A closer look at pulse diseases

Barbara Ziesman
Provincial Specialist, Plant Disease
2017 Regional Pulse Meetings
Seed quality

• Quality can mean different things depending on whether you are talking about grain or seed

• **Seed quality:**
  – Germination rate
  – Vigour
  – Purity
  – Level of seed borne diseases
Disease testing

• Disease is considered seed-borne if:
  – Seed surface is contaminated by spores or mycelium;
  – Seed is contaminated with pathogen resting structures
  – Internal colonization of seed or embryo infection.

• Will not detect or help to determine risk associated with soil or residue borne pathogens
Seed treatments

• Protect seeds and ensure that the crop gets off to a good start

• Can help poor quality seed

• Protect seedling germination in unfavourable conditions

• Will not “cure” a poor seed lot that has high levels of dead, damaged or infested seed
Seed treatments: 3 reasons

1. Manage soil borne pathogens that cause seed rots, damping-off, seedling blights and root rots

2. Manage pathogens on the surface of seeds

3. Manage internally seed borne pathogens
Seed treatments: considerations

• **Efficacy will depend on:**
  – Choice of the product
  – Application coverage
  – Environmental conditions
  – Field history and the level of disease
Seed-to-seedling transmission

• The relationship between seed infection and diseased seedlings is not 1:1

• The rates of seed-to-seedling transmission vary with the crop type, type of disease and conditions at seeding

• Seed treatments will reduce the rates of seed-to-seedling transmission of seed borne diseases

http://www.majordifferences.com/2014/08/difference-between-epigeal-and-hypogeal.html#.WIEAvlMrJaQ
<table>
<thead>
<tr>
<th>Crop</th>
<th>Disease (Pathogen)</th>
<th>Threshold on Seed</th>
<th>Action if Over Threshold</th>
</tr>
</thead>
<tbody>
<tr>
<td>All Pulses</td>
<td>Seed rot and damping off ((Pythium\ and/or \textit{Phytophthora}\ spp.))</td>
<td>N/A (soil-borne)</td>
<td>Use seed treatment IF: history of disease; seeding under cool-moist soil conditions; or if planting: kabuli chickpeas, low-tannin lentils, damaged or cracked peas.</td>
</tr>
<tr>
<td></td>
<td>Seed rot &amp; seedling blight ((\textit{Botrytis} + \textit{Sclerotinia} + \textit{Fusarium}))</td>
<td>10%</td>
<td>Use seed treatment</td>
</tr>
<tr>
<td>Crop</td>
<td>Disease (Pathogen)</td>
<td>Threshold on Seed</td>
<td>Action if Over Threshold</td>
</tr>
<tr>
<td>---------------</td>
<td>-------------------------------------</td>
<td>-------------------</td>
<td>-----------------------------------------------</td>
</tr>
<tr>
<td>Chickpea</td>
<td>Ascochyta blight ((Ascochyta\ rabiei))</td>
<td>0 to 0.3%</td>
<td>Use a registered seed treatment</td>
</tr>
<tr>
<td></td>
<td></td>
<td>&gt;0.3%</td>
<td>Do not use as seed</td>
</tr>
<tr>
<td>Lentil</td>
<td>Ascochyta blight ((Ascochyta\ lentis))</td>
<td>0%</td>
<td>Seed with 0% (Ascochyta) infection should be used in black soil zone</td>
</tr>
<tr>
<td></td>
<td></td>
<td>5%</td>
<td>May be tolerable in brown and dark brown soil zones</td>
</tr>
<tr>
<td></td>
<td></td>
<td>5-10%</td>
<td>Use a registered seed treatment</td>
</tr>
<tr>
<td></td>
<td></td>
<td>10%</td>
<td>Do not use as seed</td>
</tr>
<tr>
<td></td>
<td>Stemphylium blight</td>
<td>?</td>
<td>Significance unknown</td>
</tr>
<tr>
<td>Field Pea</td>
<td>Ascochyta complex</td>
<td>10%</td>
<td>Use a registered seed treatment</td>
</tr>
</tbody>
</table>
Take home points: Seed quality

• Seed should be submitted for a disease test

• Seed treatments can be used to protect developing seedlings from seed and soil borne pathogens

• Good coverage of seed treatments is critical
Root Rots

Photo courtesy of S. Phelps, SPG
Pea root rots - 2016

• Root rot symptoms were observed all of the 71 pea fields surveyed

<table>
<thead>
<tr>
<th>Soil Zone</th>
<th>Number of fields</th>
<th>Disease incidence</th>
</tr>
</thead>
<tbody>
<tr>
<td>Black</td>
<td>36</td>
<td>92%</td>
</tr>
<tr>
<td>Dark brown</td>
<td>17</td>
<td>82%</td>
</tr>
<tr>
<td>Brown</td>
<td>15</td>
<td>92%</td>
</tr>
<tr>
<td>Grey</td>
<td>3</td>
<td>85%</td>
</tr>
</tbody>
</table>
Lentil root rots - 2016

