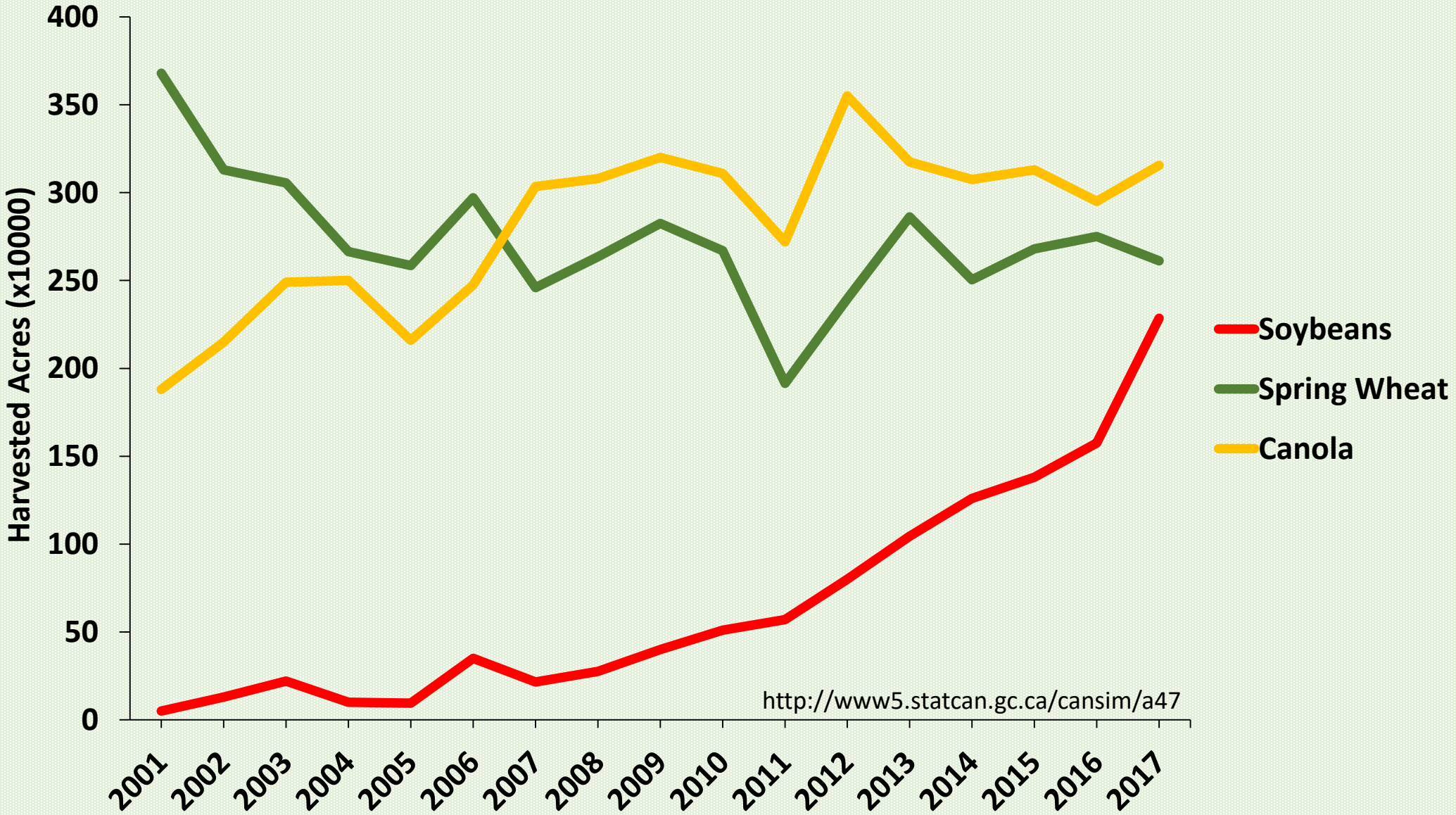
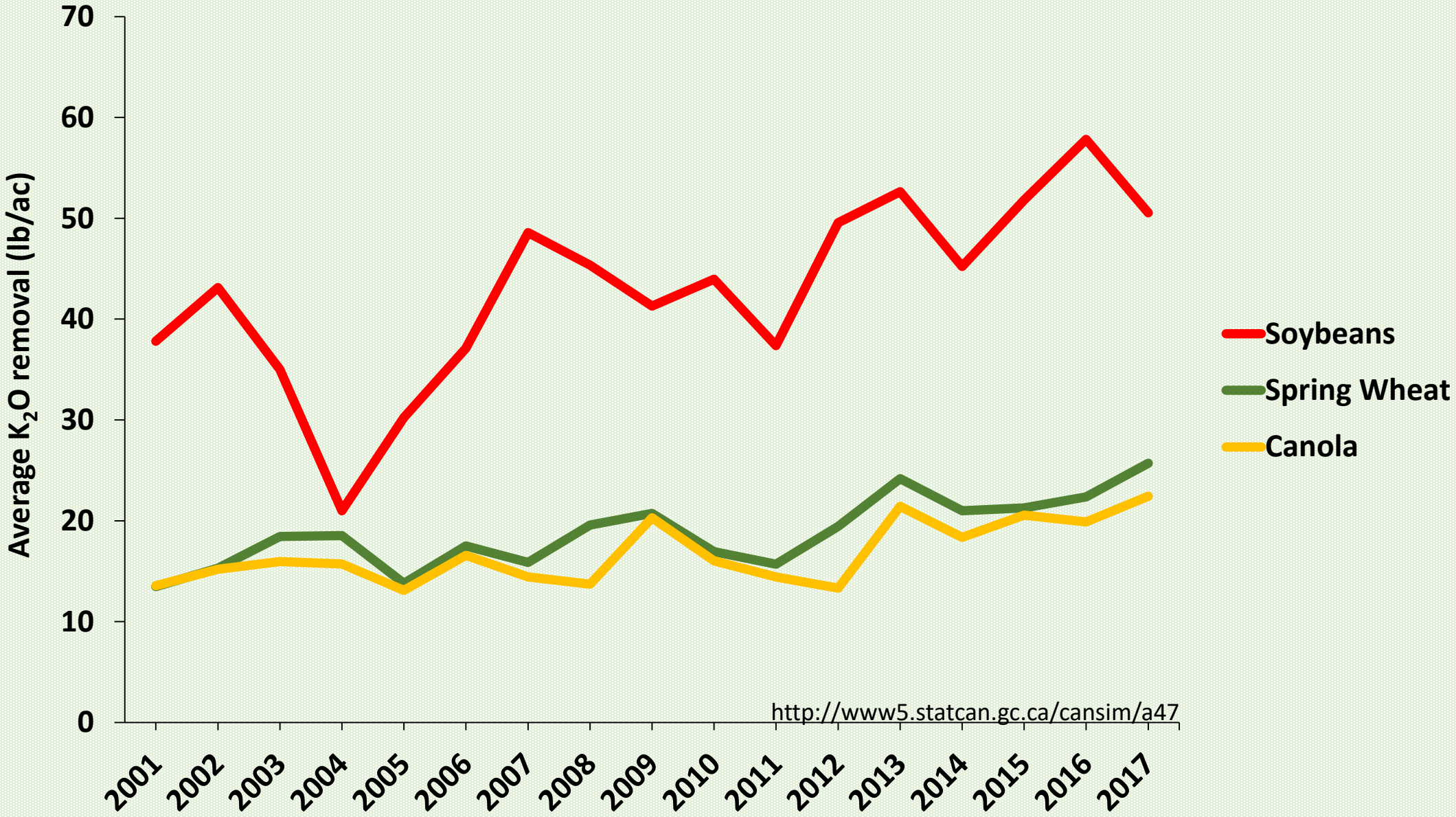
Soybean Response to Potassium Fertility and Fertilizer in MB

Megan Bourns and Don Flaten, Dept. Soil Science, Univ. of Manitoba, R3T 2N2; John Heard, Manitoba Agriculture; Greg Bartley, Manitoba Pulse and Soybean Growers

