Corn and Soybean Diseases of 2015: What Have We Learned?

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Major Diseases On Field Corn Over the Last Several Seasons

- Northern corn leaf blight (NCLB)
- Goss’s Wilt
Goss’s Wilt

- Caused by *Clavibacter michiganensis* subsp. *Nebraskensis*
- Often confused with NCLB
- Causes both a wilt and **leaf blight**
- Found throughout much of the Midwest and Southern corn producing states
Goss’s leaf blight symptoms

Usually first seen on top leaves
Goss’s wilt distribution

Goss’s Wilt of Corn
- Historical High Risk Area
- Extended Range of Disease in 2010 / 2011

Slide Courtesy of Martin Chilvers, MSU
Goss’s Wilt Confirmations in Wisconsin Since 2009

*No Confirmations before 2010 or for 2012 or 2013

**Data reflect lab findings from UW and DATCP
Why the increase in Goss’s wilt?

- Change in production systems
- Corn on corn
- Minimum or no-till systems
- Susceptible hybrids
- Change in virulence of the Cmn pathogen

Slide Courtesy of Martin Chilvers, MSU
Management

• Plant the most resistant hybrid you can find, which is appropriate for your area
• Tillage and residue management important in high-risk fields
• Longer rotations away from corn will be useful in high-risk fields
• Good weed management recommended – Grassy weed species can serve as alternative hosts
• Fungicides are not effective against Goss’s wilt
Northern Corn Leaf Blight

- Found throughout the Midwest
- Major Risk Factors:
  - Environment important: moderate temperatures (65-80°F) and prolonged periods of dew
  - Large amounts of surface residue
  - Susceptible hybrids
  - Lack of rotation
  - Several races of pathogen
    - Race 0 (found in Midwest)
    - Race 1 (most prevalent in Midwest)
**Symptoms and Signs**

Black fuzzy growth in lesions are conidia forming on conidiophores.

Lesions often appear on lower leaves first.

**Microscopically:** conidia forming on conidiophores.
Management

• Choose a resistant hybrid appropriate for your location
  – Need more than Ht1 resistance (not effective against race 1)
  – HtN, Htm1, Htm2 etc.
• Manage corn residue
• Rotate
• Fungicide application
  – Best chance for economic return in field corn has been noted at VT/R1 growth stage
  – Scouting prior to VT to assess severity of NCLB on lower leaves has helped with application timing
  – Goal in field corn is to protect ear leaves at VT
What about Using Fungicide On Field Corn?
Mean yield response compared to non-treated control in bu/A over time for the U.S. corn belt

<table>
<thead>
<tr>
<th></th>
<th>2010</th>
<th>2011</th>
<th>2012</th>
<th>2013</th>
<th>2014</th>
<th>2015</th>
<th>6-yr average</th>
</tr>
</thead>
<tbody>
<tr>
<td>Early (V5-V8)</td>
<td>3.4</td>
<td>2.1</td>
<td>-1.1</td>
<td>0.1</td>
<td>2.3</td>
<td>4.3</td>
<td>1.9</td>
</tr>
<tr>
<td>Standard (VT-R2)</td>
<td>4.5</td>
<td>0.4</td>
<td>4.9</td>
<td>4.5</td>
<td>7.6</td>
<td>6.0</td>
<td>4.7</td>
</tr>
<tr>
<td>Double (V5 + R1)</td>
<td>7.4</td>
<td>4.5</td>
<td>3.0</td>
<td>3.7</td>
<td>4.9</td>
<td>9.9</td>
<td>5.6</td>
</tr>
</tbody>
</table>

Data and Slide Courtesy of Kiersten Wise, Purdue University
# Break-even scenarios for corn

(bushels needed to cover cost)

<table>
<thead>
<tr>
<th>Corn Price ($/bu)</th>
<th>Cost Per Fungicide Application ($/A)</th>
<th>Original Formulations</th>
<th>Generic Formulations</th>
</tr>
</thead>
<tbody>
<tr>
<td>$10.00</td>
<td>$10.00</td>
<td>$12.00</td>
<td>$14.00</td>
</tr>
<tr>
<td>$12.00</td>
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<td>$18.00</td>
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<td>$18.00</td>
<td>$22.00</td>
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<td>$18.00</td>
<td>$22.00</td>
<td>$24.00</td>
</tr>
<tr>
<td>$22.00</td>
<td>$22.00</td>
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</tr>
<tr>
<td>$24.00</td>
<td>$24.00</td>
<td></td>
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</tbody>
</table>
What about the Effect Of Disease Level and the Odds of Recovering the Fungicide Cost in Wisconsin?
Wisconsin Dataset

