SOYBEAN CYST NEMATODE (SCN)

Soybean Diseases

Overview

Key points to know about SCN

- Many farmers don’t know their fields are infested with SCN – you often can’t tell SCN is there from looking at the field.
- The effect of SCN on soybean yield is directly related to the numbers of nematodes feeding on the root system.
- Observation of adult females and cysts on the roots of soybean plants is the most accurate way to diagnose SCN infestation in the field.
- Once present in the soil, SCN can be difficult to eliminate. However, the nematode can be managed to minimize SCN reproduction and maximize crop yields.
- Crop rotation coupled with planting SCN-resistant varieties are the cornerstones for the management of SCN. Non-host crops, such as corn, sorghum, sunflower, and alfalfa can reduce SCN population densities each year a non-host crop is planted.
- Anything that moves even small amounts of infested soil is capable of spreading SCN, including farm machinery, vehicles and tools, wind, water, animals, and farm
How to choose SCN-resistant soybean varieties

Look for varieties that yield consistently well in SCN-infested fields on multiple sites. Yield data from noninfested fields are not useful.

Look for varieties that consistently decrease SCN population densities or keep the SCN numbers in check in multiple fields. It is very difficult to reduce SCN numbers in a field once they develop to high levels, so it is important to consider how well SCN-resistant varieties control SCN numbers in order to maintain the productivity of fields for years to come.

Look for data from as many different reliable sources as possible, including university variety trials and strip trials conducted by co-ops, grain elevators, and seed companies.

Wise selection of varieties will ensure that soybeans can be grown profitably in SCN-infested fields for many years to come.

Cycle

The life cycle of SCN has three major stages: egg, juvenile, and adult female. The life cycle can be completed in 4 weeks under ideal conditions (soil temperatures at 75° F).

Scouting

First, determine your purpose for scouting for SCN
This will help determine your best strategy— whether to check soybean roots or to collect a soil sample — and when and how to collect the sample.

Are you scouting to...
- check if SCN is present in a field before planting next year’s soybean crop? [Collect a soil sample]
- determine if your SCN management program has been successful in keeping SCN population densities in check? [Collect a soil sample]
- determine if SCN was responsible for poor soybean yields? [Collect a soil sample]
- look for SCN in stunted or yellow soybeans observed in mid-season, OR in fields that are apparently healthy, but have not yet been checked for SCN? [Examine soybean roots]

**What about HG tests?**
Much has been learned in the past several decades about development of SCN on resistant soybean varieties. It is apparent from this new knowledge that a change in how we describe the abilities of a SCN population to reproduce on resistant soybean varieties is warranted.

A new system, called the HG Type test (HG for *Heterodera glycines*, the scientific name for soybean cyst nematode) has been developed and adopted by agronomists, plant pathologists, and soybean breeders. Read more about the new [SCN HG Type test].

**Management**
Crop rotation and planting SCN-resistant varieties are the two most important strategies for SCN management. Sample fields to determine SCN population densities — preferably before buying soybeans for the next season, but certainly before planting soybeans. Visit [TheSCNcoalition.com] for state-specific SCN management information

<table>
<thead>
<tr>
<th>Infestation Category</th>
<th>Soybean Not Next Crop to be Grown</th>
<th>Soybean Next Crop to be Grown</th>
<th>Management Recommendation</th>
</tr>
</thead>
<tbody>
<tr>
<td>No SCN eggs detected</td>
<td>0</td>
<td>0</td>
<td>No management strategies are necessary. However, not finding SCN in a soil sample does not prove that it is not present in the field. Follow-up sampling is recommended to</td>
</tr>
<tr>
<td>Infestation Category</td>
<td>Soybean Not Next Crop to be Grown</td>
<td>Soybean Next Crop to be Grown</td>
<td>Management Recommendation</td>
</tr>
<tr>
<td>----------------------</td>
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</tr>
<tr>
<td>Low</td>
<td>1 – 4,000</td>
<td>1 – 2,000</td>
<td>If this is first discovery of SCN, follow the rotation described below starting with Year 1 the next time soybeans are to be grown. If Years 1 – 4 of the rotation described below already have been completed, continue with Year 5 of the rotation.</td>
</tr>
<tr>
<td>Moderate</td>
<td>4,001 – 16,000/td&gt;</td>
<td>2,001 – 12,000</td>
<td>Begin Year 1 of the rotation described below the next time soybeans are to be grown.</td>
</tr>
<tr>
<td>High</td>
<td>16,000</td>
<td>12,000</td>
<td>Grow several years of a non-host crop and sample field again every fall to monitor decrease in SCN population densities.</td>
</tr>
</tbody>
</table>