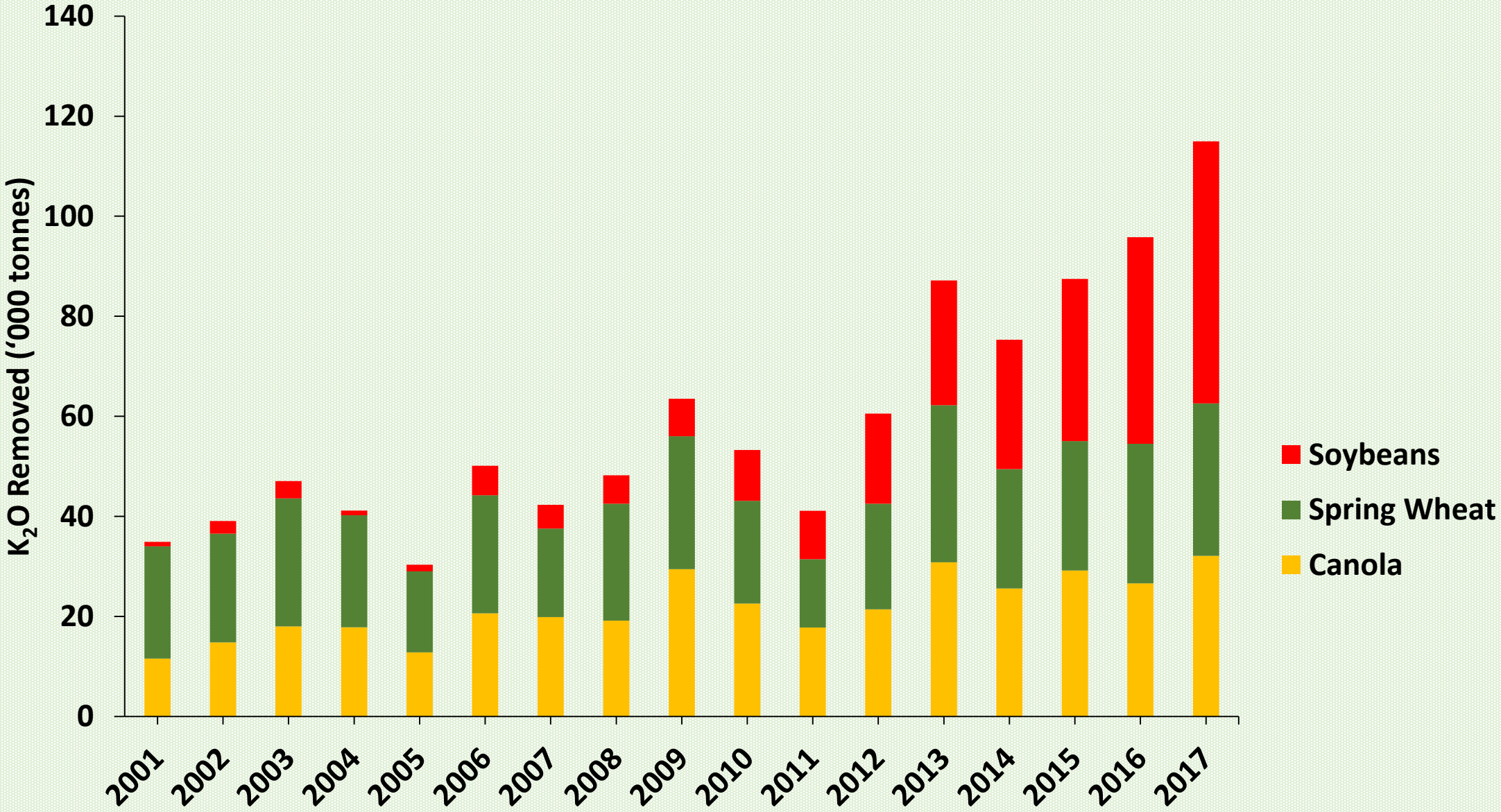
Harvested Acres of Major MB Crops



Average Annual K_2O Removal per Harvested Acre



Annual K_2O Removal



http://www5.statcan.gc.ca/cansim/a47

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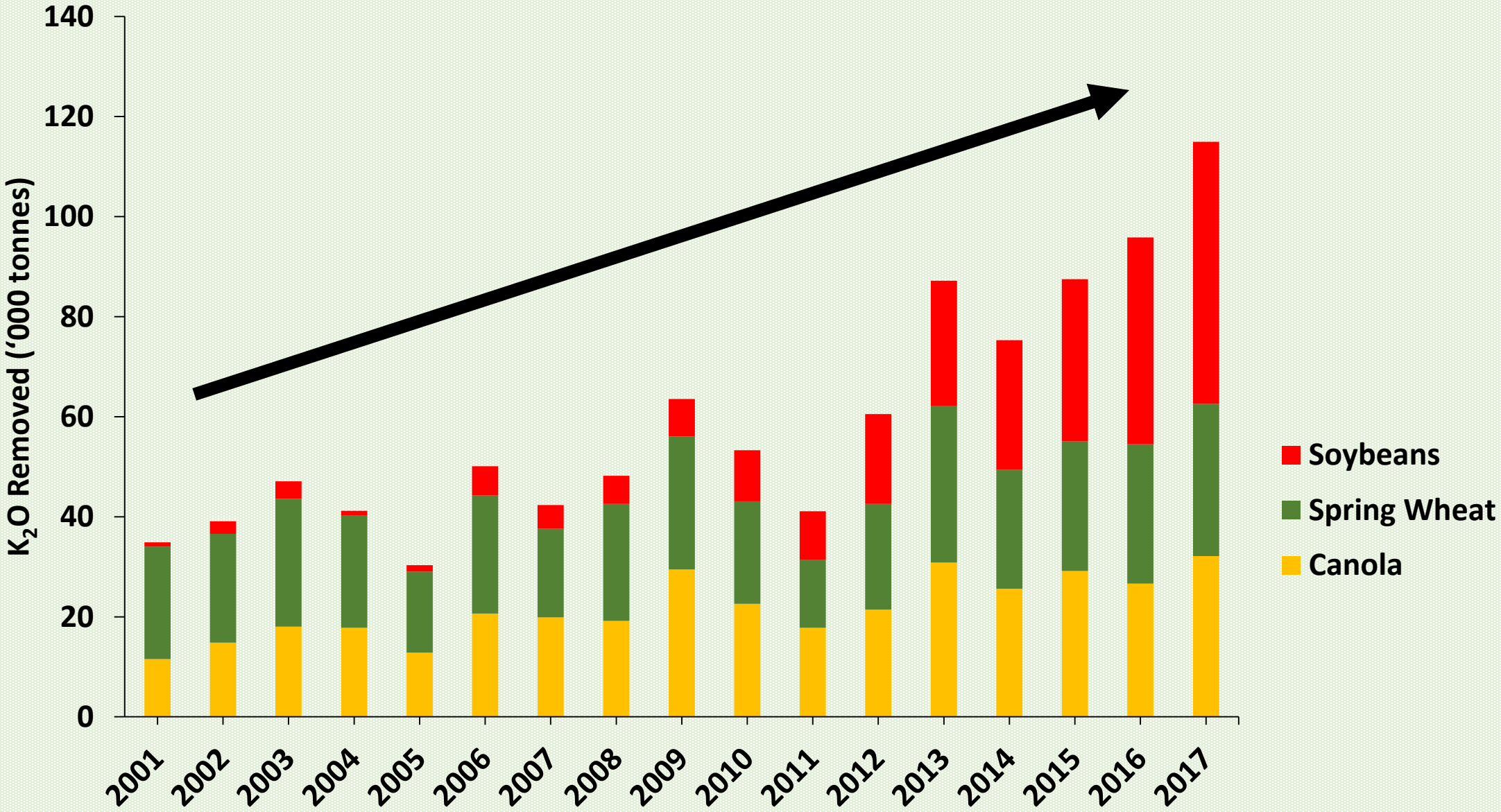

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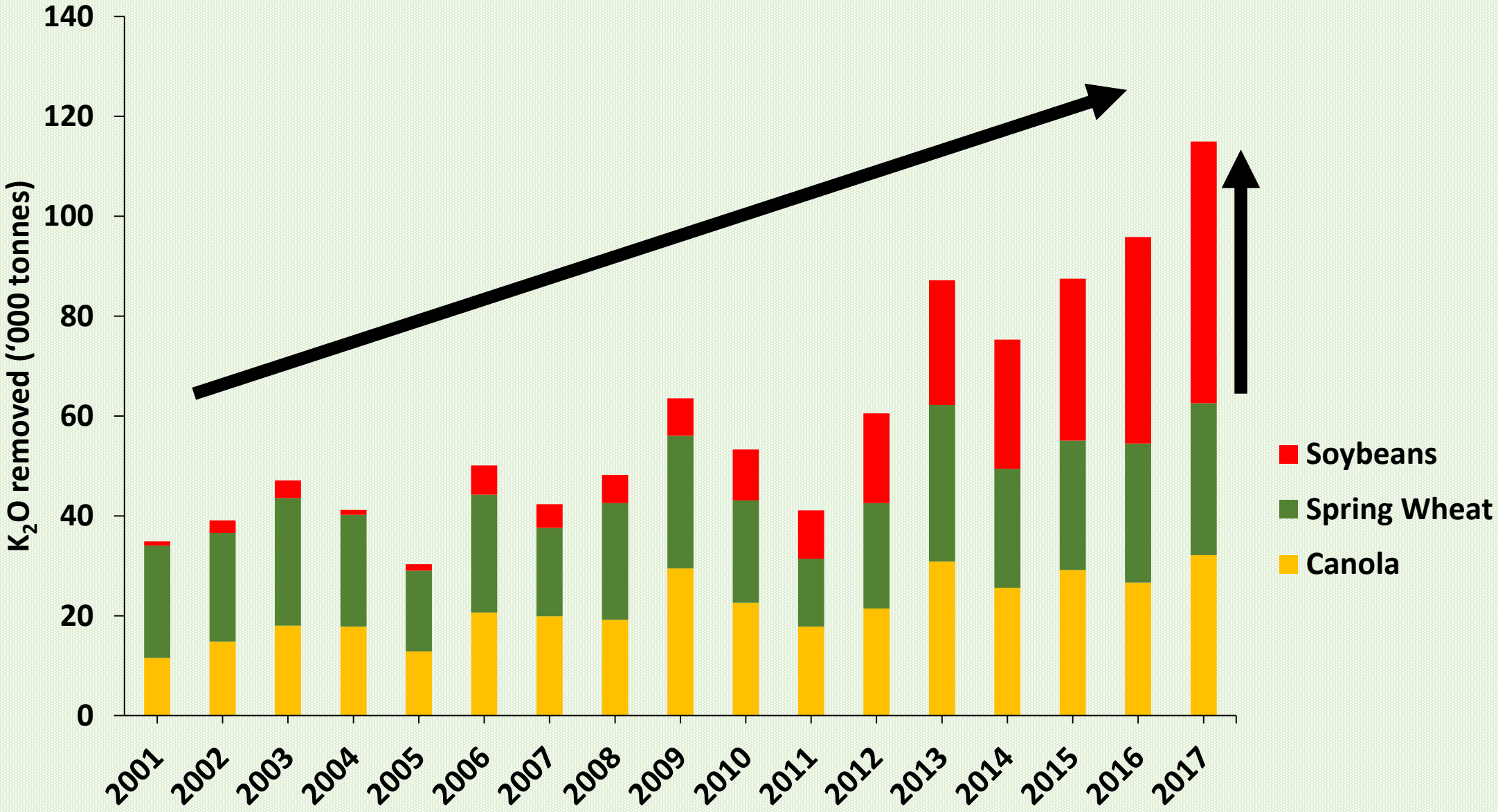

