2016 IHARF Agronomy Update

Chris Holzapfel, MSc, PAg
IHARF Funding Sources

- Grain revenues from approximately 1200 ac of owned & rented cropland comprise up to 50% of gross operating funds.
- Additional revenues come from approximately 40-50 research & demo projects annually which are funded through government (provincial & federal), producer groups & private industry.

<table>
<thead>
<tr>
<th>Source</th>
<th>% of Outside Funding (Cash &amp; In-Kind)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Industry</td>
<td>49%</td>
</tr>
<tr>
<td>Producer</td>
<td>36%</td>
</tr>
<tr>
<td>Government</td>
<td>15%</td>
</tr>
</tbody>
</table>
Phosphorus Fertilizer Rate & Placement in Faba Beans

Indian Head 2015 & 2016 (ADOPT)
Faba bean Phosphorus Trials

Treatments
2015 \( P_2O_5 \) rates: 0, 22 & 45 lb \( P_2O_5 \)/ac
2016 \( P_2O_5 \) rates: 0, 18, 36, 53, 71 lb \( P_2O_5 \)/ac

Placement Methods: Seed-placed (in-furrow) vs. Side-band

- \( P_2O_5 \) source was commercial grade monoammonium phosphate (11-52-0)
- Snowbird faba-beans direct-seeded into spring wheat stubble (SeedMaster, 12” spacing) in the 1st week of May at ~55 seeds/m²
- Nitrogen was not balanced across treatments, seed inoculated with 2x label rate of seed-applied peat based inoculant
- Weeds controlled using pre-emergent & (spring) in-crop herbicides, Priaxor applied at early-mid bloom
- Pre-harvest glyphosate applied at maturity, centre 5 rows of each plot straight-combined when fit to do so
Phosphorus Effects On Emergence

Indian Head 2015 (~4 weeks after planting)

Overall F-test: $p = 0.117$
Check vs rest: $p = 0.047$
OP vs 22P: $p = 0.069$
OP vs 45P: $p = 0.067$
22P vs 45P: $p = 0.989$
SP vs SB: $p = 0.071$

Emergence (plants/m$^2$)

Phosphorus Rate (lb P$_2$O$_5$/ac)

OP vs rest
OP vs 22P
OP vs 45P
22P vs 45P
SP vs SB
Phosphorus Effects On Seed Yield

Indian Head 2015

Seed Yield (kg/ha)

<table>
<thead>
<tr>
<th>Phosphorus Rate (lb P₂O₅/ac)</th>
<th>0P vs rest</th>
<th>0P vs 22P</th>
<th>0P vs 45P</th>
<th>22P vs 45P</th>
<th>SP vs SB</th>
</tr>
</thead>
<tbody>
<tr>
<td>12 ppm Olsen-P</td>
<td>A</td>
<td>A</td>
<td>B</td>
<td>A</td>
<td>A</td>
</tr>
</tbody>
</table>

Overall F-test: $p = 0.001$

Check vs rest: $p = 0.110$

0P vs 22P: $p = 0.968$

0P vs 45P: $p = 0.005$

22P vs 45P: $p < 0.001$

SP vs SB: $p = 0.327$
Phosphorus Effects On Emergence
Indian Head 2016 (16 days after planting)

Overall F-test: $p = 0.314$
Check vs rest: $p = 0.474$
SP vs SB: $p = 0.797$
SP (lin): $p = 0.184$
SP (quad): $p = 0.527$
SB (lin): $p = 0.184$
SB (quad): $p = 0.527$

Error Bars = S.E.M.

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Phosphorus Effects On Emergence
Indian Head 2016 (32 days after planting)

Overall F-test: $p = 0.109$
Check vs rest: $p = 0.198$
SP vs SB: $p = 0.532$
SP (lin): $p = 0.641$
SP (quad): $p = 0.036$
SB (lin): $p = 0.722$
SB (quad): $p = 0.197$

Error Bars = S.E.M.

