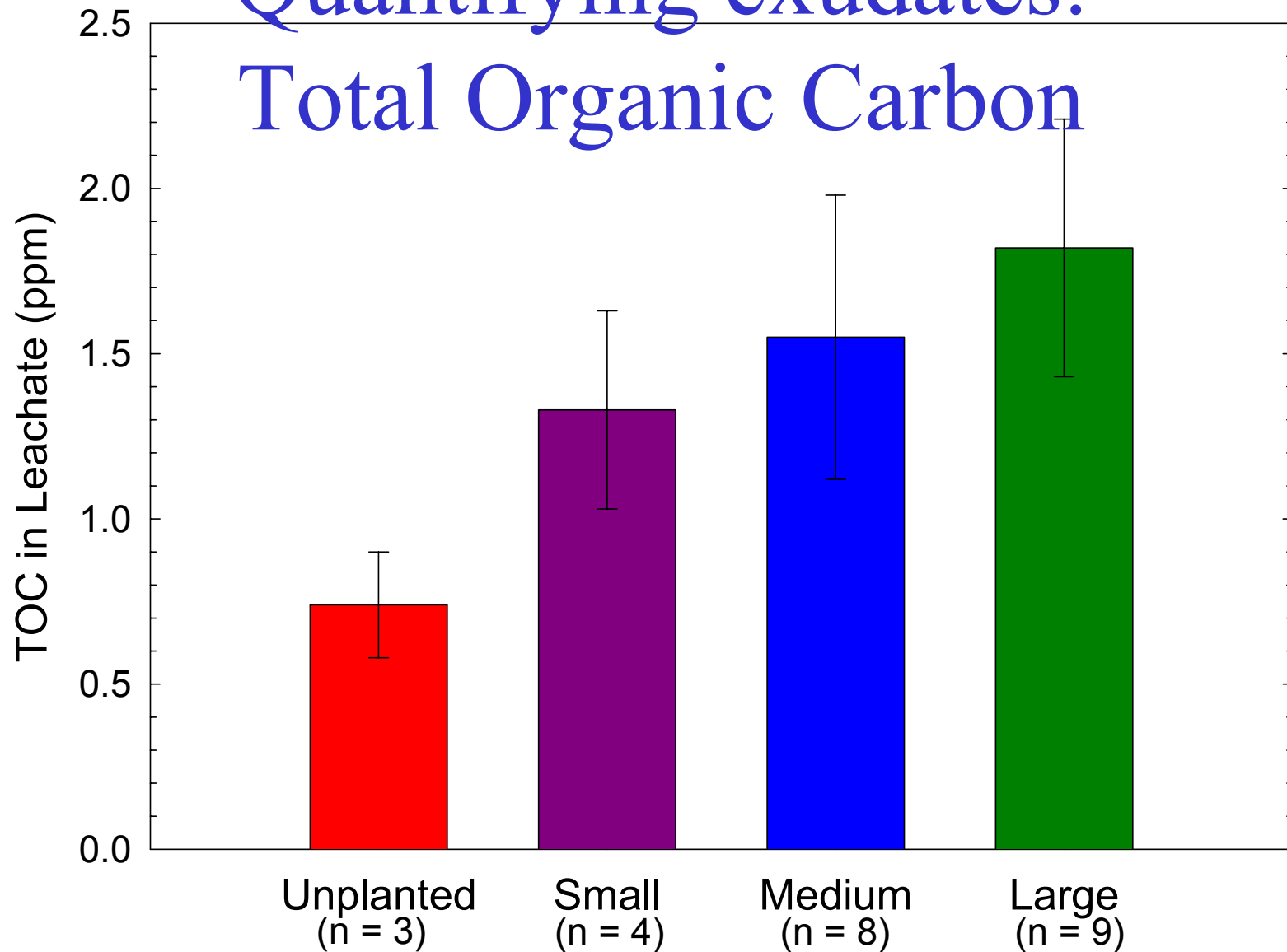


# Increasing Exudation

- Changing  $\text{NH}_4^+:\text{NO}_3^-$  ratio
- $\text{K}^+$  stress:  $5 \rightarrow 1 \text{ mM K}^+$
- Drought stress
- Hypoxia: flooding



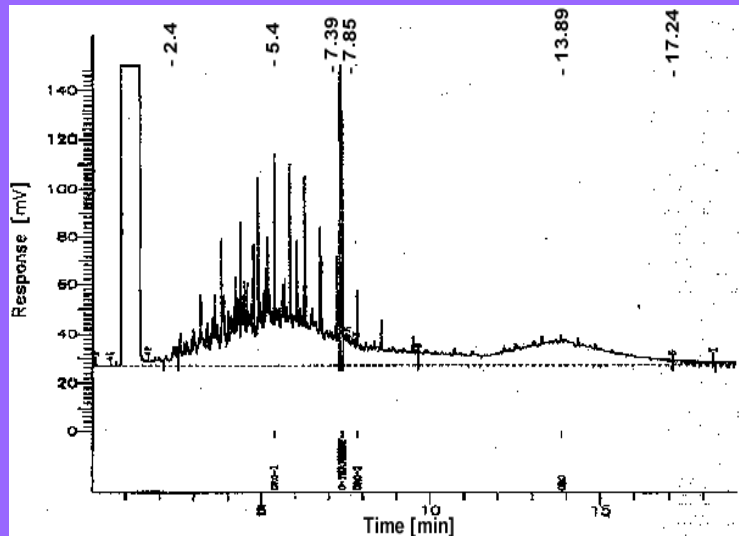
# Quantifying exudates: Total Organic Carbon