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Current Recommendations

- According to the Manitoba Soil Fertility Guide:

STK level	Recommendation
>100 ppm	No additional K
50 – 75 ppm	30 lb K_2O/ac broadcast & incorporated
<25 ppm	60 lb K_2O/ac broadcast & incorporated

- Thresholds & rates identical to K recommendations for wheat & canola, which remove K at much lower rates than soybeans
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Research Objectives

1. Determine the frequency of yield response to K fertilizer across a range of soil test K levels and soil types
2. Assess the effectiveness of different combinations of K fertilizer rates and placements for increasing soybean seed yields
3. Investigate capacity for MB soils to retain added K in non-exchangeable forms that may not be plant available

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Two groups of experiments

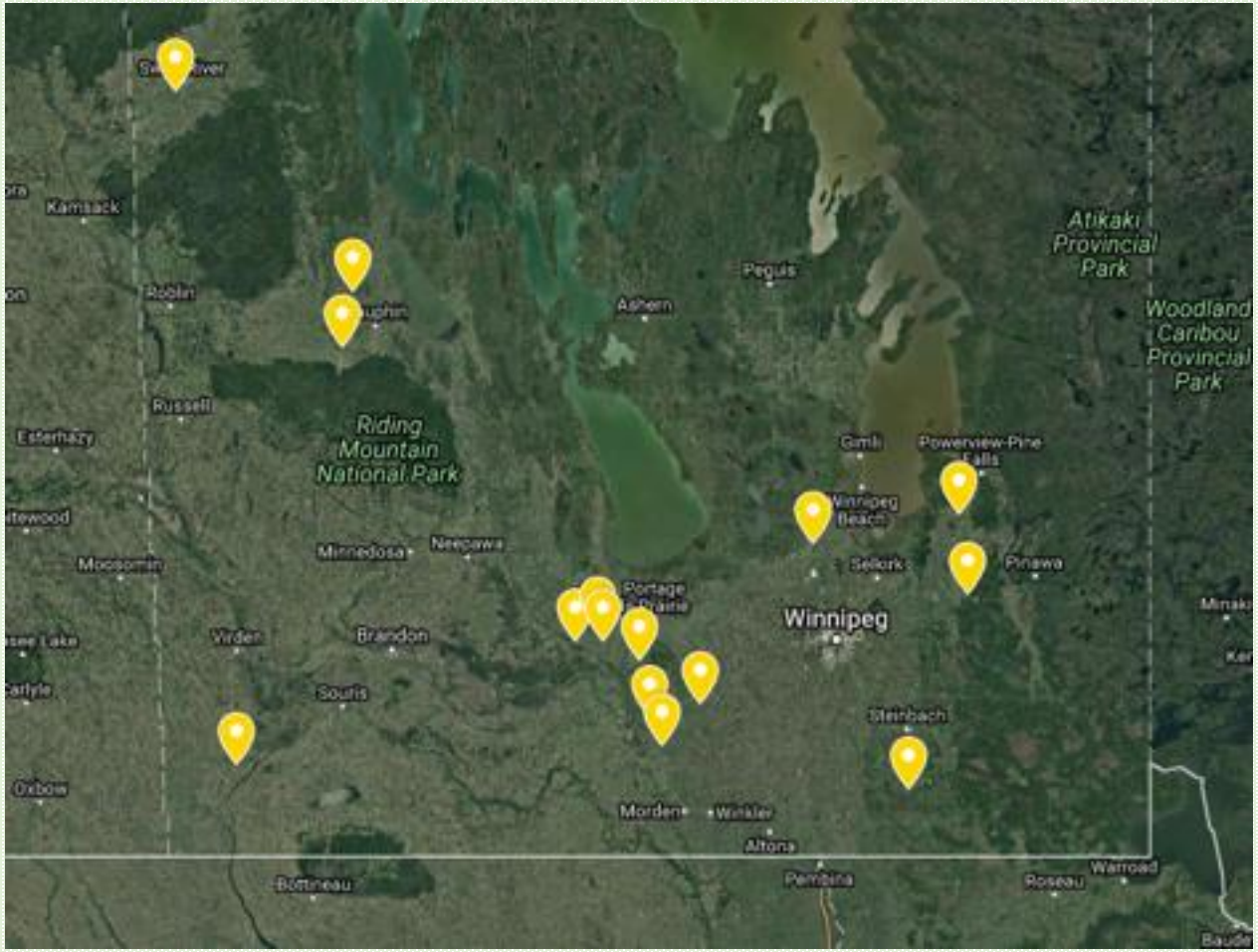
- on-farm field scale trials in conjunction with MPSG
- small plot field trials

On-farm Trial Methods

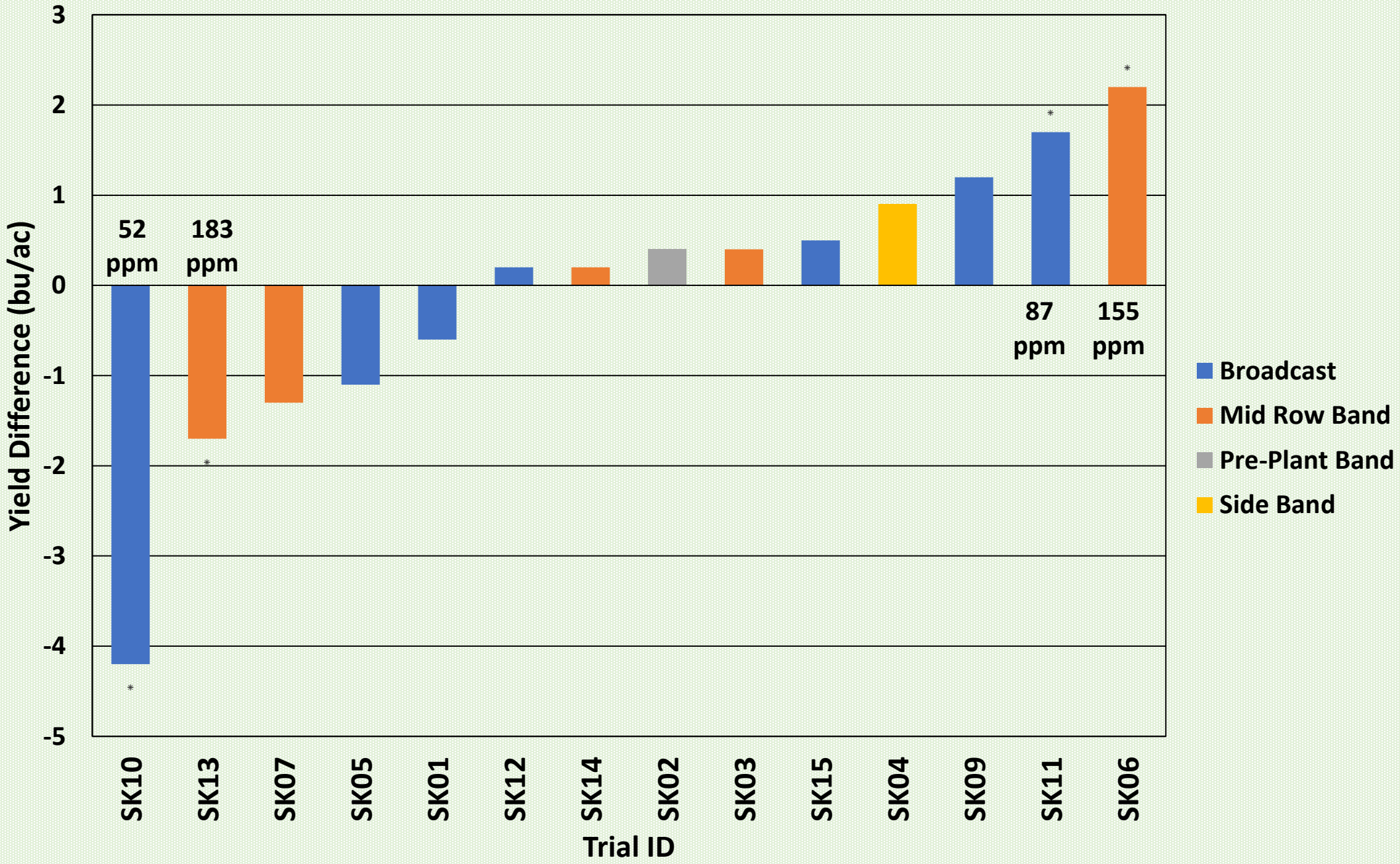
- In conjunction with MPSG
- Treated and untreated strips
  - Either 60 lb K_2O/ac pre-plant/side/mid row banded or 120 lb K_2O/ac broadcast and incorporated

