Diseases of seeds, seedlings and roots:

Aphanomyces root rot
Diseases of seeds, seedlings and roots: Aphanomyces root rot
Aphanomyces

Symptoms:

- **Initial root rot symptoms**: honey-brown root and epicotyl tissue, often up to soil line
- **Later root rot symptoms**: necrotic root and epicotyl tissue, often up to soil line; poor nodulation
- **Wilt**: plants yellow from the bottom up
Causal pathogen:  *Aphanomyces euteiches*  
(an oomycete; “water mold”)


*viewed through a microscope*  
Photos:  University of Wisconsin
Oospores germinate in response to chemical exudates from roots of susceptible hosts.

- **Germination is direct** (to produce mycelium) or
- **indirect** (to produce sporangia and zoospores).

Zoospores swim through water and water-saturated soil.

Adapted from Hughes and Grau 2007.

*Aphanomyces root rot (common root rot) of legumes.* The Plant Health Instructor; online.
Aphanomyces typically becomes economically important after peas or lentils have been cropped to a field 3+ times.

- The first epidemic is usually preceded by a previous lentil or pea crop that yielded well but conditions were favorable for disease, causing pathogen to increase.

- Long crop rotations are most important when last lentil or pea crop was grown in a wet year.
Aphanomyces

Susceptibility:

- Field peas, lentils >> chickpeas
  - Chickpeas are not very susceptible.
  - Lentils and field peas are highly susceptible.

**Susceptibility to Aphanomyces**, chickpeas vs. a representative field pea variety

University of Saskatchewan (Cho and Banniza)
Aphanomyces

Conditions that favor infection:

• **Soil moisture:** high
• **Soil temperature:** high

Pfender and Hagedorn 1982  Phytopathology 72:306-310
Aphanomyces - Response to soil temperature

Disease development at 61°F (snap beans)  Disease development at 82°F (snap beans)

Non-inoculated  Pythium  Aphanomyces  Non-inoculated  Pythium  Aphanomyces

Pfender and Hagedorn 1982  Phytopathology 72:1200-1204
**Aphanomyces - Response to planting date (field peas)**

<table>
<thead>
<tr>
<th></th>
<th>Plant Pop. 4-7 nodes plants/ac</th>
<th>Root Rot 4-8 nodes % severity</th>
<th>CV:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Early: April 17</td>
<td>223,028</td>
<td>a 52</td>
<td>18.8</td>
</tr>
<tr>
<td>Intermediate:  May 2</td>
<td>223,318</td>
<td>a 66</td>
<td>a</td>
</tr>
<tr>
<td>Late: May 15</td>
<td>204,442</td>
<td>a 88</td>
<td>b</td>
</tr>
</tbody>
</table>

**Variety:** ‘DS Admiral’ (yellow-cotyledon type)  
**Seeding rate:** 300,000 pure live seeds/ac **Direct-seeded** into wheat stubble  
**Seed treatment:** Apron XL 0.16 fl oz/cwt + Apron Maxx RFC 1.5 fl oz/cwt + Rizolex 0.3 fl oz/cwt +/- Intego Solo 0.2 fl oz/cwt  
**Pathogen isolation:** *Fusarium* sp. from 16% of roots (early planting date), 8% (intermediate), 25% (late)  
*Aphanomyces* sp. from 2% of roots (early planting date), 13% (intermediate), 0% (late)
Aphanomyces - Response to planting date (field peas)

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*Aphanomyces* sp. from 2% of roots (early planting date), 13% (intermediate), 0% (late)

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**Early: April 17**
- Soil temperature = 48°F
- Wilt: 3
- Yield: 33
- CV: 26.3

**Intermediate: May 2**
- Soil temperature = 52°F
- Wilt: 9
- Yield: 31
- CV: 14.4

**Late: May 15**
- Soil temperature = 66°F
- Wilt: 13
- Yield: 13
- CV: 14.4

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**CV** indicates the coefficient of variation.
Aphanomyces

Seed treatments:
• **Metalayxl** and **mefenofoxam**: ineffective.
• **Ethaboxam** (Intego Solo): registered on lentils and chickpeas.

