Soybean Response to Potassium Fertility and Fertilizer in Manitoba

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Background

In recent years, there has been an increase in reports of soybean potassium (K) deficiencies in Manitoba. This is likely a result of the large amount of K removed by soybeans at harvest (1.1 – 1.4 lb K₂O/bu), coupled with substantial increases in soybean acres and improvements in genetic yield potentials. Despite these factors, there has been a lack of comprehensive research on potassium fertility for soybean production in Manitoba. K fertilizer recommendations for soybeans have not been updated for several years.

Research Objectives:

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

Methodology

In 2017, four sites were established on fields with varying STK levels, as determined by a site composite spring soil test. The target range for these K rate and placement studies was soils with spring soil test potassium (STK) levels <100 ppm, the current threshold for recommending K fertilizer on soybeans in MB.

Six combinations of potash (KCl) rate and placement were replicated four times at each site:
- 0 lb K₂O/ac (control)
- 30 and 60 lb K₂O/ac, side-banded
- 30, 60 or 120 lb K₂O/ac broadcast and incorporated

Small plots (3m x 8m) were established with a John Deere 1755 4-row precision planter, with the capability to side-band 2” beside and 2” below the seed row. The variety planted was DKB005-52, with a target plant stand of 150 000 plants/ac.

In-season observations

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

Characteristic K deficiency symptoms of soybeans include interveinal chlorosis, beginning at the leaf margins of lower leaves. As the season progresses and K supply/uptake cannot keep up with plant demand, K is remobilized from older plant tissue and reallocated to newer growth areas.

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Soil Test K: moist or dry soil?

Soil samples taken from each control plot at the time of planting were analyzed for ammonium acetate extractable K. Each sample was split into two subsamples; one was kept field-moist, the other was air dried and ground. The differences between K analyzed for moist soil compared to a dried soil were inconsistent and often large.

Preliminary Results

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<th>Site ID</th>
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<th>STK (ppm)</th>
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<tbody>
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<td>SK01</td>
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<td>89</td>
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<tr>
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<td>SK14</td>
<td>SK15</td>
<td>75</td>
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Spring STK Values

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<tr>
<th>Site</th>
<th>Site STK Values</th>
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<tbody>
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<td>Collet</td>
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<td>Autsema</td>
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<tr>
<td>Verwey</td>
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On-farm Trials

- On-farm trials were established at 15 locations throughout Manitoba. The target range for the on-farm trials was soils with spring soil test potassium (STK) levels <150 ppm
- Each trial consisted of treated (either 120 lb potash/ac broadcast and incorporated, or 60 lb potash/ac banded) and untreated controls
- In addition to the harvest data collected for each entire strip, paired soil and plant samples were collected along treatment strips to determine the level of soil K and plant K uptake at mid-season (R3), as well as seed yield at maturity. Hand harvest samples were taken from the areas sampled midseason. Analysis of midseason paired samples and harvest samples is in progress.

- Statistically significant yield increases were found at SK11 and SK06.
- Statistically significant yield decreases were found at SK10 and SK13.

Midseason Tissue Samples

Midseason tissue samples taken at R2 from each plot included:
- 10 whole plants per plot (used to determine K uptake)
- 25 uppermost mature trifoliate leaves (to determine if K levels are within the established critical range for this stage)
- 25 stem pieces, from directly above the sampled trifoliate (assessed for K concentration to determine if this is a more sensitive indicator of K nutrition status of the plant than K concentration)

Tissue sampling coincided with the second PRS probe burial period. K supply rates during this period will be compared to K uptake and tissue concentration to assess the influence of K dynamics in the soil on plant nutrition status.

Acknowledgements

Manitoba Pulse and Soybean Growers, Western Grains Research Foundation, Agrium, Monsanto-Dekalb, Western Ag Labs, University of Manitoba, University of Manitoba Graduate Fellowship, Manitoba Graduate Scholarship

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