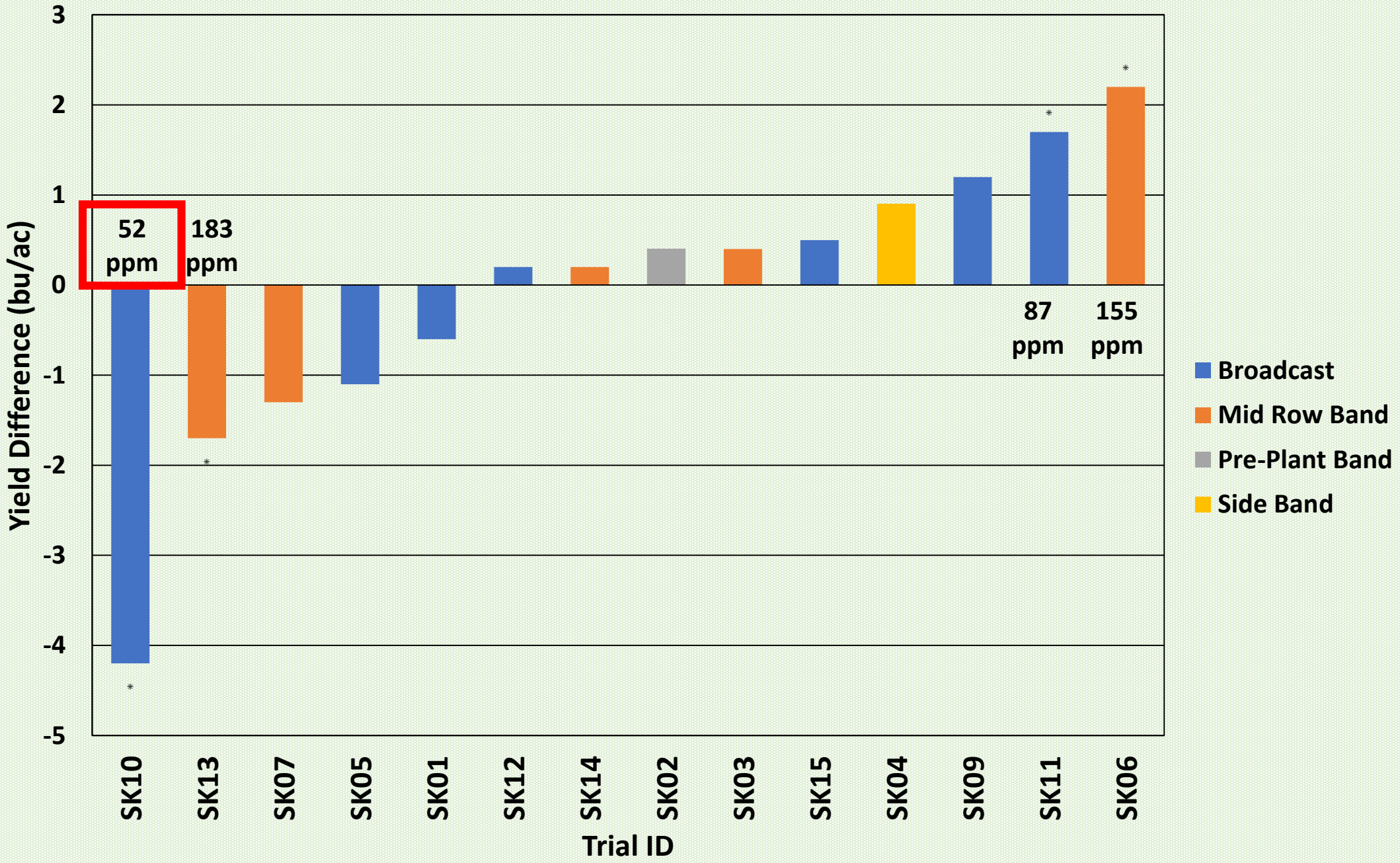
- STK levels ranged from 52-235 ppm
- Soil: sandy, loamy, organic peat

- Achieve <u>Objective #1</u>:
  - Frequency of response across the sites
  - Validate STK thresholds



MPSG on-farm K fertility 2017 trial locations


3
2
1
0
-1
-2
-3
-4
-5
Yield Difference (bu/ac)
52 ppm
183 ppm
87 ppm
155 ppm
SK10
SK13
SK07
SK05
SK01
SK12
SK14
SK02
SK03
SK15
SK04
SK09
SK11
SK06
Trial ID
Broadcast
Mid Row Band
Pre-Plant Band
Side Band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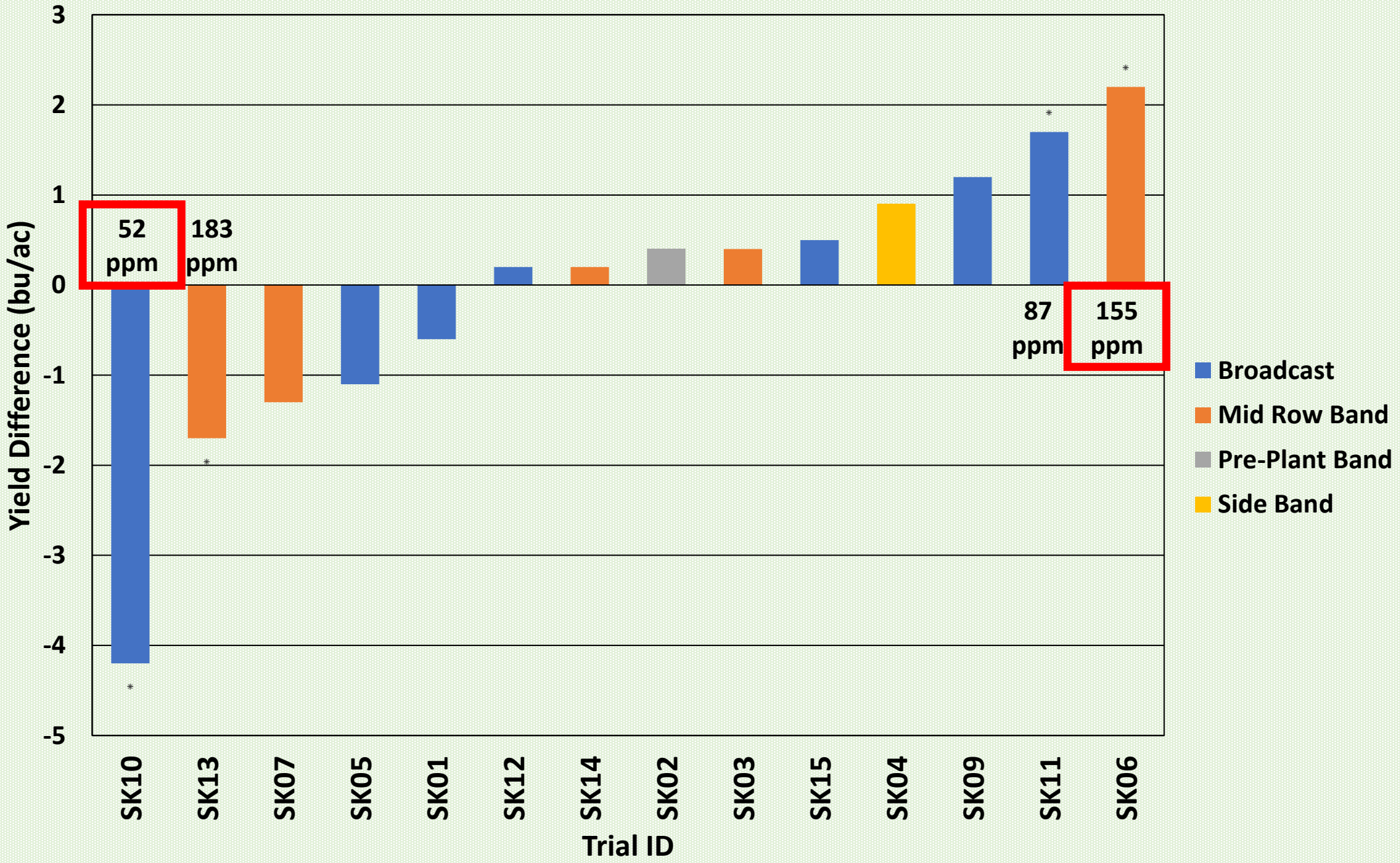
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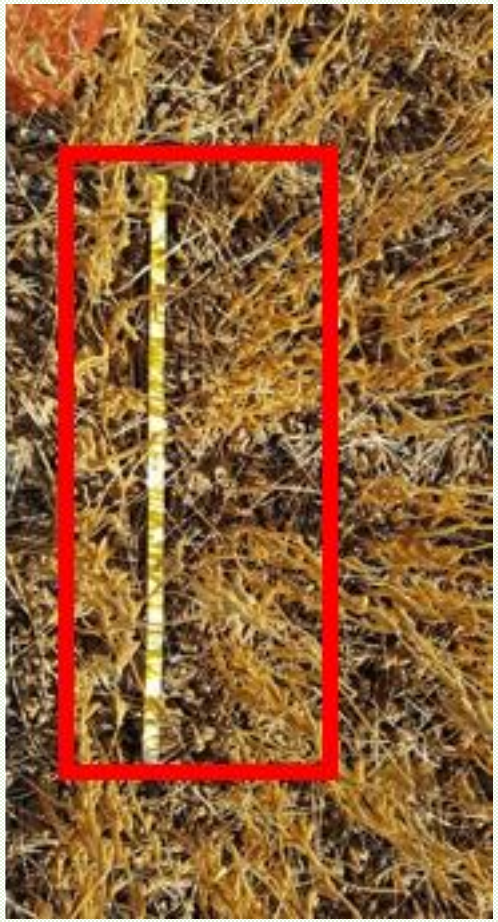
On-farm Trial Methods



