Soybean Response to Potassium Fertility and Fertilization in MB

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Harvested Acres of Major MB Crops



Annual K₂O Removal in MB



Current Recommendations

• According to the Manitoba Soil Fertility Guide:

Ammonium Acetate STK level	Recommendation
>100 ppm	No additional K
50 – 75 ppm	30 lb K ₂ O/ac broadcast & incorporated
<25 ppm	60 lb K ₂ O/ac broadcast & incorporated

- Thresholds and rates for soybean...
 - Same as those for spring wheat and canola
 - Lower than what is recommended in ND, MN and Ontario

Objectives of MB K Fertility Research

- Determine the frequency of yield response to K fertilizer across a range of soil test K levels and soil types
 - <u>On-farm</u> field scale trials in cooperation with Manitoba Pulse and Soybean Growers
- 2. Assess the effectiveness of different combinations of K fertilizer rates and placements for increasing soybean seed yields
 - <u>Small plot</u> field trials
- 3. Investigate the capacity for MB soils to retain applied K in non-exchangeable forms

Objective 1: STK & Frequency of Yield Response

- 19 on-farm trials (2017 & 2018) in commercial fields with NH₄OAc STK values from 52-451 ppm
- 1 combination of <u>spring applied potash</u> rates & placements in replicated strips at each site
 - Either 60 lb K₂O/ac banded away from seed or 120 lb K₂O/ac broadcast and incorporated
 - Untreated Control
- Yields 17 bu/ac 49 bu/ac, with lack of moisture being a limiting factor at most sites



Field-scale on-farm trials





Relative Yield (control as % of fertilized)



Ammonium Acetate STK (ppm)

On-farm Trial 2017/18 Relative Yield



Dry Basis

Objective 2: Effectiveness of K rate & placement

- 7 small plot trials (2017 & 2018) in commercial fields with NH₄OAc STK values from 49 – 117 ppm
- 6 combinations of <u>spring applied</u> <u>potash</u> rates & placements
 - 30 or 60 lb K₂O/ac sidebanded
 - 30, 60 or 120 lb K₂O/ac broadcast and incorporated
 - Control (0 added K)
- Collected a variety of soil & plant data
- Yields averaged 18 bu/ac in 2018, and 29 bu/ac in 2017, with lack of moisture as a yield limiting factor at most sites



Small plot trials

Ammonium Acetate STK at Planting



Small Plot Trial 2017/18 Relative Yield



Small Plot Trial 2017/18 Relative Yield



Conclusions

- 1. Frequency of yield response to fertilizer K
- On-farm trials: 2 of 19 sites had statistically significant positive responses to added K, and one had a significant negative response
- No agronomically significant relationship between ammonium acetate STK level and relative yield in the on-farm (or small plot) trials
- Frequency of response, and responsiveness at individual sites, not as predicted by NH₄OAc STK
- 2. <u>Effectiveness of K fertilizer rate & placement</u>
- Small plot trials: no statistically significant yield response to any treatment in any site year
- Optimum rate & placement of K fertilizer not determined, due to lack of yield response to K fertilizer

Challenges for measuring response to K fertilizer rate & placement:

- 1. Moisture was a yield limiting factor (lower than average rainfall in 2017 and 2018 field seasons)
- 2. Variability within the sites
- 3. NH₄OAc STK was not a reliable indicator for K response

Barley Soybean K Responsiveness Study

Comparison of responsiveness: Does barley respond to K addition where soybean does not?

- > Split plot design:
 - Crop (barley, soybean)
 - Fertilizer (+ 132 kg K₂O/ha broadcast & incorporated, 0 K)
- 3 site years (2018)



Barley with no added K (left), barley with 132 kg K₂O/ha spring broadcast and incorporated (right)

Barley Soybean K Responsiveness Study



- Barley had a significant yield increase with K addition (~ 20%)
- Soybean did not respond to K addition

Can soybean access more soil K than barley?

More Questions than answers...

- Are soybeans able to access more soil K than other crops?
 ➤ Barley soybean K responsiveness study
- 2. Are our soils releasing significantly more K over the growing season than we anticipate with our NH₄OAc spring soil test?
- 3. Is there yield loss in K deficient patches, and if so, what is the extent of that loss?
- 4. How do we make K recommendations if the response is unpredictable?

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