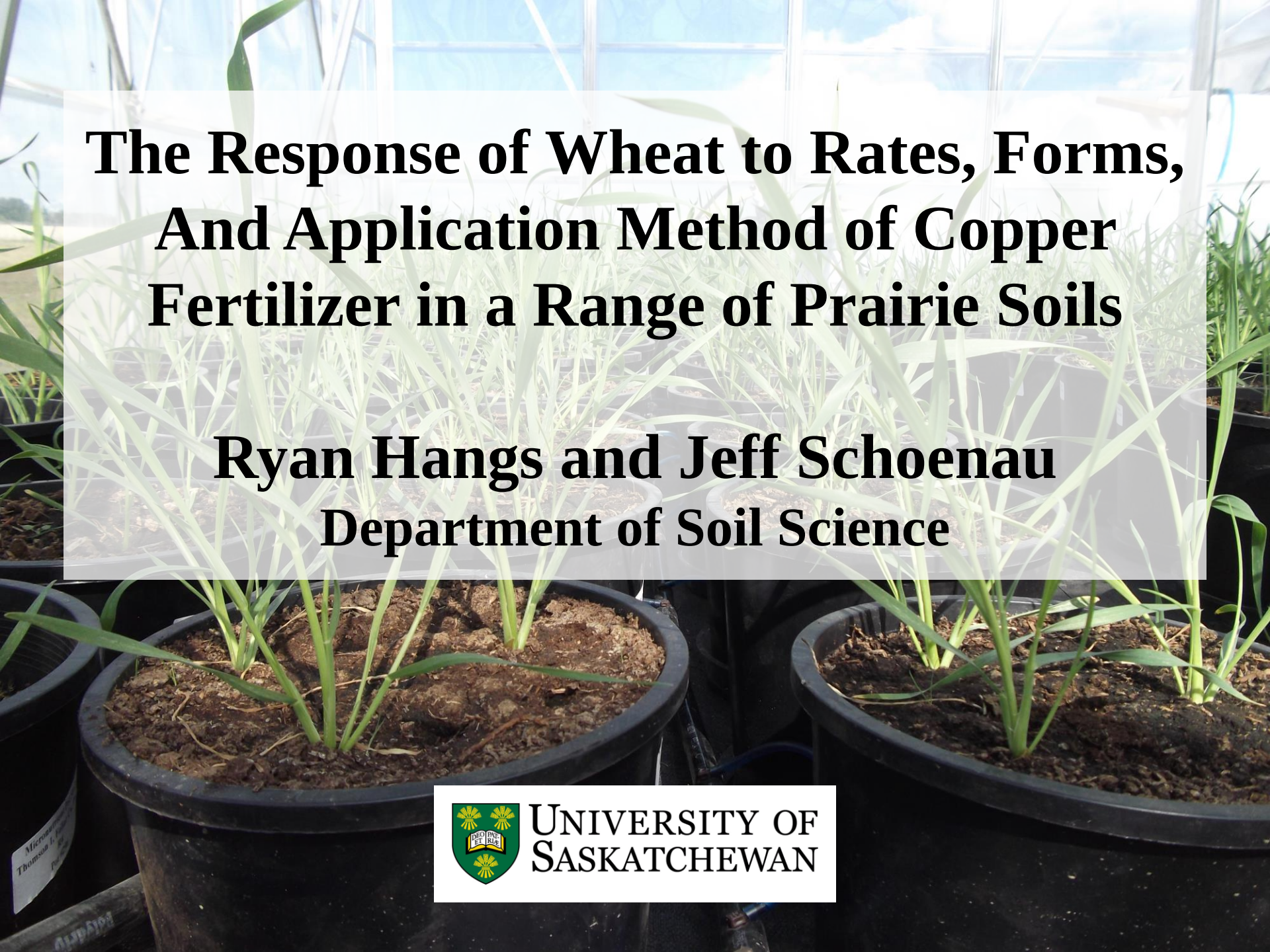


The Response of Wheat to Rates, Forms, And Application Method of Copper Fertilizer in a Range of Prairie Soils

