Fungicide usage is increasing: Don’t forget to rotate fungicides.

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AAFC, Saskatoon
Soils and Crops Symposium, Saskatoon, March 17, 2015
# Fungicide Usage on the Canadian Prairies

<table>
<thead>
<tr>
<th>Prov.</th>
<th>Area (M ha)</th>
<th>Fungicide applied (%)</th>
<th>Increase (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>AB</td>
<td>7.0</td>
<td>8</td>
<td>8</td>
</tr>
<tr>
<td>SK</td>
<td>10.9</td>
<td>5</td>
<td>9</td>
</tr>
<tr>
<td>MB</td>
<td>3.5</td>
<td>10</td>
<td>21</td>
</tr>
<tr>
<td>Total</td>
<td>21.3</td>
<td>7</td>
<td>11</td>
</tr>
<tr>
<td>ON</td>
<td>2.4</td>
<td>8</td>
<td>9</td>
</tr>
</tbody>
</table>
Gossen’s Guide to Disease Management

• Disease management activities should be almost complete **BEFORE** any crop is planted.

• Use the best genetics for the region.
  – high yield, suitable days to harvest, best disease resistance.

• Don’t plant problems with the crop.
  – use seed with high germination and vigour, treated & inoculated, minimal diseases.

• Plan for a diverse crop rotation.
  – different crops are best, but different cvs. can be useful.

• Ensure isolation from last year’s infected fields.

• Scout fields and apply a foliar fungicide if required.
Risks

• Most field crops are NOT at high risk of disease failures due to fungicide insensitivity.
  – Cultural methods (e.g., crop rotation) are adequate for disease reduction in many situations.
  – Fungicides used infrequently or managed with multi-site actives (older, but cheaper).
  – Many pathogens with no air-borne phase or low genetic diversity, so development and spread of insensitive isolates is slower.

• Fungicide insensitivity on the prairies
  – Sclerotinia - alfalfa, ascochyta - chickpea & pea
Strobilurin Insensitivity in *Ascochyta rabiei*

Risk of insensitivity to strobilurins was high:
- genetically diverse pathogen,
- air-borne sexual spores,
- several fungicide appl. / year,
- insensitivity in related fungi.

N.B. Resistance reported first in SK, but then AB and the USA.
## Increase of Insensitive Isolates in SK

### 2004 – 2005

<table>
<thead>
<tr>
<th></th>
<th>2004</th>
<th>2005</th>
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<tbody>
<tr>
<td>Headline</td>
<td>0 R, 53 S</td>
<td>100% S</td>
</tr>
<tr>
<td>Quadris</td>
<td>4 R, 49 S</td>
<td>92% S</td>
</tr>
</tbody>
</table>

### 2006

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<tr>
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<th>2006</th>
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</thead>
<tbody>
<tr>
<td>Headline</td>
<td>20 R, 17 S</td>
</tr>
<tr>
<td>Quadris</td>
<td>23 R, 14 S</td>
</tr>
</tbody>
</table>

- Control failures
  - 6 of 7 fields: 0% S
  - 1 field: 100% S

### 2007

<table>
<thead>
<tr>
<th></th>
<th>2007</th>
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<tbody>
<tr>
<td>132 R, 4 S</td>
<td>3% S</td>
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### 2008

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<tr>
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<th>2008</th>
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<tbody>
<tr>
<td>74 R, 7 S</td>
<td>8% S</td>
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</tbody>
</table>
Insensitivity of *Mycosphaerella pinodes* from field pea to strobilurins

- Pathogen at high risk of loss of sensitivity to strobilurins.
- Baseline assessment conducted using isolates collected in SK, AB, ND & WA before 2003.
- 8% of isolates from SK & AB insensitive, 0% from ND & WA.
- Populations in SK & AB at risk of loss of efficacy using strobilurins.
Reaction of *M. pinodes* isolates to strobilurins

![Graph showing the reaction of *M. pinodes* isolates to strobilurins](image)
Background

• Initially, fungicides used persistent actives with multi-site modes of action, e.g., heavy metals, some older chemistries such as mancozeb.

• Shift to focus on reduced-risk actives (usually non-persistent, single-site modes of action).

• Good efficacy, but greater risk of insensitivity

• Reduced sensitivity usually detected first under high selection pressure.

• Viticulture, golf courses, orchards > hort crops > intensive field crops > extensive field crops
Fungicide resistance development: Selection models for QoI and DMI fungicides

monogenic, single allelic resistance at target site, disruptive selection, high risk

polygenic, multi allelic resistance at target site, continuous selection, moderate risk

- Fitness cost
- Polygenic inheritance (dilution)

Loss of Control

Reduced Control

Syngenta
Factors Affecting Risk

Pathogen
- Single / multiple cycles
- Spore dispersal
- Occurrence
- Related pathogens

Risk of Insensitivity

Agronomic
- Alternation/Combination
- Different MOAs
- No. of applications
- Cropping system

Fungicide
- Single / multisite
- Qual / Quantitative
- Persistence
Risk Based on Mode of Action

Low
- Multi-site contact (M)
- Phenylpyrroles
- Dicarboxamides

Moderate
- Anilinopyrimidine Carboxamides
- Demethylation inhibitors

High
- Phenyl amides
- Strobilurins

Source: Kristina Polziehn, BASF
<table>
<thead>
<tr>
<th>Top</th>
<th>Leaf, top</th>
<th>Leaf, underside</th>
<th>Stem</th>
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</thead>
<tbody>
<tr>
<td>Middle</td>
<td></td>
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<tr>
<td>Bottom</td>
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</tbody>
</table>
Water Volume

Yield (kg ha\(^{-1}\))

<table>
<thead>
<tr>
<th>Treatment (L ha(^{-1}))</th>
<th>Yield</th>
</tr>
</thead>
<tbody>
<tr>
<td>control</td>
<td>1000</td>
</tr>
<tr>
<td>doub50</td>
<td>1100</td>
</tr>
<tr>
<td>doub100</td>
<td>1200</td>
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<tr>
<td>doub200</td>
<td>1300</td>
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<tr>
<td>doub400</td>
<td>1100</td>
</tr>
<tr>
<td>doub800</td>
<td>1000</td>
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</table>
Prevention is the best solution

• Actives will last longer if used less frequently. Limit number of applications and use IPM.
• Alternate fungicides with different MOA.
• Tank mix or select high risk products with a multi-site partner or an effective active with a different MOA, and apply label rates.
• Seed treatments generally not affected.
• Host-pathogen systems at risk: blackleg of canola, fusarium head blight of wheat, anthracnose and bacterial blight of bean, sclerotinia of many crops.
Prevention is the best solution
• Actives will last longer if used less frequently.
  Limit number of applications, use IPM.
• Alternate fungicides with different MOA.
• Tank mix or premix high resistance risk products with a multi-site partner or an effective active with different MOA.
• Apply label rates.
• Rapid screening for high-risk pathogens.
• Diseases at medium-high risk: blackleg of canola, fusarium head blight of wheat, sclerotinia.
• Generally NOT a problem for seed treatments.