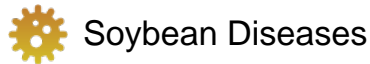


SOYBEAN CYST NEMATODE (SCN)



Overview

Key points to know about Soybean Cyst Nematode (SCN)

- Many farmers don't know their fields are infested with SCN – you often can't tell SCN is present 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.
- Seeing adult females on the roots of soybean plants is the quickest and most accurate way to diagnose SCN infestation in the field.
- Once present in the soil, SCN is nearly impossible to eliminate. However, the nematode can be managed to minimize SCN reproduction and maximize crop yields.
- Growing non-host crops in rotation with SCN-resistant soybean varieties is the cornerstone for management of SCN. Non-host crops, such as corn, sorghum, sunflower, and alfalfa can reduce SCN population densities each year they are grown.
- 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 workers.

Introduction

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

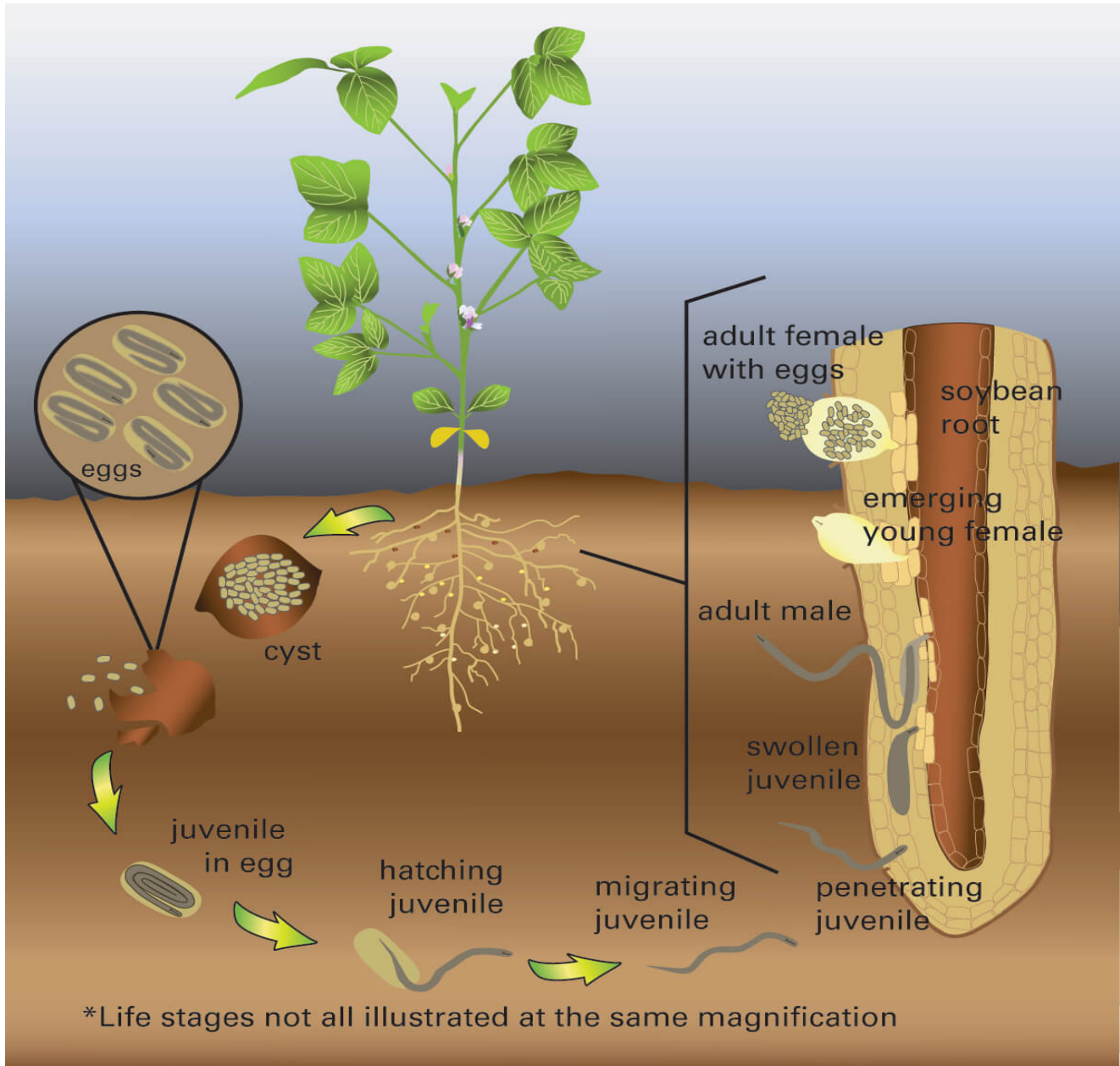


Diagram courtesy Iowa State University

Up to 50% yield loss can occur because plants are producing fewer pods than they should. The effect of SCN on soybean yield is directly related to the numbers of nematodes feeding on the root system.

Above-ground symptoms

Visible symptoms can include stunted plants, mid-season yellowing, and premature

senescence. However, symptoms of an SCN infestation are not always visible above-ground.

Injury usually is more severe in light, sandy soils and in dry growing seasons, but it also occurs in heavier soils and growing seasons with average to above-average rainfall. SCN damage is not always confined to smaller areas within a field. When fields are infested with SCN throughout, areas of stunted plants are not obvious.