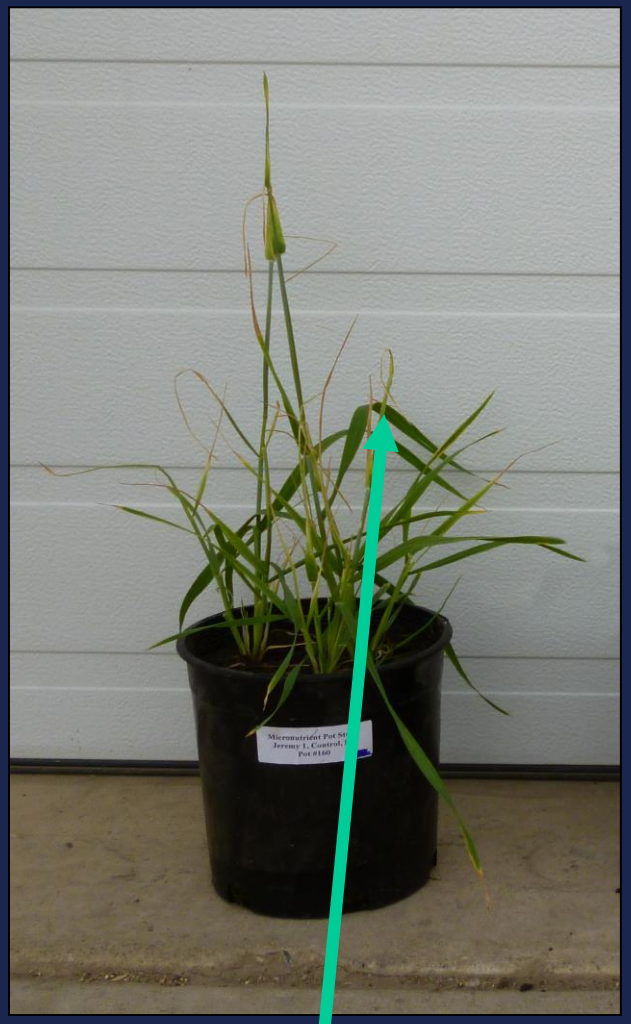
Ryan Hangs and Jeff Schoenau

Department of Soil Science

University of Saskatchewan

Soil Copper Research: Why?

- **Essential micronutrient involved in physiological processes (e.g., enzymes, photosynthesis, and respiration).**
- **The micronutrient most likely to be deficient in prairie soils.**
- **Cereals, especially wheat, are most sensitive to low soil Cu supply.**



Leaf Pig-tailing (Cu-deficiency)

Soil Copper Research: Why?

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- **The micronutrient most likely to be deficient in prairie soils.**
- **Cereals, especially wheat, are most sensitive to low soil Cu supply.**
- **Limited understanding of micronutrient (Cu, Zn, and B) fertilizer interactions.**
- **Uncertainty regarding identifying soil Cu deficiency and applying fertilizer = <u>risky business.</u>**

Empty Heads (Cu-deficiency)

Objectives

- ***Examine the effect of different forms (salt and chelated), rates (0.5 to 5 kg actual/ha), and application methods (foliar or banded) of Cu, Zn, and B fertilizers in a variety of prairie soils on the yield and nutrient uptake of wheat, peas, and canola.***

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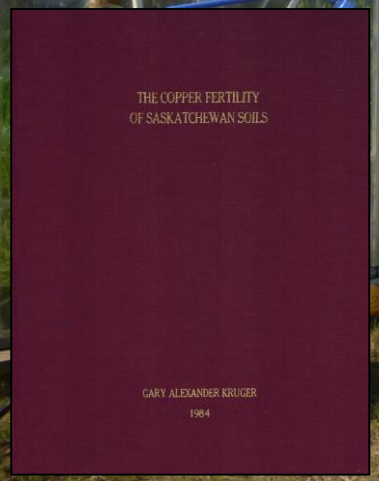
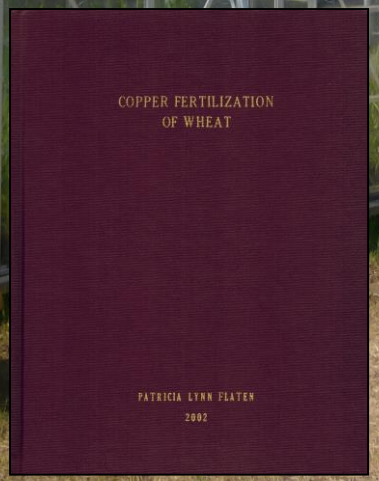
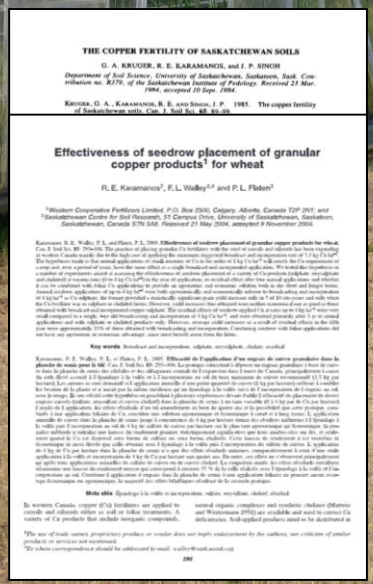





THE COPPER FERTILITY OF SASKATCHEWAN SOILS

G. A. KRUGER, R. E. KARAMANOS, and J. P. SINGH

Effectiveness of seedrow placement of granular copper products[1] for wheat

R. E. Karamanos[2], F. L. Walley[3,4] and P. L. Flaten[3]


A review of copper fertilizer management for optimum yield and quality of crops in the Canadian Prairie Provinces

S. S. Malhi[1] and R. E. Karamanos[2]

Relative effectiveness of various sources, methods, times and rates of copper fertilizers in improving grain yield of wheat on a Cu-deficient soil

S. S. Malhi[1], L. Cowell[1], and H. R. Kutcher[1]


Determining wheat responses to copper in prairie soils[1]

R. E. Karamanos[2], T. B. Goh[3], and J. T. Harapiak[2]

The effect of foliar copper application on grain yield and quality of wheat[1]