**Crop Rotation**
Non-host crops can reduce SCN population densities each year a non-host crop is planted. Non-host crops include barley, alfalfa, corn, sorghum, sunflower, oats, barrel medic, clovers (red, white, berseem and crimson), buckwheat, canola, flax, potato, sugar beet, sun hemp and tomato.

Rotation crops to avoid are dry beans, cowpeas, common and hairy vetch.

**Suggested crop rotation to decrease populations of SCN**
**Year 1** – SCN-resistant soybean with PI88788 source of resistance

**Year 2** – nonhost crop
Year 3 – SCN-resistant variety different than the one planted in Year 1.

Note: If an SCN-resistant soybean variety with resistance from a source other than PI 88788 is not available for use in Year 3, grow a soybean variety with SCN resistance derived from PI 88788 that is different from the one that was grown in Year 1. Grow the exact same PI 88788 SCN-resistant soybean variety in Years 1 and 3 only if no other SCN-resistant soybean varieties with PI 88788 or other sources of resistance are available.

Year 4 – nonhost crop

Year 5 – SCN-resistant variety different than the ones planted in Year 1 and Year 3, or susceptible soybean.

Note: What determines whether a resistant or a susceptible soybean variety should be grown in this year? Almost all SCN-resistant soybean varieties available to north-central growers have the PI 88788 SCN resistance (“PI” stands for plant introduction). Because SCN-resistant varieties allow low level of reproduction, SCN populations can become “resistant to the resistance” as resistant varieties are repeatedly grown, especially if only one source of resistance is used.

Growers concerned about this possibility can prolong the effectiveness of a single source of SCN resistance by growing a susceptible (non-resistant) variety when SCN numbers are low. But SCN causes much greater damage and seems to reproduce at a greater rate in hot, dry growing seasons than in years with adequate to excess rainfall. So if a severe drought is anticipated, growers might opt not to grow a SCN-susceptible variety in an SCN-infested field, even if SCN population densities are low.

Year 6 – non-host crop

Cover Crops
A checkoff-funded study was recently completed in which the ability of cover crops to serve as inadvertent hosts for SCN was investigated. Berseem clover, cowpea, crimson clover, red clovers, sweet clover, white clovers, Austrian winter peas, and field peas were grown in soil infested with SCN. After 30 days, SCN reproduction was assessed by carefully observing the roots of each plant for the presence of adult SCN females. Almost no SCN reproduction occurred on the six to 12 replicate plants of each of the cover crop plants tested in the two experiments.

The results of these experiments indicate that these legumes should not serve as inadvertent hosts for SCN if used as cover crops. Cover crops may reduce nematode population densities as an added benefit — but the magnitude and consistency of the effects
on SCN has yet to be demonstrated.  
*Source: Cover crops and SCN: What’s the connection?*

### Cultural practices
Providing a plant the best possible growing conditions will reduce stress and yield losses due to SCN. Maintain optimum soil fertility to optimize plant growth and development.

Weed control not only reduces plant stress, but some weeds act as alternate hosts of SCN. Disease and insect control maintains plant health and minimizes damage due to SCN.

### Weed control
On their own, winter annual weeds and soybean cyst nematode (SCN) can cause significant problems in soybean fields. But now, researchers in Indiana have identified six winter annual weeds that act as alternate hosts to SCN:

- Purple deadnettle (strong host)
- Henbit (strong host)
- Field pennycress (moderate host)
- Shepherd's-purse (weak host)
- Small-flowered bittercress (weak host)
- Common chickweed (weak host)

The Purdue researchers documented SCN reproduction on purple deadnettle and henbit in the field, and noted that reproduction in the greenhouse was as efficient as reproduction on SCN-susceptible soybean.

