Root Rot in Pulses

Faye Dokken-Bouchard, Provincial Specialist, Plant Disease
Disease Triangle
Root Rot Pathogens
Root Rot Pathogens

Fusarium
Pythium
Rhizoctonia
Aphanomyces

- Can infect plant at anytime (not just at seedling stage)
- Later infections are not as visible in the field but result in lodging and harvest difficulties
Root rot pathogens

Usually root rots caused by a combination of species = root rot complex

Soil samples analyzed to date always revealed *Fusarium* spp., in many cases *Aphanomyces euteiches*, and sometimes *Rhizoctonia* and *Pythium*

- *Fusarium* spp. very common
- Same species that can cause FHB
Root Rot Pathogen Host Range

Species with a wider host range

– *Fusarium* spp. (e.g. *solani*, *avenaceum*, *acuminatum*, *graminearum*)
– *Rhizoctonia solani*
– *Pythium* spp.

Relatively host-specific species:

– *Fusarium oxysporum* f.sp. *pisi* or f. sp. *lentis*
– *Aphanomyces euteiches*
Fusarium vs Aphanomyces

Photo courtesy of Dr. S. Chatterton, AAFC Lethbridge
Fusarium

Photo courtesy of F. Dokken-Bouchard, SMA

Photo courtesy of Dr. B. Gossen, AAFC Saskatoon
Aphanomyces infected vs healthy roots

Photo courtesy of C. Armstrong-Cho
Normal watering conditions
<table>
<thead>
<tr>
<th>Organism</th>
<th>Temperature optimums (°C)</th>
<th>Moisture favouring severity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aphanomyces</td>
<td>22 to 27</td>
<td>Excessive</td>
</tr>
<tr>
<td>Fusarium</td>
<td>25 to 30</td>
<td>Moderate</td>
</tr>
<tr>
<td>Pythium</td>
<td>17 to 23</td>
<td>Wet</td>
</tr>
<tr>
<td>Rhizoctonia</td>
<td>Can damage at 18 but most aggressive at 24 to 30</td>
<td>Wide range of conditions</td>
</tr>
</tbody>
</table>
Disease indicator for 2014 - Fusarium in wheat

Percent total Fusarium on cereals tested at Saskatchewan Seed Labs - 2014

* indicates figure based on <10 samples.
**Aphanomyces euteiches**

- Reports on *Aphanomyces* spp. in Canada since 1938
- First confirmed report in SK in 2012
- 2014 widespread identification in soil and plant roots across SK
- Therefore, has been here but conditions weren’t favoring build of pathogen or infections until recently

Data from CDC, Discovery Seed & SK Agric. Crop Protection Labs
Aphanomyces Distribution in Soil

• Most concentrated at 10 to 40 cm depth in France (present in 0 to 60 cm)
• Initial study at U of S confirmed aphonmyces at 0 to 30 cm in SK (only went to 30 cm depth)
• Variable across fields and in soil profile

Dawson Detwiller: Dr. Sabine Banniza undergrad student fall 2014
Aphanomyces euteiches

• Belongs to the ‘water moulds’ like Pythium (fungus-like)
• Survival of oospores in the soil without a host for up to 20 years
• Is mobile (zoospores) and can move with the water
• No chemical controls to date
Summary of root rot pathogens

• Root rot complex (Fusarium, Pythium, Rhizoctonia, Aphanomyces)

• Aphanomyces is a new issue to Sask
  – No chemical controls, very long lived, needs water
Environment
Weather patterns

2009- last year of normal to dry conditions

2010 - 2013 – 2 years wet spring, 2 ave to wet
Forecast for 2015: Western Producer January 29

Spring planting conditions April-May 2015

Summer weather conditions June - August 2015

Source: Drew Lerner, World Weather | MICHELLE HOULDEN GRAPHIC
Symptoms

Stunting
Yellowing
Poor root growth
Little nodulation
Browning of root area

Photo courtesy of S. Phelps, SPG
Some fields – certain areas affected

Photo courtesy of Dr. S. Chatterton
Field edges – why?

Photo courtesy of S. Phelps, SPG
Environment affects severity

**Increased severity**
- Wet condition or high moisture holding capacity
  - Heavier land
  - Compacted areas
  - Wetter areas of field (side hill seeps)

**Good Fields**
- Drier (better drainage)
  - Lighter land
  - Less compaction
What are these paths from?

Photo courtesy of Dr. Sabine Banniza, CDC
• Peas and lentil do not like wet feet
• A pea or lentil plant in wet soil is a stressed plant even without presence of pathogen

Peas grown in **sterile field soil**: left normal watering, right water-logged conditions

Photo courtesy of Dr. Sabine Banniza, CDC
Waterlogged, sterilized vs. Waterlogged, unsterilized

Photo courtesy of M. Tetreault
Environment affects severity

**Increased severity**
- Wet conditions
- Heavier soil
- Low N or other nutrients

**Good Fields**
- Dry conditions/better drainage
- Lighter soil
- Starter N or adequate soil levels

**Soil Test Characteristics**

<table>
<thead>
<tr>
<th>Depth (inches)</th>
<th>Texture</th>
<th>pH 1S:2W</th>
<th>E.C. 1S:2W (mS/cm)</th>
<th>E.C. Calc. Sat. Extr. (mS/cm)</th>
<th>Salinity Rating</th>
<th>Organic Matter %</th>
<th>NH₄-N (lb/acre)</th>
<th>Calculated CEC meq/100g</th>
<th>Ca</th>
<th>Mg</th>
<th>K</th>
<th>Na</th>
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<tr>
<td>0-6</td>
<td>Loam</td>
<td>6.4</td>
<td>0.1</td>
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**Soil Test Nutrient Levels**

<table>
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<tr>
<th>Depth (inches)</th>
<th>NO₃-N</th>
<th>P</th>
<th>K</th>
<th>SO₄-S</th>
<th>Cu</th>
<th>Mn</th>
<th>Zn</th>
<th>B</th>
<th>Fe</th>
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<tr>
<td>0-6</td>
<td>5</td>
<td>32</td>
<td>482</td>
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Soil test from June 23
Herbicide Impacts?