R. E. Karamanos[2], Q. Pomarenski[3], T. B. Goh[3], and N. A Flore[2]

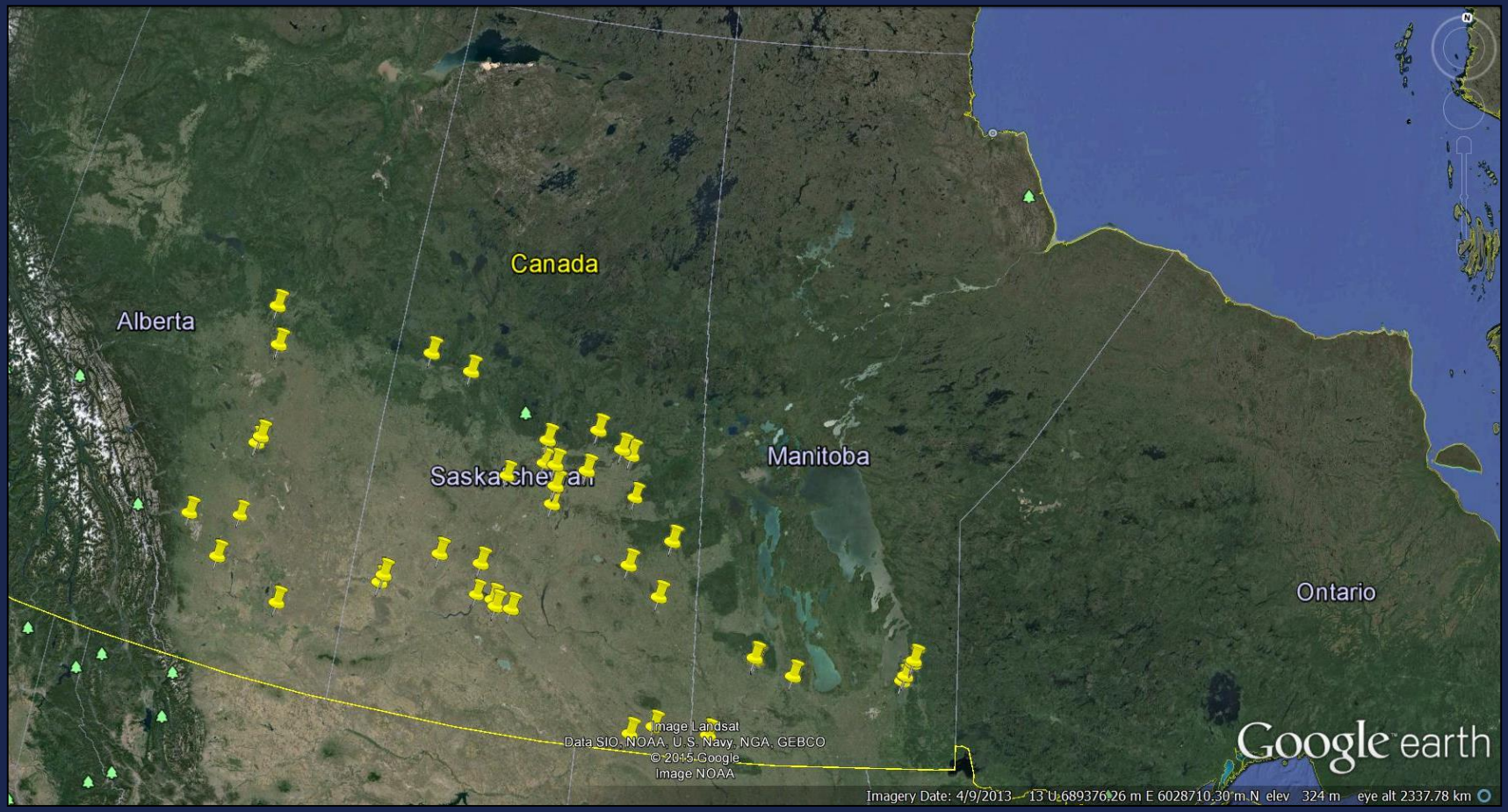
Objectives

- ***Examine the effect of different forms (salt and chelated), rates (0.5 to 5 kg actual/ha), and application methods (foliar or banded) of Cu, Zn, and B fertilizers in a variety of prairie soils on the yield and nutrient uptake of wheat, peas, and canola.***

- ***Identify any micronutrient fertilizer interactions during a cereal, pulse, and oilseed crop rotation common on the prairies.***

- ***Develop an improved method for detecting micronutrient deficiency across a broad range of western Canadian soil types.***

Soil Collection (47 soils)



Many Thanks!!!!!

Sarah Anderson
Lyle Cowell
Dave Cubbon
Garrett Darby
Emile deMilliano
Christian Doelger
Norm Flore
Edgar Hammermeister
Ken Harms
Jeremy Hodges
Rigas Karamanos
Gary Kruger
Kristyn MacDonald
Ken Morey
Gary Topham
Randy Usick

Growers who let me collect two cans of their "dirt"

CO-OP

Crop Production Services

G-mac's AgTeam Inc. "our business is growing"

KOCH AGRONOMIC SERVICES

WESTERN AG PROFESSIONAL AGRONOMY

A Variety of Soils Collected

Diverse array of soil characteristics (texture, organic matter content, pH, carbonates, micronutrient availability, etc.)