- Root rot symptoms were observed in all of the 64 lentil fields surveyed

<table>
<thead>
<tr>
<th>Soil Zone</th>
<th>Number of fields</th>
<th>Disease incidence</th>
</tr>
</thead>
<tbody>
<tr>
<td>Black</td>
<td>10</td>
<td>96%</td>
</tr>
<tr>
<td>Dark brown</td>
<td>24</td>
<td>94%</td>
</tr>
<tr>
<td>Brown</td>
<td>30</td>
<td>89%</td>
</tr>
</tbody>
</table>

saskatchewan.ca
Percent fields positive for *Aphanomyces euteiches*

<table>
<thead>
<tr>
<th></th>
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<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Lentils</td>
<td>68.8</td>
<td>69.6</td>
<td>71.4</td>
<td>66.7</td>
<td>54.2</td>
<td>66.7</td>
<td>73.3</td>
</tr>
<tr>
<td>Pea</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Courtesy of Dr. Chatterton AAFC
The root rot pathogens

Root rots are caused by a combination of different species → root rot complex

- *Fusarium* spp.
- *Rhizoctonia* spp. → True Fungi
- *Pythium* spp.
- *Aphanomyces euteiches* → Fungal-like organisms
Other soil borne fungi....

% positive fields

Pythium ultimum
Pythium irregularare
Rhizoctonia solani
avenaceum
solani
redolens
oxysporum
graminearum
culmorum

Fusarium

Virulent
Weak
Wheat

Courtesy of Dr. Chatterton AAFC
The root rot pathogens

• Knowing what pathogen(s) caused the root rot symptoms is important
Root rot risk factors

• Factors that stress plants, delay germination and slow the emergence and growth of plants increase root rot risk
  – Wet conditions
  – Cool temperatures early in the season
  – Shortened rotation
  – Soil compaction
  – Heavy textured soils
  – Nutrient deficiency
Managing root rots

• Need to use an integrated approach to manage root rots.
• Field history
• Need to know what caused disease in previous years
Managing root rots

• Crop rotation can be used as a strategy to reduce the amount of inoculum in a field

• Crop rotation is most important management strategy for aphahomyces root rot
  — 6 years away from peas and lentils
Managing root rots

• Plant health:
  – Minimize damage to seeds during seeding
  – Monitor for signs of stress
  – Follow herbicide labels

Photo courtesy of S. Phelps, SPQ
Managing root rots

Plant health continued:

• Use good quality seed

• Proper inoculant and good application methods

• Use registered seed treatments:
  – Cool soils
  – Proper method of application
  – Only effective for 3-4 weeks
Take home points: Root rots

• Root rots need to be managed through an integrated approach
• Knowing what caused the root rot symptoms is important to determine what management strategies will be most effective
• Crop rotation is the best way to manage aphanomyces root rot
Foliar diseases of pulse crops
2016 lentil disease survey results

Stemphylium blight: 88% of fields

White mould: 86% of fields

Anthracnose: 74% of fields
2016 lentil disease survey results

Root rot complex: 70% of fields
Botrytis gray mould: 66% of fields
Ascochyta blight: 6% of fields
Monocyclic diseases

- Monocyclic diseases are those that have only 1 infection cycle per season

- Instead of scouting for symptoms to determine risk..... You need to scout for the conditions that favour disease development

![Graph showing disease severity over time with a note indicating when control is needed](image-url)
Polycyclic diseases

- Polycyclic diseases are those that have >1 infection cycle per season
  - Multiple spore releases
  - Plant is susceptible over a longer period of time

- Scout for early symptoms, then provide control to stop additional infection cycles

- Need to control before too many diseases cycles have occurred
Scouting for plant diseases

• Scouting should occur weekly from crop emergence to maturity

• Intensity of scouting should increase during periods of highest vulnerability to disease
  – Most susceptible growth stage
  – When conditions are favourable for disease development
Lentils
Anthracnose of lentils

- Caused by *Colletotrichum truncatatum*
- There are two races of the pathogen in Saskatchewan
- Disease development is favoured under wet conditions
Anthracnose of lentils

• Overwinters as microsclerotia on infected residue

• Microsclerotia are splashed onto leaves and stems by rain to initiate infection

• New spores are produced within lesions and are dispersed by rain splash
Anthracnose management

- Diverse crop rotation
- Use resistant varieties
- Application of a foliar fungicide before canopy closure
Anthracnose: Fungicide timing

• Best applied when:
  – First foliar lesions are present
  – Before first lower stem lesions develop
  – Weather is favourable for disease development

