2018 IHARF Agronomy Update

Chris Holzapfel, MSc PAg
Presentation Overview

- Faba bean Row Spacing x Seed Rates (2018)
- Flax Seed Treatments & Foliar Fungicides (2018, multi-site)
- Canola Seed-placed P Fertilizer Forms & *P. bilaii* inoculation (2018)
- 4R N Management Trials in Wheat & Canola (2017-18)
- Wheat Input Demo (2018)
Faba bean Response to Row Spacing & Seed Rate (ADOPT)
Objectives

- To demonstrate the response of faba beans to varying row spacing with a focus on establishment, ability to compete with weeds, maturity and yield
- To gather additional information on faba bean seeding rate response & assess whether the observed seeding rate responses are affected by row spacing

Treatments (12)
Row Spacing (4): 10”, 12”, 14”, & 16”
Seeding Rates (3): 25, 45, & 65 seeds/m$^2$
IHARF-SeedMaster Plot Drill on Various Row Spacing Configurations

10 inch spacing
(7.5’ seeded plot width)

14” cm Spacing
(9.3’ seeded plot width)

12” cm spacing
(8.0’ seeded plot width)

16” cm Spacing
(10.7’ seeded plot width)
Seed Rate & Row Spacing Effects on Faba bean Emergence (IH-18)

SR: $P < 0.001$

RS: $P = 0.134$

SR×RS: $P = 0.923$

SR-lin: $P < 0.001$

RS-quad: $P = 0.053$
Seed Rate & Row Spacing Effects on Faba bean Maturity (IH-18)

SR: $P < 0.001$
RS: $P = 0.308$
SR×RS: $P = 0.328$

SR-lin: $P < 0.001$
RS-lin/quad: $P = 0.21-0.23$

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Seed Rate & Row Spacing Effects on Faba bean Seed Yield (IH-18)

SR: $P = 0.018$

RS: $P = 0.066$

SR×RS: $P = 0.143$

SR-lin: $P = 0.005$

RS-quad: $P = 0.010$
10” – 40 seeds/m²

12” – 40 seeds/m²

14” – 40 seeds/m²

16” – 40 seeds/m²

July 18, 2018
Seed Rate & Row Spacing Effects on Faba bean
Summary & Conclusions

- Results are not conclusive with only 1 site-year of data available
- Faba beans appeared to be relatively insensitive to row spacing within the 10-16” range evaluated and under relatively dry, low yielding conditions
- The observed seeding rate response was stronger than expected, possibly due to the extremely dry conditions
- Seeding rate appeared to have a greater impact on maturity and the ability of faba beans to compete with weeds than row spacing; however, weed pressure was very low in all treatments
Flax Seed Treatment and Foliar Fungicide Options (SaskFlax-ADOPT)
Objectives
 To demonstrate the response of flax to various seed-applied and foliar fungicide options with a focus on establishment, maturity, and yield

Treatments (9)
Seed Treatments: None, Vitaflo-280, Insure Pulse
Foliar Fungicides*: None, Headline EC, Priaxor

Locations (5)
Indian Head, Redvers, Swift Current, Scott, & Prince Albert, Saskatchewan

*fungicides applied 7-10 after initiation of flowering in a minimum of 15 U.S. gal/ac solution volume
Seed Treatment Effects on Flax Emergence (5 locations - 2018)

Error bars are S.E.M.

<table>
<thead>
<tr>
<th>Location</th>
<th>Plant Density (plants/m²)</th>
<th>None (P)</th>
<th>Vitflo (P)</th>
<th>Insure (P)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Indian Head</td>
<td>600</td>
<td>0.535</td>
<td>0.095</td>
<td>0.565</td>
</tr>
<tr>
<td>Redvers</td>
<td>400</td>
<td>0.095</td>
<td>0.565</td>
<td>0.817</td>
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<tr>
<td>Swift Current</td>
<td>300</td>
<td>0.565</td>
<td>0.817</td>
<td>0.003</td>
</tr>
<tr>
<td>Scott</td>
<td>200</td>
<td>0.817</td>
<td>0.003</td>
<td></td>
</tr>
<tr>
<td>Prince Albert</td>
<td>100</td>
<td>0.003</td>
<td></td>
<td></td>
</tr>
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</table>

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Seed Treatment Effects on Flax Seed Yield (5 locations - 2018)

Error bars are S.E.M.

Seed Yield (bu/ac)

Indian Head: $P = 0.559$
Redvers: $P = 0.447$
Swift Current: $P = 0.631$
Scott: $P = 0.835$
Prince Albert: $P = 0.047$

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Foliar Fungicide Effects on Flax Seed Yield (5 locations - 2018)

Error bars are S.E.M.

