Soybean cyst nematode in 2009 and beyond – what we gonna do?

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Crop Pest Management Short Course
December 17, 2008
- ~24 days
- >200 eggs per female
- eggs survive >10 years
Random Survey for SCN in Midwest


Updated survey results 2005–2008
Soybean cyst nematode in 2009 and beyond – what we gonna do?
Soybean Cyst Nematode Integrated Management

- scout for early detection
- grow nonhost crops
- grow resistant soybean varieties

The key to successful long-term management of SCN is to keep population densities low. The greater the population density, the greater the possible soybean yield loss.
SCN:
It's easier to keep low numbers low than it is to drive high numbers down!
Soybean Cyst Nematode Integrated Management

- scout for early detection
SCN:
It’s easier to keep low numbers low than it is to drive high numbers down!
Soybean Cyst Nematode
Integrated Management

- scout for early detection
Soybean Cyst Nematode
Integrated Management

- scout for early detection
- grow nonhost crops

SCN: obligate parasite
narrow host range
Soybean Cyst Nematode
Nonhost Crops

- alfalfa
- barley
- canola
- clover (some)
- corn
- cotton
- forage grasses
- oats
- peanut
- rye
- sorghum
- wheat
Nonhost Crops Reduce SCN Population Densities

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

2\textsuperscript{nd} year corn: not as effective as 1\textsuperscript{st} year corn at decreasing SCN numbers

3\textsuperscript{rd} year corn: even less effective at decreasing SCN numbers

funded by IOWA SOYBEAN ASSOCIATION
Decline of SCN Population Densities with Several Years of Corn

End-of-season SCN numbers (eggs/100 cc soil)

- Soybeans: 20,000
- 1st year corn: 12,000
- 2nd year corn: 10,000
- 3rd year corn: 8,000
SCN:
It’s easier to keep low numbers low than it is to drive high numbers down!
Soybean Cyst Nematode
Integrated Management

- scout for early detection
- grow nonhost crops
- grow resistant soybean varieties
SCN-resistant variety

SCN-susceptible variety
Scientific definition of soybean resistance to SCN

- resistant = <10% reproduction * relative to reproduction on a standard SCN-susceptible variety, usually Lee 74

there is no “legal” definition of SCN resistance in US!

* relative to reproduction on a standard SCN-susceptible variety, usually Lee 74
ISU SCN–resistant Soybean Variety Trial Program

- 4-row, 17-feet long plots replicated 4 times per location (end trimmed to 14 feet for harvest)

~600 plots per location, 9–10 locations per year
Beginning SCN populations
Churdan: 3,980 eggs per 100 cc
Melrose: 1,390 eggs per 100 cc

SCN resistance pays dividends TWICE!
**SCN:**
It’s easier to keep low numbers low than it is to drive high numbers down!
Sources* of SCN Resistance

- PI 88788
- Peking
- PI 209332
- PI 437654 (a.k.a. Hartwig, PUSCN14, and CystX®)

* Each source of resistance possesses several genes that contribute to resistance – i.e. resistance is oligogenic

> 95% available varieties
SCN-resistant Soybean Varieties Available for Iowa (maturity groups 0, 1, 2, 3) 1991 - 2007

2%
How Does Resistance Work?

T. Baum
How Does Resistance Work?

B. Matthews, USDA
How Does Resistance Work?

B. Matthews, USDA
in resistant varieties, syncytium does not fully form for most of the juveniles - it deteriorates after a few days

juveniles starve without fully formed syncytia
Not all resistant soybeans are the same

variety A

variety B

T. Baum
Not all SCN populations are the same

field A

field B

T. Baum
Differences in yield and SCN reproduction on SCN-resistant soybean varieties are due to:

- the genetics of the resistant soybean
- genetics of the SCN population (HG type)

SCN reproduction on different sources of resistance is measured in the SCN race test (1970–2002) and the HG type test (since 2002) in the greenhouse. The critical value is 10% reproduction.
University of Illinois
2006 SCN Race/HG Type Survey