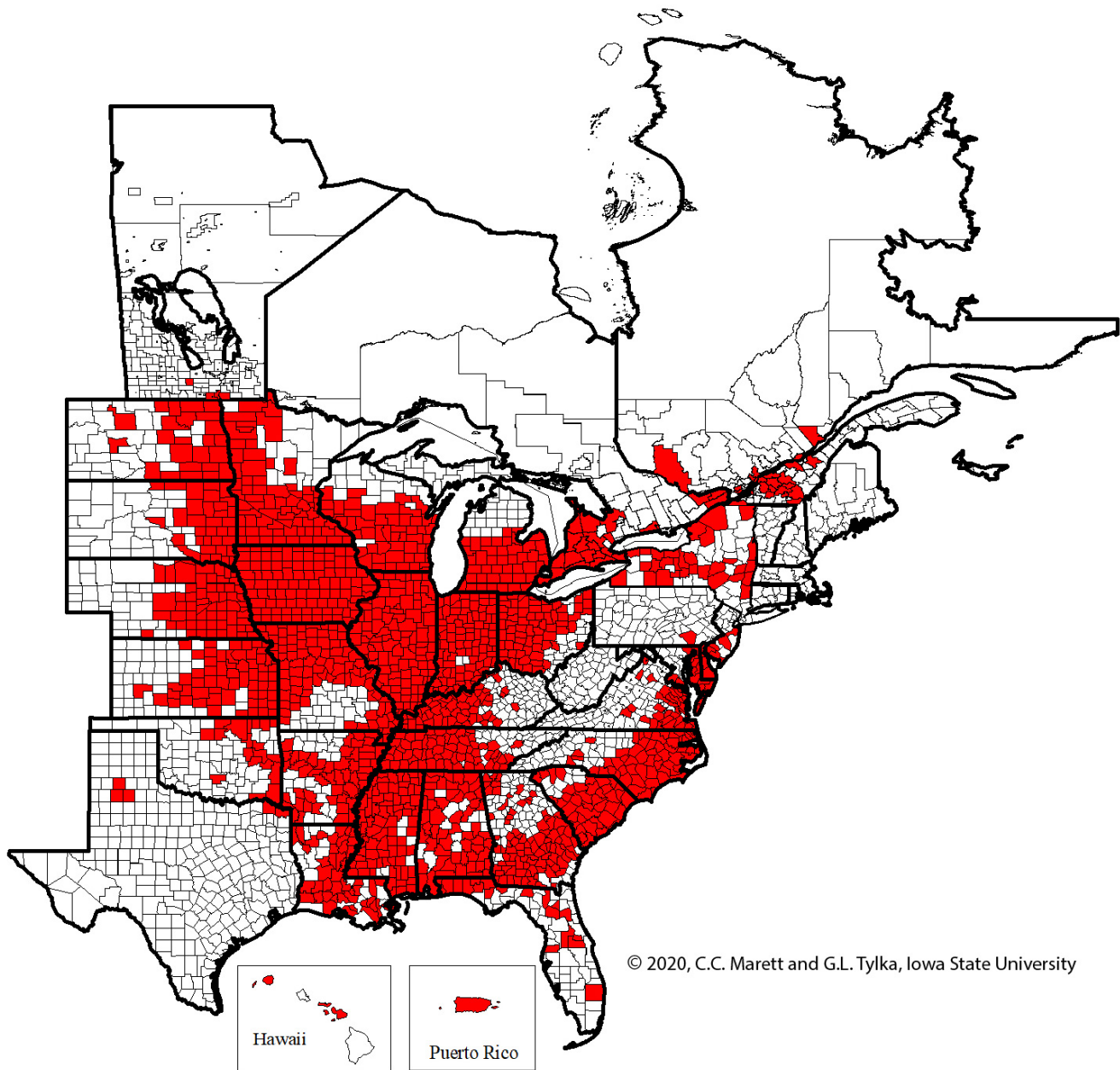
Below-ground symptoms

Root symptoms of SCN often go unrecognized. It is difficult to recognize if roots are stunted and have fewer nodules unless they are compared to uninfected soybean plants. Symptoms of SCN infection include:

- Dwarfed or stunted roots
- Fewer nitrogen-fixing nodules
- Increased susceptibility to other soil-borne plant pathogens

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 SCN in 2020.

SCN now has been found in every soybean-producing state in the United States except West Virginia. Since the last update of the map of the known distribution of SCN in the US in 2017 (shown below), SCN was discovered for the first time in 32 new counties in 11 states, namely Kansas, Kentucky, Michigan, Minnesota, Nebraska, New York, North Carolina, North Dakota, South Dakota, Virginia, and Wisconsin.



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?
- Determine if your SCN management program has been successful in keeping SCN population densities in check?
- Determine if SCN was responsible for poor soybean yields?

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?

SCN infestation categories and corresponding egg population densities and management recommendation from Iowa State University. Infestation categories and management recommendations vary from state to state.

Visit www.TheSCNCoalition.com for recommendations for every soybean-producing state.

| Infestation Category | Soybean Not Next Crop to be Grown | Soybean Next Crop to be Grown | Management Recommendation |
|-----------------------------|--|--------------------------------------|---|
| No SCN eggs detected | 0 | 0 | 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 check for SCN infestations in future years. |
| Low | 1 – 4,000 | 1 – 2,000 | 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 |

| Infestation Category | Soybean Not Next Crop to be Grown | Soybean Next Crop to be Grown | Management Recommendation |
|-----------------------------|--|--------------------------------------|--|
| Moderate | 4,001 – 16,000/td> | 2,001 – 12,000 | rotation. Begin Year 1 of the rotation described below the next time soybeans are to be grown. |
