Crop Sequence Influence on Fusarium Head Blight from Wheat and Barley

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How diverse are crop rotations in western Canada?

- Main field crops in Canada: cereals and pulses

- In the prairies the crop rotation is less-diverse wheat-canola-pea (pulses) wheat-canola-wheat

- A less-diverse crop sequence increase cereal diseases risk
Fusarium head blight (FHB) affects cereals

- Fusarium head blight affects small-grain cereals across the prairies
- Wheat, barley, oat, canary seed
- Around 17 species from *Fusarium* spp.
- Produce mycotoxin deoxynivalenol (DON) toxic for humans and animals
- Species complex: *F. culmorum, F. poae, F. avenaceum, F. sporotrichioides*
- Principal causal agent is *F. graminearum*
Research Hypothesis

A diverse crop sequence that includes host and non-host crops can influence FHB from wheat and barley at six locations across western Canada.

Research Objectives

To determine optimum crop sequences that minimize FHB of wheat and barley in the Canadian prairies.

Evaluate root rot and leaf spotting diseases in sequences that include up to five of the most widely grown crops in western Canada.
Crop sequence study in the Prairies

Locations
- Lethbridge
- Melfort
- Saskatoon
- Indian Head
- Brandon
- Morden

Crops
- Wheat
- Barley
- Canola
- Pea
- Corn/Maize
A Diverse Crop Sequence Experiment

Experiments will be conducted over three-year growing seasons in a **split-block design**

<table>
<thead>
<tr>
<th>Location</th>
<th>Additional crops seeded</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lethbridge</td>
<td>durum, dry bean</td>
</tr>
<tr>
<td>Melfort</td>
<td>lentil</td>
</tr>
<tr>
<td>Indian Head</td>
<td>durum, soybean, canary seed</td>
</tr>
<tr>
<td>Saskatoon</td>
<td>flax, canary seed, oat, lentil</td>
</tr>
<tr>
<td>Brandon</td>
<td>soybean</td>
</tr>
<tr>
<td>Morden</td>
<td>soybean</td>
</tr>
</tbody>
</table>
Year 1
2018

2020
2 sites durum/1 site wheat
3 sites barley

Year 3 – 2020 All plots with Cereal:
Durum/Wheat or Barley
Parameters

Yield (kg/ha) from all crops

(1) Diseases

(2) Quality parameters

FHB infected durum spikes
Preliminary Results
### P-value for crop yields on previous stubbles

<table>
<thead>
<tr>
<th>Location</th>
<th>Wheat</th>
<th>Durum</th>
<th>Barley</th>
<th>Canola</th>
<th>Pea</th>
<th>Maize</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lethbridge</td>
<td>0.012</td>
<td>0.005</td>
<td>0.4568</td>
<td>0.183</td>
<td>0.144</td>
<td>0.0463</td>
</tr>
<tr>
<td>Melfort</td>
<td>nd</td>
<td>0.11</td>
<td>0.03</td>
<td>0.035</td>
<td>0.211</td>
<td>nd</td>
</tr>
<tr>
<td>Saskatoon</td>
<td>nd</td>
<td>0.70</td>
<td>0.42</td>
<td>0.637</td>
<td>0.150</td>
<td>nd</td>
</tr>
<tr>
<td>Indian Head</td>
<td>0.131</td>
<td>0.14</td>
<td>0.0007</td>
<td>0.398</td>
<td>0.0006</td>
<td>0.0025</td>
</tr>
<tr>
<td>Brandon</td>
<td>0.0004</td>
<td>0.711</td>
<td>0.472</td>
<td>0.132</td>
<td>0.375</td>
<td></td>
</tr>
</tbody>
</table>
FHB index Lethbridge 2019

<table>
<thead>
<tr>
<th>Location</th>
<th>Wheat</th>
<th>Durum</th>
<th>Barley</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lethbridge</td>
<td>0.07</td>
<td>0.76</td>
<td><strong>0.05</strong></td>
</tr>
</tbody>
</table>
### Stubble effect on wheat kernels

<table>
<thead>
<tr>
<th>Pathogen</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Fusarium</em> spp.</td>
<td>&lt;.0001</td>
</tr>
<tr>
<td><em>Alternaria</em> spp.</td>
<td>0.049</td>
</tr>
<tr>
<td><em>Epicoccum</em> spp.</td>
<td>0.53</td>
</tr>
</tbody>
</table>

The graph shows the percentage of *Fusarium* spp. infection across different previous stubble crops. The pathogen percentages for each crop are as follows:

- Barley: C
- Flax: BC
- Canary: BC
- Wheat: BC
- Oat: BC
- Pea: C
- Canola: C
- Lentil: A
- Maize: B
Barley leaf spot diseases Lethbridge 2019

% Leaf spot diseases

- Barley: A
- Drybean: AB
- Wheat: B
- Durum: B
- Canola: BC
- Hemp: BC
- Maize: BC
- Quinoa: BC
- Pea: C

Previous stubble
Preliminary conclusions

• Growing barley on barley in a sequence have significant effects on FHB index and leaf spot diseases
• Lentil stubble have a significant effect on *Fusarium* spp. presence on wheat kernels from Saskatoon
• Improve recommendations for cereal growers in western Canada by adding a diverse crop sequence to reduce FHB in the prairies.
Acknowledgments

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Dr. Steve Shirtliffe
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