Fungicide dose rates & cultivar resistance
Results of 5 years of field experiments in the Netherlands

Harro Spits, Bert Evenhuis and Huub Schepers
Outline Presentation

- Background

- Experiments
  - Foliar (first half growing season)
  - Tuber (second half growing season)

- Conclusions
Background

- Umbrella plan Phytophthora
  - Integration all LB-research
  - Communication and implementation to practice

- Major objective
  - Reduce environmental burden by 50% in year 1-5
  - Reduce environmental burden by 25% in year 6-10 (2013)

- How to achieve?
  - Exploit cultivar resistance to reduce protectant dose rate
  - Improve timing of sprays
  - Development new chemicals
Experiments

- 5 years: 2002 – 2006

  - Polycyclic field experiments with spreader rows

- Tuber: reduced dose rates Shirlan (2005-2006)
  - Polycyclic field experiments with spreader rows
Foliar experiments

- 34 varieties
- 6 dose rates (0, 20, 40…100%) Fluazinam
- Split-plot design with inoculated spreaders (15 isolates)
- Sprays according to Plant Plus
- Assessments twice a week
Results

- Polycyclic data

- Parameters
  - Delay
  - stAUDPC
  - Severity 25 days

- Calculation dose rate per variety based on these parameters
Foliage (Santé, 4.5)

Inoculation

- Untreated
- Bintje 0,4

Graph showing the progression of foliage from 29-jun to 3-aug with different treatments indicated by lines and markers.
Foliage (Agria, 5.5)

- Inoculation
- Untreated
- Bintje 0.4

- 0.08
- 0.16
- 0.24
- 0.32
- 0.4

Treatments:
- Untreated
- Bintje 0.4
Foliage (Aziza, 7.5)

Inoculation

Untreated
Bintje 0.4
Foliage (Starga, 5.5)

- Untreated
- Bintje 0.4

Inoculation:
- 29-jun
- 4-jul
- 9-jul
- 14-jul
- 19-jul
- 24-jul
- 29-jul
- 3-aug

Y-axis:
- 0,08
- 0,16
- 0,24
- 0,32
- 0,40

Legend:
- Untreated
- Bintje 0.4
Foliage (Seresta, 7.5)

Inoculation

0,08
0,16
0,24
0,32
0,40
Untreated
Bintje 0,4

29-jun 4-jul 9-jul 14-jul 19-jul 24-jul 29-jul 3-aug
Foliage (Karnico, 8??)

<table>
<thead>
<tr>
<th>Date</th>
<th>Untreated</th>
<th>Bintje 0.4</th>
</tr>
</thead>
<tbody>
<tr>
<td>29-jun</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4-jul</td>
<td></td>
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</tr>
<tr>
<td>9-jul</td>
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<tr>
<td>14-jul</td>
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<td>19-jul</td>
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<tr>
<td>24-jul</td>
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<td></td>
</tr>
<tr>
<td>29-jul</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3-aug</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Legend:
- 0.08
- 0.16
- 0.24
- 0.32
- 0.40
- Untreated
- Bintje 0.4

Inoculation event occurred on 29-jun.
Dose rate

- AUDPC values were calculated
  - Dose rate & variety

- Reference was Bintje sprayed at 0.4 L / ha

- Regression analysis was conducted
  - AUDPC, dose rate, variety
  - Predicted adequate dose rate per variety was established
## Calculated doses rates

<table>
<thead>
<tr>
<th>Class 1: 0.1</th>
<th>Class 2: 0.2 (a)</th>
<th>Class 3: 0.3 (a)</th>
<th>Class 4: 0.4 (a)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aziza (7.5) (b)</td>
<td>Diamant (6)</td>
<td>Felsina (3.5)</td>
<td>Agata (4)</td>
</tr>
<tr>
<td>Biogold (7)</td>
<td>Kondor (4.5)</td>
<td>Agria (5.5)</td>
<td>Asterix (5)</td>
</tr>
<tr>
<td>Festien (8)</td>
<td>Karnico (8)</td>
<td>Karakter (6)</td>
<td>Bintje (3)</td>
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<tr>
<td>Innovator (8)</td>
<td>Katinka (6.5)</td>
<td>Santé (4.5)</td>
<td>Frieslander (3.5)</td>
</tr>
<tr>
<td>Kantara (7)</td>
<td>Seresta (7)</td>
<td>Premiere (2.5)</td>
<td>Monalisa (4)</td>
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<tr>
<td>Kartel (8)</td>
<td>Aveka (7)</td>
<td>Santana (5)</td>
<td>Mondial (4.5)</td>
</tr>
<tr>
<td>Menco (9)</td>
<td>Pimpernel (8)</td>
<td>Starga (5.5)</td>
<td>Nicola (4.5)</td>
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<td>Mercator (8)</td>
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<td>Ostara (3.5)</td>
<td>Spunta (5)</td>
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<tr>
<td>Mercury (9)</td>
<td></td>
<td>Remarka (6.5)</td>
<td>Lady Rosetta (3)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Derisee (5)</td>
</tr>
</tbody>
</table>

