Soybean Disease Management Update

Doug Jardine
Extension Plant Pathologist

K-State Research and Extension
Annual Yield Loss to Disease

Yield Loss (%)

10-yr avg = 11.1%
## Top Yield Robbers
(2004 – 2013)

<table>
<thead>
<tr>
<th>Disease</th>
<th>Yield Loss (%)</th>
<th>Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Charcoal rot</td>
<td>5.9</td>
<td>1.0 – 18.0</td>
</tr>
<tr>
<td>Seedling blights</td>
<td>3.3</td>
<td>0.5 – 8.5</td>
</tr>
<tr>
<td>Soybean Cyst Nematode (SCN)</td>
<td>1.6</td>
<td>0.7 – 4.3</td>
</tr>
<tr>
<td>Pod &amp; stem blight/anthracnose/PSS</td>
<td>0.7</td>
<td>0 – 1.3</td>
</tr>
<tr>
<td>Sudden Death Syndrome</td>
<td>0.5 in 2013</td>
<td>Trace – 0.5</td>
</tr>
<tr>
<td>Brown spot</td>
<td>0.4</td>
<td>0 – 2.0</td>
</tr>
</tbody>
</table>
Today’s Topics

- Soybean seedling disease study
- Seed treatments
- Soybean cyst nematode (SCN)
- Sudden death syndrome (SDS)
- Fungicide use in soybeans
- Charcoal rot
- Soybean vein necrosis virus
- Soybean rust
Soybean seedling disease study
Soybean stand establishment problems encountered over past five years

Survey of CCAs in Midwest and SE US, March 2012
Seedling disease

Pre- and post-emergent ‘damping off’

Causal organisms:

- *Pythium species*
- *Phytophthora sojae*
- *Rhizoctonia solani*
- *Fusarium species*
<table>
<thead>
<tr>
<th>Disease</th>
<th>Soil moisture</th>
<th>Soil temperature</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pythium</td>
<td>Flooded</td>
<td>Cool (50-60 F)</td>
</tr>
<tr>
<td>Phytophthora</td>
<td>Flooded</td>
<td>Warm (70s F)</td>
</tr>
<tr>
<td>Fusarium</td>
<td>Wet to dry</td>
<td>Cool to warm</td>
</tr>
<tr>
<td>Rhizoctonia</td>
<td>Damp to wet</td>
<td>Warm (70-80s F)</td>
</tr>
</tbody>
</table>
Pythium species diversity

43 *Pythium* spp.
<table>
<thead>
<tr>
<th>Spp</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pythium irregulare</td>
<td>39.15%</td>
</tr>
<tr>
<td>Pythium ultimum var. sporangiiferum</td>
<td>16.98%</td>
</tr>
<tr>
<td>Pythium acanthicum</td>
<td>9.91%</td>
</tr>
<tr>
<td>Pythium heterothallicum</td>
<td>4.25%</td>
</tr>
<tr>
<td>Pythium orthogonon</td>
<td>4.25%</td>
</tr>
<tr>
<td>Pythium ultimum var. ultimum</td>
<td>4.25%</td>
</tr>
<tr>
<td>Pythium sp.</td>
<td>3.77%</td>
</tr>
<tr>
<td>Pythium sylvaticum</td>
<td>3.30%</td>
</tr>
<tr>
<td>Pythium oopapillum</td>
<td>2.36%</td>
</tr>
<tr>
<td>Pythium lutarium</td>
<td>1.42%</td>
</tr>
<tr>
<td>Pythium rostratifingens</td>
<td>1.42%</td>
</tr>
<tr>
<td>Pythium tardicrescens</td>
<td>1.42%</td>
</tr>
<tr>
<td>Pythium aff. torulosum</td>
<td>0.94%</td>
</tr>
<tr>
<td>Pythium amasculinum</td>
<td>0.94%</td>
</tr>
<tr>
<td>Pythium inflatum</td>
<td>0.94%</td>
</tr>
<tr>
<td>Pythium rhizosaccharum</td>
<td>0.94%</td>
</tr>
<tr>
<td>Pythium ultimum</td>
<td>0.94%</td>
</tr>
<tr>
<td>Aphanomyces cladogamus</td>
<td>0.47%</td>
</tr>
<tr>
<td>Phytophthora sansomea</td>
<td>0.47%</td>
</tr>
<tr>
<td>Pythium cryptoirregulare</td>
<td>0.47%</td>
</tr>
<tr>
<td>Pythium hypogynum</td>
<td>0.47%</td>
</tr>
<tr>
<td>Pythium mercuriale</td>
<td>0.47%</td>
</tr>
<tr>
<td>Pythium periplocum</td>
<td>0.47%</td>
</tr>
</tbody>
</table>

