3-26-2007

Soybean cyst nematode: Still a major threat to soybean production

Gregory L. Tylka
Iowa State University, gltylka@iastate.edu

Current Newsletter

You are viewing archives for the newsletter from 1993-2007. For current news, see Integrated Crop Management News.

Archives 1993-2007

- Announcements
- Crop Production
- Insects and Mites
- Pesticide Education
- Plant Diseases
- Soils
- Weed Management
- Image Gallery

Printable Version

Printable version of this page

Related Articles

Surveying Iowa for SCN
December 10, 2007

Field testing of N-Hibit™ seed treatment in 2007 for management of SCN in Iowa
December 10, 2007

A new take on soil sampling fields for SCN
November 12, 2007

Results of SCN-resistant soybean variety testing become available
November 12, 2007

Sample fields this fall for SCN to figure out 2007 or plan for 2008
October 1, 2007

SCN females on roots signal infestations and possibly ineffectiveness of resistance
June 25, 2007

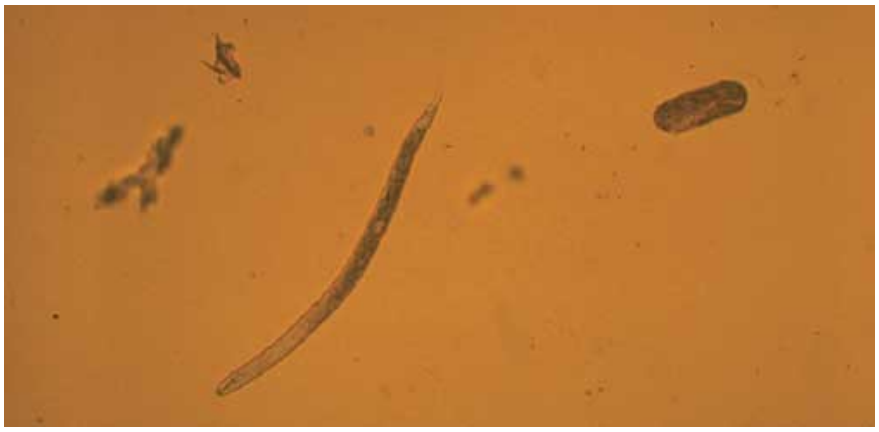
Soybean cyst nematode: Still a major threat to soybean production

by Greg Tylka, Department of Plant Pathology

The soybean cyst nematode (SCN) is the most damaging pathogen of soybeans throughout Iowa and the entire Midwestern soybean-growing region. SCN is very widespread and persistent. But profitable long-term soybean production in SCN-infested fields is possible with careful consideration of SCN biology and pathology and knowledge of the management strategies available.

Life cycle

There are three main stages to the SCN life cycle--the egg, the juvenile, and the adult (see photos).



Soybean cyst nematode juvenile (left) and egg (right). (Greg Tylka)

Adult SCN female (left, removed from root) and male (right). (Greg Tylka)

The juvenile worms hatch from eggs and must feed upon living host soybean roots to develop into adults. Juveniles swell as they feed and mature. SCN females continue to swell until they reach adulthood, eventually taking on a lemon shape and rupturing out of the root to be exposed on the root surface. The adult SCN females are visible to the unaided eye; they appear as tiny, round, white objects the size of the period at the end of this sentence. Males of SCN are not swollen as adults. Instead, males revert back into a worm shape upon reaching adulthood. The adult males exit the root and reside in the soil. Males mate with females, and females then begin producing eggs. Some eggs (up to 50 or so) are produced outside the female body in an egg mass, then the remaining eggs are retained within the SCN female body. Each adult female can produce 200 or more eggs, and eggs within the protective body of the dead female (the cyst) are capable of surviving 10 years or more without a host soybean crop. The length of the SCN life cycle is affected by temperature. Under ideal conditions, it takes only 24 days for SCN to complete a generation. There are several

Winter annual weeds and SCN: What's the connection?
April 23, 2007
SCN-resistant soybean varieties: Not all are created equal
February 26, 2007
How to interpret SCN soil test results
December 18, 2006
What's your type?: An HG type test for SCN populations
November 13, 2006

generations in a single growing season.