# Carbon Associated with glass wool

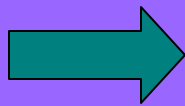
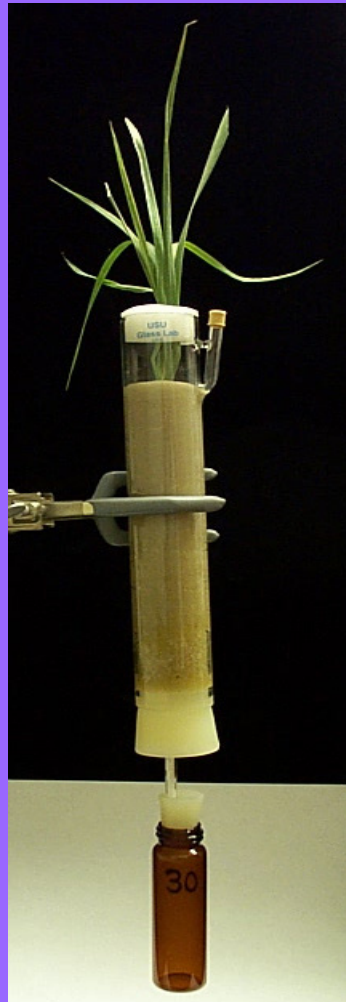


# Quantifying exudates: GC-MS, HPLC, ion chromatography



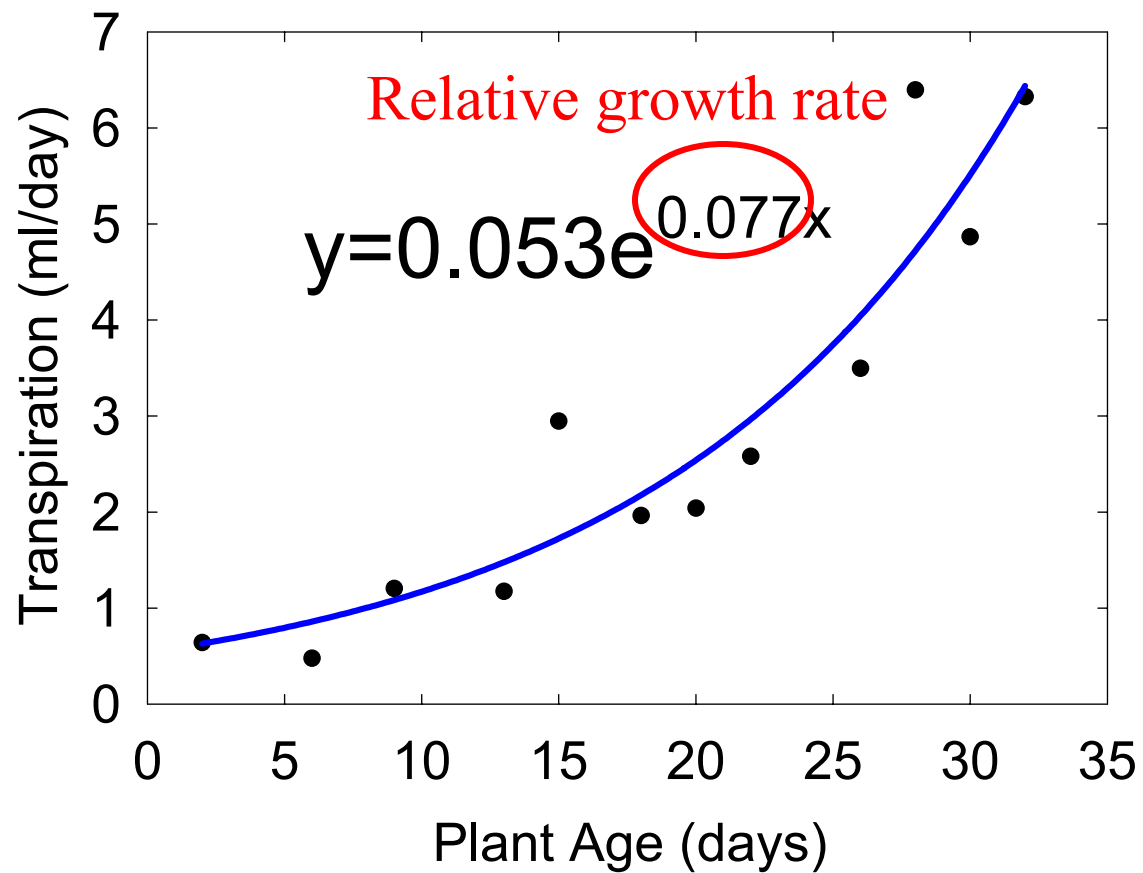
- Organic acids
- Amino Acids
- Sugars
- Phenolics
- Enzymes
- Flavonoids
- Vitamins

# Scaling to the field: Quantifying exudates in terms of growth rate

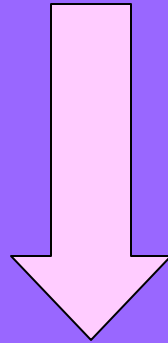




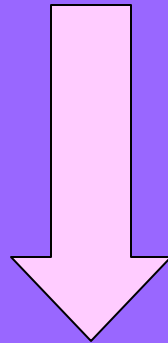
# Transpiration Data → Growth Rate



RGR



$\mu\text{g C exuded} * \text{g new growth}^{-1} \text{ day}^{-1}$



Root: shoot

$\mu\text{g C exuded} * \text{g new root growth}^{-1} \text{ day}^{-1}$

# Acknowledgement

Bruce Bugbee

Malinda Hamilton

Julie Chard


Richard Hess

Bill Doucette

Carl Palmer

Jenny Norton

**Utah State**  
**UNIVERSITY**

 **INEEL**  
Home of Science  
and Engineering Solutions