Boron Application to Canola at Early Flowering

Agri-ARM Information Day

Prairieland Park

January 12, 2017

Growing Forward 2

A federal-provincial-territorial initiative

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Key Projects in 2016

- Use of Contans for Sclerotinia Control
- Yield Response of Canola to Foliar Boron
- Forage Response of Alfalfa to Copper and Zinc
- Application of Foliar Molybdenum to Lentil
- Forage Response of Meadow Bromegrass to Phosphorus, Potassium, and Zinc

Feb 3 Meeting in Consul with South of the Divide

Cooperators

- Mark Gravelle
- Peter Ferd Frank Hiebert
- Nigel Oram – ICDC Board
- Larry Kendall
- Anthony Eliason – ICDC Board
- Greg Oldhaver – ICDC Board
- Dale Ziprick, David Jessiman - United Agri Products
- Nico de Wal - ATP Nutrition
- Doug Grandin – Omex
- Rigas Karamanos - Koch
- Jeff Schoenau - U of S
- Dan Selinger, AAFC
- Mike Leismeister
- Randy Stokke
- Scott Sanderson
- Bob Behrman
- James Bateman, Blake Weatherald - Alpine Fertilizers
- Kevin Eremenko - Richardson
- Roland Meyer – Univ. of Cal.
- Dale Tomasiewicz - AAFC
- Joel Peru
- Jeff Ewen
- Barry, Don, Alan, Darryl - CSIDC
- Andre Bonneau, Sask MAF

Boron Fertilization Scares Me!

- Difference between optimum and toxicity can be small.
- Tolerant crops – alfalfa – not hurt by up to 4 lb B/ac
- Sensitive crops – potato – as little as 0.5 lb B/ac can hurt yields
- Soil levels can readily build up to toxic levels from boron applications in low rainfall areas

Similarity to S deficiency

Pre-bolting

Late flowering to Early poding

Later podding

Photo credit: Lyle Cowell

√ Reddened cupped leaves

√ Reddened pods
√ Pale deformed flowers

√ Aborted pods
√ Poorly developed pods
√ Dead terminal buds

Boron Fertility of Canola

- First symptoms of deficiency appears in new growth - immobile in plant
- Plant needs continual supply of boron – not transferred in plant
- Required for pollen germination and pollen tube growth
- Aids in cell wall growth
- Aids in limiting flower blasting due to heat

Boron for Canola ? !!

- Karamanos Goh and Stonehouse 2003
  - B fertility and practices research limited in Western Canada until routine techniques common
  - Hot water soluble boron levels less than 0.35 mg/kg considered deficient

AAFC Melfort

- Four years on suspect soils (Gray Wooded)
  - 7 field trials + many survey demos
  - B fertilizer broadcast and incorporated (0.9-3.6 lb B/ac)
  - Seedrow placement (0.45-1.8 lb B/ac)
  - Foliar spray at 10-20% bloom (0.2 and 0.45 lb B/ac) plus zero B control
  - Increase in B concentration and uptake in straw
    - Incorporated > Seedrow > Foliar
  - No consistent increase in seed yield
  - Inconsistency due to patch nature of deficiency

Malhi and Karamanos, 2013

University of Saskatchewan

- Dr. Fran Walley and Dr. Rigas Karamanos
  - ADF Project
- Assessing the Cu requirements of cereals and the B requirements of oilseeds in Saskatchewan
- 6 field experiments – no responses to B
- 27 pot experiment – no responses to B

Malhi and Karamanos, 2013

Agrium

- 4 field experiments
- No visual or yield responses to soil and foliar treatments

Malhi and Karamanos, 2013

Westco

- 18 strips trials in 1999 and 22 replicated field experiments over 4 year period
- Only 1 yield response