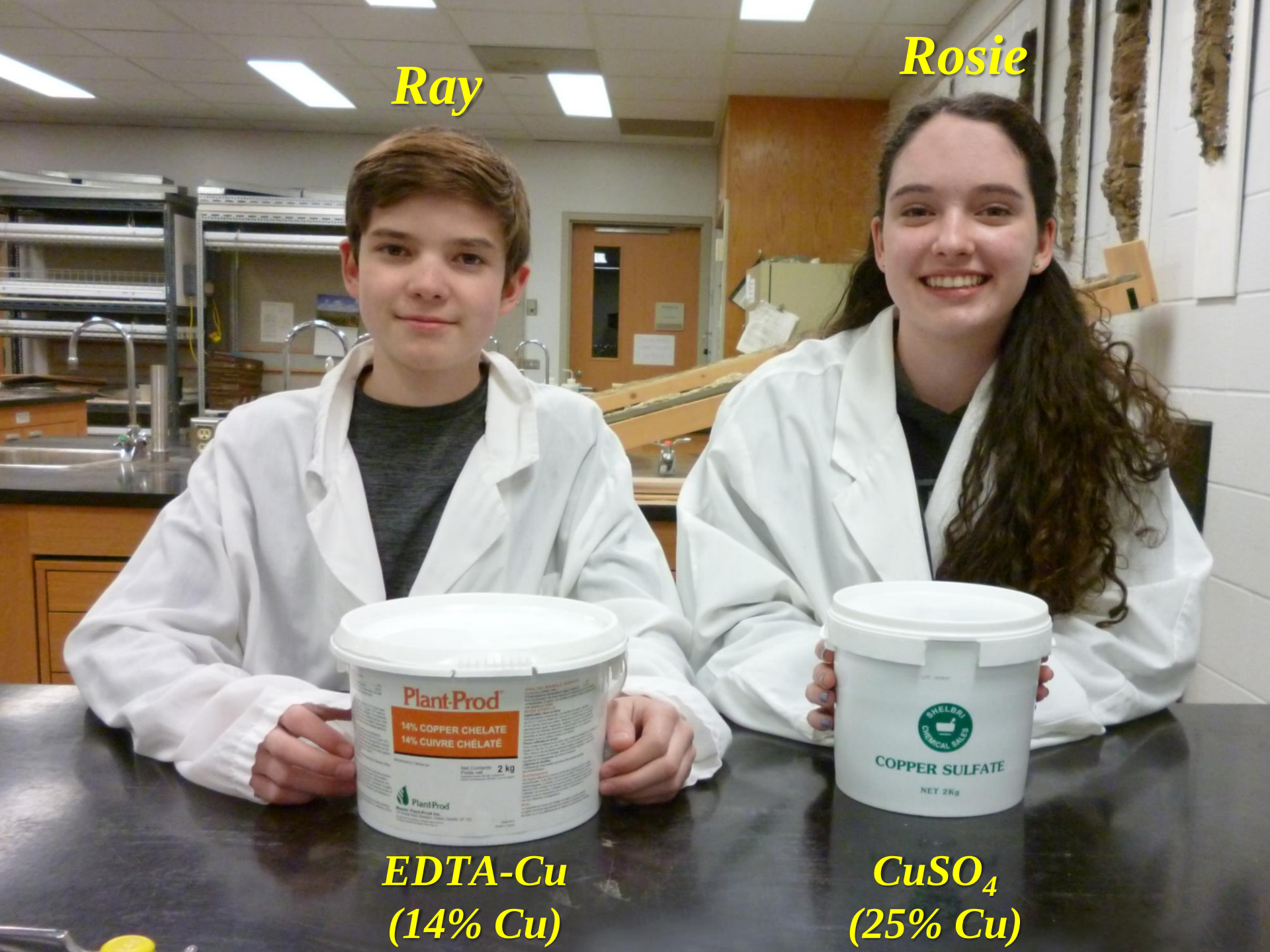
Copper-Deficient Soils (The Usual Suspects)

POLICE DEPARTMENT	POLICE DEPARTMENT	POLICE DEPARTMENT	POLICE DEPARTMENT
CALCAREOUS	**SANDY**	**GRAY**	**PEAT**
PROFILE#: 001241972	PROFILE#: 001241999	PROFILE#: 001242002	PROFILE#: 001241874

Experimental Design

- **Two factors, completely randomized design, four replicates**
- **Factor #1: soil type (15 soils; 12 mineral and three organic)**
- **Factor #2: Cu fertilizer (5 treatments):**