Seed Yield (bu/ac)

- Indian Head: P = 0.529
- Redvers: P = 0.082
- Swift Current: P = 0.072
- Scott: P = 0.909
- Prince Albert: P = 0.357

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Site (S): $P < 0.001$
Fung (F): $P < 0.001$
S x F: $P < 0.001$

Error bars = S.E.M.

Seed Yield (bu/ac)

<table>
<thead>
<tr>
<th>Year</th>
<th>Control</th>
<th>Headline</th>
</tr>
</thead>
<tbody>
<tr>
<td>IH-2010</td>
<td>+27%***</td>
<td>+5%ns</td>
</tr>
<tr>
<td>IH-2011</td>
<td>+23%***</td>
<td>ns</td>
</tr>
<tr>
<td>IH-2012</td>
<td>+3%*</td>
<td>+13%**</td>
</tr>
<tr>
<td>IH-2013</td>
<td>+9%***</td>
<td>+10%***</td>
</tr>
<tr>
<td>IH-2014</td>
<td>-2%ns</td>
<td></td>
</tr>
<tr>
<td>IH-2015</td>
<td></td>
<td></td>
</tr>
<tr>
<td>IH-2016</td>
<td></td>
<td></td>
</tr>
<tr>
<td>AVG</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

ns – not significant  * $0.05 < P < 0.100$  ** $0.01 < P \leq 0.05$  *** $P \leq 0.01$
Flax response to seed treatment in small plot trials has been variable, with occasional benefits detected but a high frequency of non-responsive sites.

Significant responses have mostly been limited to higher plant populations which may or may not lead to yield benefits depending on the absolute numbers.

Probability of economic benefit is likely low with sound seed, normal seeding conditions, adequate seed rates, and no known history of root disease in flax (i.e. fusarium wilt, root rot/seedling blight).

No responses to fungicide in the current trial – consistent with previous results showing no benefit under low disease pressure (all sites were dry).

Past IHARF trials at Indian Head have shown at least marginally significant responses 5/7 seasons with an overall 10% yield benefit to fungicide.
Canola Phosphorus Fertilizer Form & P. bilaii Inoculant (ADOPT)
**Canola Response to P Form & P. bilaiii Inoculant**

**Indian Head 2018**

**Objectives**
- To demonstrate the relative crop safety and agronomic performance of seed-placed granular phosphorus (P) fertilizer forms with & without a P solubilizing *P. bilaiii* inoculant

**Treatments (10)**

**P Rates:** 0, 22, & 45 lb P\(_2\)O\(_5\)/ac

**P Forms:** MAP (11-52-0) or MES15 (13-33-0-15)

**Inoculant:** None vs label rate granular Jumpstart®

**Notes:** 7 ppm Olsen-P, pH 7.5, S.O.M. 5.9%; all P fertilizer seed-placed; broadcast K\(_2\)SO\(_4\) across entire site before seeding (S rates not balanced across treatments but non-limiting in all)
Plant Density (plants/m²) vs. P Fertilizer Rate (lb P₂O₅/ac)

- All P fertilizer seed-placed, 12” row spacing, SBU of ~8%
- Seed-placed S not balanced between MAP and MES treatments

MAP-lin: $P = 0.122$
MAP-quad: $P = 0.744$
MES-lin: $P = 0.001$
MES-quad: $P = 0.595$

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Group Comparisons: Seed-Placed P Effects on Canola Emergence (IH-18)

**Plant Density (plants/m²)**

- **No P Fert**
  - A (72.5)
  - P Applied
  - B (62.7)
  - \( P = 0.010 \)

- **MAP vs MES**
  - MAP
  - A (66.5)
  - B (58.9)
  - \( P = 0.022 \)

*Seed-placed S was not balanced between MAP & MES*
Group Comparisons: Seed-Placed P Effects on Canola Growth (IH-18)

* Measured at early bud formation (GS51)

Bar chart showing early-season biomass (kg/ha) for different treatments:
- **No P Fert** (B)
  - 1006 kg/ha
  - \( P = 0.001 \)
- **P Applied** (A)
  - 1280 kg/ha
  - \( P = 0.001 \)
- **MAP** (A)
  - 1306 kg/ha
  - \( P = 0.444 \)
- **MES15** (A)
  - 1254 kg/ha

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Group Comparisons: Seed-Placed P Effects on Canola Tissue P (IH-18)