Mechanisms of damage

There are at least five ways in which SCN damages soybean plants. In addition to feeding on the plants, the nematodes also stunt the roots, thereby reducing the nutrients and water that the plant is able to extract from the soil. The feeding sites that SCN juveniles form are typically located in the vascular tissue of the roots, which hinders the plant's ability to move water and nutrients through the plant. Infection by SCN also can reduce the number and size of nitrogen-fixing nodules that form on soybean roots, thereby affecting the nitrogen metabolism of the plants. Finally, plants infected with SCN are more susceptible to some common soilborne fungal diseases like brown stem rot and sudden death syndrome.

Checking fields for SCN

It is relatively easy to keep SCN population densities from increasing if infestations are discovered when numbers are low or moderate. So scouting for early detection of infestations is critical for effective management of the nematode. Unfortunately, SCN-infested soybean fields may not show obvious symptoms of damage for years following initial infestation. All fields in Iowa in which soybeans will be grown should be checked for SCN, either by observing roots for presence of the swollen, white SCN females or by collecting soil samples for laboratory testing. The first adult SCN females will appear on roots about 5 or 6 weeks after planting (depending on soil temperature) and can be easily observed on roots through July and August. Soil samples for SCN can be collected any time except when soils are frozen or saturated with water.

Nonhost crops for management

Soybean is the only SCN host crop typically grown in Iowa. The nematode cannot reproduce on corn, alfalfa, or small grains. Because SCN requires a living host to complete its life cycle, population densities will decline in any year that a nonhost crop is grown. In Iowa, SCN population densities decline 5 to 50 percent in a year of corn following soybean. Unfortunately, there is less of a decline in SCN population densities in the second consecutive year of corn, and even less in a third successive corn crop (see Figure 1).

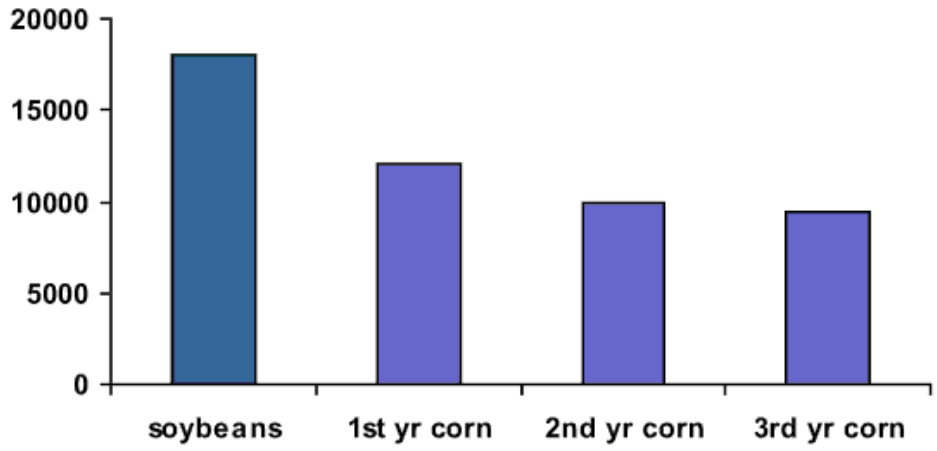


Figure 1. End-of-season SCN population densities (eggs per 100 cc soil) in a continuous corn cropping sequence following a soybean crop.

SCN-resistant soybean varieties

Another very effective management tactic providing profitable yields and preventing increases in SCN population densities is the use of SCN-resistant soybean varieties (see Figure 2). Resistant varieties are not immune; they allow a reduced amount of SCN reproduction to occur. Several soybean lines are used as sources of SCN resistance in breeding programs, including 'PI 88788', 'Peking', and 'PI 437654' (also referred to as 'Hartwig' resistance and 'CystX'® resistance). There are more than 700 SCN-resistant soybean varieties available to Iowa soybean growers in maturity groups 0, 1, 2, and 3, but only 3 percent contain a source of resistance other than PI 88788.