- SCN populations from 260 randomly selected fields from throughout Illinois

  - 65% of SCN populations had >10% reproduction on PI 88788
  - \( \rightarrow 31\% \) increase from 1990

Niblack et al., Plant Health Progress 2008

University of Missouri
2005 SCN Race/HG Type Survey

- SCN populations from 45 randomly selected fields from throughout Missouri

  - 78% of SCN populations had >10% reproduction on PI 88788
  - \( \rightarrow 20\% \) increase from 1998

Mitchum et al., Plant Disease 2007
Without a doubt, the ability of SCN populations to reproduce on PI 88788 is increasing in most Midwestern states.

If SCN reproduction is $>10\%$ on PI 88788, must another source of resistance be used to obtain maximum yield?

That is, if SCN reproduction is $>10\%$ on PI 88788, has that source of resistance failed?
yield (bu/ac)

- SCN #s same
- SCN #s decreased
- SCN #s increased
SCN reproduction
12.4% on PI88788
0.3% on Peking

yield LSD: 5.1 bu/ac
SCN reproduction
24.3 % on PI88788
0.1 % on Peking

all but 1 variety had SCN resistance from PI88788

yield LSD: 4.4 bu/ac

~ 65 bu/ac

~ 55 bu/ac
SCN reproduction
13.4 % on PI88788
1.8 % on Peking

yield LSD: 5.9 bu/ac
Selecting SCN–resistant Varieties

- HG type test results may not predict yield results in SCN–infested fields – sometimes it’s not that simple.
- SCN reproduction >10% on PI 88788 doesn’t mean that varieties with PI 88788 SCN resistance won’t be high yielding.
- Look for SCN–resistant varieties that consistently yield well in various SCN–infested fields (yield data from noninfested fields not useful).
- Look for SCN–resistant varieties with resistance from various sources – i.e. PI 88788, Peking, Hartwig, etc.
Want more information on SCN?

- www.soymaxcyst.info
- www.isuscntrials.info
- www.planthealth.info

Local information is the best information

University of Minnesota:

Dr. Dean Malvick
dmalvick@umn.edu
612-625-5282

Dr. Senyu Chen
chenx099@umn.edu
507-835-3620
Soybean Cyst Nematode
Integrated Management in the Future

- scout for early detection
- grow nonhost crops
- grow resistant soybean varieties
- other products ?? ??
N-Hibit™ contains harpin protein
N-Hibit treated soybeans also averaged more plant growth: nodes, leaves, stem diameter, roots length and volume, and plant weights (root, shoot, and leaf) compared with the Untreated Control.

At 0.3 ounces per cwt, N-Hibit provides an economical option in soybeans for reducing cyst nematodes and improving plant health and growth.
ASA and Plant Health Care’s Soybean Partnership Program

An opportunity to test N-HIBIT™ on your soybeans

Plant Health Care and the American Soybean Growers Association have formed a partnership to test N-HIBIT™ on soybeans. This technology has been shown to improve crop health and lower soybean cyst nematode counts in previous trials. The object of this partnership is to have ASA members in conjunction with their crop advisors evaluate the technology on a commercial scale under growing conditions. A summary of the test protocol is outlined below. Plant Health Care will supply a kit containing the following materials:

1. A coupon to have your Preferred Local Seed Treatment Dealer treat your soybean seed with N-HIBIT CST, enough to treat 2,500 lbs. of soybean seed or approximately 42 bushels.
2. Flags to mark the trial location.
3. A trial notebook containing detailed instructions, data sheets and other information.