This means that fields with these weed hosts may be increasing SCN population densities at a faster rate than fields without these weeds. A recent study in Indiana found that known SCN weed hosts were prevalent in 93 percent of the fields surveyed (Creech and Johnson, 2006), indicating the possibility of a statewide increase in nematode population densities due to weeds.

Read more in the recent full-color extension publication from Purdue University [*Winter Annual Weeds and Soybean Cyst Nematode Management* »](#)

### Sanitation
Avoid spreading SCN from infested to noninfested fields. If possible, plant noninfested fields first and power wash equipment after working infested fields.

### Nematicides
Nematicides will reduce yield loss of SCN-susceptible varieties planted in infested fields but increases the cost of production. Although nematicide will give early season protection against yield loss they do not reduce nematode population densities. Final SCN population densities are often as high as if a nematicide had not been used.

In general, nematicide use should be considered only where adapted resistant varieties are unavailable and where susceptible varieties are planted and SCN population densities are above the threshold level.

**Preplant soil sampling**
Sampling can be done following either soybeans or corn. If samples are taken in a soybean field, sample only the margins of affected areas, not the centers.

Sample fields to determine SCN population densities preferably before buying soybeans for the next season, but certainly before planting soybeans.

Samples for SCN can be taken anytime during the year, but soil samples taken following harvest provide the best population density estimates.

Check roots during midseason for the presence of females and cysts. Although SCN population density is only one component in soybean yield loss, it may suggest potential yield loss and is information vital for sound SCN management decisions.

The various details to consider when interpreting results of soil tests for SCN are explained in [Interpreting SCN Soil Sample Results](#) (Iowa State University).

**Reference**

**HG Types**

**What are HG Types?**
The soybean cyst nematode (SCN) is a widespread and serious pest of soybeans. The microscopic worm is long-lived in the soil, can develop and reproduce quickly on susceptible soybean varieties, and is capable of causing significant yield loss even in years with ideal growing conditions.

Fortunately, soybean varieties have been developed that are resistant to SCN. These resistant varieties suppress 90% or more of the development of most SCN populations, resulting in a significant increase in soybean yields in SCN-infested fields.
However, soon after the release of resistant varieties, scientists discovered some SCN populations that were capable of reproducing at elevated levels on resistant soybean varieties. Consequently, a race test system was developed in 1970 to assess the abilities of SCN populations to reproduce on resistant soybean varieties.

Much has been learned in the past several decades about development of SCN on resistant soybean varieties. It is apparent from this new knowledge that a change in how we describe the abilities of a SCN population to reproduce on resistant soybean varieties is warranted.

A new system, called the HG Type test (HG for *Heterodera glycines*, the scientific name for soybean cyst nematode) has been developed and adopted by agronomists, plant pathologists, and soybean breeders.

**What is a SCN HG Type test?**
A HG Type test is a greenhouse test performed on a SCN population isolated from a field to determine how well the SCN population can develop on soybean lines that were used as sources of resistance for SCN-resistant soybean varieties.

**Why not a SCN race test?**
The HG Type test is similar to a SCN race test, but includes only soybean lines that are sources of resistance in available SCN-resistant soybean varieties. It is much easier to understand than the race test. Once the HG Type test system has been used for a while, it should be easy to remember what an HG Type designation means in relation to the resistance possessed by available SCN-resistant soybean varieties.

For example, if the HG Type of a SCN population in your field has the number 2 in its designation, you will come to recognize that the number 2 corresponds to PI 88788, the most commonly available source of resistance in soybean varieties in the Midwest. The number 2 means the same thing whether the population is an HG Type 2, an HG Type 2.3.7, or an HG Type 1.2.6.

**Who needs an HG Type test?**
Soybean growers who have experienced sub-par performance from SCN-resistant soybean varieties in SCN-infested fields should consider having an HG Type test performed. Also, soybean growers who farm in an SCN-infested area that has had resistant soybeans grown numerous times in the past might consider having an HG Type test performed.

**How is a HG Type test conducted?**
To determine the HG Type of a SCN population, we put the nematodes on soybean lines with different genes for SCN resistance in the greenhouse under controlled conditions (Figure 1). These conditions are similar to those under which resistant soybean varieties are developed.
After 30 days, enough time for SCN females to develop, we count the numbers of females that form on the roots of the various resistant soybean lines (Figures 2 and 3). We compare these numbers to the number of females that formed on a standard susceptible soybean variety. Finally, we note which resistant soybean lines show elevated development by the SCN population. “Elevated development” means that a resistant line has 10% or more of the number of females that developed on the susceptible variety.

