Soybean Response to Potassium Fertility and Fertilizer in MB

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Harvested Acres of Major MB Crops

- Soybeans
- Spring Wheat
- Canola

http://www5.statcan.gc.ca/cansim/a47
Average Annual K$_2$O Removal per Harvested Acre

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Annual $K_2O$ Removal

$K_2O$ Removed (1000 tonnes)

Soybeans
Spring Wheat
Canola

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Annual K$_2$O Removal

K$_2$O removed (‘000 tonnes)


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Current Recommendations

- According to the Manitoba Soil Fertility Guide:

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- 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 K₂O/ac pre-plant/side/mid row banded or 120 lb K₂O/ac broadcast and incorporated
- STK levels ranged from 52-235 ppm
- Soil: sandy, loamy, organic peat

- Achieve **Objective #1:**
  - Frequency of response across the sites
  - Validate STK thresholds

MPSG on-farm K fertility 2017 trial locations
Yield Difference (bu/ac)

**Trial ID**
- SK10
- SK13
- SK07
- SK05
- SK01
- SK12
- SK14
- SK02
- SK03
- SK15
- SK04
- SK09
- SK11
- SK06

**Broadcast**
- 52 ppm
- 183 ppm

**Mid Row Band**
- 87 ppm
- 155 ppm

**Pre-Plant Band**

**Side Band**

- SK10: -4.1
- SK13: -2.1
- SK07: -0.8
- SK05: -0.4
- SK01: 0.3
- SK12: 0.1
- SK14: 0.5
- SK02: 0.9
- SK03: 1.5
- SK15: 1.8
- SK04: 2.2
- SK09: 2.5
- SK11: 3.0
- SK06: 2.7
Yield Difference (bu/ac)

- **SK10**: 52 ppm
- **SK13**: 183 ppm
- **SK07**: 87 ppm
- **SK05**: 155 ppm

- **Broadcast**
- **Mid Row Band**
- **Pre-Plant Band**
- **Side Band**

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**SK06**
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

<table>
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<tr>
<th>Site</th>
<th>STK (ppm)</th>
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<tr>
<td>Elm Creek</td>
<td>101</td>
</tr>
<tr>
<td>Haywood</td>
<td>61</td>
</tr>
<tr>
<td>St. Claude</td>
<td>96</td>
</tr>
<tr>
<td>Portage</td>
<td>65</td>
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- 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 K₂O/ac sidebanded
  - 30, 60 or 120 lb K₂O/ac broadcast and incorporated
  - Control (0 added K)
- All plots planted at 30 inch row spacing
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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   • Increase/decrease in extractable K as a result of the drying process:
Soil Test K: dry vs. moist soil?

STK level (ppm)
Soil Test K: dry vs. moist soil?

No consistent differences in ammonium acetate extractable K between moist and dry soil samples
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

- Control
- High rate broadcast (120lb K2O/ac)

Burial Period

K supply rate (µg/10cm²/burial period)

- 2 weeks AP
- V4-V6
- R4-R5
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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Responsive???
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

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