To complement the STK measurements:

- Midseason paired soil and plant tissue samples
  - Compare relatively good and relatively poor growth areas
  - Analysis in progress
- Hand harvest samples from the midseason sampling locations
  - Analysis for seed K concentration in progress

Small Plot Trial Methods

2017 Spring STK Values	
Site	**STK (ppm)**
Elm Creek	101
Haywood	61
St. Claude	96
Portage	65

- In 2017, 4 small plot sites established in commercial fields with varying STK levels (targeting <100 ppm)
- Main purpose is to address Objective #2:
  - Effectiveness of different KCl rate/placement combinations for increasing seed yield
- 6 combinations of potash rates & placements
  - 30 or 60 lb K_2O/ac sidebanded
  - 30, 60 or 120 lb K_2O/ac broadcast and incorporated
  - Control (0 added K)
- All plots planted at 30 inch row spacing

St. Claude

Haywood


Portage


Elm
Creek

In-season Measurements

1. **Ammonium acetate extractable soil test K from field-moist and air dried samples**
   - **Increase/decrease in extractable K as a result of the drying process:**

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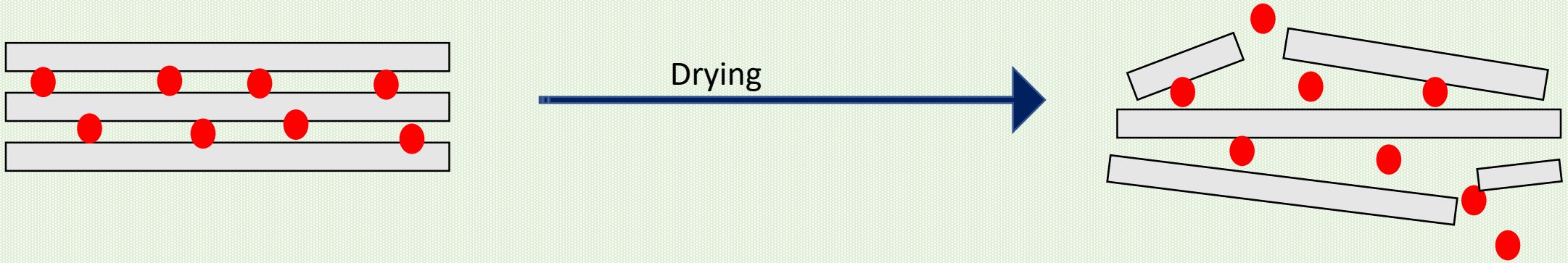

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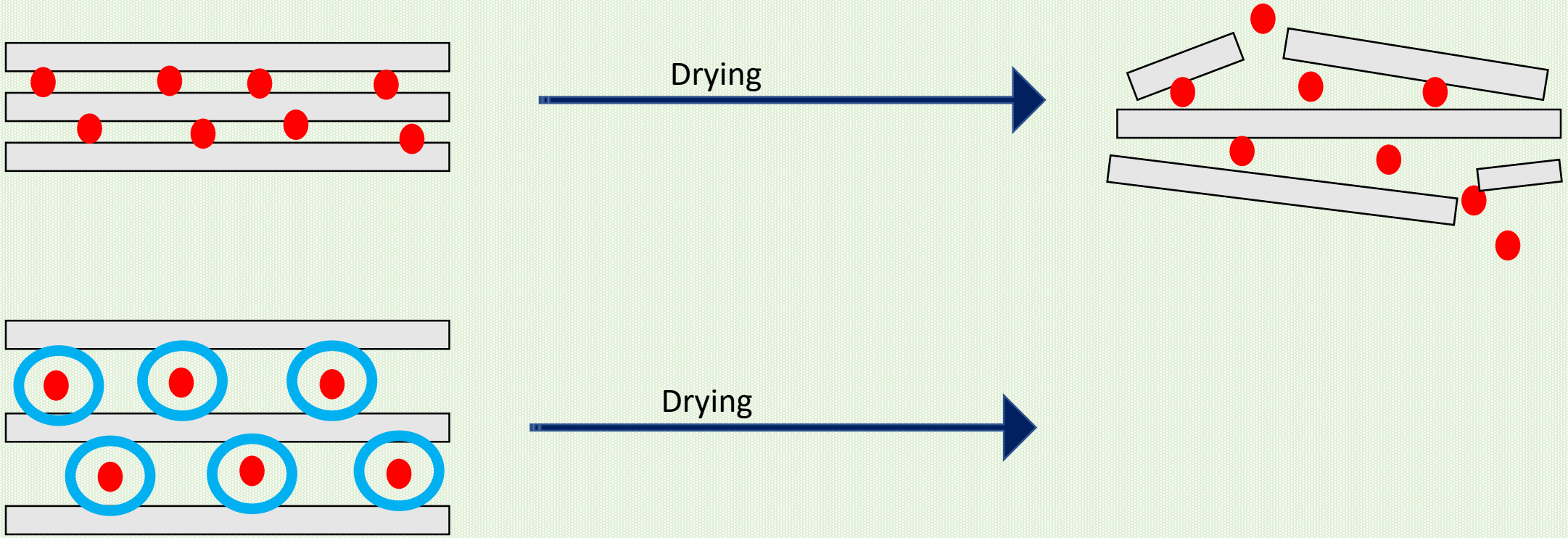