**How do I interpret the results of a HG Type test?**

The number or numbers in the HG Type designation correspond directly to sources of resistance used in available SCN-resistant soybean cultivars.

For example, a SCN population of HG Type 1.2 indicates that the nematode population has elevated development on Peking (line #1) and PI88788 (line #2). Either or both lines have been used to breed some SCN-resistant soybean varieties. A grower with a field infested with an HG Type 1.2 might not want to plant SCN-resistant varieties that contain resistance from Peking or PI88788, if possible. Facilities that provide SCN HG Type testing should also offer assistance in interpreting the results of the test.

**Examples of HG Type Testing**

**How do I interpret descriptions of public and private SCN-resistant varieties?**

Growers should be aware that the traditional way that SCN-resistant varieties are labeled is somewhat misleading. For example, an SCN-resistant variety with resistance from PI 88788 may be labeled as resistant to SCN race 3, when in fact it might also be resistant to as many as seven additional SCN races. In addition, this variety also might be vulnerable to elevated development by as many as eight other SCN races. Unfortunately, none of this management-type information is conveyed in the labeling.

With the HG Type designation, we label the nematodes, not the varieties. For example, if a grower’s SCN population is an HG Type 2, the name clearly indicates that the nematode exhibited elevated development on PI 88788 (line #2). That makes it more likely that the nematodes could develop on any SCN-resistant variety that obtained its SCN resistance from PI 88788, and it likely would be in the grower’s best interest to use a SCN-resistant variety that obtained its SCN resistance genes from a source other than PI 88788, if possible.

**Examples of HG Type Testing**

**Where can I get a SCN HG Type test performed?**

**Distribution**

At various times since these initial discoveries, maps were created of the counties in the United States and Canada that were known to be infested with the nematode. Recently,
nematologists, plant pathologists, and state plant regulatory officials in the soybean-producing areas of the United States and Canada were surveyed to update the map of the known distribution of *H. glycines* in 2017.

*H. glycines* has now been found in every soybean-producing state in the United States except West Virginia. Since the last update of the map in 2014, *H. glycines* was discovered for the first time in 37 counties in 17 states, namely Alabama, Georgia, Indiana, Iowa, Kansas, Kentucky, Minnesota, Missouri, Nebraska, New Jersey, New York, North Carolina, North Dakota, Ohio, South Dakota, Virginia, and Wisconsin.


**Resources**

**Beat SCN Resistance - New Active Approach Saves Yield:** 32-page SCN special insert
*Corn+Soybean Digest, 2018*

Cover Crops and SCN - What's the connection?
_iowa State University, 2014_

Interpreting SCN Soil Sample Results
_iowa State University, 2013_

The new SCN Coalition Website
https://www.thescncoalition.com/

SCN Management Guide 5th edition
_NCSRP_

SCN: The Invisible Threat
_University of Illinois_

SCN-resistant varieties for Iowa 2018 (updated annually)
_iowa State University PM 1649, 2018_

The Relationship Between the Causal Agent of SDS and SCN in Wisconsin
_University of Wisconsin_

Soybean Cyst Nematode Management Guide
_University of Wisconsin_

Soybean Cyst Nematode
_Ohio State University, 2019_
https://ohioline.osu.edu/factsheet/plpath-soy-5
Soybean Cyst Nematode in South Dakota: History, Biology, and Management
South Dakota State University Extension
https://extension.sdstate.edu/

Soybean Cyst Nematode Field Guide 2nd Edition
Iowa State University, 2012
https://store.extension.iastate.edu/Product/Soybean-Cyst-Nematode-Field-Guide

Understanding Soybean Cyst Nematode HG Types and Races
Plant Health Progress, 2016

Soybean Cyst Nematode HG Type Test Results Differ Among Multiple Samples from the Same Field but the Management Implications Are the Same
Plant Health Progress, 2016

Soybean Cyst Nematode Sampling
University of Minnesota
https://sroc.cfans.umn.edu/research/plant-pathology/nematode-soil-sampling