- 3 years of field data at Arlington Wisconsin (2013-2015)
  - http://fyi.uwex.edu/fieldcroppathology/research-summaries/
- Used observations for Pre-Mix Fungicide Products Only (DMI + Strobilurins)
  - Most popular products being sprayed on corn
  - Had the largest number of observations over the three-year period
- Used Single-Application Trials Only
  - V6, V8, or VT
  - Total of 41 replicated study observations
- Looked at
  - Frequency distributions
  - Mean yield advantage
  - Considered variation across a field
  - Calculated Odds of a Positive ROI
Yield Difference Compared to Not-Treating for 41 Studies

Mean Difference: 2.2 bu/a

$P = 0.10$

- Confidence in this mean being different from 0 is not strong
- Frequency of positives = 51%
Effect of Disease Level Highly Significant on Yield Response to Fungicide

<table>
<thead>
<tr>
<th>Foliar Disease &lt; 5%</th>
<th>Yield Difference Relative to the Non-Treated Check (bu/a)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frequency of Positives = 32%</td>
<td>1  2  3  4  5  6  7  8  9  10  11  12  13  14  15  16  17  18  19  20  21  22</td>
</tr>
<tr>
<td>Mean Yield = -3.2 (SE= 2.2)</td>
<td>-15 -14 -13 -12 -11 -10 -9 -8 -7 -6 -5 -4 -3 -2 -1 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22</td>
</tr>
<tr>
<td>P = 0.15 (Yield gain not significantly different from 0)</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Foliar Disease &gt; 5%</th>
<th>Yield Difference Relative to the Non-Treated Check (bu/a)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frequency of Positives = 74%</td>
<td>1  2  3  4  5  6  7  8  9  10  11  12  13  14  15  16  17  18  19  20  21  22</td>
</tr>
<tr>
<td>Mean Yield = 5.4 (SE= 1.5)</td>
<td>-15 -14 -13 -12 -11 -10 -9 -8 -7 -6 -5 -4 -3 -2 -1 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22</td>
</tr>
<tr>
<td>P &lt;0.01 (Yield gain significantly different from 0)</td>
<td></td>
</tr>
</tbody>
</table>
Probability Of Recovering the Cost of A Fungicide Application Under **Low** Foliar Disease Pressure

12-22% Chance of Recovering Costs With Optimistic Pricing of the Fungicide Product (e.g. Generic)
Probability Of Recovering the Cost of a Fungicide Application Under **High** Foliar Disease Pressure

50 - 65% Chance of Recovering Costs with Optimistic Pricing of the Fungicide Product (e.g. Generic)
Summary

• Foliar diseases can rob yield on corn in Wisconsin (e.g. NCLB)
• Fungicide application in fields where foliar disease pressure is **high** = high odds of recovering the fungicide cost
• Fungicide application in fields where foliar disease pressure is **low** = low odds of recovering the fungicide cost
• Fungicide application timing did not have a strong effect – VT/R1 application is recommended
Recommendations for Managing Foliar Disease in Wisconsin

- Avoid long-term, repeated planting of corn in the same field – Rotate!
- Manage corn residue
- Choose hybrids with the best NCLB rating you can find for your location – resistance isn’t immunity
- Scout!!!! - Especially prior to VT
- Consider a fungicide application at the VT/R1 timing when the following are issues (best chance to control mid-season epidemics that are common in WI)
  - When foliar diseases are active in the lower canopy prior to VT
  - High-risk fields (no-till, corn-on-corn, etc.)
  - Susceptible hybrids
  - Late-planted fields
  - Overhead irrigation
Emerging Diseases of Corn
Physoderma Brown Spot and Stalk Rot

- Caused by the water-mold, *Physoderma maydis*
- Favored by wet weather
- No lab confirmations in WI in 2015; likely in the state and will be found soon

Photo Credit: Alison Robertson, ISU
Physoderma Disease Cycle

Sporangia – survive 3+ years

Excessive Rain;