In order to conduct a proper trial under your growing conditions, we are requesting that you take the following steps:

1. Select a uniform field for the trial—one with variety, same cropping history, uniform fertility, etc. Use 20 to 50 acres for the treated area, and the rest as the untreated control. Other arrangements are possible, but keep the treated and untreated areas as similar as possible, except for treatment with N-HIBIT.
2. Treat soybean seed with N-HIBIT. N-HIBIT CST is sprayed onto the seed by your local retailer, and N-HIBIT HR is a grower-applied dry, hopperbox material.
3. Mark the treated area, using the flags and/or GPS.
4. Keep records on the crop planting, spraying, harvesting and growing conditions. A form is provided in the kit to make this easier.
5. Using your yield monitor and/or weight wagon, determine and record the yield for 2 treated and 2 untreated strips.
6. Return the data by mailing it to Ned M. French, Ph.D., Plant Health Care, 33200 Burlington Road, Little Rock, AR 72223.

When your results are received, you will be entered into a drawing for a Dewalt cordless kit, as a thank you for your participation in this Soybean Partnership test program. The program will be made available to ASA members when they are tabulated.

The full test protocol is included in the demonstration trial notebook.

www.n-hibitpartners.com
ISU Field Testing of N–Hibit™
2007 & 2008

● 4 treatment combinations:
  ♦ SCN–susceptible variety – treated with N–Hibit™
  ♦ SCN–susceptible variety – untreated
  ♦ SCN–resistant variety – treated with N–Hibit™
  ♦ SCN–resistant variety – untreated

● 4–row, 17–feet long plots replicated 4 times per location (end trimmed to 14 feet for harvest)

● SCN soil egg population densities of each plot assessed at planting and at harvest

● yield assessed at harvest

funded by
ISU Field Testing of N-Hibit™

experimental locations - 2007

funded by
## Data from susceptible varieties – 2007

<table>
<thead>
<tr>
<th>Location</th>
<th>Initial SCN Egg Density (eggs/100 cc)</th>
<th>Yield (bu/ac)</th>
<th>Final SCN Egg Density (eggs/100 cc)</th>
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<tr>
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<td>Untreated N-Hibi™ Treated</td>
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</table>
ISU Field Testing of N-Hibit™

experimental locations - 2008

funded by
ISU Field Testing of N–Hibit™ 2008

- no difference in yield of N–Hibit™–treated or untreated SCN–resistant or SCN–susceptible soybean varieties at any of the 9 experiments

- SCN egg population density data not yet fully available for 2008 experiments, but no effect of N–Hibit™ on final SCN egg population densities in the 3 experiments for which data are available so far
ISU Field Testing of N–Hibit™
Summary 2007–2008

- no significant effect on yield of the SCN–resistant varieties at any of the 18 location–year combinations

- susceptible varieties with N–Hibit™ yielded greater than untreated in 2 of 18 location–year combinations (Urbana and Melrose in 2007)

- no decrease in final SCN egg densities in N–Hibit™–treated plots compared to untreated plots at any of 12 year–location combinations for resistant or susceptible varieties (data not yet available for six 2008 locations yet)
The Source for Iowa Crop Production News

Soybean cyst nematode confirmed in Ida County in 2008
12/10/2003
The soybean cyst nematode first arrived in Iowa in 1978. With the confirmed finding in Ida County, SCN has been found and confirmed in all but one Iowa County.

Is All That Ends Well? Iowa Corn – 2008
12/9/2008
The 2008 corn growing season will long be remembered for weather and yields. Researchers share what was learned in this article and the full report.

Effects of N-HiBi™ Seed Treatment on Soybean Yields – 2008 Iowa Research
12/9/2008
Learn what Iowa State University Extension researchers found out when they evaluated the effects of N-HiBi™ seed treatment on soybean yield and SCN population densities in nine field experiments located throughout Iowa in 2007 and in nine different field experiments in 2008.

Collaborative Training Results in Safer, Wiser Pesticide Use
12/1/2008
Training is helping pesticide applicators become better stewards of the land and water, which benefits producers and consumers in Iowa and beyond. The training is the result of a collaboration between Extension and Iowa Department of Agriculture and Land Stewardship.