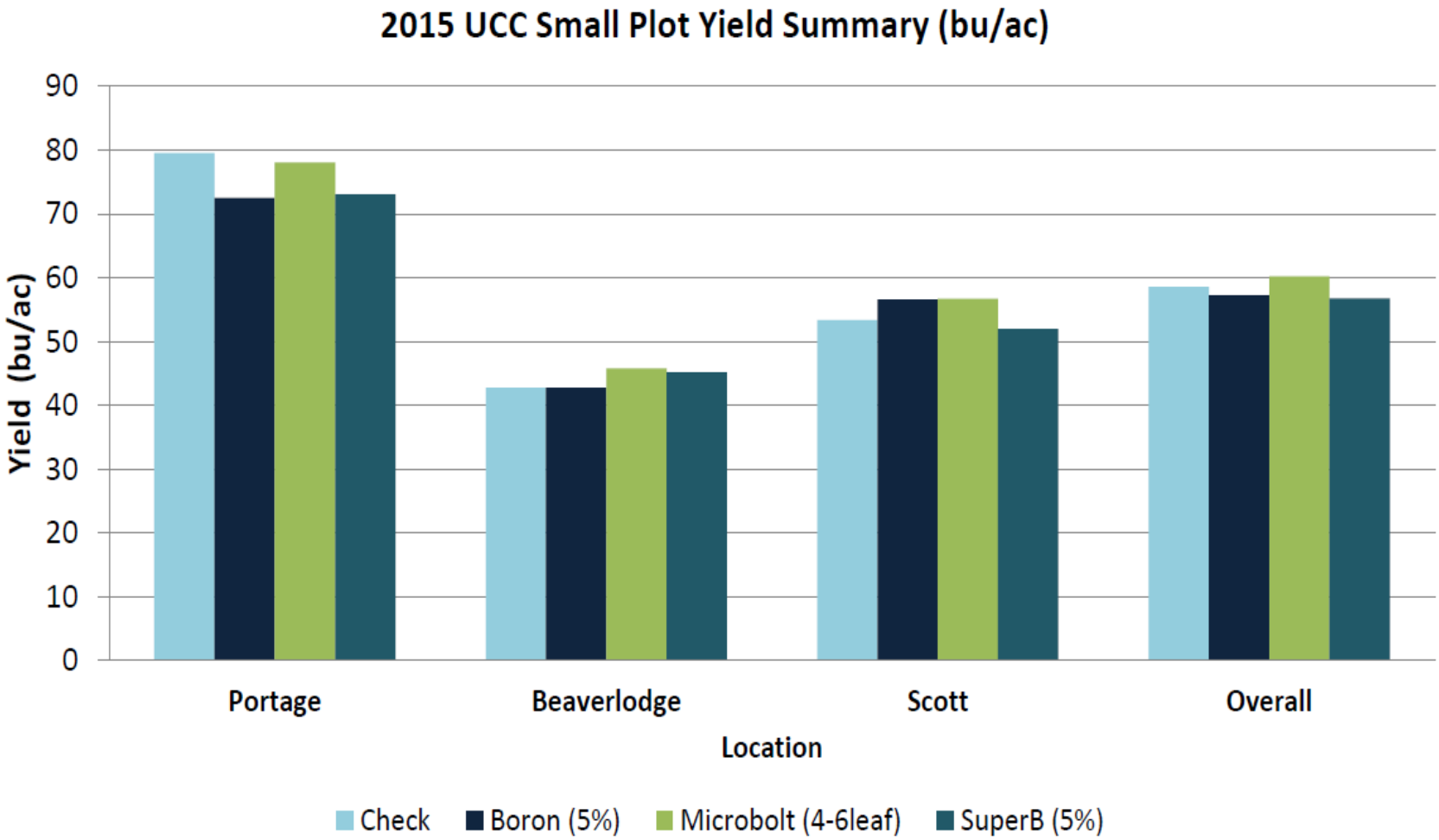
Malhi and Karamanos, 2013

Alberta Agriculture

- Deficiency suspected in canola on sandy Gray Wooded soils
- Brown and Dark Brown irrigated soils test deficient in boron
- No response with cereal crops
- Canola, pea, and bean yields declined 10-20% after 2 lb B/ac pre-plant banded with other nutrients

Malhi and Karamanos, 2013

Ultimate Canola Challenge 2015 (Philp)



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Ultimate Canola Challenge Soils

Trial Location	Soil Texture	Soil Organic Matter	Soil Boron Levels	Soil pH
Portage	Loam	3.5	1.2 ppm	7.9
Beaverlodge	Clay Loam	4.5	0.8 ppm	5.6
Scott	Loam		1.5 ppm	5.6