Total frequency: 79%
Cold soil loving Pythium species

Intermediate

Warmer soil loving Pythium species
The decision to use a seed treatment is more important than what product is used.
Benefits

• Allows for earlier planting into less friendly seed bed environments

• Seeding rate can be reduced to save on seed expenses

• Results in increased stands and yields in many years

• Cheap insurance to protect high dollar seed expenses
Costs

• Increases production costs $2 - $4 and acre (more if an insecticide such as Cruiser is co-applied)

• Full line products like Clariva Complete are priced in the $20 per acre range
  • Pasteuria nishizawae, sedaxane, thiamethoxam, fludioxonil and mefenoxam

• In the past, some companies have not taken back unplanted, treated seed. Check with your dealer.
Seven-year fungicide seed treatment trial results

<table>
<thead>
<tr>
<th>Year</th>
<th>Untreated Bu/a</th>
<th>Treated Bu/a</th>
<th>Difference Bu/a</th>
</tr>
</thead>
<tbody>
<tr>
<td>2006</td>
<td>24.8</td>
<td>27.2</td>
<td>+ 2.4</td>
</tr>
<tr>
<td>2007</td>
<td>37.9</td>
<td>38.0</td>
<td>+0.1</td>
</tr>
<tr>
<td>2008</td>
<td>41.9</td>
<td>45.1</td>
<td>+3.2</td>
</tr>
<tr>
<td>2009</td>
<td>63.3</td>
<td>67.8</td>
<td>+4.5</td>
</tr>
<tr>
<td>2010</td>
<td>36.8</td>
<td>39.5</td>
<td>+2.7</td>
</tr>
<tr>
<td>2011</td>
<td>43.0</td>
<td>43.2</td>
<td>+0.2</td>
</tr>
<tr>
<td>2013</td>
<td>42.7</td>
<td>47.9</td>
<td>+5.2</td>
</tr>
</tbody>
</table>

Locations: Scandia (irrigated), Ottawa, Parsons, Rossville, Silver Lake
Seven year average = 2.6bu/a
## Seed treatments

<table>
<thead>
<tr>
<th>Active ingredient</th>
<th><em>Phytophthora sojae</em></th>
<th><em>Pythium species</em></th>
<th><em>Rhizoctonia solani</em></th>
<th><em>Fusarium species</em></th>
</tr>
</thead>
<tbody>
<tr>
<td>mefenoxam/ metalaxyl</td>
<td>E</td>
<td>E</td>
<td>N</td>
<td>N</td>
</tr>
<tr>
<td>azoxystrobin</td>
<td>-</td>
<td>P</td>
<td>F</td>
<td>F</td>
</tr>
<tr>
<td>fludioxonil</td>
<td>N</td>
<td>N</td>
<td>G</td>
<td>G</td>
</tr>
<tr>
<td>ipconazole</td>
<td>-</td>
<td>P</td>
<td>F</td>
<td>G</td>
</tr>
<tr>
<td>pyraclostrobin</td>
<td>-</td>
<td>P</td>
<td>F</td>
<td>F</td>
</tr>
<tr>
<td>trifloxystrobin</td>
<td>-</td>
<td>P</td>
<td>F</td>
<td>F</td>
</tr>
<tr>
<td>ethaboxam</td>
<td>E</td>
<td>E</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

E = excellent; G = good; F = fair; P = poor N = none
Products

• Use products containing two or more active ingredients for seed and soilborne pathogens plus *Pythium* specific products.