(a) At low disease pressure dose rate can decreased with maximum of 0.1L

(b) Between brackets resistance
## Calculated dose rate

<table>
<thead>
<tr>
<th>namenras</th>
<th>Adv 02c04 d=0.4</th>
<th>Adv 02c04 d=0.3</th>
<th>namenras</th>
<th>Adv 02c04 d=0.4</th>
<th>Adv 02c04 d=0.3</th>
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</thead>
<tbody>
<tr>
<td>Agata</td>
<td>0.36</td>
<td>0.29</td>
<td>Kondor</td>
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<td>0.10</td>
</tr>
<tr>
<td>Agria</td>
<td>0.21</td>
<td>0.15</td>
<td>LadyRoset</td>
<td>0.33</td>
<td>0.25</td>
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<td>Asterix</td>
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<td>0.26</td>
<td>Menco</td>
<td>0.05</td>
<td>0.03</td>
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<td>Aveka</td>
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<td>0.08</td>
<td>Mercator</td>
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<td>0.05</td>
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<tr>
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<td>Mercury</td>
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<td>Biogold</td>
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<td>0.00</td>
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<td>Derisee</td>
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<td>0.19</td>
<td>Nicola</td>
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<td>Diamant</td>
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<td>0.09</td>
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<tr>
<td>Felsina</td>
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<td>0.18</td>
<td>Pimpernel</td>
<td>0.15</td>
<td>0.10</td>
</tr>
<tr>
<td>Festien</td>
<td>0.07</td>
<td>0.04</td>
<td>Premiere</td>
<td>0.25</td>
<td>0.20</td>
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<tr>
<td>Frieslander</td>
<td>0.38</td>
<td>0.32</td>
<td>Remarka</td>
<td>0.25</td>
<td>0.14</td>
</tr>
<tr>
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<td>0.10</td>
<td>0.07</td>
<td>Santana</td>
<td>0.29</td>
<td>0.20</td>
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<tr>
<td>Kantara</td>
<td>0.05</td>
<td>0.03</td>
<td>Sante</td>
<td>0.21</td>
<td>0.14</td>
</tr>
<tr>
<td>Karakter</td>
<td>0.27</td>
<td>0.19</td>
<td>Seresta</td>
<td>0.16</td>
<td>0.10</td>
</tr>
<tr>
<td>Karnico</td>
<td>0.18</td>
<td>0.12</td>
<td>Spunta</td>
<td>0.36</td>
<td>0.25</td>
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<tr>
<td>Kartel</td>
<td>0.06</td>
<td>0.03</td>
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<td>0.27</td>
<td>0.19</td>
</tr>
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<td>0.20</td>
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</tr>
</tbody>
</table>
Lowering the dose rate in the second half of the season

- Foliage and tuber resistance does not match

- If the canopy is not infested, no tuber infection is expected

- If a slight infection of the canopy is present tubers are at risk

- What is the acceptable dose rate in the second half of the season considering tuber blight?
Tuber experiments

- 14 varieties
- 6 dose rates (0, 20, 40…100%) Fluazinam
- Split-plot design with inoculated spreaders (15 isolates)
- Spray interval 5-8 days
- Assessments foliage
- Artificially raining (10 mm)
- Harvest/storage tubers
- Assessments tubers (twice)
Results tuber blight (%)

- Bintje
- Kartel
- Ostara
- Starga
- Menco
- Festien
- Mondial
- Asterix
- Agria
- Felsina
- Karakter
- Kantara
- Seresta
- Remarka
Results tuber blight (%)
Results Tuber

[Graph showing precipitation and foliar infection over time for different treatments: Bintje untreated, Bintje 0.4, Bintje 0.24, Bintje 0.08, Bintje 0.16.]

Precipitation (mm)
- 0
- 10
- 20
- 30
- 40
- 50
- 60
- 70
- 80
- 90
- 100
- 110

Foliar infection (%)
- 3.6%
- 18.4%
- 8.50%
- 5.7%
- 1.8 %
Calculated doses rates.

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<td>Festien (8 / 9)</td>
<td>Seresta (7 / 8)</td>
<td>Agria (5.5 / 7.5)</td>
<td>Asterix (5 / 8.5)</td>
</tr>
<tr>
<td>Kartel (8 / 6.5)</td>
<td>Remarka (6.5 / 9)</td>
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</tbody>
</table>

(a) At a low disease pressure dose rate can be decreased with maximum 25%.
(Resistance Folliage / tuber)
Infection of foliage and tubers at calculated dose rates.

[Graph showing foliar and tuber blight infection across different dates and potato varieties.]
Conclusions

- Reduced protectant dose rates are feasible on more resistant cultivars.
- Possibilities to reduce dose rates are more feasible in the first half of season.
- Reliable resistance ratings are crucial!
- Resistance ratings ≥ 7 suitable for reduced dose rates.
- In the second half of the season tuber blight must be taken into consideration, which limits possibilities to reduce the dose rate.
Thank you for your attention

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