• When favourable conditions persist, a second application 7-14 days later may be needed
Ascochyta blight

• Caused by *Ascochyta lentis*

• Both seed and stubble borne

• Spores produced in pycnidia spread from residue to plants and from plant-to-plant mainly by rain splash
Ascochyta management

• Grow resistant varieties
• Diverse crop rotation
• Use disease-free seed
• Foliar fungicide application
  – Should be based on scouting, field history and disease risk
Disease decision support checklist

<table>
<thead>
<tr>
<th>A. Plant Stand</th>
<th>Risk Factor</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Thin (high weed pressure, low yield expectations)</td>
<td>0</td>
</tr>
<tr>
<td>2. Moderate (some weeds, possibly low yield)</td>
<td>5</td>
</tr>
<tr>
<td>3. Normal (about 12 lentil plants/ft² or 136/m²)</td>
<td>10</td>
</tr>
<tr>
<td>4. Dense (more plants than normal, lush growth)</td>
<td>15</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>B. Number of days with rain in the last 14 days</th>
<th>Risk Factor</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. 0 days</td>
<td>0</td>
</tr>
<tr>
<td>2. 1-2 days</td>
<td>5</td>
</tr>
<tr>
<td>3. 3-4 days</td>
<td>10</td>
</tr>
<tr>
<td>4. 5-6 days</td>
<td>15</td>
</tr>
<tr>
<td>5. 7 or more days</td>
<td>20</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>C. The five day weather forecast</th>
<th>Risk Factor</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Dry</td>
<td>0</td>
</tr>
<tr>
<td>2. Unpredictable</td>
<td>10</td>
</tr>
<tr>
<td>3. Light showers</td>
<td>15</td>
</tr>
<tr>
<td>4. Rain</td>
<td>20</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>D. Symptoms of anthracnose and ascochyta blight on lentil plants</th>
<th>Risk Factor</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. No visible symptoms</td>
<td>0</td>
</tr>
<tr>
<td>2. Few lesions on the lower half of the foliage (up to 10 per cent infected)</td>
<td>5</td>
</tr>
<tr>
<td>3. Lesions on lower half of the foliage (up to 25 per cent infected)</td>
<td>15</td>
</tr>
<tr>
<td>4. Lesions on lower (up to 25 per cent) as well as upper foliage (up to 10 per cent)</td>
<td>25</td>
</tr>
<tr>
<td>5. Lesions on lower foliage and premature leaf drop characteristics of anthracnose</td>
<td>25</td>
</tr>
<tr>
<td>6. Flowers and/or peduncles infected, characteristics of ascochyta blight</td>
<td>25</td>
</tr>
<tr>
<td>7. Lesions at the stem base</td>
<td>30</td>
</tr>
</tbody>
</table>

TOTAL SCORE OF RISK FACTORS
White mould and grey mould

- Most commonly develops later in the season after canopy closure
- Favoured under wet conditions
- Limited effectiveness of fungicides

White mould
(Sclerotinia sclerotiorum)

Grey mould
(Botrytis cinerea)
Peas
Mycosphaerella blight of peas

• Most common disease of field pea

• Severe epidemics can occur under wet conditions

• Most commonly caused by *Mycosphaerella pinodes* (*Ascochyta pinodes*)
Mycosphaerella blight management

• Diverse crop rotation

• Foliar fungicides – if symptoms move above the lower $\frac{1}{3}$rd of the plant
Using fungicides for disease management

• Fungicides can be used to reduce yield and quality losses due to diseases

• The decision to spray should be based on:
  – Favorability of environmental conditions
  – Disease pressure influenced by field history, presence of symptoms during scouting etc...
  – Economics
Using fungicides for disease management

Fungicide effectiveness is influenced by:

– Timing

– Coverage (droplet size, water volume)

– Sensitivity of the pathogen to the fungicide
Managing fungicide resistance

• Can occur when selection pressure is placed on a fungal population

• **Risk of resistance is highest when:**
  – Fungicides with a single mode of action are used
  – The pathogen has a high degree of genetic variation within a population
  – Pathogen undergoes multiple spore stages
  – Fungicides are used frequently
Managing fungicide resistance

1. Use multiple modes of action

2. Use an appropriate fungicide for the disease and pathogen you are trying to manage

1. Follow label rates

2. Use one application for each mode of action/chemistry

3. Use an integrated approach
Take home points

• Diseases should be managed through an integrated approach:
  • Crop rotation
  • Variety selection
  • Seed quality
  • Seed treatments
  • Crop scouting
  • Foliar fungicides
  • Harvest considerations
Take home points: Foliar diseases

• A knowledge of the pathogens biology and the factors the influence disease development is important for optimum disease management

• The effectiveness of a fungicide application will be influence by application timing, product selection and coverage
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