Institute of Ag Professionals

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Using Resistant Varieties to Manage SCN: It’s Not as Simple as it Sounds

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Crop Pest Management Short Course
November 22, 2005
Discussion Outline

- Introduction to SCN
- Integrated management of SCN
- SCN–resistant varieties
Discussion Outline

• Introduction to SCN
Soybean Cyst Nematode – *Heterodera glycines*

- **Cyst**
- **Egg**
- **Unhatched J1**
- **Hatching J2**
- **Male**
- **Female**
- **J3 → J4**
- **Penetrating J2**
- **Soybean root**
Factors That Make SCN Management Difficult

- widespread distribution
Factors That Make SCN Management Difficult

- widespread distribution
- lack of symptoms
Factors That Make SCN Management Difficult

- widespread distribution
- lack of symptoms
- potential for devastating damage
Discussion Outline

- Introduction to SCN
- Integrated management of SCN
Soybean Cyst Nematode Integrated Management

- scout for early detection
- grow nonhost crops
- grow resistant soybean varieties
How to Scout for SCN:

- dig roots and look for females
- collect soil samples
Dig roots and look for SCN females
SCN females
Collect soil samples to test for SCN
## Soybean Cyst Nematode Nonhost Crops

<table>
<thead>
<tr>
<th>Alfalfa</th>
<th>Forage Grasses</th>
</tr>
</thead>
<tbody>
<tr>
<td>Barley</td>
<td>Oats</td>
</tr>
<tr>
<td>Canola</td>
<td>Peanut</td>
</tr>
<tr>
<td>Clover</td>
<td>Rye</td>
</tr>
<tr>
<td>Corn</td>
<td>Sorghum</td>
</tr>
<tr>
<td>Cotton</td>
<td>Wheat</td>
</tr>
</tbody>
</table>

*(some)*
Nonhost Crops Reduce SCN Population Densities

1\textsuperscript{st} year corn: from 5 – 10\% decrease to 45 – 50\% decrease

2\textsuperscript{nd} year corn probably not as effective as 1\textsuperscript{st} year corn at decreasing SCN numbers
SCN-resistant variety

SCN-susceptible variety
### SCN–resistant Soybean Variety Trials
Central Iowa – 2001

<table>
<thead>
<tr>
<th></th>
<th>Yield – SCN–infested field* (bu/A)</th>
<th>Final SCN population densities (eggs/100 cc)</th>
<th>Yield – noninfested field (bu/A)</th>
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<tbody>
<tr>
<td>conv.</td>
<td>42.5</td>
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<td>3,558</td>
</tr>
<tr>
<td>RR</td>
<td>40.3</td>
<td>28.6</td>
<td>4,961</td>
</tr>
</tbody>
</table>

* initial SCN population density ≅ 3,300 eggs per 100 cm³ soil

Most seed companies DO NOT charge a higher price for seed of SCN–resistant varieties
Discussion Outline

• Introduction to SCN
• Integrated management of SCN
• SCN–resistant varieties
Definitions of SCN resistance

- resistant = <10% reproduction *
- moderately resistant = 10 to 30% reproduction *
- moderately susceptible = 30 to 60% reproduction *
- susceptible = >60% reproduction *

* relative to reproduction on a standard SCN-susceptible variety, usually Lee 74
Sources of SCN Resistance *

- PI 88788 (common)
- Peking
- PI 209332
- PI 437654

* oligogenic resistance
SCN-resistant Varieties Available for Iowa
1991 - 2004
SCN-resistant Varieties Available for Iowa
1991 - 2004

- PI88788
- Other
SCN-resistant Varieties Available for Iowa
1991 - 2004

- Conventional
- Roundup Ready
Definitions of SCN resistance

- resistant = <10% reproduction

consequences: 1) can have some yield loss with resistant varieties
2) can have selection of SCN populations that effectively reproduce on the resistant varieties (i.e. race shift)
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* initial SCN population density ≈ 3,300 eggs per 100 cm³ soil
2001 North Central Iowa Variety Trial
Best 3 Yielding Roundup Ready Varieties

Yield (bu/Ac)

- LSD = 4.1

Eggs / 100 cc soil at harvest

- LSD = 3,524
2001 North Central Iowa Variety Trial

Best 3 Yielding Conventional (non Roundup Ready) Varieties

- Yield (bu/Ac):
  - LSD = 4.9
  - Varieties:
    - Red: 52
    - Blue: 51.1
    - Yellow: 49.9