• Examples of commonly available products
  – CruiserMaxx – (Syngenta)
  – Rancona Summit – (Chemtura)
  – Trilex + Allegiance – (Bayer)
  – Warden CZ – (Winfield)
  – Etc
K-State recommendations

• Use a seed treatment on all soybeans planted before May 15th

• For no-till, extend the date to May 31st

• June or later planted soybeans only occasionally benefit from a seed treatment
  – However, higher seed costs and higher prices may still make this cheap insurance
Distribution of SCN in Kansas

- Cheyenne
- Rawlins
- Decatur
- Norton
- Phillips
- Smith
- Jewell
- Republic
- Washington
- Marshall
- Nemaha
- Brown
- Doniphan
- Atchison
- Sherman
- Thomas
- Sheridan
- Graham
- Rook
- Osborne
- Nottoway
- Wyanottee
- Douglas
- Cherokee
- Franklin
- Osage
- Shawnee
- Woodson
- Neosho
- Labette
- Stafford
- Crawford
- Ellsworth
- Bourbon
- Linn
- Montgomery
- Pottawatomie
- Cloud
- Clay
- Riley
- Wabaunsee
- Geary
- McPherson
- Sedgwick
- Sedgwick
- Butler
- Greenwood
- Wilson
- Wilson
- Neosho
- Crawford
- Chautauqua
- Graham
- Coffey
- Coffey
- Wyandotte
- Johnson
- Miami
- Osage
- Franklin
- Kiowa
- Meade
- Clark
- Meade
- Clark
- Meade
- Burton
- Meade
- Burton
- Meade
- Burton
- Meade
- Burton
- Meade
- Burton
- Meade
- Burton
- Meade
- Burton
- Meade
- Burton
- Meade
- Burton
- Meade
- Burton
- Meade
- Burton
- Meade
- Burton
- Meade
- Burton
- Meade
- Burton
- Meade
- Burton
- Meade
- Burton
- Meade
- Burton
- Meade
- Burton
- Meade
- Burton
- Meade
- Burton
- Meade
- Burton
- Meade
- Burton
- Meade
- Burton
- Meade
- Burton
- Meade
- Burton
- Meade
- Burton
- Meade
- Burton
- Meade
- Burton
- Meade
- Burton
- Meade
- Burton
- Meade
- Burton
- Meade
- Burton
- Meade
- Burton
- Meade
- Burton
- Meade
- Burton
- Meade
- Burton
- Meade
- Burton
- Meade
- Burton
- Meade
- Burton
- Meade
- Burton
- Meade
- Burton
- Meade
- Burton
- Meade
- Burton
- Meade
- Burton
- Meade
- Burton
- Meade
- Burton
- Meade
- Burton
- Meade
- Burton
- Meade
- Burton
- Meade
- Burton
- Meade
- Burton
- Meade
- Burton
- Meade
- Burton
- Meade
- Burton
- Meade
- Burton
- Meade
- Burton
- Meade
- Burton
- Meade
- Burton
- Meade
- Burton
- Meade
- Burton
- Meade
- Burton
- Meade
- Burton
- Meade
- Burton
- Meade
- Burton
- Meade
- Burton
- Meade
- Burton
- Meade
- Burton
- Meade
- Burton
- Meade
- Burton
- Meade
- Burton
- Meade
- Burton
- Meade
- Burton
- Meade
- Burton
- Meade
- Burton
- Meade
- Burton
- Meade
- Burton
- Meade
- Burton
- Meade
- Burton
- Meade
- Burton
- Meade
- Burton
- Meade
- Burton
- Meade
- Burton
- Meade
- Burton
- Meade
- Burton
- Meade
- Burton
- Meade
- Burton
- Meade
- Burton
- Meade
- Burton
- Meade
- Burton
- Meade
- Burton
- Meade
- Burton
- Meade
- Burton
- Meade
- Burton
- Meade
- Burton
- Meade
- Burton
- Meade
- Burton
- Meade
- Burton
- Meade
- Burton
- Meade
- Burton
- Meade
- Burton
- Meade
- Burton
- Meade
- Burton
- Meade
- Burton
- Meade
- Burton
- Meade
- Burton
- Meade
- Burton
- Meade
- Burton
- Meade
- Burton
- Mead
Kansas SCN Survey Summary