*Measured at early bud formation (GS51)
Group Comparisons: Seed-Placed P Effects on Canola P Uptake (IH-18)

* Whole plant, measured at early bud formation (GS51)

<table>
<thead>
<tr>
<th>Treatment</th>
<th>P Uptake (lb P₂O₅/ac)</th>
<th>Comparison</th>
</tr>
</thead>
<tbody>
<tr>
<td>No P Fert</td>
<td>8.1</td>
<td>B</td>
</tr>
<tr>
<td>P Applied</td>
<td>10.8</td>
<td>A</td>
</tr>
<tr>
<td>MAP</td>
<td>11.0</td>
<td>A</td>
</tr>
<tr>
<td>MES15</td>
<td>10.8</td>
<td>A</td>
</tr>
</tbody>
</table>

P < 0.001

0P vs P Fert

P = 0.435

MAP vs MES*
P Rate x Form Effects on Canola Seed Yield (IH-18)

Seed Yield (bu/ac)

P Fertilizer Rate (lb P₂O₅/ac)

MAP

MES15

MAP-quad: $P = 0.587$

MES-quad: $P = 0.575$

MAP-ln: $P = 0.005$

MES-ln: $P < 0.001$
Group Comparisons: Seed-Placed P Effects on Canola Yield (IH-18)

- Seed Yield (bu/ac)
  - No P Fert (0P): 53.4
  - P Applied (P): 55.4
  - MAP vs MES: 55.9

* Whole plant, measured at early bud formation (GS51)

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P Rate x *P. bilaii* Effects on Early-Season Canola Growth (IH-18)

*Measured at early bud formation stage (GS51)*

<table>
<thead>
<tr>
<th>P Fertilizer Rate (lb P$_2$O$_5$/ac)</th>
<th>700</th>
<th>800</th>
<th>900</th>
<th>1000</th>
<th>1100</th>
<th>1200</th>
<th>1300</th>
<th>1400</th>
<th>1500</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control</td>
<td>-1</td>
<td>3</td>
<td>7</td>
<td>11</td>
<td>15</td>
<td>19</td>
<td>23</td>
<td>27</td>
<td>31</td>
</tr>
<tr>
<td>Inoculated</td>
<td>1183 a</td>
<td>1268 a</td>
<td>Pr &gt; F: 0.166</td>
<td>1330 a</td>
<td>1400 a</td>
<td>1500 a</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- Check-lin: $P = 0.011$
- Check-quad: $P = 0.022$
- Inoc-lin: $P = 0.077$
- Inoc-quad: $P = 0.286$

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**P Rate x P. bilaii Effects on Canola Tissue P Concentration (IH-18)**

- **Control:** Tissue P Concentration (% P) = 0.41 a
- **Inoculated:** Tissue P Concentration (% P) = 0.41 a

**Statistical Analysis:**

- Pr > F: 0.346

**Note:** Whole plant, measured at early bud formation stage (GS51)

**Fertilizer Rate:**

- **Check-lin:** P = 0.015
- **Check-quad:** P = 0.075
- **Inoc-lin:** P < 0.001
- **Inoc-quad:** P = 0.341

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**IHARF Winter Seminar & AGM 06-02-18**
P Rate x *P. bilaii* Effects on Early-Season Canola P Uptake (IH-18)

Measured at early bud formation stage (GS51)
P Rate x *P. bilaii* Effects on Canola Seed Yield (IH18)

Seed Yield (bu/ac)

<table>
<thead>
<tr>
<th>Check</th>
<th>Inoculated</th>
</tr>
</thead>
<tbody>
<tr>
<td>54.6 a</td>
<td>55.4 a</td>
</tr>
</tbody>
</table>

Pr > F: 0.128

Check-lin: $P = 0.001$
Check-quad: 0.669
Inoc-lin: $P = 0.007$
Inoc-quad: $P = 0.154$

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06-02-18
Canola Response to P Form & P. bilaiii Inoculant Summary & Conclusions

- Single site-year, results not to be considered conclusive
- High rates (45 lb P₂O₅/ac) of MES15 cause greater stand reductions than MAP when considered as a P source alone
  - Compared to equivalent blend of MAP/AS, MES15 has generally been shown to be safer for seed-placement; however, there is no agronomic reason to seed-place S (i.e. any benefits are usually logistic)
- Responses to P fertilizer in general were small but consistently significant
  - Similar early-season growth, tissue P concentrations, and P uptake for MAP and MES15, marginally significant yield benefit to MES15 (2% or 1 bu/ac; P = 0.063)
- Inoculation with P. bilaiii tended to increase early season biomass slightly in the absence of P fertilizer; however, there was no yield benefit and yield responses to P fertilization were similar regardless of inoculation
4R Nitrogen Fertilizer Management in Wheat & Canola (ADOPT)
4R N Management in Canola & Wheat
Indian Head 2017

**Objectives:** To demonstrate crop response to varying rates of N along with different forms, timing & placement relative to side-banded, untreated urea.