Most susceptible 50-60 days after planting; whorls filled with water

During day, swimming spores produced

infection

Slide Courtesy of Alison Robertson, ISU
Physoderma Management

**Resistance** – available in Central America; not U.S.
Hybrids vary in susceptibility

**Cultural** – rotation and/or residue management

**Fungicides** – most are labeled; logistics of an application
  - No public efficacy data for U.S.
  - China – tebuconazole @ V8 = 94.2% suppression
  - One trial done in IA in 2015
    - No significant results

Slide Courtesy of Alison Robertson, ISU
Tar spot

Caused by *Phyllachora maydis*

2015 – reported in IN and IL

Slide Courtesy of Alison Robertson, ISU
Tar spot complex

Caused by *Phyllachora maydis* and *Monographella maydis*

- Usually a minor problem
- Occurs in cool, high areas of Mexico, Central and South America
- Rare to find alone

- Lesions caused by *M. maydis* alone not been seen in field
- Needs *P. maydis* infections
- Fisheye spots develop around tar spots
- Causes severe leaf blight
- Yield losses 30-70% in Mexico and Guatemala

Neither pathogens are seed-borne; risk of survival in residue?

Slide Courtesy of Alison Robertson, ISU
Tar spot complex

Tar spots

‘Fisheye’ spots developing around tar spots

Blight developing between ‘fisheye’ spots

Slide Courtesy of Alison Robertson, ISU

Stem Canker/Stem Blight

- These diseases can be caused by different but related fungi
- Disease can collectively be referred to as the Diaporthe Disease Complex
- Stem Canker
  - Northern caused by *Diaporthe caulivora*
  - Southern caused by *Diaporthe phaseolorum*
- Pod and Stem Blight caused by *Diaporthe sojae*
Stem Canker

• Both Northern and Southern found in WI – Northern more common
• Associated with wet weather early in the season
• Mild temperature requirement
• Often= found on the higher ground
• Lesions tend to appear after flowering at a node
  – Phytophthora root rot always occurs at the soil line
• Bleached area with red pigment
• Often no fruiting bodies present
• Lesions expand and girdle the stem
Pod and Stem Blight

- Associated with wet weather early in the season
- Warmer, humid weather favor disease progress
- Bleached area with rows of black specks (pycnidia)
- Lesions expand and girdle the stem
- Fruiting bodies (pycnidia) can also appear on pods
- Also causes seed decay
Management

- Foliar fungicides between R3 and R6 can reduce stem blight – Research in progress
- Foliar fungicides not recommended for stem canker
- Seed treatments might be useful as both pathogens can be seedborne – efficacy information not known
- Conservation tillage can promote both diseases – incorporation of residue can help reduce damage
- Resistance
Sclerotinia Stem Rot (SSR) or White Mold
Disease and sclerotia development occur from R3 to R8 growth stages
White Mold
## Typical Fungicide Results

<table>
<thead>
<tr>
<th>Product</th>
<th>Timing</th>
<th>Sclerotinia Stem Rot DSI (R7 Growth Stage)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aproach Prima; 6.8 fl.oz.</td>
<td>R3</td>
<td>85.6</td>
</tr>
<tr>
<td>Incognito; 20.0 fl.oz.</td>
<td>R1</td>
<td>81.4</td>
</tr>
<tr>
<td>Non-treated Control</td>
<td>--</td>
<td>77.5</td>
</tr>
<tr>
<td>Proline; 5.0 fl.oz.</td>
<td>R1</td>
<td>74.5</td>
</tr>
<tr>
<td>Priaxor; 4.0 fl.oz.</td>
<td>R3</td>
<td>74.2</td>
</tr>
<tr>
<td>Endura; 8.0 oz.</td>
<td>R1</td>
<td>38.6</td>
</tr>
<tr>
<td>Aproach 9.0 fl.oz.</td>
<td>R1+R3</td>
<td>28.1</td>
</tr>
<tr>
<td>Proline; 3.0 fl.oz. + Stratego YLD 4.0 fl.oz.</td>
<td>R1+R3</td>
<td>25.3</td>
</tr>
<tr>
<td>Cobra; 6.0 fl.oz.</td>
<td>R1</td>
<td>6.4</td>
</tr>
<tr>
<td>LSD (0.05)</td>
<td></td>
<td>37.9</td>
</tr>
</tbody>
</table>