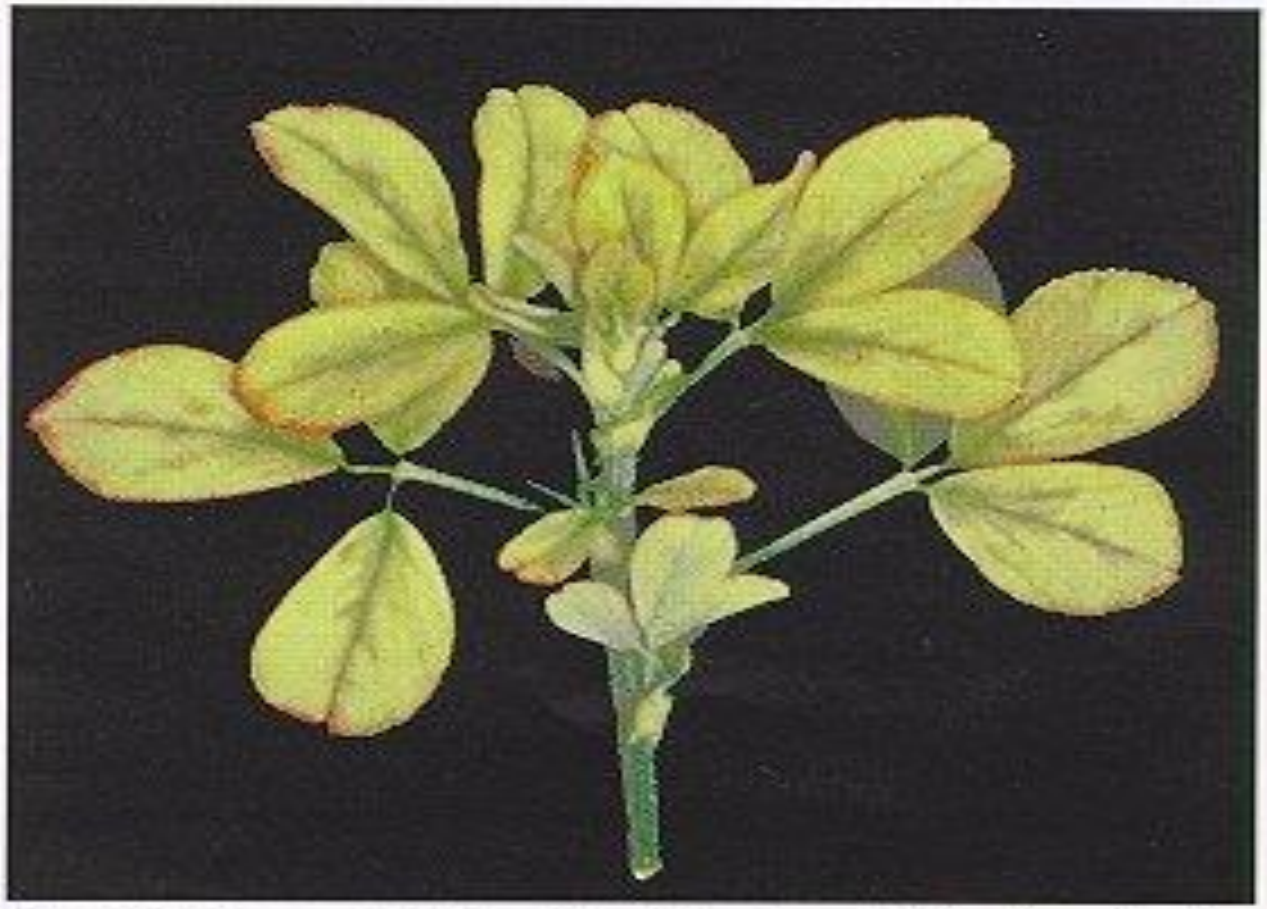
