Winter Wheat 2013
What worked & what didn’t in a challenging year?

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INDIAN HEAD AGRICULTURAL RESEARCH FOUNDATION

Canada

Ducks Unlimited Canada
Conserving Canada’s Wetlands
Winter Cereal Challenges in 2013

- Extremely dry soil and weather from prior to planting until just before freeze-up
  - No significant (>1/10”) rain from Aug. 2- Oct. 17
  - Poor seeding conditions, hard soil, large cracks
  - No germination or emergence observed in the fall

- Unusually late arrival of spring
  - Record breaking snow cover did not fully recede from most fields until late in the first week of May

- Dry and warm weather in May
  - What was good for spring seeding was not necessarily good for emerging winter wheat
  - Crop generally emerged poorly and developed slowly early in the season
1) Seed Treatments & Seeding Rates (DU)

2) Foliar Fungicide Applications (DU)

3) N Form, Placement & Timing (ADOPT)
Seed Treatments and Rates

**Treatments:**

1) Unt – 200* seeds m\(^{-2}\)
2) Unt – 400 seeds m\(^{-2}\)
3) Trt ** – 200 seeds m\(^{-2}\)
4) Trt – 400 seeds m\(^{-2}\)

* 60-120 lb/ac seeding rates

**Raxil Pro (325 ml/100kg)
- Tebuconazole (1 gai/100kg), prothioconazole (5 gai/100kg) and metalaxyl (4 gai/100kg)
Moats WW seeded into canola stubble on Sept. 14 2012 using a SeedMaster drill on 12” row spacing

All fertilizer applied at seeding with NKS side-banded & P seed-placed to supply 102-27-36-12 lb/ac of N-P₂O₅-K₂O-S

No pre-seed burnoff, weeds controlled using in-crop MCPA, flurasulam and pyroxsulam (Simplicity) and disease controlled using a single application of Prosaro at early heading stage

Pre-harvest glyphosate (356 g/ac) applied on August 23

Straight-combined plots on September 2
June 12, 2013

Raxil Pro Treated (left) vs Untreated (right)
200 seeds/m²
June 12, 2013

Untreated (left) vs Raxil Pro Treated (right)
400 seeds/m²
Seed Treatment & Rates

Main Effects – Emergence

Seed Treatment

- P < 0.001

Seeding Rate

- P < 0.001

Plants/m² vs. Seeds/m²

UNT vs. TRT

P < 0.001

Main Effects – Emergence
Seed Treatment & Rates

Interactions – Emergence

P = 0.019 (trt x rate)

UNT  TRT

Plants/m²

Seedling Rate (plants m⁻²)
Seed Treatment & Rates

Main Effects – Spring NDVI

Seed Treatment

<table>
<thead>
<tr>
<th>NDVI (Jun-13)</th>
<th>UNT</th>
<th>TRT</th>
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<tbody>
<tr>
<td>0.2</td>
<td>b</td>
<td>a</td>
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P < 0.001

Seedling Rate

<table>
<thead>
<tr>
<th>Seeds/m²</th>
<th>175</th>
<th>225</th>
<th>275</th>
<th>325</th>
<th>375</th>
<th>425</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.2</td>
<td>b</td>
<td>a</td>
<td></td>
<td></td>
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P = 0.004
Seed Treatment & Rates

Main Effects – Yield

Seed Treatment

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Yield (bu/ac)</th>
<th>P = 0.004</th>
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<tbody>
<tr>
<td>UNT</td>
<td>80</td>
<td></td>
</tr>
<tr>
<td>TRT</td>
<td>100</td>
<td></td>
</tr>
</tbody>
</table>

