Pea foot rots

Lea Herold
Foot rot

• Poor root system
• Pale or yellow plants
• Stunted plants
• Impact on yield

• Compaction
• Water logging
• Poor soil health

➤ Disease complex
Foot rot pathogens

- *Fusarium solani* – red vascular tissue

- *Didymella pinodella* – black stem base

- *Aphanomyces euteiches* – soft roots, honey coloured

**Soil tests**
- Colony numbers – risk factor (*Fusarium* and *Didymella*)
- Disease severity seedling – risk factor (*Aphanomyces*)
Variety trials 2019

**Aphanomyces severity**

- **Angus**: Moderate, High, Severe
- **Lincolnshire**: Moderate, High, Severe

**Fusarium severity**

- **Angus**: Severe, Strong infection
- **Lincolnshire**: Fusarium severity

![Aphanomyces severity chart](chart1)

![Fusarium severity chart](chart2)
Calcium

Heyman et al. (2007) Soil Biology & Biochemistry 39, 2222-2229


Heyman et al. (2007) Soil Biology & Biochemistry 39, 2222-2229

Table 2
Coefficients table from multiple regression analysis of relationship between soil parameters (independent) and disease severity (dependent variable) in 732 samples with confirmed Aphanomyces root rot prevalence

<table>
<thead>
<tr>
<th></th>
<th>Intercept</th>
<th>pH</th>
<th>P</th>
<th>Mg</th>
<th>K</th>
<th>Ca</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coefficient</td>
<td>3.67</td>
<td>4.43</td>
<td>0.048</td>
<td>-0.211</td>
<td>0.746</td>
<td>-0.028</td>
</tr>
<tr>
<td>P</td>
<td>0.775</td>
<td>0.027</td>
<td>0.629</td>
<td>0.458</td>
<td>0.0017</td>
<td>0.0023</td>
</tr>
</tbody>
</table>

Element concentrations as mg 100 g⁻¹ soil. Adjusted $R^2 = 0.026$
Gypsum

Gypsum – Glasshouse trial

![Graph showing yield (% of control) vs. Gypsum amendment levels (control, 200ppm, 500ppm, 1000ppm, 2000ppm, 3500ppm). The graph also includes a scatter plot showing root mass (% of control) vs. Foot rot score (2.0, 2.5, 3.0, 3.5, 4.0).]
Gypsum – Glasshouse trial

Control

2000ppm
Fusarium in fields 2018

**Calcium**

Foot rot vs. Ca (mg/ml)

**Organic matter**

Foot rot vs. OM (LOI %)
Foot rot in fields 2019

- Foot rot severity in the field explained by (45%)
  - Abundance of *Fusarium* spores
  - Abundance of *Didymella* spores
  - Magnesium in soil (clay related?)
  - Reduced by higher amounts of organic matter
Alternative seed treatments - glasshouse

Product I (2018) – pot tests

**Didymella**

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Foot rot score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control</td>
<td>d</td>
</tr>
<tr>
<td>0.4ml/kg</td>
<td>c</td>
</tr>
<tr>
<td>0.8ml/kg</td>
<td>bc</td>
</tr>
<tr>
<td>1.6ml/kg</td>
<td>ab</td>
</tr>
<tr>
<td>3.2ml/kg</td>
<td>a</td>
</tr>
</tbody>
</table>

**Fusarium**

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Foot rot score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control</td>
<td>b</td>
</tr>
<tr>
<td>0.4ml/kg</td>
<td>ab</td>
</tr>
<tr>
<td>0.8ml/kg</td>
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</tr>
</tbody>
</table>

No effect on *Aphanomyces*
Alternative seed treatments - field


Foot rot

Yield (t/ha)

Four products, four field trials performed, results not consistent.
Cover crops

- Black oats in combination with
  - Oil radish
  - Phacelia
  - Berseem clover
- Winter vetch
Pea yields 2019

Vicarage, power harrow, 2019

Vicarage, plough, 2019

Eastfield, 2019
Increased moisture retention at drilling and during pod fill improved yield.
Soil structure

Good structure vital for correct root development and thus resilience to stress and disease.
Conclusions

Yield

- Foot rot: Reduction
- Compaction: Reduction
- Cover crops: Reduction
- Water balance: Improvement
- Soil structure: Improvement

- Improvement
Recommendation

• Oat based cover crop mixtures - good partners are phacelia, potentially clover or vetch (no negative impact on foot rot observed)

• Sow clover carefully – does not like to be buried

• Best avoid using oil radish prior to peas – seems to increase foot rot risk
Recommendation

• Drill cover crops early, ideally mid-August (mid-September at the very latest)
• Destroy cover crops about 6 weeks prior to drilling peas (from around the end of January)
• Shallow cultivations prior to peas seem sufficient – no contamination issues and preserves positive effects on soil structure
Thank you

- Green Pea Company
- Holbeach Marsh Co-operative
- Bruce Farms

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- Technical reports on the cover crop work can be found at https://www.pgro.org/r-d-news/