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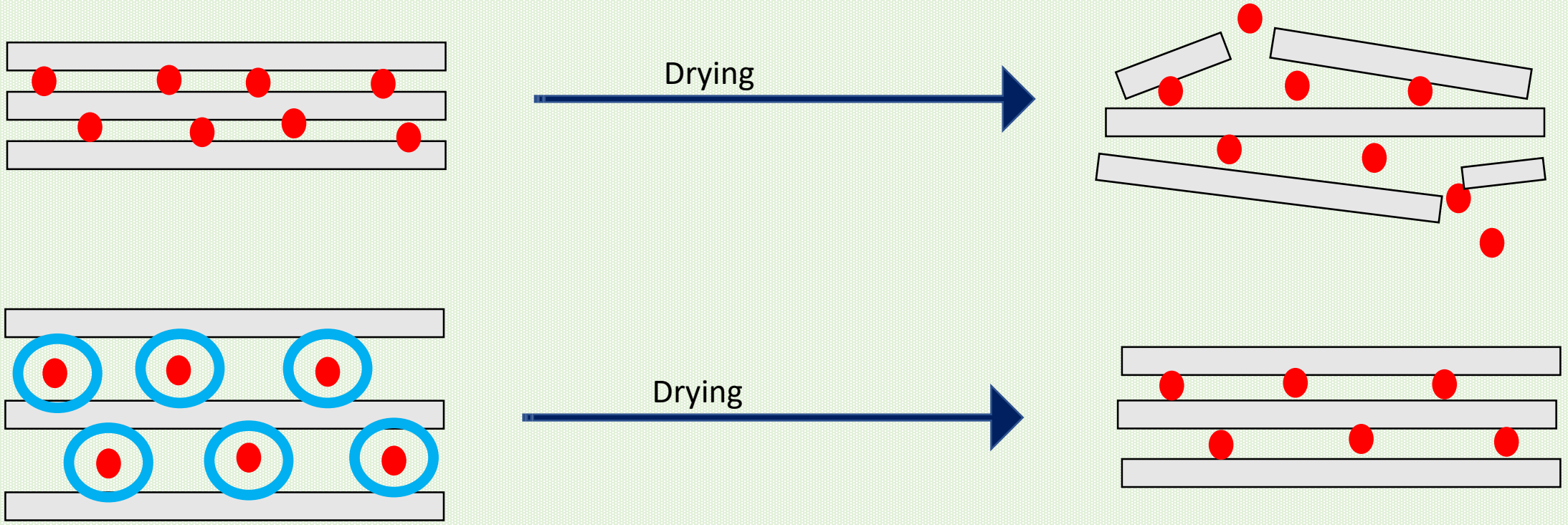
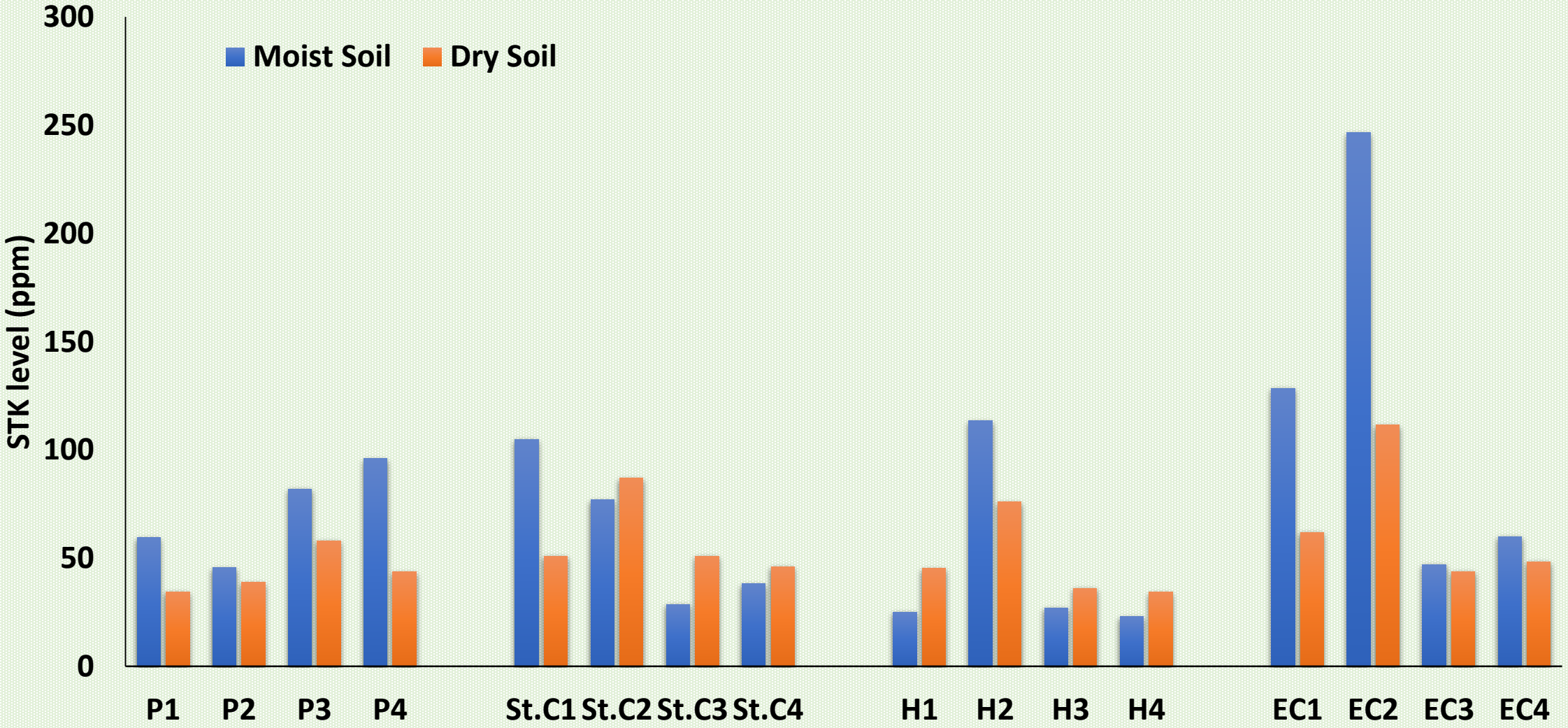


Soil Test K: dry vs. moist soil?



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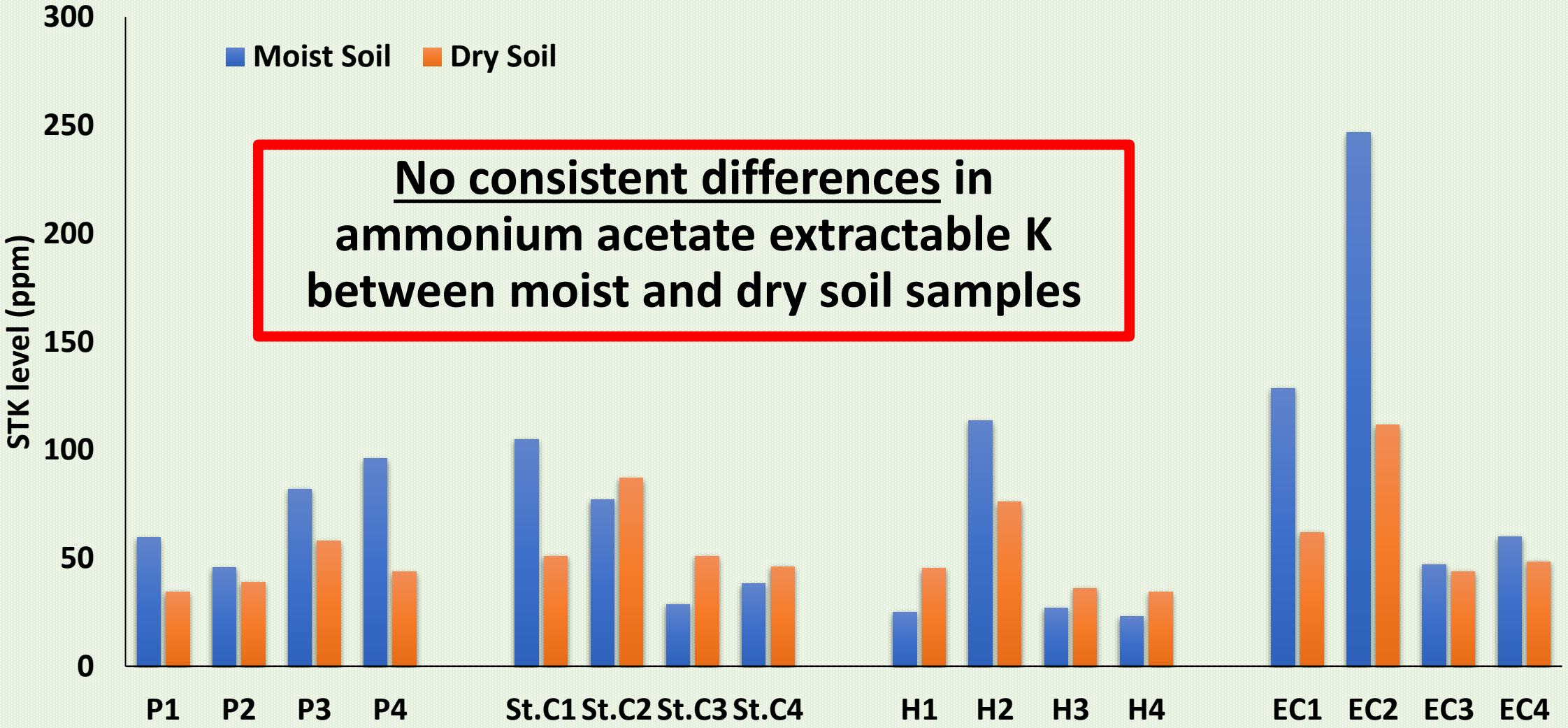