<table>
<thead>
<tr>
<th>#</th>
<th>Form</th>
<th>Timing / Placement</th>
<th>Rate *</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>2</td>
<td>Urea (untreated)</td>
<td>Side-band (during seeding)</td>
<td>0.5x</td>
</tr>
<tr>
<td>3</td>
<td>Urea</td>
<td>Side-band</td>
<td>1.0x</td>
</tr>
<tr>
<td>4</td>
<td>Urea</td>
<td>Side-band</td>
<td>1.5x</td>
</tr>
<tr>
<td>5</td>
<td>Urea</td>
<td>Spring surface broadcast (pre-seed)</td>
<td>1.0x</td>
</tr>
<tr>
<td>6</td>
<td>Urea Ammonium-Nitrate (UAN)</td>
<td>Spring surface dribble-band</td>
<td>1.0x</td>
</tr>
<tr>
<td>7</td>
<td>Agrotain® (AT)</td>
<td>Spring surface broadcast</td>
<td>1.0x</td>
</tr>
<tr>
<td>8</td>
<td>SuperUrea® (SU)</td>
<td>Spring surface broadcast</td>
<td>1.0x</td>
</tr>
<tr>
<td>9</td>
<td>Urea / Urea</td>
<td>50:50 Split (side-band : in-crop)</td>
<td>1.0x</td>
</tr>
<tr>
<td>10</td>
<td>Urea / UAN</td>
<td>50:50 Split</td>
<td>1.0x</td>
</tr>
<tr>
<td>11</td>
<td>Urea / Agrotain®</td>
<td>50:50 Split</td>
<td>1.0x</td>
</tr>
<tr>
<td>12</td>
<td>Urea / SuperUrea®</td>
<td>50:50 Split</td>
<td>1.0x</td>
</tr>
</tbody>
</table>

* 1x = 129 lb N/ac (soil + fertilizer) for canola & 116 lb/ac for wheat
Grain Yield (bu/ac)

N Rate Effects on Canola Yield
Indian Head 2017

N Source = Side-banded Urea
Residual NO$_3$ = 31 lb/ac

SB N - linear: $p < 0.001$
SB N - quadratic: $p = 0.001$

Error Bars = S.E.M.
N Management Effects on Canola Yield
Indian Head 2017

Error Bars = S.E.M.

~100 lb N/ac fertilizer N rate in all treatments (1x rate)

Grain Yield (bu/ac)

<table>
<thead>
<tr>
<th>Nitrogen Treatment</th>
<th>Grain Yield (bu/ac)</th>
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</thead>
<tbody>
<tr>
<td>SB - Ur</td>
<td>52</td>
</tr>
<tr>
<td>PSS - Ur</td>
<td>47</td>
</tr>
<tr>
<td>PSS - UAN</td>
<td>45</td>
</tr>
<tr>
<td>PSS - AT</td>
<td>44</td>
</tr>
<tr>
<td>PSS - SU</td>
<td>47</td>
</tr>
<tr>
<td>Split - Ur</td>
<td>47</td>
</tr>
<tr>
<td>Split - UAN</td>
<td>47</td>
</tr>
<tr>
<td>Split - AT</td>
<td>46</td>
</tr>
<tr>
<td>Split - SU</td>
<td>48</td>
</tr>
</tbody>
</table>

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N Rate Effects on Wheat Yield
Indian Head 2017

Grain Yield (bu/ac)

Error Bars = S.E.M.