- Five new counties added
  - Chase, Chautauqua, Butler, Finney, Morris,

- Statewide, 18.9% of fields are infested

- Most infested counties
  - Cherokee @ 95%
  - Doniphan @ 75%
<table>
<thead>
<tr>
<th>County</th>
<th># Samples</th>
<th>% Positive</th>
<th>County</th>
<th># Samples</th>
<th>% Positive</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anderson</td>
<td>5/16</td>
<td>31</td>
<td>Johnson</td>
<td>1/4</td>
<td>25</td>
</tr>
<tr>
<td>Atchison</td>
<td>4/12</td>
<td>25</td>
<td>Kingman</td>
<td>1/5</td>
<td>20</td>
</tr>
<tr>
<td>Bourbon</td>
<td>1/3</td>
<td>33</td>
<td>Kiowa</td>
<td>1/1</td>
<td>100</td>
</tr>
<tr>
<td>Brown</td>
<td>2/20</td>
<td>10</td>
<td>Labette</td>
<td>5/14</td>
<td>36</td>
</tr>
<tr>
<td>Butler</td>
<td>1/6</td>
<td>17</td>
<td>Leavenworth</td>
<td>1/5</td>
<td>20</td>
</tr>
<tr>
<td>Chase</td>
<td>1/4</td>
<td>25</td>
<td>Linn</td>
<td>4/11</td>
<td>36</td>
</tr>
<tr>
<td>Chautauqua</td>
<td>1/1</td>
<td>100</td>
<td>Lyon</td>
<td>2/15</td>
<td>13</td>
</tr>
<tr>
<td>Cherokee</td>
<td>19/20</td>
<td>95</td>
<td>Marshall</td>
<td>3/28</td>
<td>11</td>
</tr>
<tr>
<td>Clay</td>
<td>2/16</td>
<td>13</td>
<td>McPherson</td>
<td>1/13</td>
<td>8</td>
</tr>
<tr>
<td>Cloud</td>
<td>1/9</td>
<td>11</td>
<td>Mitchell</td>
<td>1/8</td>
<td>13</td>
</tr>
<tr>
<td>Coffey</td>
<td>1/19</td>
<td>5</td>
<td>Morris</td>
<td>2/12</td>
<td>17</td>
</tr>
<tr>
<td>Crawford</td>
<td>7/16</td>
<td>44</td>
<td>Nemaha</td>
<td>3/21</td>
<td>14</td>
</tr>
<tr>
<td>Doniphan</td>
<td>9/12</td>
<td>75</td>
<td>Osage</td>
<td>6/15</td>
<td>40</td>
</tr>
<tr>
<td>Douglas</td>
<td>5/8</td>
<td>63</td>
<td>Pottawatomie</td>
<td>2/8</td>
<td>25</td>
</tr>
<tr>
<td>Edwards</td>
<td>3/6</td>
<td>50</td>
<td>Riley</td>
<td>1/7</td>
<td>14</td>
</tr>
<tr>
<td>Finney</td>
<td>1/3</td>
<td>33</td>
<td>Sedgwick</td>
<td>2/12</td>
<td>17</td>
</tr>
<tr>
<td>Franklin</td>
<td>9/16</td>
<td>56</td>
<td>Shawnee</td>
<td>3/7</td>
<td>43</td>
</tr>
<tr>
<td>Geary</td>
<td>1/2</td>
<td>50</td>
<td>Stafford</td>
<td>1/9</td>
<td>11</td>
</tr>
<tr>
<td>Jackson</td>
<td>2/9</td>
<td>22</td>
<td>Wabaunsee</td>
<td>1/5</td>
<td>20</td>
</tr>
<tr>
<td>Jefferson</td>
<td>4/11</td>
<td>36</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

~ 13% of NC Kansas fields are infested in positive counties
There is usually a lack of above ground symptoms
SCN on roots
SCN sampling statistics

• Kansas harvested 3.54 million acres of soybeans in 2013

• There were 31 SCN soil samples submitted to the K-State Plant Diagnostic Lab
  – One sample per 118,000 acres

• 32% of the samples were positive
  – Economic yield loss begins with populations as low as 300 eggs-J2 / 100 cc
  – An average of 3,453 eggs-J2 per sample with a range of 0 – 18,720
  – Samples of over 10,000 are not unusual in Kansas
Soil sampling is a must......