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Phosphorus Effects On Seed Yield
Indian Head 2016

Overall F-test: $p = 0.003$
Check vs rest: $p = 0.058$
SP vs SB: $p = 0.820$
SP (lin): $p < 0.001$
SP (quad): $p = 0.118$
SB (lin): $p = 0.002$
SB (quad): $p = 0.068$

Error Bars = S.E.M.

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Faba beans are large users of P, removing 1.1-1.3 lb P₂O₅/bu
- 2015 crop removed ~51-60 lb P₂O₅ at 46 bu/ac, ~68-81 lb/ac in 2016
- 90 bu/ac faba beans in 2014, estimated removal was 99-117 lb P₂O₅/ac
- Not likely practical to fertilize for replacement under high yielding conditions

No evidence of seedling toxicity w/seed-placed P in either year
- 8% fewer plants on average w/P fertilizer in 2015 but no SP vs SB difference
- High rates of seed-placed P not recommended, results may vary widely depending on seeding equipment, soil properties & environmental conditions

Relatively strong yield response to high rates of P fertilizer observed in both 2015 and 2016
- 20% yield increase w/45 lb P₂O₅/ac in 2015 but no increase at 22 lb P₂O₅/ac
- 6% avg yield increase w/P but linear response & 15% (9 bu/ac) at 71 lb P₂O₅/ac

Small & inconsistent effects on seed size over the 2-yr period
Soybean Response to Dual Inoculation & N Fertilizer

Indian Head 2015 & 2016 (SPG)
Nitrogen Management Recommendations for Soybeans in Saskatchewan (SPG)
Indian Head, Outlook & Melfort (2015-17)

<table>
<thead>
<tr>
<th>Inoculant</th>
<th>N Fertilization</th>
</tr>
</thead>
<tbody>
<tr>
<td>Liquid only (single inoculant)</td>
<td>No supplemental N fertilizer</td>
</tr>
<tr>
<td>Liquid + 1x rate granular (3.6 lb/ac)</td>
<td>50 lb N/ac as side-banded urea</td>
</tr>
<tr>
<td>Liquid + 2x rate granular (7.2 lb/ac)</td>
<td>50 lb N/ac as side-banded ESN</td>
</tr>
<tr>
<td>Liquid + 2x rate granular (14.4 lb/ac)</td>
<td>50 lb N/ac as dribble-banded UAN (R3 stage)</td>
</tr>
</tbody>
</table>

Data Collection
1) Biomass Yield  2) Tissue Nitrogen  2) N Uptake  3) Pod Height  4) Seed Yield  5) Seed Size  6) Grain Nitrogen  7) N Exports

- All seed commercially treated w/ Optimize liquid inoculant
- Granular product was Cell-Tech soybean (3.6 lb/ac on 12” spacing)
- DK23-10, all other factors constant & intended to be non-limiting
- Only data from Indian Head is presented for brevity
Inoculant Effects on Soybean Biomass Yield (Indian Head)

**IH-2015**
- Pr > F: $P = 0.792$
- Lin: $P = 0.378$
- Quad: $P = 0.914$

**IH-2016**
- Pr > F: $P < 0.001$
- Lin: $P = 0.011$
- Quad: $P = 0.011$

**NOTE:** N x I interaction NS both years

Residual NO$_3$-N: 2015 – 13 lb/ac, 2016 – 19 lb/ac

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**IHARF**
**INDIAN HEAD AGRICULTURAL RESEARCH FOUNDATION**

**SASKATCHEWAN PULSE Growers**
Nitrogen Effects on Soybean Biomass Yield (Indian Head)

Residual NO₃-N: 2015 – 13 lb/ac, 2016 – 19 lb/ac  
SDB - UAN applied at R3 stage  
Error bars = S.E.M.