N Source = Side-banded Urea
Residual NO$_3$ = 27 lb/ac

SB N - linear: $p < 0.001$
SB N - quadratic: $p = 0.001$

Lb N/ac (soil + fertilizer)
# N Management Effects on Wheat Yield

**Indian Head 2017**

<table>
<thead>
<tr>
<th>Nitrogen Treatment</th>
<th>Grain Yield (bu/ac)</th>
</tr>
</thead>
<tbody>
<tr>
<td>SB - Ur</td>
<td>63</td>
</tr>
<tr>
<td>PSS - Ur</td>
<td>61</td>
</tr>
<tr>
<td>PSS - UAN</td>
<td>61</td>
</tr>
<tr>
<td>PSS - AT</td>
<td>63</td>
</tr>
<tr>
<td>PSS - SU</td>
<td>64</td>
</tr>
<tr>
<td>Split - Ur</td>
<td>63</td>
</tr>
<tr>
<td>Split - UAN</td>
<td>65</td>
</tr>
<tr>
<td>Split - AT</td>
<td>62</td>
</tr>
<tr>
<td>Split - SU</td>
<td>65</td>
</tr>
</tbody>
</table>

*Error Bars = S.E.M.*

~90 lb N/ac fertilizer N rate in all treatments (1x rate)
N Rate Effects on Wheat Grain Protein
Indian Head 2017

Grain Protein (%) vs. lb N/ac (soil + fertilizer)

Error Bars = S.E.M.

N Source = Side-banded Urea
Residual NO$_3$-N = 27 lb/ac

SB N - linear: $p < 0.001$
SB N - quadratic: $p = 0.044$
N Management Effects on Wheat Protein
Indian Head 2017

Error Bars = S.E.M.  
~90 lb N/ac fertilizer N rate in all treatments (1x rate)

<table>
<thead>
<tr>
<th>Nitrogen Treatment</th>
<th>Grain Protein (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>SB - Ur</td>
<td>13.6</td>
</tr>
<tr>
<td>PSS - Ur</td>
<td>11.6</td>
</tr>
<tr>
<td>PSS - UAN</td>
<td>11.8</td>
</tr>
<tr>
<td>PSS - AT</td>
<td>11.8</td>
</tr>
<tr>
<td>PSS - SU</td>
<td>12.1</td>
</tr>
<tr>
<td>Split - Ur</td>
<td>12.4</td>
</tr>
<tr>
<td>Split - UAN</td>
<td>11.8</td>
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<tr>
<td>Split - AT</td>
<td>12.4</td>
</tr>
<tr>
<td>Split - SU</td>
<td>12.1</td>
</tr>
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# 4R N Management in Canola & Wheat
## Indian Head 2018

<table>
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<tr>
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<td>Urea</td>
<td>Side-band</td>
<td>1.0x</td>
</tr>
<tr>
<td>4</td>
<td>Urea</td>
<td>Side-band</td>
<td>1.5x</td>
</tr>
<tr>
<td>5</td>
<td>Agrotain® (AT)</td>
<td>Side-band</td>
<td>1.0x</td>
</tr>
<tr>
<td>6</td>
<td>SuperUrea® (SU)</td>
<td>Side-band</td>
<td>1.0x</td>
</tr>
<tr>
<td>7</td>
<td>ESN® Smart Nitrogen (ESN)</td>
<td>Side-band</td>
<td>1.0x</td>
</tr>
<tr>
<td>8</td>
<td>Urea</td>
<td>Fall Surface Broadcast</td>
<td>1.0x</td>
</tr>
<tr>
<td>9</td>
<td>Agrotain® (AT)</td>
<td>Fall Surface Broadcast</td>
<td>1.0x</td>
</tr>
<tr>
<td>10</td>
<td>SuperUrea® (SU)</td>
<td>Fall Surface Broadcast</td>
<td>1.0x</td>
</tr>
<tr>
<td>11</td>
<td>Urea</td>
<td>Fall In-Soil Band</td>
<td>1.0x</td>
</tr>
<tr>
<td>12</td>
<td>Agrotain® (AT)</td>
<td>Fall In-Soil Band</td>
<td>1.0x</td>
</tr>
<tr>
<td>13</td>
<td>SuperUrea® (SU)</td>
<td>Fall In-Soil Band</td>
<td>1.0x</td>
</tr>
<tr>
<td>14</td>
<td>ESN® Smart Nitrogen (ESN)</td>
<td>Fall In-Soil Band</td>
<td>1.0x</td>
</tr>
</tbody>
</table>

*1x = 129 lb N/ac (soil + fertilizer) for canola & 116 lb/ac for wheat*
N Rate Effects on Canola Yield
Indian Head 2018

Grain Yield (bu/ac)

Error Bars = S.E.M.

N Source = Side-banded Urea
Residual NO₃ = 18 lb/ac

SB N - linear: p < 0.001
SB N - quadratic: p = 0.001

IHARF Winter Seminar & AGM
06-02-18
N Management Effects on Canola Yield
Indian Head 2018

Error Bars = S.E.M.