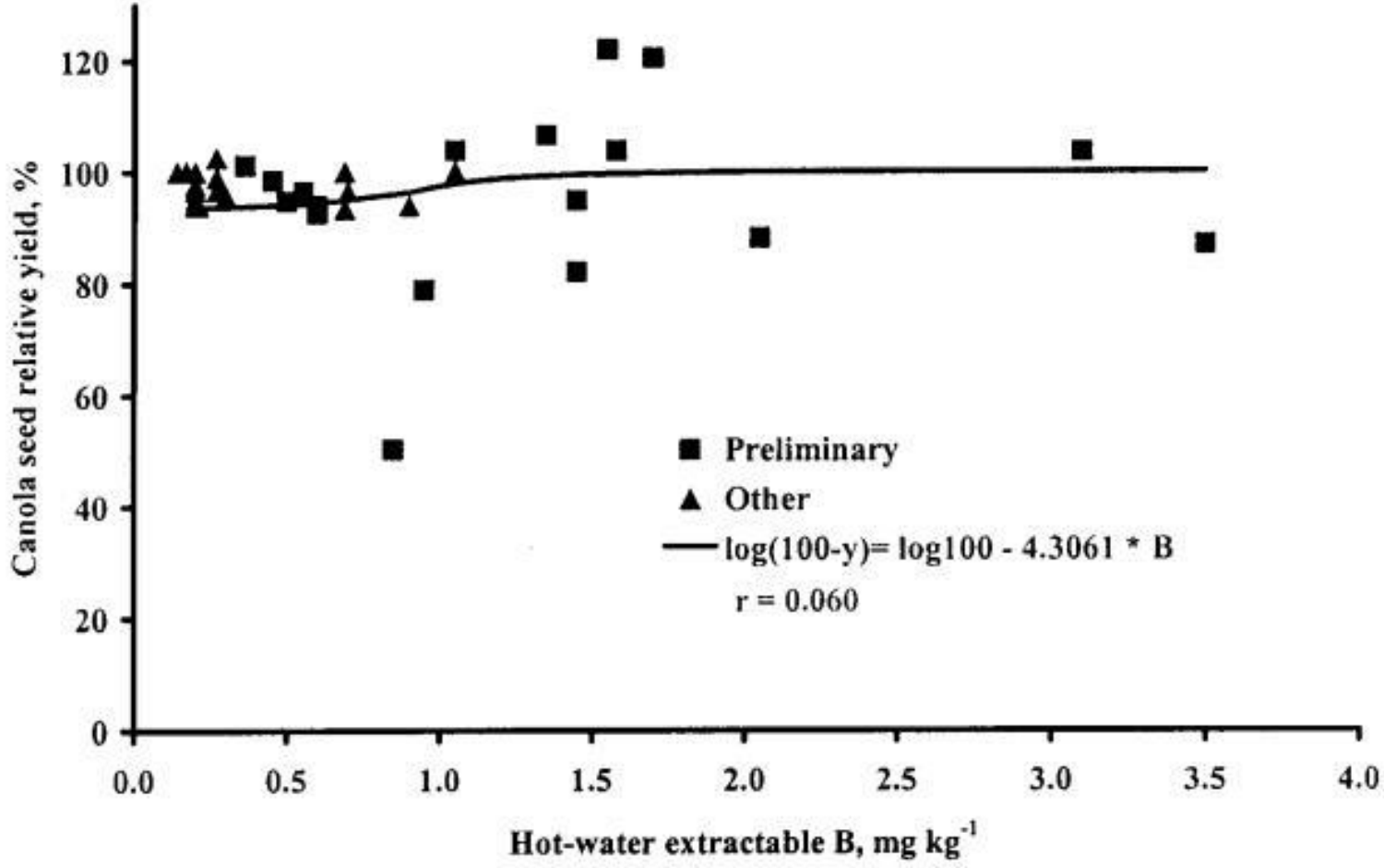


