Optimal Application Timing of Fungicide to Control Leaf Spots in Wheat

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Wheat production

- 27.7 million tonnes (mt) in 2014.
- 13.4 mt in Saskatchewan in 2014.
- Grown on 52,000 Canadian farms on 22.8 million acres (9.26 million hectares).
- Canada is the 7th largest producer in the world, exporting 17 mt worth approximately $5.4 billion.
Leaf spot diseases

- Variety of leaf spot diseases, including species that make up the septoria leaf spot complex as well as spot blotch and tan spot.
Leaf spot diseases

- Infect the leaves of wheat plants.
- Appear to occur together in most areas.
- Diseases are often very difficult to distinguish.
- Result in yield losses up to 15%.
Optimal application

- Inconclusive, although several studies suggest early fungicide application improves yield.

- Leaf spot diseases at GS39, or the flag leaf stage.

- FHB at the beginning of anthesis, GS60.
Fungicide timing

- Is it required to spray at both flag leaf stage and at anthesis?
- Will spraying at anthesis alone provide adequate control of leaf diseases?
Hypothesis

- Control of leaf spot diseases will vary depending on timing of fungicide application.

Objective

- Evaluate the efficacy of two fungicides and a bio-fungicide for controlling leaf spot disease severity at three application timings.
Experimental design

- 16 treatments each site-year: 3 timings x 5 fungicide treatments plus an unsprayed check.
- RCBD with 4 replications.
- cv. Carberry.
Data collection

- Rated leaf spots on leaves at each application date.
- Rated % infection by FHB on heads.
- Collected yield, thousand kernel weight, test weight, and protein content.
## Treatments

<table>
<thead>
<tr>
<th>Fungicide</th>
<th>Timing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prothioconazole+tebuconazole (Prosaro)</td>
<td>Flag, anthesis, both</td>
</tr>
<tr>
<td>Tebuconazole (Folicur)</td>
<td>Flag, anthesis, both</td>
</tr>
<tr>
<td><em>Bacillus subtilis</em> (Serenade optimum)</td>
<td>Flag, anthesis, both</td>
</tr>
<tr>
<td>Prosaro+Serenade optimum</td>
<td>Flag, anthesis, both</td>
</tr>
<tr>
<td>Folicur+Serenade optimum</td>
<td>Flag, anthesis, both</td>
</tr>
<tr>
<td>Unsprayed Check</td>
<td></td>
</tr>
</tbody>
</table>
## Results

<table>
<thead>
<tr>
<th>Contrast</th>
<th>Leaf disease (%)</th>
<th>Yield (kg/ha)</th>
<th>Fusarium head Blight (%)</th>
<th>Thousand Kernal Weight (g)</th>
<th>Protein (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flag leaf vs anthesis</td>
<td>+</td>
<td>ns</td>
<td>ns</td>
<td>*</td>
<td>ns</td>
</tr>
<tr>
<td>Flag leaf vs both timings</td>
<td>***</td>
<td>*</td>
<td>ns</td>
<td>***</td>
<td>ns</td>
</tr>
<tr>
<td>Anthesis vs both timings</td>
<td>***</td>
<td>ns</td>
<td>ns</td>
<td>ns</td>
<td>+</td>
</tr>
<tr>
<td>Unsprayed vs biological</td>
<td>*</td>
<td>ns</td>
<td>ns</td>
<td>ns</td>
<td>ns</td>
</tr>
<tr>
<td>Unsprayed vs fungicide</td>
<td>***</td>
<td>**</td>
<td>ns</td>
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<td>ns</td>
</tr>
<tr>
<td>Full-rate vs half-rate</td>
<td>ns</td>
<td>ns</td>
<td>ns</td>
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<td>ns</td>
</tr>
<tr>
<td>Prosaro® vs Folicur®</td>
<td>*</td>
<td>ns</td>
<td>ns</td>
<td>ns</td>
<td>ns</td>
</tr>
</tbody>
</table>

ns, $P>0.10$, not significant; +, $0.05<P<0.10$, not significant, but tend to be significant; *, $P<0.05$, significant; **, $P<0.01$, strongly significant; ***, $P<0.001$, very strongly significant
Unsprayed vs fungicide – leaf disease

![Graph showing disease severity comparison between unsprayed and fungicide treatments.](image)
Unsprayed vs biological – leaf disease

Disease severity (%)

Uns vs. Bio *

Unsprayed vs. Biological
Unsprayed vs biological vs control
2013 Lethbridge

Disease severity (%)

Uns vs. Bio  ***
Uns vs. Fung  ***

unsprayed  bio  fung
Application timing – leaf disease

- F vs. A: +
- F vs. B: ***
- A vs. B: ***

Disease severity (%)

- Flag
- Anthesis
- Both
Unsprayed vs fungicide - yield

Uns vs. Fung **

Yield (kg/ha)

Unsprayed  Fungicide
Application timing - yield

Yield (kg/ha)

4000 4200 4400 4600 4800 5000

F vs. A  ns
F vs. B  *
A vs. B  ns

Flag  Anthesis  Both
Application timing – thousand kernel weight (TKW)

Flag

Anthesis

Both

<table>
<thead>
<tr>
<th>Thousand kernel weight (g)</th>
<th>F vs. A</th>
<th>F vs. B</th>
<th>A vs. B</th>
</tr>
</thead>
<tbody>
<tr>
<td>37</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>37.5</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>38</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>38.5</td>
<td>*</td>
<td>***</td>
<td>ns</td>
</tr>
<tr>
<td>39</td>
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<td></td>
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<tr>
<td>39.5</td>
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<td></td>
<td></td>
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<tr>
<td>40</td>
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</tbody>
</table>
Application timing - protein

<table>
<thead>
<tr>
<th></th>
<th>Protein (%)</th>
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<tbody>
<tr>
<td>F vs. A</td>
<td>ns</td>
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<tr>
<td>F vs. B</td>
<td>ns</td>
</tr>
<tr>
<td>A vs. B</td>
<td>+</td>
</tr>
</tbody>
</table>

Protein (%)

Flag  Anthesis  Both
Conclusion

- No significant difference in leaf disease when spraying at flag leaf stage compared to anthesis.
- Significant difference in leaf disease when spraying at both timings compared to either flag leaf stage or anthesis.
- Yield was increased when sprayed at both timings compared to sprayed at flag leaf stage.
- Biological fungicide reduced leaf disease compared to the unsprayed check, but the data was strongly influenced by one location.
Acknowledgements

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  Dr. Brian Fowler

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Questions?