~112 lb N/ac fertilizer N rate in all treatments (1x rate)

Grain Yield (bu/ac)

<table>
<thead>
<tr>
<th>Nitrogen Treatment</th>
<th>Grain Yield (bu/ac)</th>
</tr>
</thead>
<tbody>
<tr>
<td>SB - Ur</td>
<td>52</td>
</tr>
<tr>
<td>SB - AT</td>
<td>51</td>
</tr>
<tr>
<td>SB - SU</td>
<td>51</td>
</tr>
<tr>
<td>SB - ESN</td>
<td>51</td>
</tr>
<tr>
<td>fBC - Ur</td>
<td>46</td>
</tr>
<tr>
<td>fBC - AT</td>
<td>46</td>
</tr>
<tr>
<td>fBC - SU</td>
<td>49</td>
</tr>
<tr>
<td>fBnd - Urea</td>
<td>52</td>
</tr>
<tr>
<td>fBnd - AT</td>
<td>53</td>
</tr>
<tr>
<td>fBnd - SU</td>
<td>52</td>
</tr>
<tr>
<td>fBnd - ESN</td>
<td>51</td>
</tr>
</tbody>
</table>

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N Rate Effects on Wheat Yield
Indian Head 2018

Error Bars = S.E.M.

N Source = Side-banded Urea
Residual NO$_3$ = 9 lb/ac

SB N - linear: $p < 0.001$
SB N - quadratic: $p = 0.001$

grain yield (bu/ac)

lb N/ac (soil + fertilizer)
N Management Effects on Wheat Yield
Indian Head 2018

Grain Yield (bu/ac)

Error Bars = S.E.M.
~107 lb N/ac fertilizer N rate in all treatments (1x rate)

Nitrogen Treatment

- SB - Ur
- SB - AT
- SB - SU
- SB - ESN
- fBC - Ur
- fBC - AT
- fBC - SU
- fBnd - Urea
- fBnd - AT
- fBnd - SU
- fBnd - ESN

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N Rate Effects on Wheat Grain Protein
Indian Head 2018

Grain Protein (%)

Error Bars = S.E.M.

N Source = Side-banded Urea
Residual NO₃ = 9 lb/ac

SB N - linear: p < 0.001
SB N - quadratic: p = 0.001

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06-02-18
**N Management Effects on Wheat Protein**

**Indian Head 2018**

Error Bars = S.E.M.

~107 lb N/ac fertilizer N rate in all treatments (1x rate)

<table>
<thead>
<tr>
<th>Nitrogen Treatment</th>
<th>Grain Protein (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>SB - Ur</td>
<td>14.2</td>
</tr>
<tr>
<td>SB - AT</td>
<td>abc</td>
</tr>
<tr>
<td>SB - SU</td>
<td>abc</td>
</tr>
<tr>
<td>SB - ESN</td>
<td>abc</td>
</tr>
<tr>
<td>fBC - Ur</td>
<td>14.6</td>
</tr>
<tr>
<td>fBC - AT</td>
<td>ab</td>
</tr>
<tr>
<td>fBC - SU</td>
<td>a</td>
</tr>
<tr>
<td>fBnd - Urea</td>
<td>13.4</td>
</tr>
<tr>
<td>fBnd - AT</td>
<td>d</td>
</tr>
<tr>
<td>fBnd - SU</td>
<td>d</td>
</tr>
<tr>
<td>fBnd - ESN</td>
<td>cd</td>
</tr>
</tbody>
</table>

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4R N Management in Canola & Wheat
Summary & Conclusions

- From an agronomic perspective, it is difficult to improve upon side or mid-row banding a crop’s entire N requirements during seeding under Prairie conditions
  - Incentives for considering alternative timing/placement options are usually logistic (i.e. limitations on amount of product that can be delivered through seeding implement; desire to handle less product during seeding, lower fertilizer prices in fall)
- Alternative timing/placement options can perform quite well but are usually more sensitive to environment than side or mid-row banding
  - Fall in-soil banding less susceptible to loss than surface broadcast applications, especially under dry conditions – in both cases fertilizer should not be applied until later in fall when soils have cooled as off much as possible
  - Split applications can work quite well provided that there is enough moisture to move N applied in-crop into the rooting zone but past research in western Canada has not generally shown any agronomic advantage over banding the entire amount during seeding
- EEF products do not always provide economic benefits but can reduce the risk of loss particularly when timing/placement options are not ideal
  - Choose a product that protects against the type of loss(es) that is/are most likely to occur
Wheat Response to Various Inputs Alone and in Combination (ADOPT)
**ADOPT Wheat Input Demonstration**