Figure 24. Boron-deficient alfalfa. Yellow to reddish yellow discoloration of the upper leaves. Often confused with leafhopper damage, which also causes yellowing of the tips of leaves.

Canola Yield vs Soil Test Hot Water B



Karamanos, Goh, & Stonehouse, 2002

Boron Deficiency in Rapeseed

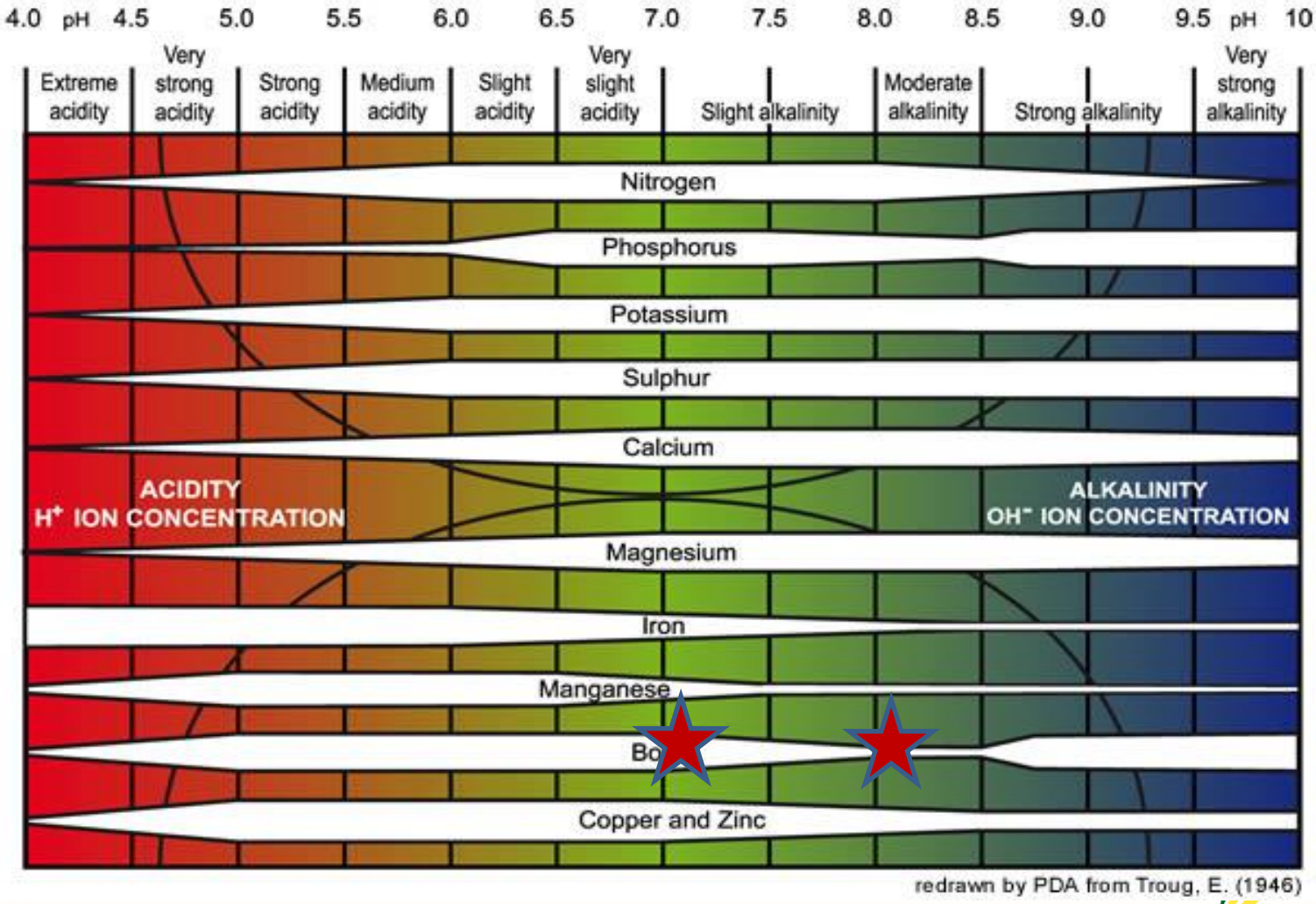
Figure 1. Boron-deficient (left) and normal (right) rapeseed plants.

Wooding, F.J. 1985. Agroborealis 17:47-49

Soil Boron

- Boron salts very soluble in water
- Adsorption of B in soils
  - soil pH – increased pH = decreased B supply
  - soil texture – more clay, more B supply
- Main source – organic matter
- Plants require continual supply over growing season – immobile within plants

pH Effect on Nutrient Availability



B Uptake

- Absorbed by roots as **undissociated** boric acid
- Only element taken up by plants as a molecule
- Factors – soil type (texture, pH, calcium, OM%)
  - B concentration
  - Soil moisture
  - Plant species
- Uptake by mass flow
- Plant distribution by xylem transpiration
- Immobile in plant, but active transport

Crops Sensitive to B Deficiency

- Cotton
- Rice
- Wheat
- Corn
- Canola
- Soybean
- Barley
- Potato
- Alfalfa

Vulnerable Soils

- Highly leached
- Calcareous
- Alluvial
- Loessial
- Low organic matter
- Coarse textured
- High pH
- Liming
- Drought
- Intense cultivation

Boron Removal from Soil

Crop	Irrigated Yield	Boron Uptake (lb/ac)
Alfalfa	4.0 tons/ac	0.3
Canola	60 bu/ac	0.4
Wheat	80 bu/ac	0.1
Sunflower	120 bu/ac	3.0

