Winter Wheat Cropping System Response to Seed Treatments, Seed Size and Sowing Density

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Winter Wheat Cropping System Response to Seed Treatments, Seed Size and Sowing Density

Expt 211. Winter wheat response to seed treatment and fall fungicide applications.

- Locations: Lethbridge (irrigated; rainfed clay loam and silty clay sites), Medicine Hat, Beaverlodge and Lacombe, AB; Scott, Melfort, Canora, and Indian Head, SK; and Brandon, MB.
- Treatments:
  - Seed Treatments: (5)
    a) Check – untreated seed
    b) Fungicide 1 – to control Fusarium, Cochliobolus and seed borne fungi (Septoria, smut and bunt) – tebuconazole (Raxil®)
    c) Fungicide 2 – to control Pythium only - metaly ( Allegience)
    d) Insecticide – to deter mine insect damage only, such as wireworms – will be imidacloprid (Stress Shield™)
    e) Combination product of fungicide and insecticide (Raxil WW™) with tebuconazole, metaly and imidacloprid.
  - Fall Foliar Treatments (2):
    a) Check (no fungicide)
    b) prothioconazole (Proline®) applied at 3-4 leaf stage in mid-October


ANOVA Results for 26 site-years 2011-13

Table 3. Analysis of variance for winter wheat data collected at 26 sites in Manitoba, Saskatchewan and Alberta, Canada from the fall of 2011 to the winter of 2013.

<table>
<thead>
<tr>
<th>Effect / Seed treatment</th>
<th>Fall</th>
<th>Spring</th>
<th>Yield</th>
<th>Test</th>
<th>Net revenue</th>
</tr>
</thead>
<tbody>
<tr>
<td>Seed treatment (T)</td>
<td>0.966**</td>
<td>0.223**</td>
<td>0.008**</td>
<td>0.891**</td>
<td>0.009**</td>
</tr>
<tr>
<td>Foliar fungicide (F)</td>
<td>0.818**</td>
<td>0.184**</td>
<td>0.023**</td>
<td>0.508**</td>
<td>0.046**</td>
</tr>
<tr>
<td>S x T x F</td>
<td>0.046</td>
<td>0.162</td>
<td>0.367</td>
<td>0.365</td>
<td>0.607</td>
</tr>
</tbody>
</table>

% variance S x T x F is estimated by dividing the site by seed treatment by foliar fungicide variance estimate by the sum of the variance estimates associated with the effect of site.


Winter Wheat Yield Responses to Seed Treatment and Fall Foliar Fungicide – Based on 26 Pan-Prairie Site-Yrs 2011-13

Coefficient of Variation (%)

- Group I: High mean, low variability
- Group II: High mean, high variability
- Group III: Low mean, high variability
- Group IV: Low mean, low variability

Effects of Dual Seed Treatment on Winter Wheat

Observations may be consistent with:
1) Ford et al. (2010; ST induced stress tolerance. PNAS 107:17527-17532)
Winter Wheat Yield Responses to Seed Treatment and Fall Foliar Fungicide – Based on 26 Pan-Prairie Site-Yrs 2011-13

Coefficient of Variation (%)

Group 1: High mean, low variability (optimal)
Group 2: High mean, high variability
Group 3: Low mean, high variability
Group 4: Low mean, low variability

Grain Yield Effects of Fall-Applied Foliar Fungicide (prothioconazole-‘Proline’) in Winter Wheat with Confirmed Incidence of Stripe Rust

<table>
<thead>
<tr>
<th>Environment</th>
<th>Fall Foliar</th>
<th>Check</th>
</tr>
</thead>
<tbody>
<tr>
<td>Leth Dry</td>
<td>A</td>
<td>A</td>
</tr>
<tr>
<td>Melfort</td>
<td>A</td>
<td>B</td>
</tr>
<tr>
<td>Scott</td>
<td>B</td>
<td>B</td>
</tr>
<tr>
<td>Overall</td>
<td>A</td>
<td>A</td>
</tr>
</tbody>
</table>