Seeding Rate

<table>
<thead>
<tr>
<th>Seeds/m²</th>
<th>P = 0.002</th>
</tr>
</thead>
<tbody>
<tr>
<td>175</td>
<td></td>
</tr>
<tr>
<td>225</td>
<td></td>
</tr>
<tr>
<td>275</td>
<td></td>
</tr>
<tr>
<td>325</td>
<td></td>
</tr>
<tr>
<td>375</td>
<td></td>
</tr>
<tr>
<td>425</td>
<td></td>
</tr>
</tbody>
</table>

Differences:
- UNT vs. TRT: P = 0.004 (significant difference)
- Seed Rate: P = 0.002 (significant increase)

Legend:
- a
- b
Seed Treatment & Rates

Interactions – Yield

P = 0.139 (trt x rate)

UNT – TRT
Seed Treatment & Rates

Main Effects – Test Weight

Seed Treatment

P < 0.001

Seed Treatment

UNT  TRT

60  62  64  66  68  70

Seeding Rate

P < 0.001

Seeding Rate

175  225  275  325  375  425

Seeds/m²

b  a

b  a
Seed Treatment & Rates

Interactions – Test Weight

P = 0.046 (trt x rate)

UNT  TRT

Ub/bu

Seeding Rate (seeds m⁻²)
Seed Treatment & Rates

Indian Head 2013 Conclusions

- Seed treatment dramatically improved winter wheat establishment (123% overall increase in plant populations)
- Similar plant densities achieved with 200 seeds m$^{-2}$ of treated seed versus 400 seeds m$^{-2}$ of untreated seed
- Seed treatments increased yield by 15.4% while doubling the seeding rate from 200 to 400 seeds m$^{-2}$ increased yields by 17.2%; yields maximized with high rate of treated seed (137% of low rate/untreated)
- Test weight increased with seed treatment & seeding rate; rate effect on test weight was smaller with treated (0.9%) versus untreated seed (2.4%)
- Seed treatment response of this magnitude not typical but results show the potential benefits under highly stressful conditions. Best results when emergence does not occur in the fall? Potential for dry seed decay?
- Trials expanded upon in 2014 with sites at Indian Head and Scott
Treatments:
1) Check (no fungicide)
2) Twinline* (T1–flag)
3) Prosaro** (T2–head)
4) Dual (T1 + T2)

* Pyraclostrobin (65 gia/ha) + metconazole (40 gai/ha)
**Prothioconazole (100 gia/ha) + tebuconazole (100 gai/ha)
Methods / Site Information

- Treated Moats WW seeded at 300 seeds/m² into canola stubble on Sept. 14 2012 using a SeedMaster drill on 12” row spacing
- All fertilizer applied at seeding with NKS side-banded and P seed-placed to supply 102-27-36-12 lb/ac of N-P₂O₅-K₂O-S
- No pre-seed burnoff, weeds controlled using in-crop MCPA, flurasulam and pyroxsulam (Simplicity)
- Foliar fungicides applied as per protocol on June 26 (flag-leaf stage) and July 4 (early heading stage)
- Leaf disease and FHB rated on July 29
- Pre-harvest glyphosate (356 g/ac) applied on August 18
- Straight-combined plots on August 27
June 26 – immediately prior to T1 fungicide application
June 26 – immediately prior to T1 fungicide application
## Foliar Fungicide Demo

### Leaf Disease Ratings

<table>
<thead>
<tr>
<th>Leaf Level</th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
<th>12</th>
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<tbody>
<tr>
<td>Upper (flag)</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0-1</td>
<td>2-5</td>
<td>6-10</td>
<td>11-25</td>
<td>26-50</td>
</tr>
<tr>
<td>Mid</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0-1</td>
<td>2-5</td>
<td>6-10</td>
<td>6-10</td>
<td>11-25</td>
<td>26-50</td>
<td>&gt;50</td>
<td>&gt;50</td>
<td>&gt;50</td>
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<tr>
<td>Lower</td>
<td>0</td>
<td>0-1</td>
<td>2-5</td>
<td>6-10</td>
<td>11-25</td>
<td>26-50</td>
<td>&gt;50</td>
<td>&gt;50</td>
<td>&gt;50</td>
<td>&gt;50</td>
<td>&gt;50</td>
<td>&gt;50</td>
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</table>