- Eggs/100 cc soil at harvest:
  - LSD = 5,430
  - Varieties:
    - Red: 2713
    - Blue: 7450
    - Yellow: 1400

Best 3 Yielding Conventional (non Roundup Ready) Varieties

- 2001 North Central Iowa Variety Trial
Growing soybean varieties in SCN-infested fields in an attempt to maximize soybean yields in the short term without any consideration of the effect of the varieties on SCN population densities can seriously reduce the long-term soybean productivity of the land.

CAUTION
Recommended rotation for fields with *low* or *moderate* SCN infestations:

- **Yr. 1**: PI 88788 SCN-resistant soybean
- **Yr. 2**: Nonhost crop
- **Yr. 3**: SCN-resistant soybean different from Yr. 1
- **Yr. 4**: Nonhost crop
- **Yr. 5**: SCN-susceptible soybean
- **Yr. 6**: Nonhost crop
Recommended rotation for fields with *low* or *moderate* SCN infestations:

1. **Yr. 1**: PI 88788 SCN-resistant soybean
2. **Yr. 2**: Nonhost crop
3. **Yr. 3**: SCN-resistant soybean different from Yr. 1
4. **Yr. 4**: Nonhost crop
5. **Yr. 5**: SCN-susceptible soybean
6. **Yr. 6**: Nonhost crop
Sources of SCN Resistance

- PI 88788 (common)
- Peking
- PI 209332
- PI 437654 (a.k.a. Hartwig and CystX®)
What do you do if you can’t get non-PI88788 SCN resistance?

1st alternative:
grow a different PI 88788 SCN-resistant variety

2nd alternative:
grow exactly the same PI 88788 SCN-resistant variety
CystX®

- branded PI 437654/Hartwig resistance
- allows virtually 0% SCN reproduction
- useful as an effective 2nd type of SCN resistance (if varieties are high yielding)
- to be used in conjunction with PI 88788, not as a replacement
- especially useful in fields with high SCN population densities
CystX® type SCN-resistant soybean

Possible rotation for fields with *moderate* or *high* SCN infestations

Yr. 1

Yr. 6

Yr. 2

Yr. 3

Yr. 4

Yr. 5

SCN-susceptible soybean

Nonhost crop

PI 88788 SCN-resistant soybean

Nonhost crop

Nonhost crop
“What race of SCN do I have?”
Problems With SCN Race Testing

- soybean seed industry does not screen for resistance to all SCN races
### SCN Race Scheme

<table>
<thead>
<tr>
<th>race</th>
<th>Pick</th>
<th>Pek</th>
<th>PI 88</th>
<th>PI 90</th>
<th>race</th>
<th>Pick</th>
<th>Pek</th>
<th>PI 88</th>
<th>PI 90</th>
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<td>+</td>
<td>-</td>
<td>9</td>
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<td>+</td>
<td>+</td>
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<td>16</td>
<td>-</td>
<td>+</td>
<td>+</td>
<td>+</td>
</tr>
</tbody>
</table>

- Race 1, 3, and 14 indicate a special condition or priority.
Problems With SCN Race Testing

- soybean seed industry does not screen for resistance to all SCN races
- “cross protection”
“Cross Protection” of SCN–resistant Soybean Varieties

T.L. Niblack, Univ. MO
Problems With SCN Race Testing

- soybean seed industry does not screen for resistance to all SCN races
- “cross protection”
- lack of protection (race 3 ≠ race 3)
August 2000
Call from seed company agronomist

- race 3 SCN–resistant variety severely stunted with many SCN females on roots in field in NC Iowa
- no resistance had been grown in the field before
- suspected SCN race other than race 3
- population density 12,000 eggs/100 cc soil
Race test results

# H. glycines females / root

Lee  Peking  Pickett  PI88788  PI90763

10% of Lee
Race test results

Result: race 3

# H. glycines females / root

10% of Lee
Race test results

Result: race 3

(race 3 ≠ race 3)

10% of Lee
You usually don’t need to know what SCN race you have to use SCN-resistant soybean varieties to manage SCN.
Want more information?

www.soybeancyst.info

www.isuscnvarietytrials.info