Irrigation water contains 0.005 lb B /ac-in

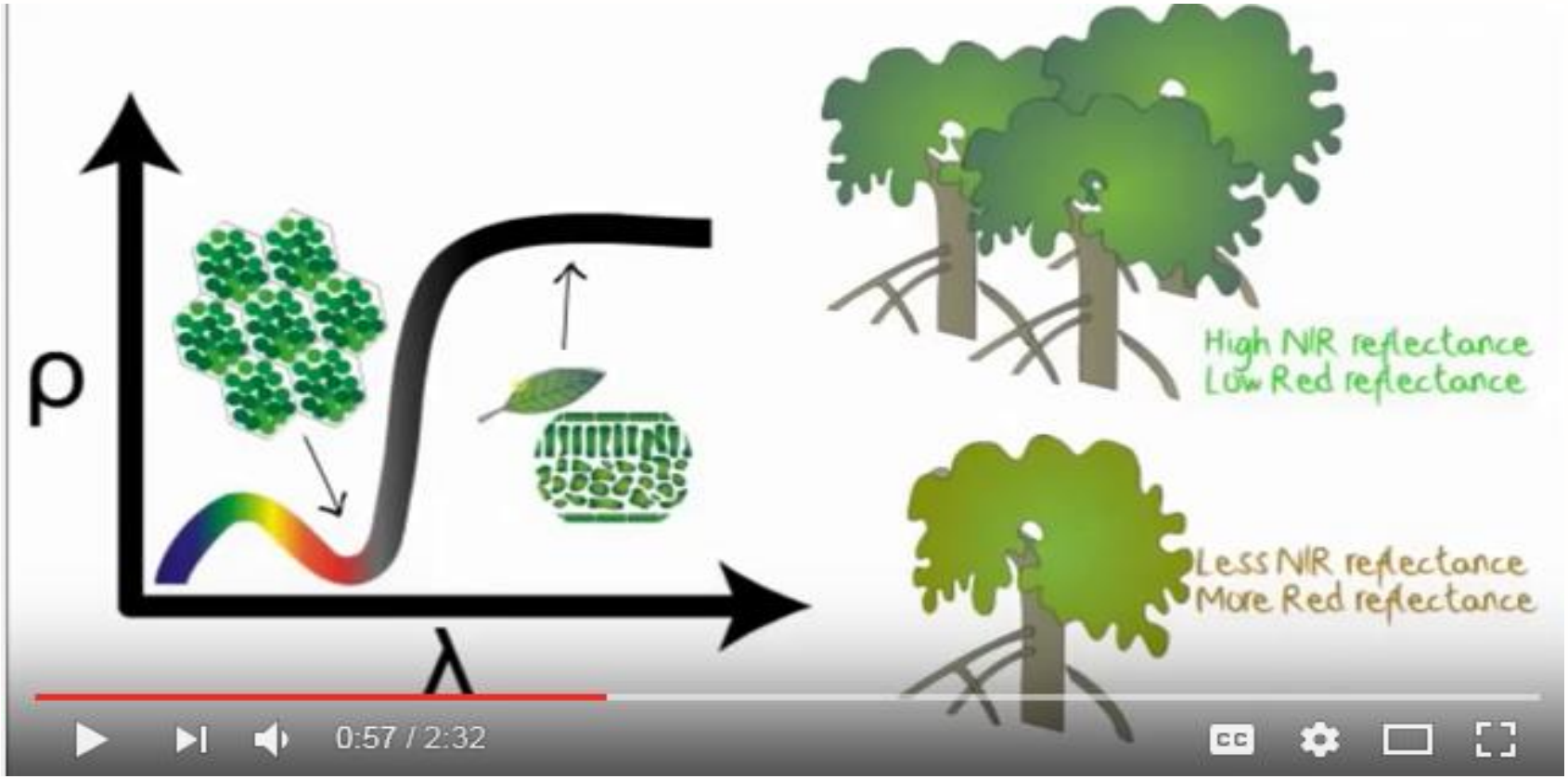
Yield Response of Canola to Foliar Boron

- Local dealers have promoted B application to canola with first foliar fungicide application
- In 2015, Joel conducted an irrigated project at both Riverhurst and Assiniboia
- Riverhurst demonstration showed promise
- Three sites for 2016 – Grainland and Riverhurst

Normalized Difference Vegetation Index (NDVI)

- Based on absorption of different spectra of light by crop growth
- Able to identify differences in the field indistinguishable to the eye