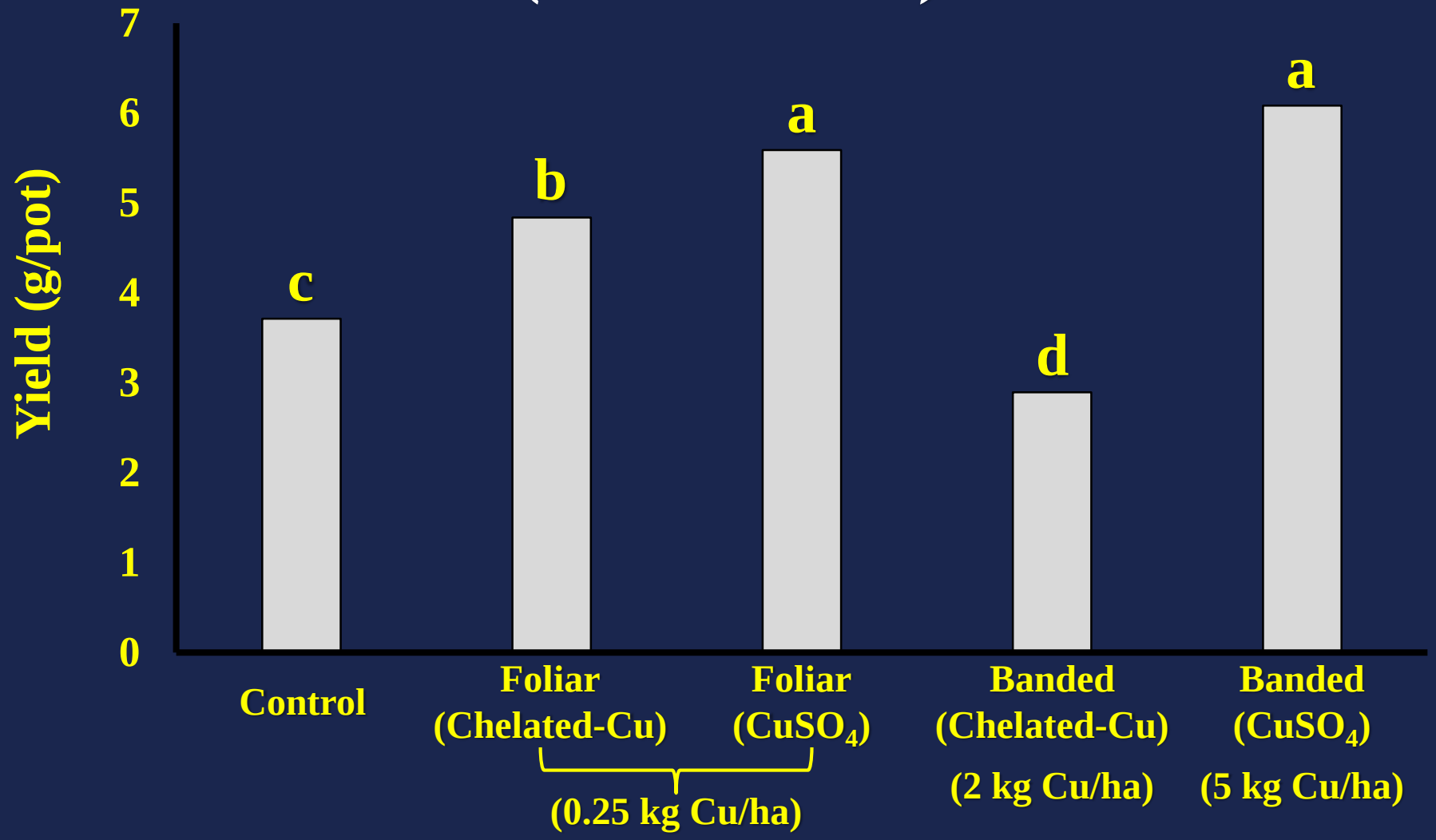
1) **Control (i.e., no Cu fertilizer added)**
2) **Foliar $CuSO_4$ (0.25 kg Cu/ha; flag leaf; Feekes 8)**
3) **Foliar EDTA-Cu (0.25 kg Cu/ha; flag leaf; Feekes 8)**
4) **Banded $CuSO_4$ (6 µg Cu/g soil; 5 or 2.5 kg Cu/ha for mineral and organic soils, respectively)**
5) **Banded EDTA-Cu (2 µg Cu/g; 2 or 1 kg Cu/ha for min/org soils)**


Ray
Rosie
Plant-Prod
14% COPPER CHELATE
14% CUIVRE CHÉLATÉ
2 kg
PlantProd
SHELBRI
CHEMICAL SALES
COPPER SULFATE
NET 2Kg
EDTA-Cu
(14% Cu)
CuSO4
(25% Cu)

Hard Red Spring Wheat (AC® Waskada)

