Update on pea root rot in 2016

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Agronomy Update

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Overview

• Root rot surveys in 2016
  – Distribution of pathogens in AB
• Intro to causal agents
  – Complex of agents
  – Host range of Aphanomyces
• Current research projects
  – Field trials
2016 was a great year for pulses!

High prices help lentils take top spot in exports

Lentils beat canola in seed sales, but canola still reigns if the value of oil and canola meal are taken into account

The mighty lentil dethroned Cinderella to become Saskatchewan’s top crop last year. The province’s lentil exports were valued at $2.5 billion last year compared to $2.4 billion worth of canola seed sales and $2.3 billion of wheat shipments.

“Quite honestly, I was a little bit surprised to see it exceed canola because canola is such a large acreage and large production crop in Saskatchewan,” said Carl Porta, executive director of Saskatchewan Pulse Growers.
Field surveys for root rot of pea and lentil in 2016

- 27 lentil and 89 pea fields surveyed during flowering
- Samples sent to Lethbridge for rating and analysis
- Diagnostic DNA tests for common pathogens
Disease severity rating scale

1. Healthy
2. Moderate
3. Severe
# Pea root rot by soil zones in 2016

<table>
<thead>
<tr>
<th>Soil Zone</th>
<th>Incidence DS &gt; 1 (healthy – severe)</th>
<th>Incidence DS &gt; 3 (moderate + severe)</th>
<th>Mean DS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Black</td>
<td>60</td>
<td>18</td>
<td>2.4</td>
</tr>
<tr>
<td>Dark Brown</td>
<td>60</td>
<td>30</td>
<td>2.6</td>
</tr>
<tr>
<td>Brown</td>
<td>74</td>
<td>27</td>
<td>2.8</td>
</tr>
</tbody>
</table>
## Lentil root rot in 2016

<table>
<thead>
<tr>
<th>Incidence</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>DS &gt; 1</td>
<td>78</td>
<td></td>
</tr>
<tr>
<td>DS &gt; 3</td>
<td>33</td>
<td></td>
</tr>
</tbody>
</table>

**Mean DS:** 2.4
Percent fields positive for *Aphanomyces euteiches*

<table>
<thead>
<tr>
<th>Color</th>
<th>Percent Positive</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brown</td>
<td>48.0</td>
</tr>
<tr>
<td>Lentil</td>
<td></td>
</tr>
<tr>
<td>Black</td>
<td>29.2</td>
</tr>
<tr>
<td>Pea</td>
<td>43.9</td>
</tr>
<tr>
<td>Brown</td>
<td>45.8</td>
</tr>
</tbody>
</table>
Distribution of Ae samples within fields

**Lentil**

- Number of fields in each category
- % positive samples

**Pea**

- Number of fields in each category
- % positive samples
Other soilborne fungi...

- Pythium ultimum
- Pythium irregular
- Rhizoctonia solani
- avenaceum
- solani
- redolens
- oxysporum
- graminearum
- culmorum

Virulent
Weak
Wheat
Root rots are caused by a complex of organisms

- Two main pathogen groups of focus
  - *Aphanomyces euteiches* – highly aggressive on pea and lentil, long-lived resting spore
  - *Fusarium* spp. - distributed widely
    - *F. avenaceum and F. solani* most virulent species
Symptom expression is not clear-cut

Most often roots are infected with a pathogen complex
Control options – what can you do right now?

• If you have had a history of root rots – get soil tested to confirm presence of Aphanomyces
• Avoid planting peas and lentils in Aphanomyces-infested fields
• Prolonged rotations of susceptible hosts (peas and lentils) in infested fields (6 – 8 years)
• Consider using a seed treatment that targets the root rot complex
• An in-crop fungicide application will not have any effect
## Host range testing of Aphanomyces