- To determine if SCN was responsible for poor soybean yields
- To properly diagnose stunted or yellow soybeans observed in mid-season (both to confirm or rule out SCN as the problem)
- To determine if your SCN management program has been successful in keeping SCN population densities in check
## Soybean Performance Test Results

### 2013 Soybean Performance Test Results

<table>
<thead>
<tr>
<th>Region</th>
<th>County</th>
</tr>
</thead>
<tbody>
<tr>
<td>North Central</td>
<td>Pottawatomie, Republic</td>
</tr>
<tr>
<td>East/Central</td>
<td>Franklin, Shawnee, Saline, Chase*abandoned</td>
</tr>
<tr>
<td>Southeast</td>
<td>Crawford, MG III-IV, Crawford, MG IV-V, Neosho, MG III-IV, Neosho, MG IV-V, Labette, MG III-IV, Labette, MG IV-V</td>
</tr>
<tr>
<td>Southeast Double Crop</td>
<td>Cherokee, MG IV-V*abandoned</td>
</tr>
</tbody>
</table>

### Archives

- 2012/2011 archive
- 2010 archive
- 2009 archive
- 2008 archive

### Related Tables

- Related tables include:
  - 2013 SCN and SDS Ratings

### Related Links

- Soybean Production
- Soybean Scene
- Weather Data Library
Interpreting Female Indices

- 1 – 10 is considered “Resistant”
- 11 – 30 is considered “Moderately resistant”
- 31 – 60 is considered “Moderately Susceptible”
- > 61 is considered “Susceptible”

- For fields known to be infested, use varieties with scores of < 30
## Effect of Source of Resistance on SCN levels and yield

**St. Mary, KS 2008**

<table>
<thead>
<tr>
<th>Variety</th>
<th>Source</th>
<th>Female Index</th>
<th>Spring Count</th>
<th>Fall Count</th>
<th>$\frac{Pf}{Pi}$</th>
<th>Yield (bu/a)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ohlde O-3997</td>
<td>None</td>
<td>92</td>
<td>659</td>
<td>991</td>
<td>1.5</td>
<td>30.8</td>
</tr>
<tr>
<td>O-3927 NRR</td>
<td>PI88788</td>
<td>60</td>
<td>979</td>
<td>764</td>
<td>0.8</td>
<td>29.8</td>
</tr>
<tr>
<td>Dyna-Gro 3362 NRR</td>
<td>PI88788</td>
<td>137</td>
<td>955</td>
<td>1075</td>
<td>1.1</td>
<td>36.7</td>
</tr>
<tr>
<td>Croplan 3864</td>
<td>PI88788</td>
<td>12</td>
<td>922</td>
<td>575</td>
<td>0.6</td>
<td>40.4</td>
</tr>
</tbody>
</table>
### Effect of Source of Resistance on SCN levels and yield

#### Silver Lake, KS  2009

<table>
<thead>
<tr>
<th>Variety</th>
<th>Source</th>
<th>Female Index</th>
<th>Spring Count</th>
<th>Fall Count</th>
<th>Pf ÷ Pi</th>
<th>Yield (bu/a)</th>
</tr>
</thead>
<tbody>
<tr>
<td>NK-S41-M5</td>
<td>None</td>
<td>100</td>
<td>1101</td>
<td>2396</td>
<td>2.1</td>
<td>69.8</td>
</tr>
<tr>
<td>AG 3803</td>
<td>PI88788</td>
<td>11</td>
<td>1419</td>
<td>1191</td>
<td>0.8</td>
<td>73.1</td>
</tr>
<tr>
<td>Midland 4289 NRS</td>
<td>PI88788</td>
<td>10</td>
<td>1234</td>
<td>1185</td>
<td>0.96</td>
<td>70.0</td>
</tr>
<tr>
<td>Midland 9A385 NRS</td>
<td>PI88788</td>
<td>11</td>
<td>1092</td>
<td>1250</td>
<td>1.1</td>
<td>69.3</td>
</tr>
</tbody>
</table>
# 2013 Topeka, Kansas Irrigated Soybean Performance Test, Shawnee County