IH-2015  
Pr > F: P = 0.007

IH-2016  
Pr > F: P < 0.001

<table>
<thead>
<tr>
<th>Inoculant Treatment</th>
<th>IH15</th>
<th>IH16</th>
</tr>
</thead>
<tbody>
<tr>
<td>None</td>
<td>b</td>
<td>b</td>
</tr>
<tr>
<td>SB Urea</td>
<td>a</td>
<td>a</td>
</tr>
<tr>
<td>SB ESN</td>
<td>a</td>
<td>a</td>
</tr>
<tr>
<td>DB UAN</td>
<td></td>
<td></td>
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Inoculant Effects on Soybean Seed Yield (Indian Head)

NOTE: N x I interaction significant in both years

Residual NO₃-N: 2015 – 13 lb/ac, 2016 – 19 lb/ac

IH-2015
Pr > F: P < 0.001
Lin: P < 0.001
Quad: P < 0.001

IH-2016
Pr > F: P < 0.001
Lin: P < 0.001
Quad: P = 0.001
Nitrogen Effects on Soybean Seed Yield (Indian Head)

- **NOTE**: N x I interaction significant in both years
- Residual NO$_3$-N: 2015 – 13 lb/ac, 2016 – 19 lb/ac
- SDB - UAN applied at R3 stage
- Error bars = S.E.M.

**IH-2015**
Pr > F: $P < 0.001$

**IH-2016**
Pr > F: $P < 0.001$

**NOTE**: N x I interaction significant in both years

Residual NO$_3$-N: 2015 – 13 lb/ac, 2016 – 19 lb/ac

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Inoculant x N Interactions for Soybean Seed Yield (IH15)

Residual NO₃-N: 2015 – 13 lb/ac

SDB - UAN applied at R3 stage

Error bars = S.E.M

IH-2015
Pr > F: P = 0.039

Residual NO₃-N: 2015 – 13 lb/ac

<table>
<thead>
<tr>
<th>Inoculant Treatment</th>
<th>Seed Yield (bu/ac)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0x</td>
<td>30</td>
</tr>
<tr>
<td>1x</td>
<td>35</td>
</tr>
<tr>
<td>2x</td>
<td>40</td>
</tr>
<tr>
<td>4x</td>
<td>45</td>
</tr>
</tbody>
</table>

None
SB Urea
SB ESN
SDB UAN

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Inoculant x N Interactions for Soybean Seed Yield (IH16)

Residual NO₃-N: 2016 – 19 lb/ac
SDB - UAN applied at R3 stage
Error bars = S.E.M

Pr > F: P < 0.001

N X I: IH-2016

- None
- SB Urea
- SB ESN
- SDB UAN

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Visual Response to Dual Inoculant (IH-2015)

liquid only

+ 8 lb/ac granular
Visual Response to Dual Inoculant (IH-2016)

liquid only

+ 8 lb/ac granular
Soybean Inoculation & Starter Nitrogen - Conclusions

- Effective nodulation critical to meet the N demands of high yielding soybeans & most SK field trials in SK show benefits to double application
  - Total above-ground N uptake is approximately 152-180 lb N/ac at 40 bu/ac
  - In current trial, 24% & 52% higher yield w/dual inoculant in 2015 & 2016 (across N rates)
  - 19% & 36% benefit at Melfort & Outlook (2015), 33% across all currently available sites

- Start N consistently increased biomass yield but only had a positive effect on seed yield in the absence of granular inoculant
  - Late season N (R3 stage) always the most effective to recover yield loss w/poor nodulation
  - 16% over control & 91% of double inoculated at IH-15, 63% and 79% at IH-16

- As soybeans become well established in crop rotations, likelihood of yield benefits from dual inoculation is expected to diminish
  - Economic response in only 2/25 fields in MB w/field history of 2 or more soybean crops

- Always assess nodulation, regardless of field history or inoculation methods
  - Look for at >5 healthy nodules/plant at R1 growth stage (gives time to address deficiency)
  - When nodulation is poor, 50 lb N/ac applied at R3 mitigates some yield loss

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Thank you

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IHARF Crop Management Field Day
Jul. 18, 2017, Indian Head, SK

Feb 1, 2017
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