Control of Aphanomyces with seed treatments is difficult:
• Aphanomyces root rot develops during vegetative growth and bloom, when the concentration of fungicide active ingredients in the target tissues (tap root, epicotyl) is low.
Aphanomyces – Efficacy of seed treatments (field peas)

Intego Solo, 0.2 fl oz/cwt
Ethaboxam, 2.27 g ai/cwt

### Plant Pop.
- **BASE SEED TREATMENT**: 204,974 (CV: 8.1)
- **Intego Solo 0.2 fl oz/cwt + BASE SEED TREATMENT**: 211,314 (CV: 7.2)

### Root Rot
- **BASE SEED TREATMENT**: 68% (CV: 7.2)
- **Intego Solo 0.2 fl oz/cwt + BASE SEED TREATMENT**: 59% (CV: 7.2)

**BASE SEED TREATMENT:**
- **Cruiser 1.28 fl oz**
- **Apron XL 0.16 fl oz**
- **ApronMaxx RFC 1.5 fl oz**
- **Rizolex 0.3 fl oz**

**Variety:** ‘DS Admiral’ (yellow-cotyledon type)
**Seeding rate:** 300,000 pure live seeds/ac 
**Direct-seeded** into wheat stubble

**Pathogen isolation:** *Fusarium* sp. from 15% of roots and *Aphanomyces* sp. from 5% of roots
Aphanomyces – Efficacy of seed treatments (field peas)

**Intego Solo, 0.2 fl oz/cwt**
Ethaboxam, 2.27 g ai/cwt

<table>
<thead>
<tr>
<th></th>
<th>Wilt</th>
<th>Yield</th>
</tr>
</thead>
<tbody>
<tr>
<td>BASE SEED TREATMENT</td>
<td>8.8% (CV: 20.0)</td>
<td>22 (CV: 4.5)</td>
</tr>
<tr>
<td>Intego Solo 0.2 fl oz/cwt + BASE SEED TREATMENT</td>
<td>7.5%</td>
<td>24</td>
</tr>
</tbody>
</table>

**BASE SEED TREATMENT:**
Cruiser 1.28 fl oz + Apron XL 0.16 fl oz + ApronMaxx RFC 1.5 fl oz + Rizolex 0.3 fl oz

**Variety:** ‘DS Admiral’ (yellow-cotyledon type)

**Seeding rate:** 300,000 pure live seeds/ac Direct-seeded into wheat stubble

**Pathogen isolation:** Fusarium sp. from 15% of roots and Aphanomyces sp. from 5% of roots
Response to seed treatment (field peas): Intego Solo, 2.0 fl oz/cwt

Aphanomyces root root severity

% root rot severity in the control (at mid-vegetative growth)

Unique planting date and/or crop residue environment; Carrington, ND (2016)
Response to seed treatment (field peas):
Intego Solo, 2.0 fl oz/cwt

Aphanomyces root rot severity
% root rot severity in the control (at mid-vegetative growth)

Unique planting date and/or crop residue environment;
Carrington, ND (2016)
Response to seed treatment (field peas):
Intego Solo, 2.0 fl oz/cwt

Yield response
yield increase, bushels per acre

Aphanomyces root rot severity
% root rot severity in the control (at mid-vegetative growth)

Unique planting date and/or crop residue environment; Carrington, ND (2016)
Aphanomyces – Efficacy of seed treatments (field peas)

**Intego Solo**, 0.075 to 0.30 fl oz/cwt
Ethaboxam, 0.85 to 3.40 g ai/cwt

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Plant Population</th>
<th>Root Rot Severity</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>5 nodes plants/acre</td>
<td>6-7 nodes % necrosis</td>
</tr>
<tr>
<td>Non-treated control</td>
<td>277,539</td>
<td>a 46 b</td>
</tr>
<tr>
<td>Base seed treatment</td>
<td>321,099</td>
<td>a 46 b</td>
</tr>
<tr>
<td>Base seed treatment + <strong>Intego Solo</strong> 0.075 fl oz/cwt</td>
<td>301,809</td>
<td>a 37 ab</td>
</tr>
<tr>
<td>Base seed treatment + <strong>Intego Solo</strong> 0.15 fl oz/cwt</td>
<td>282,518</td>
<td>a 37 ab</td>
</tr>
<tr>
<td>Base seed treatment + <strong>Intego Solo</strong> 0.30 fl oz/cwt</td>
<td>303,053</td>
<td>a 29 a</td>
</tr>
<tr>
<td>Cruiser 1.28 fl oz + Vibrance Maxx 1.54 fl oz/cwt</td>
<td>262,356</td>
<td>a 40 b</td>
</tr>
</tbody>
</table>