<table>
<thead>
<tr>
<th>BRAND</th>
<th>NAME</th>
<th>YIELD (bu/a)</th>
<th>PAVG (%)</th>
<th>MAT (date)</th>
<th>LDG (score)</th>
<th>HT (in)</th>
<th>2013 SCN Female Index*</th>
<th>2013 SDS Score**</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Race 3</td>
<td>Race 4</td>
<td></td>
<td>Rossville</td>
</tr>
<tr>
<td>MIDLAND</td>
<td>3884NR2</td>
<td>75</td>
<td>109</td>
<td>09/29</td>
<td>3</td>
<td>37</td>
<td>6</td>
<td>49</td>
</tr>
<tr>
<td>MIDLAND</td>
<td>4373NR2</td>
<td>81</td>
<td>117</td>
<td>10/2</td>
<td>4</td>
<td>39</td>
<td>13</td>
<td>48</td>
</tr>
<tr>
<td>PHILLIPS</td>
<td>363 NR2YE</td>
<td>82</td>
<td>118</td>
<td>09/28</td>
<td>3</td>
<td>40</td>
<td>15</td>
<td>45</td>
</tr>
<tr>
<td>PHILLIPS</td>
<td>375 NR2YS</td>
<td>76</td>
<td>109</td>
<td>09/30</td>
<td>1</td>
<td>40</td>
<td>15</td>
<td>54</td>
</tr>
<tr>
<td>WILLCROSS</td>
<td>WX 2434N</td>
<td>82</td>
<td>119</td>
<td>10/10</td>
<td>5</td>
<td>50</td>
<td>25</td>
<td>8</td>
</tr>
<tr>
<td>WILLCROSS</td>
<td>WX 2464N</td>
<td>81</td>
<td>117</td>
<td>10/7</td>
<td>4</td>
<td>46</td>
<td>12</td>
<td>27</td>
</tr>
<tr>
<td></td>
<td>Average</td>
<td>69</td>
<td>100</td>
<td>10/1</td>
<td>3</td>
<td>42</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>CV (%)</td>
<td>13</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>LSD (0.01)</td>
<td>11</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>3</td>
</tr>
</tbody>
</table>

*2013 SCN Female Index*

**2013 SDS Score**
Recommended crop rotations to manage SCN in fields with less than 5000 eggs/100 cc soil. Source: Greg Tylka, Iowa State University.
Take the test. Beat the pest.
Sudden Death Syndrome (SDS)
Distribution of SDS in 2013
Sudden Death Syndrome (SDS)
Sudden Death Syndrome (SDS)
SDS Management

• Choose resistant varieties
• Avoid early planting when fields are wet
• Avoid compacted soils
• Manage SCN
• Keep in mind that not all SDS resistant varieties are resistant to SCN and vice versa
Fluopyram from Bayer Crop Science
Submitted for registration as IleVo for 2015
Do I need to spray my soybeans with a foliar fungicide?

- Soybean diseases that might warrant fungicide control include frogeye leaf spot, brown spot, Cercospora leaf blight and pod and stem blight

- Only brown spot is common in Kansas although Cercospora and pod and stem blight can be present in excessively wet years
Brown Spot (Septoria)
Frogeye leaf spot
Cercsopora blight/Purple seed stain
Pod and Stem Blight (Phomopsis)
2007 Leavenworth County Soybean Fungicide Plot
9 oz Headline/a Sprayed July 26, soybeans at R4
6 replications
Harvested October 31 with a plot combine
Harvested area was 5’x 25’
Soybeans were planted with a drill with row spacing on 7.5” centers

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Yield</th>
<th>Moisture</th>
<th>Test Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ununtreated Check</td>
<td>40.4</td>
<td>12.0</td>
<td>52.3</td>
</tr>
<tr>
<td>Headline – 9 oz/a</td>
<td>45.2</td>
<td>12.4</td>
<td>52.8</td>
</tr>
<tr>
<td>LSD(0.10)</td>
<td>3.9</td>
<td>NS</td>
<td>NS</td>
</tr>
</tbody>
</table>

11.9% yield increase
Soybean Fungicides, 2007-2012

11 sites – eight dryland; three irrigated.
10 in 30-inch rows; one in 7.5-inch rows
480 individual plots

Yield, bu/a

P = 0.1965

Untreated Check

47.2

Fungicide at R3

48.3

Knowledge for Life
Fungicide recommendations

• In Kansas, fungicides have not been economical unless significant levels of disease are present

• A decision to spray should only be made after physically scouting the field at growth stage R3

• There would be increased potential for economic gain if there are frequent rainfall events between R1 and R5
Locations of strobilurin resistant frogeye leafspot
Charcoal rot

• Charcoal rot has been thought of as primarily a southern production area disease since it is favored by hot, droughty conditions.