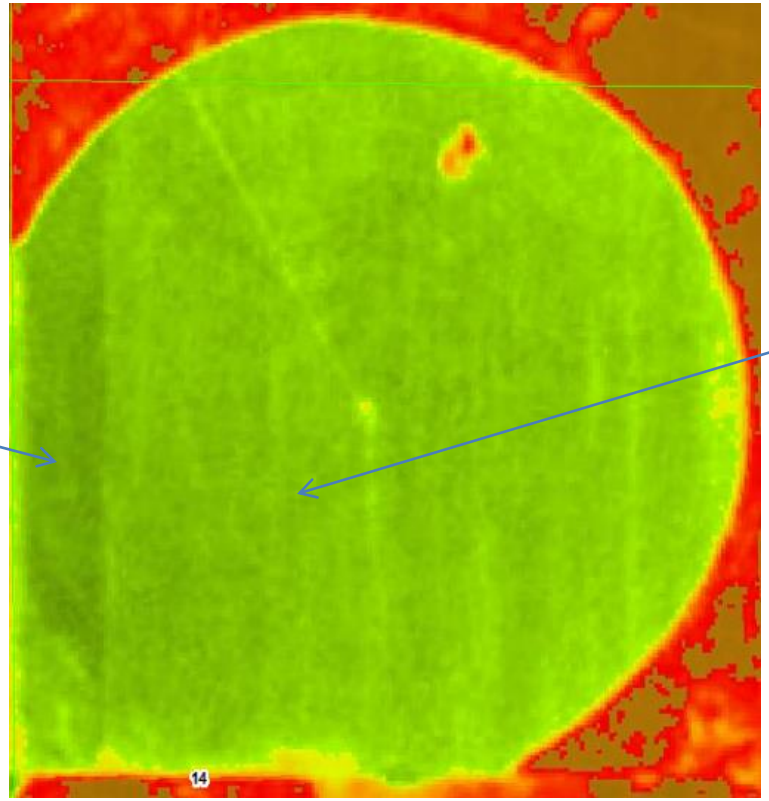
NDVI Interpretation



https://www.youtube.com/watch?v=rxOMhQwApMc

Riverhurst – Gravelle site

ATP Nutrition
Kinetic Boron



Contans

NDVI image taken
August 16, 2016

NDVI image shows darker area where B was applied

Image courtesy: Kris Ewen
Farmers Edge Outlook

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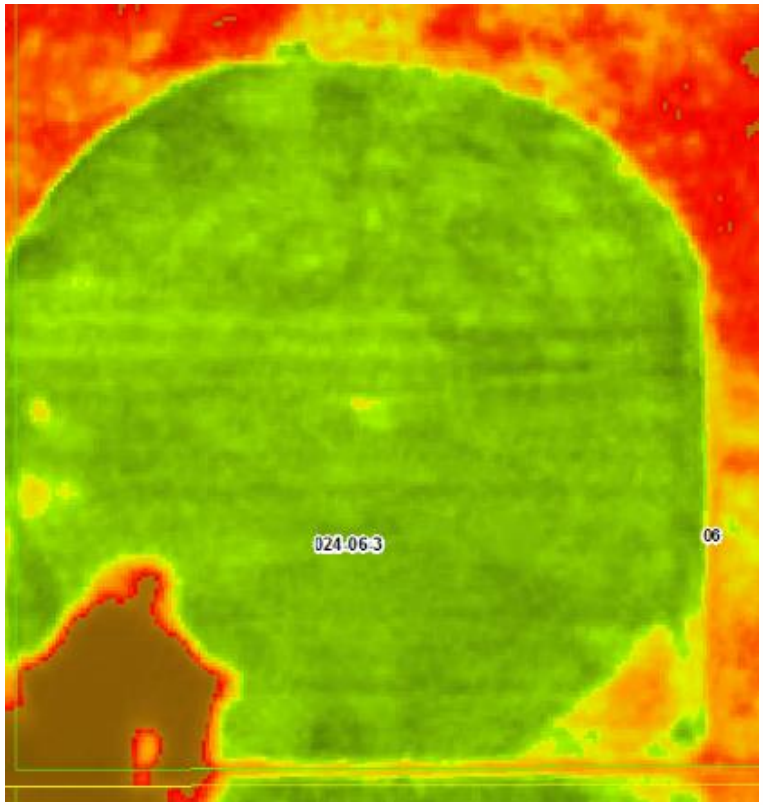
Riverhurst – Hiebert site