**Base seed treatment** = Cruiser 1.28 fl oz + Spirato 0.08 fl oz + S-2200 0.4 fl oz + Sebring 0.5 fl oz/cwt

**Variety:** ‘Abarth’ (yellow-cotyledon type)  **Seeding rate:** 330,000 pure live seeds/ac  **Direct-seeded** into wheat stubble
Aphanomyces – Efficacy of seed treatments (field peas)

Intego Solo, 0.075 to 0.30 fl oz/cwt
Ethaboxam, 0.85 to 3.40 g ai/cwt

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Wilt Symptoms late pod-fill % incidence</th>
<th>Yield 13.5% moisture bushels/acre</th>
</tr>
</thead>
<tbody>
<tr>
<td>Non-treated control</td>
<td>12</td>
<td>a</td>
</tr>
<tr>
<td>Base seed treatment</td>
<td>8</td>
<td>a</td>
</tr>
<tr>
<td>Base seed treatment + Intego Solo 0.075 fl oz/cwt</td>
<td>7</td>
<td>a</td>
</tr>
<tr>
<td>Base seed treatment + Intego Solo 0.15 fl oz/cwt</td>
<td>8</td>
<td>a</td>
</tr>
<tr>
<td>Base seed treatment + Intego Solo 0.30 fl oz/cwt</td>
<td>8</td>
<td>a</td>
</tr>
<tr>
<td>Cruiser 1.28 fl oz + Vibrance Maxx 1.54 fl oz/cwt</td>
<td>6</td>
<td>a</td>
</tr>
</tbody>
</table>

Base seed treatment = Cruiser 1.28 fl oz + Spirato 0.08 fl oz + S-2200 0.4 fl oz + Sebring 0.5 fl oz/cwt
Carrington, ND (2017) Variety: ‘Abarth’ Seeding rate: 330,000 pure live seeds/ac Direct-seeded into wheat stubble
### Aphanomyces – Efficacy of seed treatments (lentils)

**Intego Solo**, 0.30 and 0.60 fl oz/cwt  
Ethaboxam, 3.40 to 6.80 g ai/cwt

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Root Rot Severity</th>
<th>Yield</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>% necrosis</td>
<td>pounds/acre</td>
</tr>
<tr>
<td><strong>Base seed treatment 1</strong></td>
<td><strong>Non-inoculated</strong></td>
<td>13</td>
</tr>
<tr>
<td>Base seed treatment 1</td>
<td></td>
<td>87</td>
</tr>
<tr>
<td>Base seed treatment 2</td>
<td></td>
<td>83</td>
</tr>
<tr>
<td>Base seed treatment 2 + <strong>Intego Solo</strong> 0.3 fl oz/cwt</td>
<td></td>
<td>56</td>
</tr>
<tr>
<td>Base seed treatment 2 + <strong>Intego Solo</strong> 0.6 fl oz/cwt</td>
<td></td>
<td>78</td>
</tr>
<tr>
<td>Obvious 4.6 fl oz/cwt</td>
<td></td>
<td>81</td>
</tr>
<tr>
<td>Obvious 4.6 fl oz/cwt + <strong>Intego Solo</strong> 0.6 fl oz/cwt</td>
<td></td>
<td>97</td>
</tr>
</tbody>
</table>

**Base seed treatment 1** = Cruiser 0.80 fl oz + Maxim 0.08 fl oz/cwt  
**Base seed treatment 1** = Cruiser 0.80 fl oz + Maxim 0.08 fl oz + Allegiance FL 0.25 fl oz/cwt

DATA generated in Canada; obtained from Valent USA
Thank you!

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