**Indian Head 2018**

**Objectives:** To demonstrate agronomic and economic responses of CWRS wheat to various crop inputs both individually and collectively

<table>
<thead>
<tr>
<th>#</th>
<th>Name</th>
<th>Seed Trt (no/yes)</th>
<th>Seed Rate (seeds/m²)</th>
<th>Fertility (lb/ac N-P₂O₅-K₂O-S)</th>
<th>PGR (no/yes)</th>
<th>Fungicide (no/yes)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Low Input</td>
<td>No</td>
<td>250</td>
<td>80-18-9-9</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>2</td>
<td>Seed-Trt</td>
<td>Yes</td>
<td>250</td>
<td>80-18-9-9</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>3</td>
<td>Seed Rate</td>
<td>No</td>
<td>400</td>
<td>80-18-9-9</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>4</td>
<td>Fertility</td>
<td>No</td>
<td>250</td>
<td>120-36-18-18</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>5</td>
<td>PGR</td>
<td>No</td>
<td>250</td>
<td>80-18-9-9</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>6</td>
<td>Fungicide</td>
<td>No</td>
<td>250</td>
<td>80-18-9-9</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>7</td>
<td>High Input</td>
<td>Yes</td>
<td>400</td>
<td>120-36-18-18</td>
<td>Yes</td>
<td>Yes</td>
</tr>
</tbody>
</table>

**Data Collected:** plants/m², heads/m², height, lodging, biomass/harvest index, yield, seed size, test weight, protein, fus. damaged kernels
Input Effects on Wheat Plant Density
Indian Head 2018

Overall F-test: $p < 0.001$
Error Bars = S.E.M.

<table>
<thead>
<tr>
<th>Input Treatment</th>
<th>Plant Density (plants/m²)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low Input</td>
<td>224</td>
</tr>
<tr>
<td>Seed Trt</td>
<td>222</td>
</tr>
<tr>
<td>Seed Rate</td>
<td>323</td>
</tr>
<tr>
<td>Fertility</td>
<td>256</td>
</tr>
<tr>
<td>PGR</td>
<td>226</td>
</tr>
<tr>
<td>Fungicide</td>
<td>226</td>
</tr>
<tr>
<td>High Input</td>
<td>336</td>
</tr>
</tbody>
</table>

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## Input Effects on Wheat Tillering
### Indian Head 2018

### Overview
- **Overall F-test:** \( p < 0.001 \)
- Error Bars = S.E.M.

### Graph Details
- **Y-axis:** Tillering (heads/plant)
- **X-axis:** Input Treatment

### Treatments and Values
- **Low Input:** 2.1
- **Seed Trt:** 2.0, 1.5
- **Seed Rate:** c
- **Fertility:** 2.0
- **PGR:** ab
- **Fungicide:** a
- **High Input:** 2.2, 1.6
- **Legend:**
  - ab
  - b
  - c
  - a
Input Effects on Wheat Height
Indian Head 2018

Overall F-test: $p < 0.001$
Error Bars = S.E.M.

### Input Treatment

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Plant Height (cm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low Input</td>
<td>96</td>
</tr>
<tr>
<td>Seed Trt</td>
<td>96</td>
</tr>
<tr>
<td>Seed Rate</td>
<td>97</td>
</tr>
<tr>
<td>Fertility</td>
<td>97</td>
</tr>
<tr>
<td>PGR</td>
<td>b 82</td>
</tr>
<tr>
<td>Fungicide</td>
<td>a 96</td>
</tr>
<tr>
<td>High Input</td>
<td>b 80</td>
</tr>
</tbody>
</table>
Input Effects on Wheat Yield
Indian Head 2018

Overall F-test: $p < 0.001$
Error Bars = S.E.M.

Grain Yield (bu/ac)

<table>
<thead>
<tr>
<th>Input Treatment</th>
<th>Symbol</th>
<th>Grain Yield (bu/ac)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low Input</td>
<td>c</td>
<td>51.9</td>
</tr>
<tr>
<td>Seed Trt</td>
<td>c</td>
<td>52.1</td>
</tr>
<tr>
<td>Seed Rate</td>
<td>c</td>
<td>51.8</td>
</tr>
<tr>
<td>Fertility</td>
<td>b</td>
<td>54.6</td>
</tr>
<tr>
<td>PGR</td>
<td>ab</td>
<td>56.2</td>
</tr>
<tr>
<td>Fungicide</td>
<td>ab</td>
<td>55.9</td>
</tr>
<tr>
<td>High Input</td>
<td>a</td>
<td>57.8</td>
</tr>
</tbody>
</table>
### Input Effects on Wheat Protein
**Indian Head 2018**