AC® Waskada Wheat Grain Yield

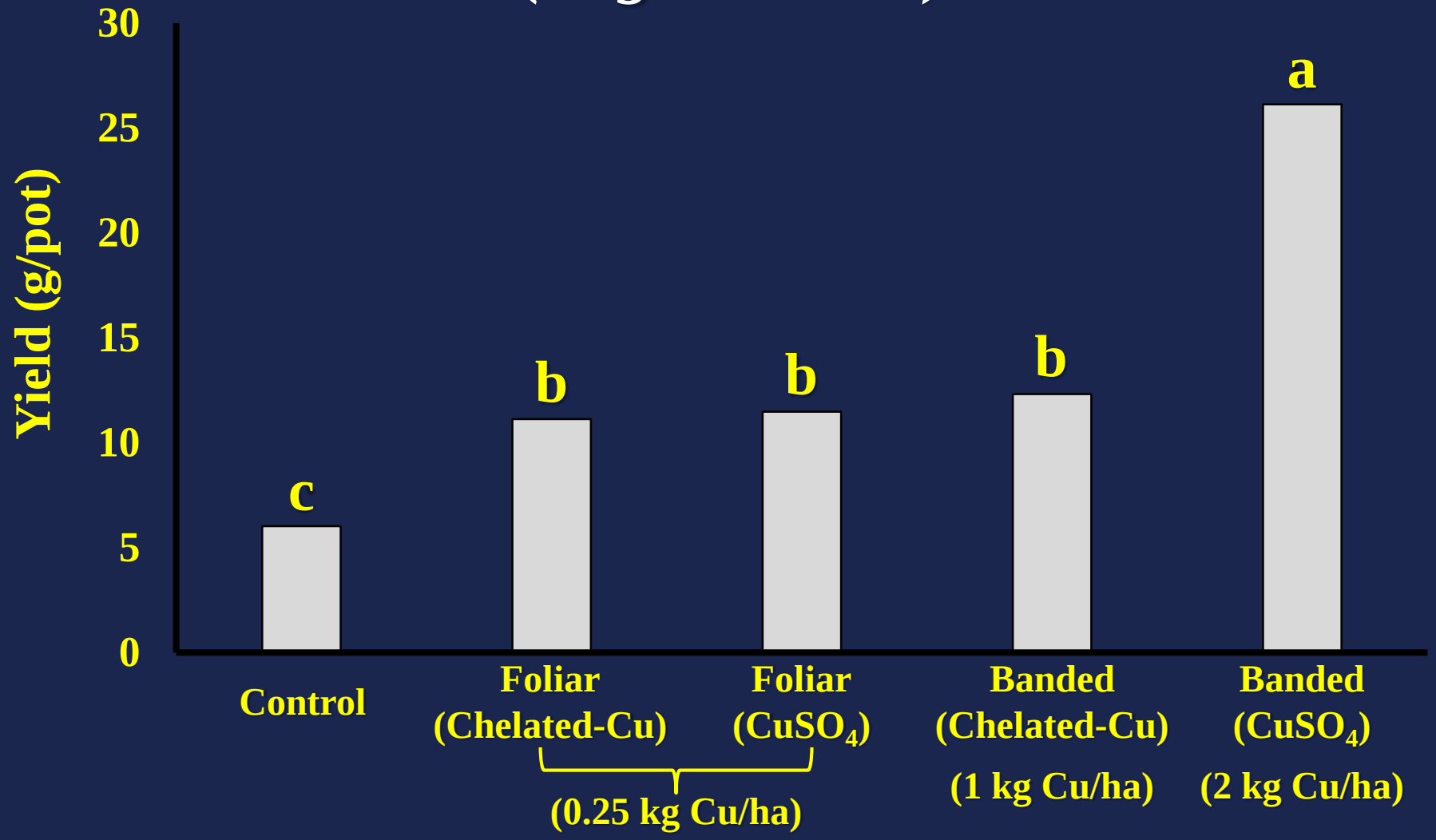
(Mineral Soils)



**Bars with the same letters are not significantly different (P >0.05) using LSD.*

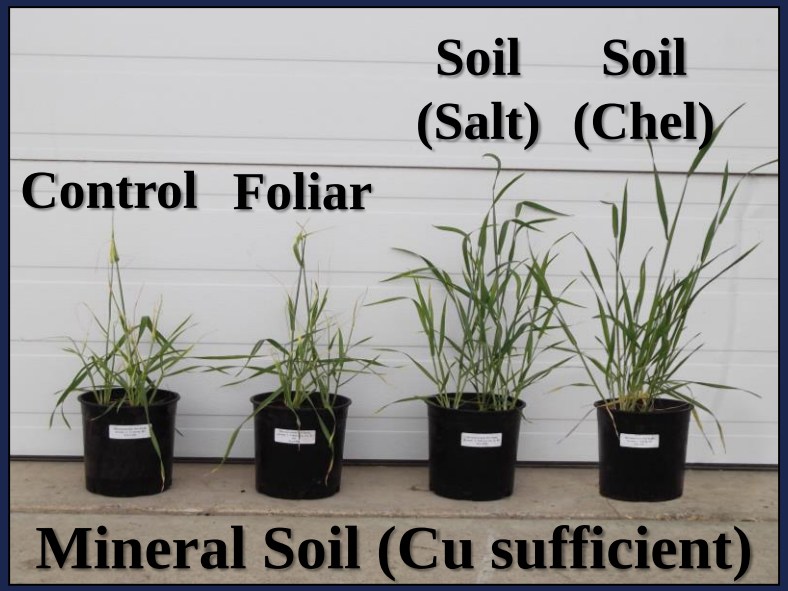
AC® Waskada Wheat Grain Yield

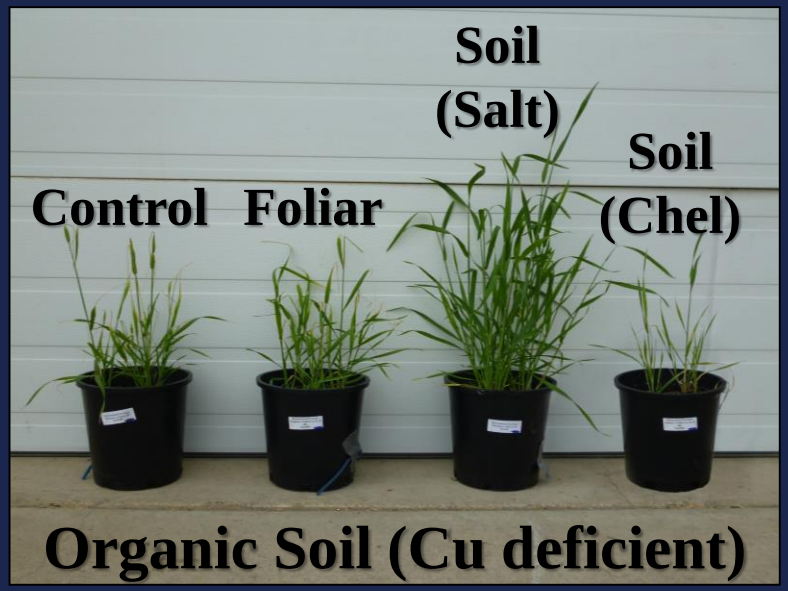
(Organic Soils)