| High | 16,000 | 12,000 | Grow several years of a non-host crop and sample field again every fall to monitor decrease in SCN population densities. |

The various details to consider when interpreting results of soil tests for SCN are explained in Interpreting SCN Soil Sample Results (Iowa State University). See resource page for link.

Management

SCN-resistant soybean varieties

[SCN Testing](#)

1. 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.

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.

2. Non-host crops

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.

Recommended Rotation

Suggested crop rotation for long-term management of SCN:

Year 1 – SCN-resistant soybean with PI 88788 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, like Peking, is not available, grow a soybean variety with PI 88788 SCN resistance that is different from the one that was grown in Year 1.

Year 4 – nonhost crop

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

Year 6 – non-host crop

Cover crops

A series of checkoff-funded greenhouse studies measured the ability of SCN to reproduce on cover crops. The legumes berseem clover, cowpea, crimson clover, red clovers, sweet clover, white clover, Austrian winter peas, and field peas were grown in soil infested with SCN. Almost no SCN reproduction occurred on the plants. Non-legume cover crop plants were grown in SCN-infested soil in similar experiments and no SCN reproduction was observed.

Thus, it appears that most cover crops will not serve as inadvertent hosts for SCN. The one

exception is the winter annual weed pennycress, which currently is being studied as a possible oilseed crop. Ohio State University researchers have reported that pennycress supports the productions of hundreds of SCN females per root. So pennycress should not be grown as a cover crop in SCN-infested fields.

Cover crops may reduce nematode population densities as an added benefit — but the effects on SCN have been inconsistent. For example, a University of Illinois study published in 2017 reported that canola, cereal rye, and rapeseed reduced SCN population densities when grown as cover crops, but only in 25% to 33% of the experiments.