<table>
<thead>
<tr>
<th>Input Treatment</th>
<th>Grain Protein (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low Input</td>
<td>13.3</td>
</tr>
<tr>
<td>Seed Trt</td>
<td>13.4</td>
</tr>
<tr>
<td>Seed Rate</td>
<td>13.1</td>
</tr>
<tr>
<td>Fertility</td>
<td>14.3 (a)</td>
</tr>
<tr>
<td>PGR</td>
<td>12.9 (de)</td>
</tr>
<tr>
<td>Fungicide</td>
<td>12.8 (e)</td>
</tr>
<tr>
<td>High Input</td>
<td>13.9 (b)</td>
</tr>
</tbody>
</table>

Overall F-test: $p < 0.001$

Error Bars = S.E.M.
Input Effects on FDK in Wheat
Indian Head 2018

Overall F-test: $p < 0.001$
Error Bars = S.E.M.

Input Treatment

Low Input  | Seed Trt  | Seed Rate  | Fertility | PGR    | Fungicide | High Input
--- | --- | --- | --- | --- | --- | ---
0.05 | 0.04 | 0.08 | 0.06 | 0.04 | 0.02 | 0.02

bc | cd | a | ab | bcd | de | e
### Wheat Input Demo: Marginal Profits
#### Indian Head 2018

<table>
<thead>
<tr>
<th>Trt #</th>
<th>Seed Trt(^Z)</th>
<th>Seed Rate(^Y)</th>
<th>Fertility(^X)</th>
<th>PGR(^W)</th>
<th>Fungicide(^W)</th>
<th>Revenue(^V)</th>
<th>Profit(^U)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low Input</td>
<td>$0.00</td>
<td>$16.41</td>
<td>$51.01</td>
<td>$0.00</td>
<td>$0.00</td>
<td>$364.26</td>
<td>$296.84</td>
</tr>
<tr>
<td>Seed Trt</td>
<td>$6.32</td>
<td>$16.41</td>
<td>$51.01</td>
<td>$0.00</td>
<td>$0.00</td>
<td>$365.06</td>
<td>$291.32</td>
</tr>
<tr>
<td>Seed Rate</td>
<td>$0.00</td>
<td>$26.84</td>
<td>$51.01</td>
<td>$0.00</td>
<td>$0.00</td>
<td>$363.44</td>
<td>$285.59</td>
</tr>
<tr>
<td>Fertility</td>
<td>$0.00</td>
<td>$16.41</td>
<td>$81.69</td>
<td>$0.00</td>
<td>$0.00</td>
<td>$382.71</td>
<td>$284.61</td>
</tr>
<tr>
<td>PGR</td>
<td>$0.00</td>
<td>$16.41</td>
<td>$51.01</td>
<td>$19.00</td>
<td>$0.00</td>
<td>$394.07</td>
<td>$307.65</td>
</tr>
<tr>
<td>Fungicide</td>
<td>$0.00</td>
<td>$16.41</td>
<td>$51.01</td>
<td>$0.00</td>
<td>$25.23</td>
<td>$391.95</td>
<td>$299.30</td>
</tr>
<tr>
<td>High Input</td>
<td>$6.32</td>
<td>$26.84</td>
<td>$81.69</td>
<td>$19.00</td>
<td>$25.23</td>
<td>$405.21</td>
<td>$246.13</td>
</tr>
</tbody>
</table>

\(^Z\) Not adjusted for differences in seeding rate between Trt. 2 and 7  
\(^Y\) Assumes certified seed price of $0.478/kg ($478/tonne)  
\(^X\) Assumes $725/tonne for MAP and $525/tonne for urea – K and S costs excluded  
\(^W\) Includes SRP of products plus $5/ac application cost  
\(^V\) Based on actual yields and a CWRS wheat price of $257/Mt ($7/bu) regardless of quality  
\(^U\) Values do not take into account all production costs and are only estimates – actual expenses/revenues may vary
Average PGR Effects on Wheat Yield
Indian Head 2013-2017

Year
- 2013: Control 72, PGR 82
- 2014: Control 76, PGR 85
- 2015: Control 70, PGR 76
- 2016: Control 59, PGR 68
- 2017: Control 67, PGR 74
- 2018: Control 52, PGR 53
- 6-yr Avg: Control 69, PGR 73

Increase:
- Control: +14%
- PGR: +12%

IHARF Winter Seminar & AGM
Thank you

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