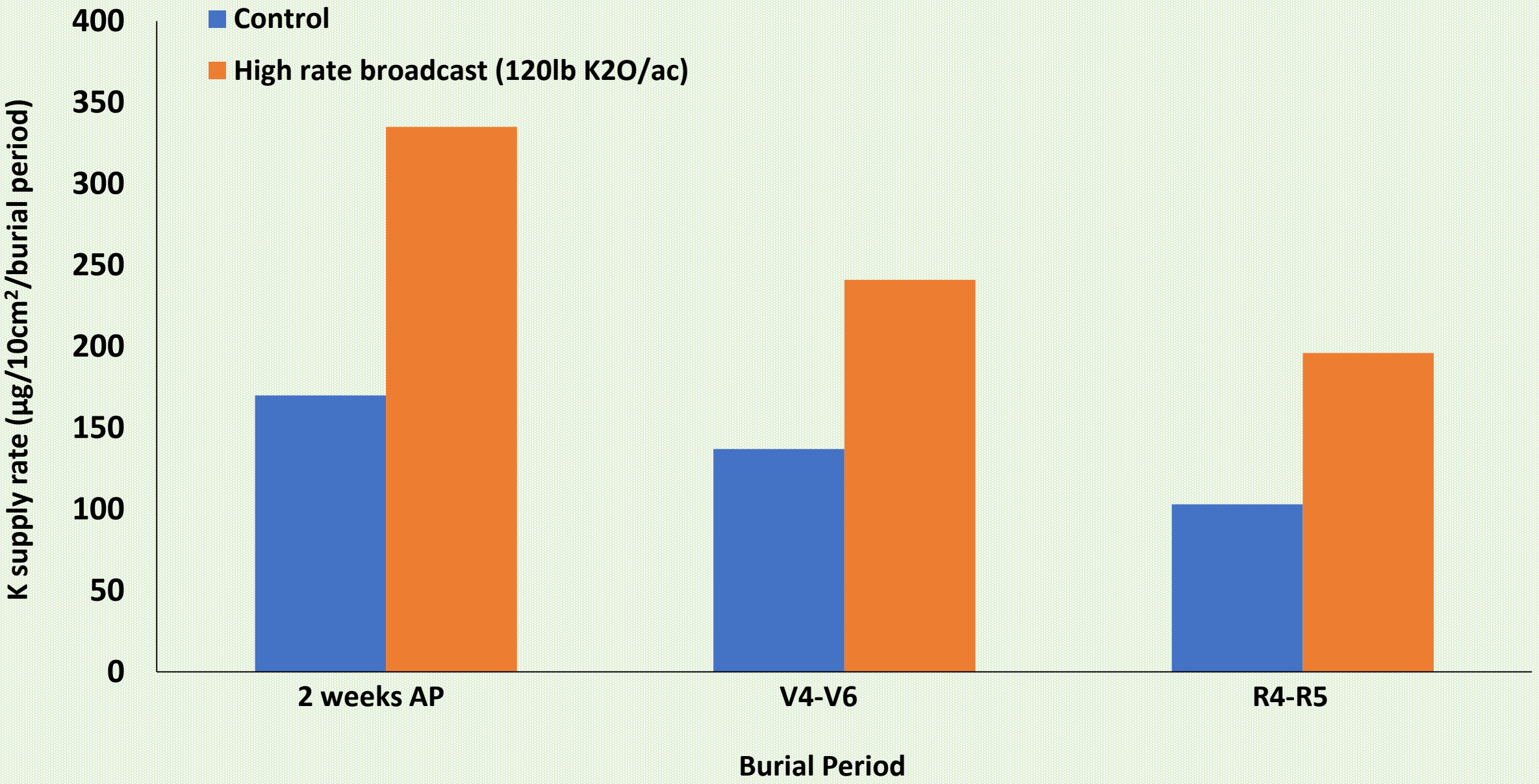
In-season Measurements

2. K supply rates in the field

- **Measured with Plant Root Simulator (PRS) probes**

***PRS probes are a registered trademark of Western Ag Labs**

PRS Probe K Supply Rates



In-season Measurements

3. Midseason soybean K nutrition status

- Tissue samples

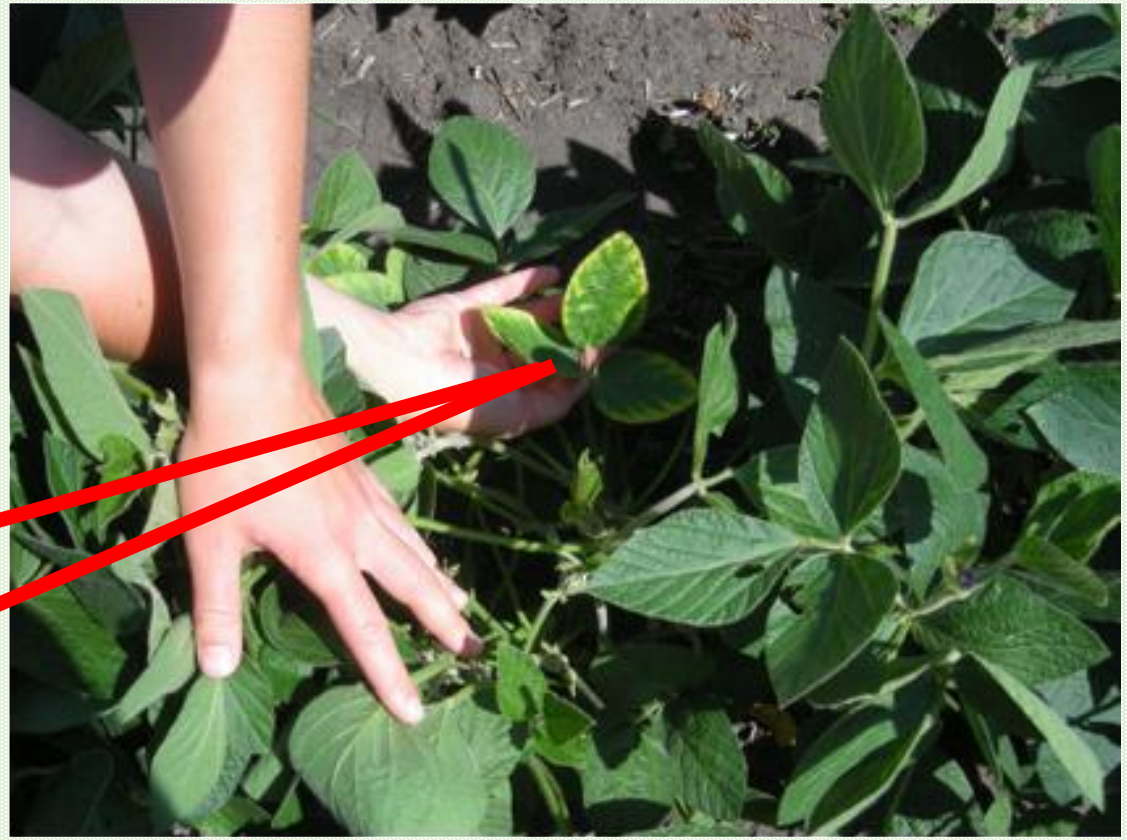
Midseason Soybean K Nutrition Status

- Midseason tissue samples (R2)
  - Critical K concentration
    - Uppermost mature trifoliate leaves
    - Stem samples
  - K uptake
    - Whole plant
- Tissue sampling coincided with second PRS probe burial
  - Look at relationship between K supply rates and plant K uptake

In-season Observations

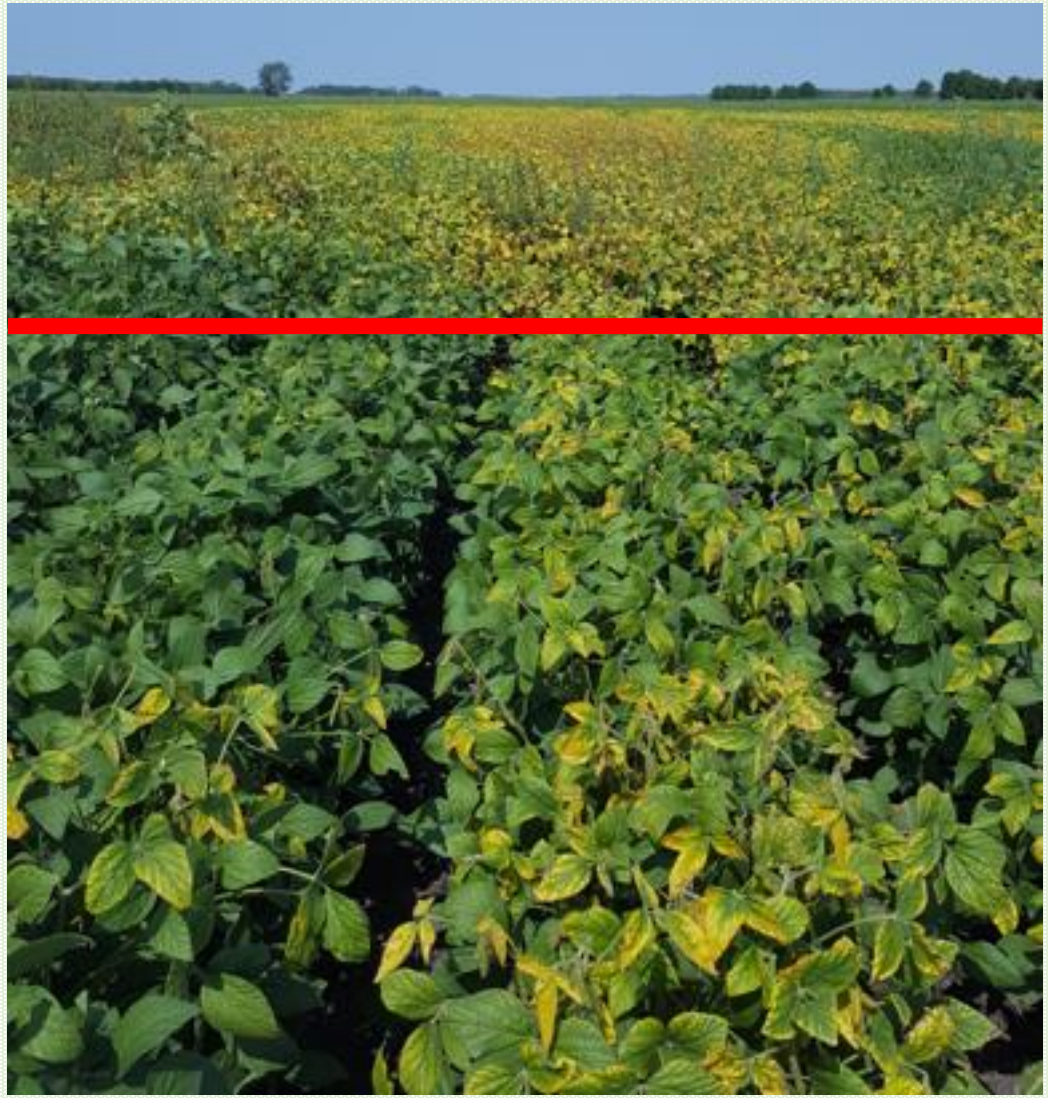
June 30th: Early season K deficiency symptoms observed at Haywood (V3)