Seed treatments

There are many nematode-protectant seed treatments available for soybean farmers to use to help manage SCN, and they have a wide range of active ingredients and modes of action. The seed treatments can reduce SCN yield loss by providing early season protection against SCN feeding but they rarely result in decreased SCN population densities at the end of the growing season. Nematode-protectant seed treatments can provide some protection against yield loss with SCN-resistant soybean varieties that are being increasingly fed upon by SCN populations that have developed increased SCN reproduction on the very commonly used PI 88788 source of resistance.

Weed control

On their own, winter annual weeds and SCN cause significant problems in soybean fields. But now, researchers in Indiana have identified six winter annual weeds that can serve as 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 University 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.

HG Types

[HG Type tests](#)

Soybean varieties that are resistant to SCN have been available to Midwestern soybean farmers since the early 1990s. When working effectively, 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 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.

In 2002 a new system, called the HG Type test (“HG” for *Heterodera glycines*, the scientific name for SCN) was developed and has been 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 used as sources of resistance for SCN-resistant soybean varieties.

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, the nematodes are grown 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, the numbers of females that form on the roots of the various resistant soybean lines are counted (Figures 2 and 3) and compared to the number of females that form on a standard susceptible soybean variety. Finally, the resistant soybean lines with elevated development by the SCN population are noted in the HG type designation. “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.

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.

Distribution

For more information about SCN, visit our [resource library](#)

Additional resource: <https://soybeanresearchinfo.com/wp-content/uploads/2022/04/PP1732-Soybean-Cyst-Nematode.pdf>

Resources

Beat SCN Resistance - New Active Approach Saves Yield: 32-page SCN special insert

Corn+Soybean Digest, 2018

https://soybeanresearchinfo.com/wp-content/uploads/2019/03/SCN_Resistance_CSD_Insert_FINAL2.pdf

Cover Crops and SCN - What's the connection?

Iowa State University, 2014

<https://crops.extension.iastate.edu/cropnews/2014/09/cover-crops-and-scn-whats-connection>

Interpreting SCN Soil Sample Results

Iowa State University, 2013

<https://soybeanresearchinfo.com/wp-content/uploads/2019/03/Interpreting-SCN-Soil-Sample-IPM61.pdf>

Known Distribution of the Soybean Cyst Nematode, *Heterodera glycines*, in the United States and Canada in 2020

<https://apsjournals.apsnet.org/doi/10.1094/PHP-10-20-0094-BR>

The new SCN Coalition Website

<https://www.thescncoalition.com/>

SCN Coalition: Taking the Gloves Off

https://soybeanresearchinfo.com/wp-content/uploads/2021/12/2024618_SCN-scaled.jpg

SCN Management Guide 5th edition

NCSRP

https://soybeanresearchinfo.com/wp-content/uploads/2019/03/SCNGuide_5thEd.pdf

SCN: The Invisible Threat

University of Illinois

<https://soybeanresearchinfo.com/wp-content/uploads/2019/03/703.pdf>

SCN-resistant varieties for Iowa 2018 (updated annually)

Iowa State University PM 1649, 2018

https://soybeanresearchinfo.com/wp-content/uploads/2019/03/SCN_resistant_varieties_Iowa2018_PM1649.pdf

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

University of Wisconsin

https://soybeanresearchinfo.com/wp-content/uploads/2019/03/SCN_SDS_2015_FINAL.pdf

Soybean Cyst Nematode Management Guide

University of Wisconsin

<https://soybeanresearchinfo.com/wp-content/uploads/2019/03/Soy-Nematode-Brochure-5.2.13-with-WI-at-top.pdf>

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 (SCN) Guide

North Dakota State University Extension

<https://soybeanresearchinfo.com/wp-content/uploads/2022/04/PP1732-Soybean-Cyst-Nematode.pdf>

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

<https://soybeanresearchinfo.com/wp-content/uploads/2019/03/PHP-PS-16-0615.pdf>

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

<https://soybeanresearchinfo.com/wp-content/uploads/2019/03/PHP-BR-16-0033.pdf>

Soybean Cyst Nematode Sampling

University of Minnesota

<https://sroc.cfans.umn.edu/research/plant-pathology/nematode-soil-sampling>



This website is funded by the soybean checkoff



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