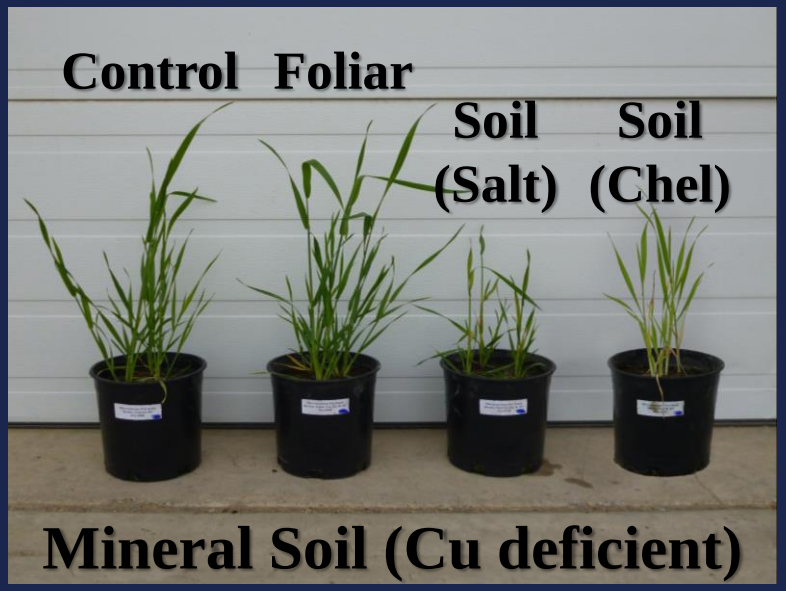


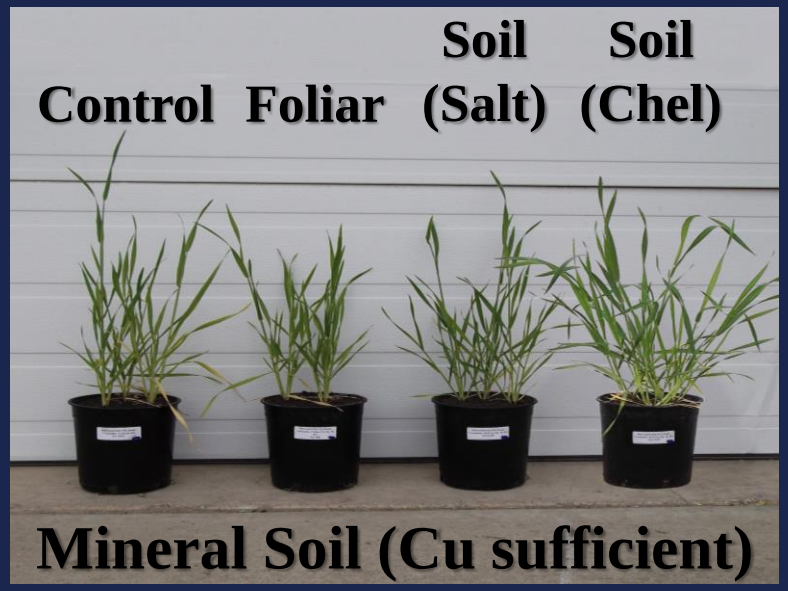
**Bars with the same letters are not significantly different (P >0.05) using LSD.*