Liquid Omex Boron

0.5 L/ac

1.0 L/ac



NDVI image shows lighter bands where B was applied

NDVI image taken August 16, 2016

Image courtesy: Kris Ewen
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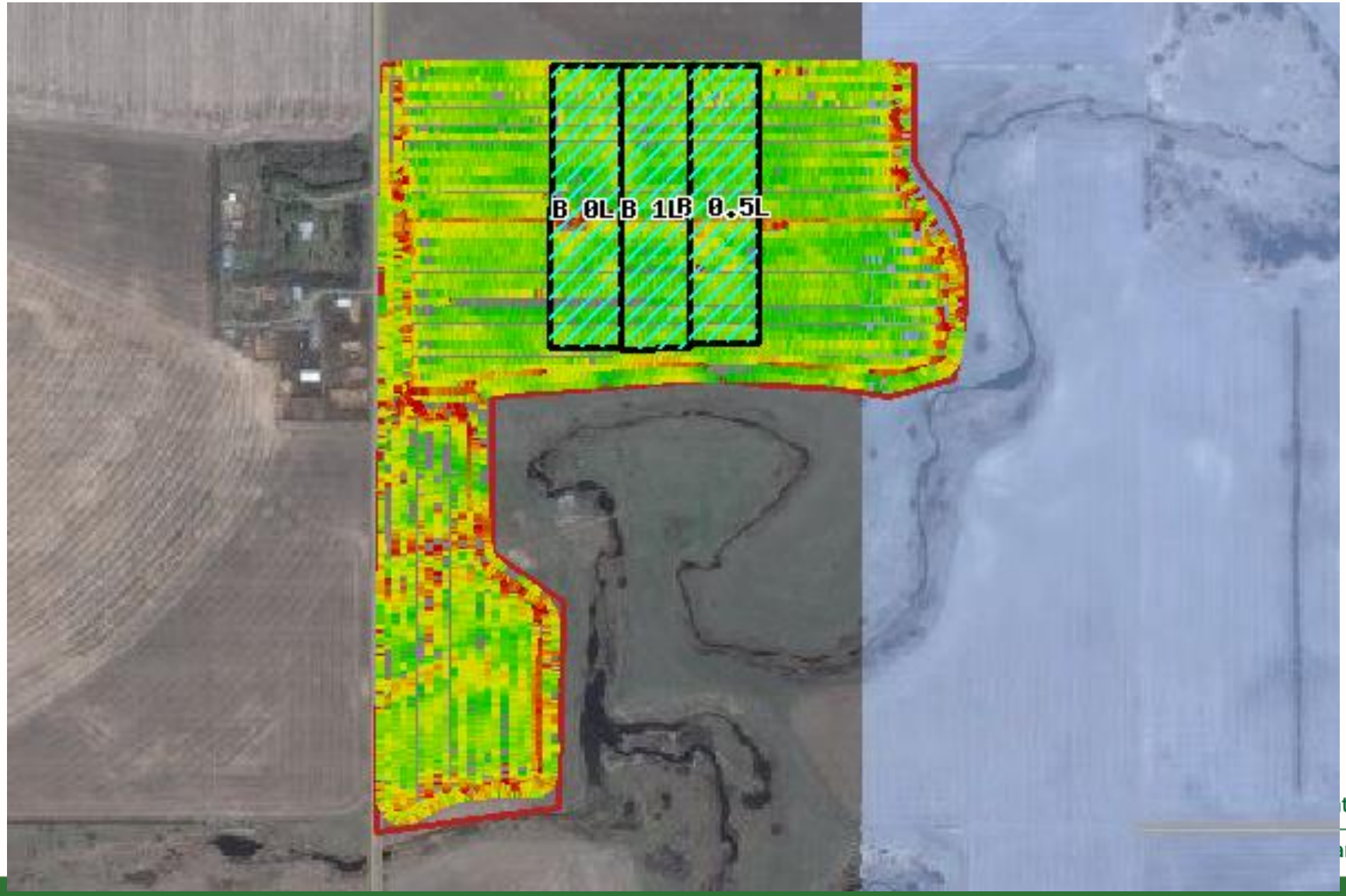
Central Butte – Oram site



Drone Aerial Photo – Oram site

Photo credit: Nigel Oram

Canola Harvest Data
2016 Boron Projects

Treatment	Plant Tissue Boron (ug/g)	Canola Yield (bu/ac)	Oil Content (%)
Gravelle			
Control	-	65.9	45.7
Boron foliar	-	71.7	45.9
Hiebert			
Control	18	47.9	43.8
0.5 l/ac	-	43.7	45.1
1.0 l/ac	-	44.5	42.7
Oram			
Control	19	69.3	-
0.5 l/ac	-	71.3	-
1.0 l/ac	-	74.6	-

2016 Canola
Plant Tissue Analysis

Site	N (%)	P (%)	K (%)	S (%)	Ca (%)	Mg (%)	Cu ug/g	Fe ug/g	Mn ug/g	Zn ug/g	B ug/g
Hiebert	5.5	0.42	4.3	0.66	2.5	0.52	6.0	131	89	39	18
Oram	6.0	0.50	3.8	0.77	2.2	0.46	5.0	89	102	9	19
Target	4.0	0.25	2.0	0.30	0.5	0.20	4.5	40	20	15	30

Conclusion

- Response to B occurred frequently in Lake Diefenbaker Development Area in 2016
- What about 2017? ??
- How much precipitation will fall?
- How cool will the growing season be?
- Potential use of plant tissue testing as a guide – currently insufficient data

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