*Z* Percentage of leaf area with lesions in the upper, middle and lower leaf canopies

Foliar Fungicide Demo

Effects on Leaf Disease

Leaf Disease (0-12)

CHECK

FLAG

HEAD

DUAL

Fungicide Treatment

P < 0.001
July 29, 2013

UNTREATED CHECK
FUNGICIDE APPLIED
Foliar Fungicide Demo
Effects on Fusarium Head Blight

Fusarium Index (0-100)

- FHB 1 (P = 0.100)
- FHB 2 (P = 0.005)

Fungicide Treatment:
- CHECK
- FLAG
- HEAD
- DUAL

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Ducks Unlimited Canada
July 29, 2013 (untreated)
Foliar Fungicide Demo
Effects on Grain Yield

Grain Yield (bu/ac)

P = 0.002

Fungicide Treatment

CHECK

FLAG

HEAD

DUAL

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Ducks Unlimited Canada
Foliar Fungicide Demo
Effects on Test Weight

\[ P = 0.024 \]

Test Weight (lb/bu)

<table>
<thead>
<tr>
<th>Fungicide Treatment</th>
<th>Test Weight</th>
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<tr>
<td>CHECK</td>
<td>66</td>
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<tr>
<td>FLAG</td>
<td>66</td>
</tr>
<tr>
<td>HEAD</td>
<td>69</td>
</tr>
<tr>
<td>DUAL</td>
<td>69</td>
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</table>

\textbf{Effects on Test Weight}

\textbf{CHECK}

\textbf{FLAG}

\textbf{HEAD}

\textbf{DUAL}
Relatively high pressure for both leaf disease and fusarium head blight observed in 2013 winter wheat at Indian Head.

Similar reduction in leaf disease achieved with both foliar fungicide application times – relatively low levels observed at flag-leaf timing.

Yields for all three treatments where fungicide was applied were similar (13-15% above check) but flag-leaf application did not provide the FHB control achieved with the later application.

Test weight increased with fungicide applied at early heading; flag-leaf application did not increase test weights over the check.

Unless disease pressure is high early in the season (prior to flag-leaf emergence), a single fungicide at the early heading stage will likely provide acceptable control of both leaf and head disease.

Field trials continuing in 2014 with sites at Indian Head and Scott.
Nitrogen Fertility Options
Indian Head 2013

23 N fertilizer treatments where:

- 0, 75 or 150 kg N ha\(^{-1}\) applied
  - Soil test N recommendation was 99 kg N ha\(^{-1}\)
- Untreated urea, ESN®®, Nutrisphere-N®® or liquid UAN use as primary N fertilizer source
- N fertilizer either side-banded (at seeding), surface broadcast (early spring) or applied in a split-application (40/60)
Untreated Buteo WW seeded at 300 seeds/m² into canola stubble on Sept. 14 2012 using a SeedMaster drill on 12” row spacing.

All PKS fertilizer applied at seeding 27-36-12 lb/ac of P₂O₅-K₂O-S.

Where applicable liquid UAN was surface dribble banded either in late fall or early spring.

No burnoff, weeds controlled w/in-crop MCPA, flurasulam & pyroxsulam.

No foliar fungicide applied.

Pre-harvest glyphosate (356 g/ac) applied August 23.