• As the growing season has gotten hotter and in some places drier, the disease has become more prevalent as far north as Iowa and even into southern Minnesota.
Cycle of disease development

1. Inoculum returned to soil
2. Invasion of tissue
3. Survival of microsclerotia in root and stem debris
4. Stems and roots loaded with microsclerotia
5. Grey discoloration of stems and roots
6. Mycelium infects below ground parts
7. Soybean roots
8. Microsclerotia
9. Switch from vegetative to reproductive
10. STRESS:
   - Drought
   - Fertility
   - High temperatures
   - Reproduction:

Symptoms:
- Premature death
- Yellow, brown leaves
- Leaves remain attached to the stem
When does infection occur?

• Initial infection takes place in the spring, often during the first 3 – 4 weeks after planting.

• The disease remains dormant through the vegetative stages.

• If favorable conditions for disease development occur starting at about pod set, then the typical symptoms of charcoal rot will begin to develop. Those conditions favorable for symptom development include droughty soils and soil temperatures > 90° F.
Where does it occur in the field?

- Symptoms generally occur in the driest part of the field
  - Compacted areas
  - Sandy areas
  - Terrace tops
  - Next to tree lines

Photo © Doug Jardine, Kansas State University
Symptoms

- Charcoal rot can reduce plant height, root volume, and root weight by more that 50%.

Photo © Doug Jardine, Kansas State University
Symptoms

- The plants eventually die and the leaves remain attached
Symptoms

• Internal streaking is often present in the tap root and can be either brown or black.

Photos © Doug Jardine, Kansas State University
Symptoms

• Above ground, black sclerotia may be found embedded in the outer epidermis or the inner stem tissue

Photos © Doug Jardine, Kansas State University
Symptoms

• Because the plant dies prematurely, seed size is greatly reduced, resulting in reduced yields.

Photo © Doug Jardine, Kansas State University
Charcoal Rot Management

- Rotate

<table>
<thead>
<tr>
<th>Rotation</th>
<th>Charcoal Rot (cfu / gm tissue)</th>
<th>Yield Bu/acre</th>
</tr>
</thead>
<tbody>
<tr>
<td>Continuous soybean</td>
<td>7800*</td>
<td>20.8*</td>
</tr>
<tr>
<td>Corn - soybean</td>
<td>4000</td>
<td>23.6</td>
</tr>
</tbody>
</table>

*Within column differences are significant at $P = 0.05$) J. Long, SE Agriculture Experiment Station, Parsons, KS
Charcoal Rot Management

• Reduce plant populations to match water availability

Photo © Doug Jardine, Kansas State University
Charcoal Rot Management

• Conserve soil moisture
  – Irrigate
  – Use no-till
  – Reduce soil compaction
  – Reduce weed competition
• Reduce seeding rates
• Plant tolerant varieties
• Crop rotation
Soybean Vein Necrosis Virus
Soybean vein necrosis virus

*Tospovirus*

- First identified in 2008 in Tennessee
  - Identified in Kansas in 2011
- Spread by soybean thrips (*Sericothrips variabilis*)
- There are differences in variety susceptibility
- Yield loss assessment is under way
- Vector management will probably not be economical
Symptoms
Soybean Rust Update
FOCUS ON SOYBEAN

Enhancing the Health, Management, and Production of Soybean Crops

Educational Webcasts

USDA Grant Outreach Webcasts

- *Oomycete Diseases of Soybean and Current Management* - Jim Kurle, University of Minnesota, December 2013. [Fully Open Access](#)

Latest Webcasts

- *No-Till Soybean* - Chad Lee, University of Kentucky, January 2014. [Open Access Until April 30, 2014](#)
- *Advances in Soybean Breeding* - Brian Diers, University of Illinois, September 2013.
facebook.com/kstate.cropdiseases

Twitter: Doug1954@KSU_CropDoc