<table>
<thead>
<tr>
<th>Crop</th>
<th>Disease reaction</th>
<th>Oospores</th>
</tr>
</thead>
<tbody>
<tr>
<td>Peas</td>
<td>Susceptible</td>
<td>Yes</td>
</tr>
<tr>
<td>Lentils</td>
<td>Susceptible</td>
<td>Yes</td>
</tr>
<tr>
<td>Cicer milkvetch</td>
<td>Susceptible</td>
<td>Yes</td>
</tr>
<tr>
<td>Dry bean</td>
<td>Variable</td>
<td>Few</td>
</tr>
<tr>
<td>Alfalfa</td>
<td>Variable</td>
<td>Yes</td>
</tr>
<tr>
<td>Chickpeas</td>
<td>Resistant</td>
<td>Few</td>
</tr>
<tr>
<td>Sainfoin</td>
<td>Resistant</td>
<td>Few</td>
</tr>
<tr>
<td>Faba bean</td>
<td>Resistant</td>
<td>No</td>
</tr>
<tr>
<td>Soybean</td>
<td>Non-host</td>
<td>No</td>
</tr>
<tr>
<td>Fenugreek</td>
<td>Non-host</td>
<td>No</td>
</tr>
</tbody>
</table>
## Root rot in other legume crops

<table>
<thead>
<tr>
<th>Crop</th>
<th>Incidence DS &gt; 1</th>
<th>Incidence DS &gt; 3</th>
<th>Mean DS</th>
<th>Ae positive</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alfalfa</td>
<td>7.5</td>
<td>0.92</td>
<td>1.1</td>
<td>2*/13</td>
</tr>
<tr>
<td>Dry Bean</td>
<td>60</td>
<td>1.7</td>
<td>1.8</td>
<td>4*/15</td>
</tr>
<tr>
<td>Faba bean</td>
<td>13</td>
<td>0.7</td>
<td>1.2</td>
<td>0/14</td>
</tr>
</tbody>
</table>

*being confirmed with soil baiting assays, incidence is very low
Research projects on the go

1. Survey and map root rot incidence and severity in Alberta and Saskatchewan
2. Evaluate field-based solutions to reducing root rot impact – seed treatments, cultivar effects, soil amendments
3. Develop inoculum quantification tools for predicting root rot risk in Canadian prairie soils
4. Determine spatial distribution of *A. euteiches* in vertical and horizontal soil profiles, and in different soil zones
5. Identify interactions between species that affect root rot development
Field-based solutions

• Most are in the research phase…

• Ethaboxam (Intego Solo)
  – Registered for early suppression of Aphanomyces root rot
  – Must be used in combination with other seed treatments with actives against Fusarium and other damping-off pathogens

• Phostrol (phosphite salts)
  – Not registered on pulse crops
  – Good efficacy in trials in the U.S. on processing pea when applied at seeding or emergence
  – More widespread trials taking place in 2016

➢ Won’t provide full-season protection
Results

*A. euteiches* + ethaboxam in the greenhouse

**Figure 4.** Disease rating of seedlings grown from seed treated with ethaboxam vs. untreated seed planted in soil inoculated with *A. euteiches* at concentrations ranging from 0 to 1000 oospores per mL.
Figure 3. Severity of root rot disease in pea measured over 3 sampling periods
Control options

• Liming or Ca\(^+\) amendments
  – Calcium prevents zoospores from germinating
  – Feasibility of applying and incorporating calcium?

• Brassica cover crops
  – Green manure break-down products “biofumigate” soil and suppress oospores
  – Feasibility in no-till systems if green manure needs to be incorporated?
  – Increased disease risk to canola?
  ➢ Long-term effects as amending inoculum levels in soil
Minimal reductions in disease severity in some treatments, but doesn’t translate to changes in yield
Conclusions

• Root rots are widespread – impact in 2016 was variable and depended on soil moisture levels

• Aphanomyces and Fusarium root rots occur as a complex, are difficult to distinguish and act synergistically

• Long rotations between susceptible pulse crop only control option

• Faba beans, soybean and chickpeas best pulse crop option in infested fields
Collaborators

- Mike Harding and Robyne Bowness, Alberta Agriculture
- Sabine Banniza, U of S
- Sherilllyn Phelps and Brian Olson, SPG
- Bruce Gossen, AAFC

Technical Assistance

- Christine Vucurevich
- Carol Mueller, Scott Erickson
- Trina Dubitz
- Dustin Burke, Carol Pugh
- Cheryl Cho
- Telsa Willsey (MSc student)
- A lot of coop students