Variable Growth Response to Copper Fertilizer





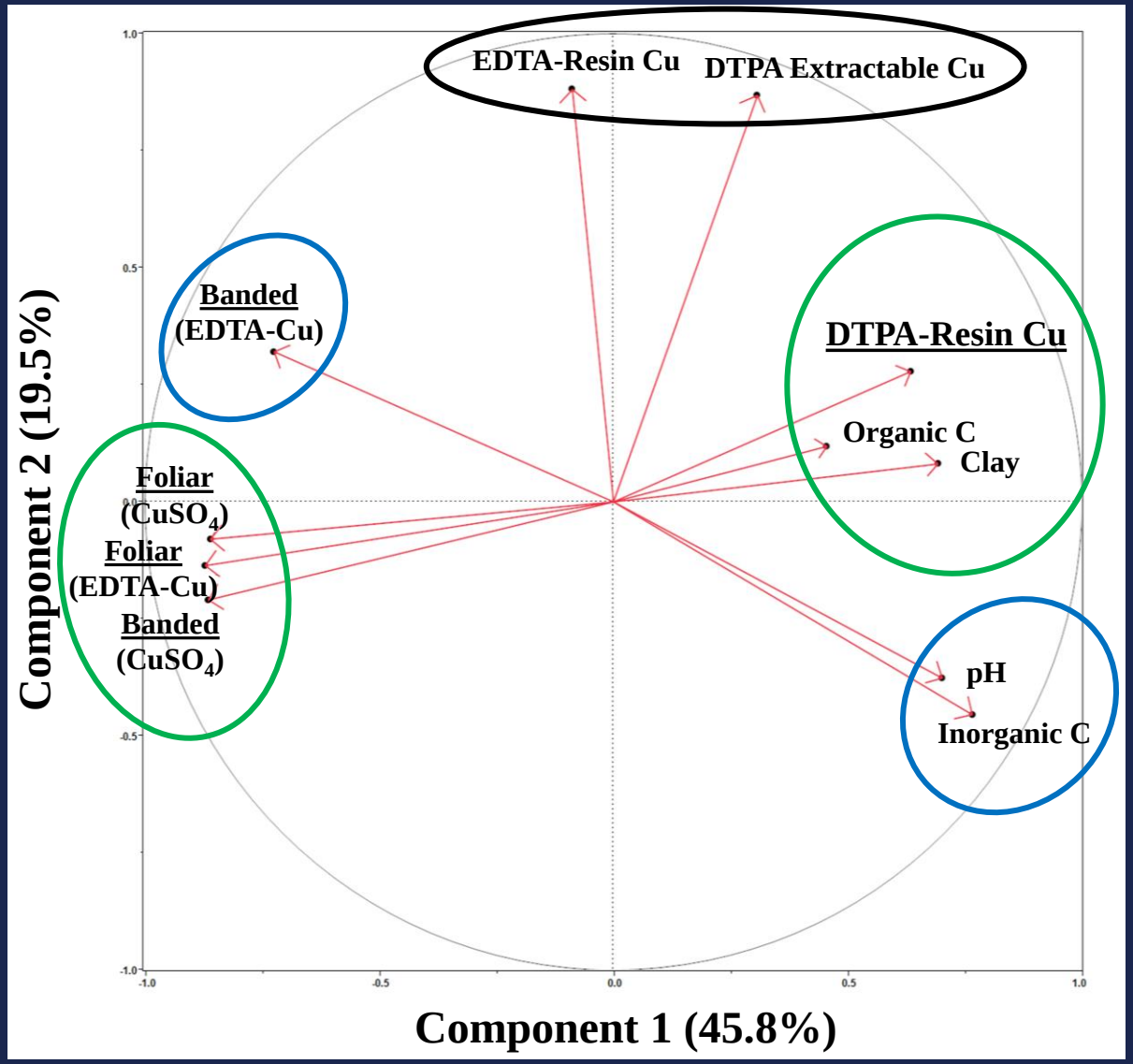




Ion-exchange Resin "Sandwich" Method

Qian, P., Schoenau, J.J., and Ziadi, N. 2008. Ion Supply Rates Using Ion-Exchange Resins. Soil Sampling and Methods of Analysis, Second Edition. Carter, M.R. and Gregorich, E.G. (Eds.)

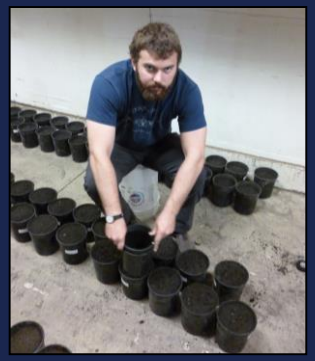
Principal Component Analysis of Wheat Grain Yield Response to Added Cu fertilizers and Selected Soil Properties (Mineral Soils)

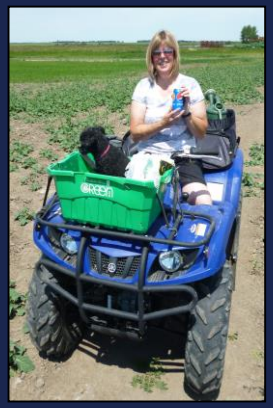


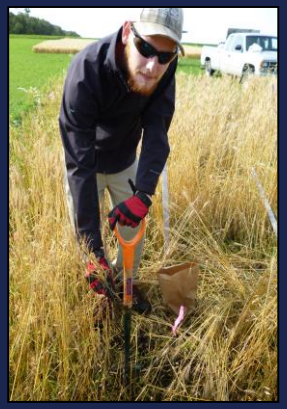
Conclusions

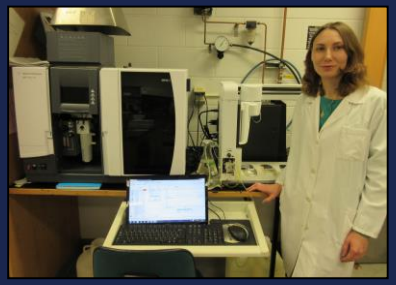
- **Banded $CuSO_4$ provided a timely Cu supply; thus, promoting maximum yields in our study, especially with organic soils.**
- **Applying foliar Cu corrected the Cu-deficiency symptoms and prevented yield loss in the mineral soils, but not in organic soils.**
- **Foliar $CuSO_4$ was as effective as foliar chelated-Cu for most soils.**
- **Banded chelated-Cu had mixed results; likely due to direct (toxic) or indirect (Zn deficiency) effects of the relatively high application rates used (1 or 2 kg Cu/ha).**
- **DTPA-Resin appears to be provide a reliable index of soil Cu supply for identifying mineral soils responsive to Cu fertilization, however, <u>field study validation is required</u>.**

Thank You!!









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Questions?