*Data from 2013 trial located at Arlington ARS*
<table>
<thead>
<tr>
<th>Product</th>
<th>Timing</th>
<th>Yield (bu/a)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aproach Prima; 6.8 fl.oz.</td>
<td>R3</td>
<td>58.0</td>
</tr>
<tr>
<td>Incognito; 20.0 fl.oz.</td>
<td>R1</td>
<td>65.3</td>
</tr>
<tr>
<td>Non-treated Control</td>
<td>--</td>
<td>56.0</td>
</tr>
<tr>
<td>Proline; 5.0 fl.oz.</td>
<td>R1</td>
<td>58.7</td>
</tr>
<tr>
<td>Priaxor; 4.0 fl.oz.</td>
<td>R3</td>
<td>63.7</td>
</tr>
<tr>
<td>Endura; 8.0 oz.</td>
<td>R1</td>
<td>78.3</td>
</tr>
<tr>
<td>Aproach 9.0 fl.oz.</td>
<td>R1+R3</td>
<td>73.9</td>
</tr>
<tr>
<td>Proline; 3.0 fl.oz.+ Stratego YLD 4.0 fl.oz.</td>
<td>R1+R3</td>
<td>74.0</td>
</tr>
<tr>
<td>Cobra; 6.0 fl.oz. **</td>
<td>R1</td>
<td>67.4</td>
</tr>
<tr>
<td>LSD (0.05)</td>
<td></td>
<td>10.8</td>
</tr>
</tbody>
</table>

*Data from 2013 trial located at Arlington ARS*
## Arlington, WI - 2015

<table>
<thead>
<tr>
<th>Product and rate</th>
<th>Timing</th>
<th>DSI</th>
<th>DI</th>
<th>Yield (bu/a)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Headline 12 fl oz</td>
<td>R1</td>
<td>26.2 ab</td>
<td>15.8 abc</td>
<td>67.8</td>
</tr>
<tr>
<td>Omega 12 fl oz + Headline 12 fl oz</td>
<td>R1</td>
<td>24.7 ab</td>
<td>15.5 abc</td>
<td>70.9</td>
</tr>
<tr>
<td>Non-treated</td>
<td>--</td>
<td>24.3 ab</td>
<td>14.2 abc</td>
<td>64.4</td>
</tr>
<tr>
<td>Incognito 4.5 fl oz</td>
<td>R1</td>
<td>9.9 ae</td>
<td>4.4 be</td>
<td>67.4</td>
</tr>
<tr>
<td>Omega 12 fl oz</td>
<td>R1</td>
<td>8.5 bce</td>
<td>3.1 cde</td>
<td>66.1</td>
</tr>
<tr>
<td>Omega 12 fl oz + Incognito 4.5F 10 fl oz</td>
<td>R1</td>
<td>3.2 de</td>
<td>1.3 de</td>
<td>64.2</td>
</tr>
<tr>
<td>Endura 11 oz</td>
<td>R1</td>
<td>0.4 e</td>
<td>0.1 e</td>
<td>70.2</td>
</tr>
</tbody>
</table>
2016 Break-even Scenarios for Soybeans (bu/a)

<table>
<thead>
<tr>
<th>Price /bu</th>
<th>Approach @ 9.0 fl oz (2x)</th>
<th>Endura @ 8.0 oz (1x)</th>
<th>Proline @ 3 fl oz (R1) then Stratego YLD @ 4 fl oz (R3)</th>
<th>Omega @ 12 fl oz + Incognito 4.5F @ 10 fl oz</th>
</tr>
</thead>
<tbody>
<tr>
<td>$41</td>
<td>$40</td>
<td>$30</td>
<td>$42</td>
<td></td>
</tr>
<tr>
<td>$8.00</td>
<td>5.1</td>
<td>5.0</td>
<td>3.8</td>
<td>5.3</td>
</tr>
<tr>
<td>$9.00</td>
<td>4.5</td>
<td>4.4</td>
<td>3.3</td>
<td>4.7</td>
</tr>
<tr>
<td>$10.00</td>
<td>4.1</td>
<td>4.0</td>
<td>3.0</td>
<td>4.2</td>
</tr>
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</table>
New Updates on SVNV

http://badgerbean.com

http://soybeanresearchinfo.com
Questions?

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Field Crops Pathology

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