Producer comments

– Field edges are better .......
– Notice after herbicide application...
– Better around power poles....

No support for herbicides causing root rots.....but additional stress can add to already stressed plants

Leave check strips....
Hosts
Crop & Variety

• All pulse crops susceptible to root rot organisms (Fusarium, Pythium, Rhizoctonia)
• Soybean, fababean & chickpea have good resistance to aphanomyces compared pea and lentil
Alternative pulse crop: Faba bean

Dr. Sabine Banniza, CDC
Resistance in pea to Aphanomyces root rot

- Extensive screening in France and USA
- USDA lines received by CDC (shown here)
- French lines currently not available until released to their farmers first

Dr. Sabine Banniza, CDC
Resistance in lentil

- Preliminary testing of CDC interspecific lentil populations (*Lens ervoides*) showed some with moderate resistance (scored 3)
- Still to evaluate current varieties in SK

<table>
<thead>
<tr>
<th>Parents/Lines</th>
<th>Disease reactions</th>
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<th>Disease reactions</th>
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<tr>
<td>P-LR26-Eston</td>
<td>5</td>
<td>P-LR59-Eston</td>
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<tr>
<td>P-IG 72815</td>
<td>3</td>
<td>P-L01827 A</td>
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<tr>
<td>LR26-300</td>
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<td>LR59-133</td>
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</tr>
</tbody>
</table>

Dr. Sabine Banniza, CDC
Host affects severity

**Increased severity**

**Shortened rotations**

- pea/lentils 2-3 years ago

**Good Fields**

No peas or lentils > 4yrs ago
Rotation

2010 - peas

2010 - canola

Photo courtesy of S. Phelps, SPG
Photo courtesy of Dr. S. Chatterton
Planning for 2015
Prevention: Field Choice

Field selection – lighter land with good drainage

Avoid compacted areas or manage compaction

Fertility – know nutrient status & correct if needed
Prevention: Host Choice & Health

**Rotation** – pea/lentil once every 4 yrs (6+ if aphanomyces)

**Test seed** – Germ & quality, disease levels

**Seed treatment**
- Cool soils
- Proper method of application
- Only effective for 3-4 weeks
Prevention: Plant Health

• Healthy seedlings = better able to withstand infections or recover from stress
• Proper **inoculant** and good application methods
• Minimize damage to seed through air systems and in handling
• Roll under appropriate conditions (not wet)
• Monitor for signs of stress
• Follow herbicide labels

Photo courtesy of S. Phelps, SPG
## Prevention

1. **Rotation**
2. **Field choice**
3. **Fertility**
4. **Seed testing/trtmnts**
5. **Maximize seedling vigor**
6. **Monitor**

### Table: Options for Reducing Risk of Root Rots

<table>
<thead>
<tr>
<th>Choices</th>
<th>Options for Reducing Risk of Root Rots</th>
</tr>
</thead>
</table>
| Field Choice      | - Lighter textured soils (sandier) with good drainage  
                   - Out of peas/lentils for at least three years (four year rotation) and maybe up to six years if Aphanomyces positively identified  
                   - Manage or avoid compacted fields or areas                                                                   |
| Soil Testing and Fertility | - Apply nutrients as needed  
                             - Starter nitrogen if soils <15 lbs/acre available nitrogen in top 12 inches  
                             - Phosphorous if seeding early into cool soils  
                             - Other nutrients only if deficient  
                             - Know the safe rates of nutrients that can be safely seed placed |
| Seed Testing      | - Plant good quality seed  
                   - Apply seed treatments as warranted for seed borne disease or if planting early into cool soils (see next table) |
| Seeding Decisions | - Use appropriate inoculant and good application methods  
                   - Choose more resistant crops - fababeans, chickpea, and soybeans (only for Aphanomyces root rot)  
                   - Minimize seed damage and watch airspeed of seeder  
                   - Seed into warm moist soil – the quicker the emergence the more vigorous the seedlings |
| After Seeding     | - Monitor crop for signs of stress  
                   - Follow herbicide labels - increased injury can occur when plants are stressed |
<table>
<thead>
<tr>
<th>Lab</th>
<th>Location</th>
<th>Website</th>
</tr>
</thead>
<tbody>
<tr>
<td>Discovery Seed Lab</td>
<td>Saskatoon</td>
<td><a href="http://www.seedtesting.com">www.seedtesting.com</a></td>
</tr>
<tr>
<td>BDS Labs</td>
<td>Qu’Appelle</td>
<td><a href="http://www.bdslabs.com">www.bdslabs.com</a></td>
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<tr>
<td>20/20 Seed Labs</td>
<td>Nisku</td>
<td><a href="http://www.2020seedlabs.ca">www.2020seedlabs.ca</a></td>
</tr>
<tr>
<td>Crop Protection Lab</td>
<td>Regina</td>
<td><a href="http://www.agriculture.gov.sk.ca/Crop_Protection_Lab">www.agriculture.gov.sk.ca/Crop_Protection_Lab</a></td>
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Individual labs may differ in testing methods and sample requirements. Please check with lab prior to sending samples.
More Root Rot Information

Root rot document:  
www.saskpulse.com

Root rot topics at events:  
Regional Pulse (Feb)  
Webinar (March)
A successful 2015!