Straight-combined plots on September 2.
Nitrogen Fertility Options

Effects on Winter Wheat Establishment

\[ P < 0.001 \]
Contrasts – Rate & Timing
Effects on Winter Wheat Establishment

- **ns**
- ***
- **ns**
- ***

<table>
<thead>
<tr>
<th>plants / m²</th>
<th>CHECK vs REST</th>
<th>75N vs 115N</th>
<th>FALL vs SPR</th>
<th>SPR vs SPLIT</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>***</td>
<td>ns</td>
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Contrasts – Form x Timing

Effects on Winter Wheat Establishment

plants / m²

<table>
<thead>
<tr>
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<th>FALL</th>
<th>SPRING</th>
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</thead>
<tbody>
<tr>
<td>UREA</td>
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<td></td>
</tr>
<tr>
<td>ESN</td>
<td>***</td>
<td></td>
</tr>
<tr>
<td>NSN</td>
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</tr>
<tr>
<td>UAN</td>
<td>ns</td>
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</table>

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Saskatoon Inn, Saskatoon SK
January 17 2014
Nitrogen Fertility Options
Versus Spring Broadcast 34-0-0

Nitrogen Treatment

plants/m²

SPRING-AN
FALL-UREA
FALL-ESN
FALL-NSN
FALL-UAN
SPRING-UREA
SPRING-ESN
SPRING-NSN
SPRING-UAN

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Nitrogen Fertility Options
Versus Untreated Urea (by placement/timing)

Nitrogen Treatment

plants/m²

FALL-UREA  FALL-ESN  FALL-NSN  FALL-UAN  SPRING-UREA  SPRING-ESN  SPRING-NSN  SPRING-UAN

** ns ns ns ns

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Nitrogen Fertility Options
Effects on Winter Wheat Yield

$P < 0.001$

Nitrogen Treatment

- Check
- SB-UR-75
- SB-ESN-75
- FALL-UAN-75
- SB-NSN-75
- FALL-UR-75
- BC-AN-75
- BC-ESN-75
- BC-NSN-75
- SPRING-UAN-75
- BC-UR-115
- BC-ESN-115
- BC-NSN-115
- SPL-UR-115
- SPL-ESN-115
- SPL-NSN-115
- SPL-UAN-115

buen/ac
Contrasts – Rate & Timing

Effects on Winter Wheat Yield

bu/ac

ns  ns  ***  ns  ***

75N vs 115N  FALL vs SPR  SPR vs SPLIT

CHECK vs REST  FALL vs SPR

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Saskatoon Inn, Saskatoon SK
January 17 2014
Contrasts – Form x Timing
Effects on Winter Wheat Yield

![Bar Chart showing the effects of different forms and timing on winter wheat yield.](chart.png)

- **UREA**
- **ESN**
- **NSN**
- **UAN**

*FALL* vs *SPRING*

**Significance Levels:**
- *****:** High significance
- ****:** Moderate significance

**bu/ac**

<table>
<thead>
<tr>
<th>Form</th>
<th>FALL</th>
<th>SPRING</th>
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<tbody>
<tr>
<td>UREA</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ESN</td>
<td></td>
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<tr>
<td>NSN</td>
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<tr>
<td>UAN</td>
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Saskatoon Inn, Saskatoon SK
January 17 2014

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**Canada**
Nitrogen Fertility Options
Versus Spring Broadcast 34-0-0

Nitrogen Treatment

bu/ac
Nitrogen Fertility Options
Versus Untreated Urea (by timing)
Reasonably strong overall N response observed but no difference between 75 and 115 kg N ha\(^{-1}\) fertilizer treatments for any variables

Nitrogen fertilizer crop establishment provided that it was applied in the fall – best results with side-banding regardless of form

Similar results for grain yield where fall-applied N resulted in higher yields than spring broadcast applications & best yields were achieved with side-banding

Urea ammonium-nitrate (UAN) not typically recommended for fall application due to susceptibility of NO\(_3\)-N to leaching and denitrification; however it is a good choice for spring, surface applications and easy to apply with a sprayer

No significant benefits to slow release forms of N observed but such products may be advantageous when used properly and can be a good fit for winter wheat

Split-application performed equal to fall application but with the potential advantage of allowing N rates to be adjusted depending on stand establishment and economics

Trials continuing at Indian Head, Scott and Melfort in 2014
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