Does It Pay? Average for 26 Pan-Prairie Site-Yrs 2011-13

<table>
<thead>
<tr>
<th>Seed Treatment</th>
<th>Gross Returns $/ha</th>
<th>Total Costs $/ha</th>
<th>Net Returns $/ha</th>
</tr>
</thead>
<tbody>
<tr>
<td>Check</td>
<td>804</td>
<td>695</td>
<td>110</td>
</tr>
<tr>
<td>Tebuconazole</td>
<td>818</td>
<td>702</td>
<td>116</td>
</tr>
<tr>
<td>Metalxyl</td>
<td>806</td>
<td>702</td>
<td>104</td>
</tr>
<tr>
<td>Imidacloprid</td>
<td>820</td>
<td>702</td>
<td>118</td>
</tr>
<tr>
<td>Raxil WW</td>
<td>835</td>
<td>712</td>
<td>123</td>
</tr>
</tbody>
</table>

Expt 221. Winter wheat response to seed size, density and seed-applied fungicide/insecticide treatments.

- Locations: Lethbridge (irrigated; and rainfed clay loam and silty clay sites), Medicine Hat, Beaverlodge and Lacombe, AB; Scott, Melfort, Indian Head, and Canora, SK; and Brandon, MB.
- Experimental design: Four replicate randomized complete block with a factorial arrangement of treatments.

Treatments:

1. Seeding Rate (2):
   - a) 200 seeds m⁻²
   - b) 400 seeds m⁻²
2. Seed Size (3):
   - a) Light
   - b) Moderate (bulk seed not sized)
   - c) Heavy
3. Seed treatment (2):
   - a) Check
   - b) Dual Fungicide/Insecticide (Raxil WW™)

ANOVA Results for 26 site-years 2011-13

Table 6. Analysis of variance for winter wheat data collected at environments in MB, SK, and AB from the fall of 2010 to the summer of 2013.

<table>
<thead>
<tr>
<th>Environment</th>
<th>Test wt.</th>
<th>2010</th>
<th>2011</th>
<th>2012</th>
<th>2013</th>
<th>Treatment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fall Foliar</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Light</td>
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<td></td>
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<tr>
<td>Moderate</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Heavy</td>
<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>200 seeds m²</td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>400 seeds m²</td>
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<td></td>
</tr>
<tr>
<td>Seed treatment</td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Check</td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Tebuconazole</td>
<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Metalxyl</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Imidacloprid</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Raxil WW</td>
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<td></td>
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<tr>
<td>R x Z x T</td>
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<tr>
<td>R x Z</td>
<td></td>
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<tr>
<td>R x T</td>
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</tr>
</tbody>
</table>

*Denotes significant differences between treatments at P ≤ 0.05.
**Denotes significant differences between treatments at P ≤ 0.01.


Winter Wheat Spring Plant Density Response to Seed Size x Seed Treatment x Sowing Density

Based on 20 Pan-Prairie Site-Years 2011-12

Winter Wheat Yield Responses to Seed Size x Seed Treatment x Sowing Density – Based on 26 Pan-Prairie Site-Yrs 2011-13

Most sustainable?
Most Profitable??

Conclusions

- Dual fungicide/insecticide seed treatments improve crop stands, health, and vigour - leading to higher yields or greater yield stability
- Seed treatments do not replace sound agronomic practices, but can provide ‘insurance’:
  • Mitigate biotic and abiotic factors that can be yield-limiting
  • Protect yield from compromised seed lots/crop stands
- Fall foliar fungicide applications have reduced stripe rust and improved grain yield – reduced disease load also observed in stripe rust free sites, but cost-prohibitive
  • Tebuconazole seed treatment combined with fall foliar prothioconazole = same 2 actives for Raxil Pro seed treatment, which is purported to improve frost tolerance in winter wheat ……

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  • Dean Spaner

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†Costs and revenue derived from ‘Crop Planning Guide 2015’, Ministry of Agriculture of Saskatchewan

†How to quantify in $ system stability? How do you balance that with ecosystem services or sustainability??

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