In-season Observations



July 31st: Haywood site, still some deficiency symptoms (R4-5)

In-season Observations



K deficiency symptoms present in both the control plots of our site, and the farmer's field (R6)

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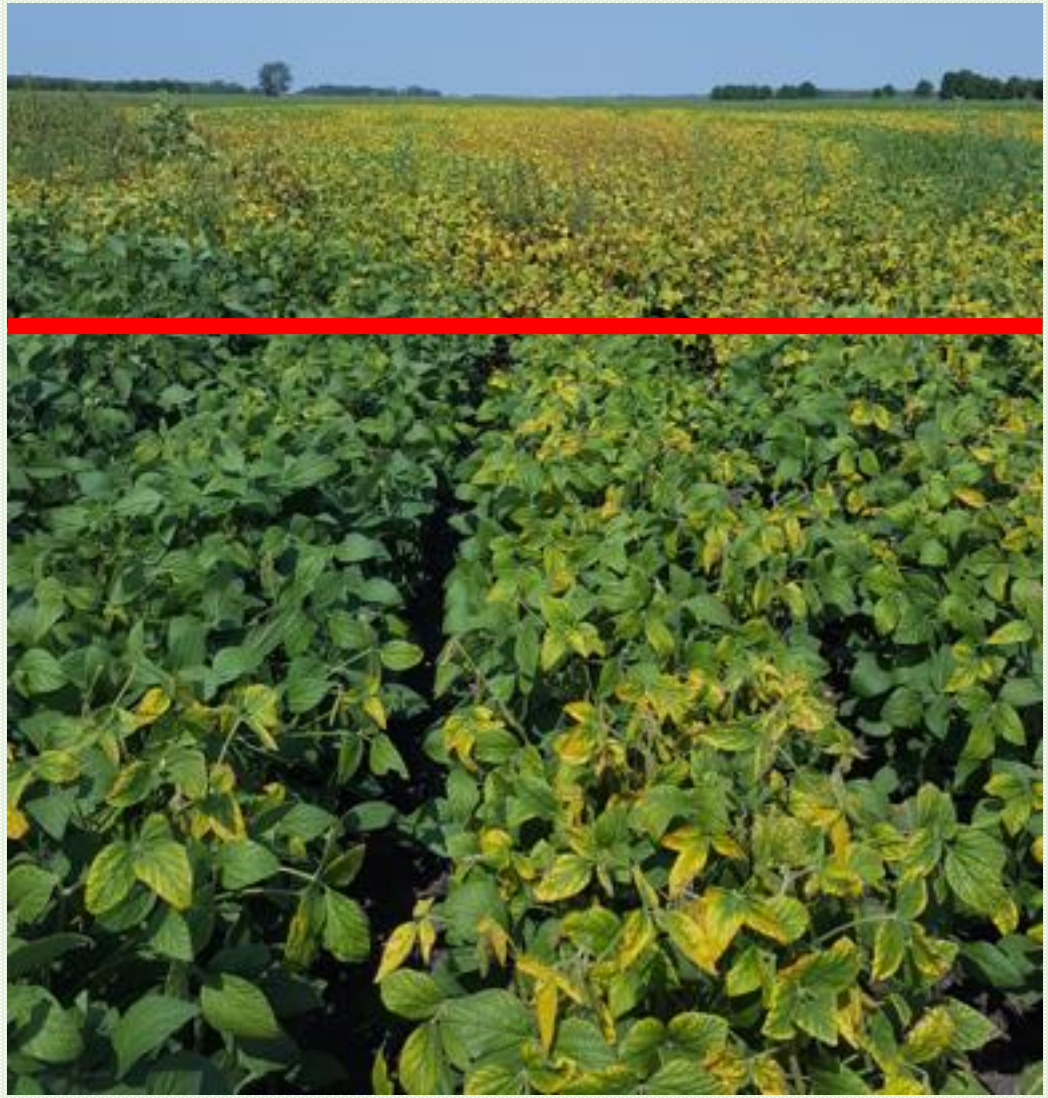

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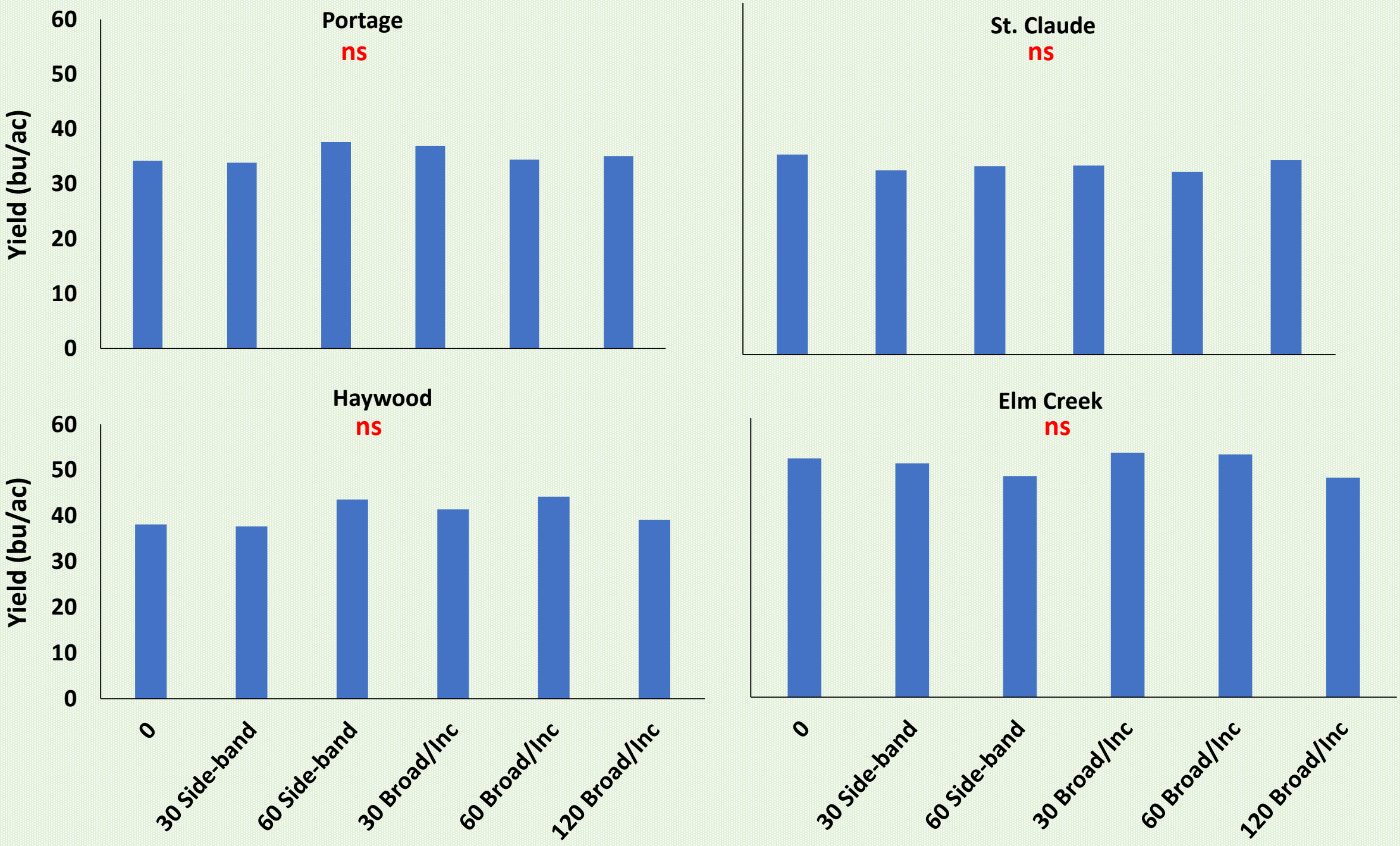
Responsive???


Portage
ns
St. Claude
ns
Haywood
ns
Elm Creek
ns
Yield (bu/ac)
60
50
40
30
20
10
0
0
30 Side-band
60 Side-band
30 Broad/Inc
60 Broad/Inc
120 Broad/Inc

Preliminary Conclusions

- **On-Farm Trials:**
  - **K responses infrequent and unrelated to STK**
- **Small Plot trials**
  - **No significant K response at any site**

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So…now what????

Next Steps

- Complete analysis of 2017 data
  - Small plots: midseason tissue K and uptake, further analysis of PRS supply rate data, seed K concentration
  - OFTs: midseason STK and tissue K concentrations, seed K concentration from hand harvested samples
- Repeat small plot and on-farm trials in 2018
- Explore soil-K dynamics
  - K fixation/adsorption
  - K supply
- K responsiveness of soybeans vs. barley

Acknowledgements

- Manitoba Pulse and Soybean Growers
- Western Grains Research Foundation
- Grower Cooperators
- Agrium
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- Western Ag Labs
- University of Manitoba
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- Technical support: Trevor & Lanny
- Summer help: Amy, Kris, Meghan and Joel

Contacts

Megan Bourns
(@meg_bourns)
204-599-0980
bournsm@myumanitoba.ca

Greg Bartley
204-751-0219
greg@manitobapulse.ca