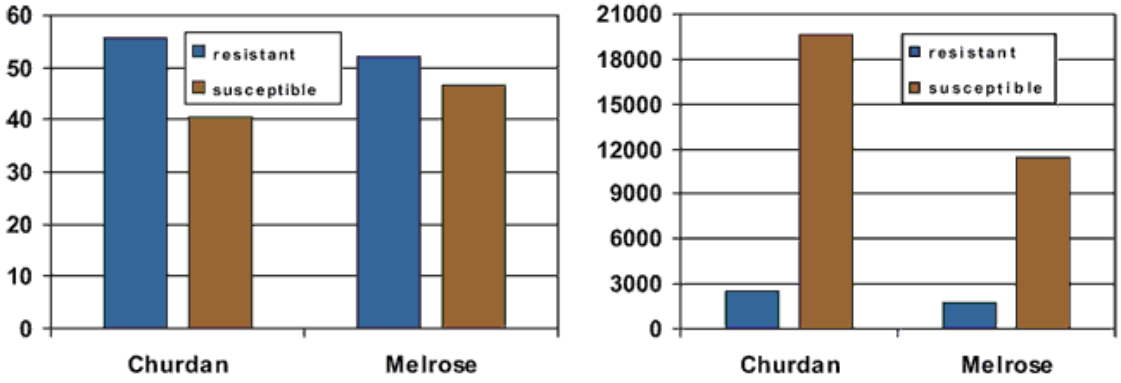


Figure 2. Typical, average yields and end-of-season SCN population densities for SCN-resistant and -susceptible varieties in a location of the ISU SCN-resistant Soybean Variety Trial program (Churdan and Melrose, 2006).

Because resistance is not immunity and a small amount of SCN reproduction occurs, it is important to try to use different sources of resistance to reduce the chance of the SCN population becoming resistant to the resistance. If growing soybean varieties with different sources of SCN resistance is not possible, growing different varieties with the common PI 88788 source of SCN resistance is advised.

SCN-resistant soybean varieties vary in yield and also in ability to suppress SCN reproduction. Due to the effect of environment, both yield and SCN control offered by SCN-resistant soybean varieties can only be assessed in the field. The Iowa State University SCN-resistant Soybean Variety Trial program evaluates varieties for yield and SCN control in multiple locations throughout Iowa each year and results are available online at www.isuscntrials.info. Single copies of the 2006 Iowa State University SCN-resistant Soybean Variety Trial program results (ISU Extension publication IPM 52) can be obtained free of charge from county extension offices or from the Iowa State University Extension Distribution Center by calling (515) 294-5247. Consult the article titled SCN-resistant soybean varieties: Not all are created equal in the last issue of Integrated Crop Management for a more in-depth discussion of SCN-resistant soybean varieties.

Current research

There are many areas of research being pursued with SCN. Basic research is underway at the cellular and molecular levels to understand the factors that influence SCN egg hatching and the mechanisms by which SCN juveniles establish feeding sites formed of live cells in the vascular tissue of soybean roots. Other work is underway to clone SCN-resistance genes to allow more efficient development of SCN-resistant varieties and to determine the exact mechanism for resistance to SCN in soybeans. Soybean breeders are searching for additional sources of SCN resistance to complement the common PI 88788 SCN resistance source. Considerable effort also is being put forth to understand the genetic mechanisms that allow some SCN juveniles in populations to feed and mature on SCN-resistant soybean varieties. On a larger scale, research is underway to understand how SCN infection makes plants more susceptible to infection by soilborne pathogens that cause brown stem rot and sudden death syndrome and how SCN can negate soybean resistance to brown stem rot. Researchers also are beginning to explore how SCN parasitism possibly affects soybean aphid feeding on soybeans. Much of the work on interactions of SCN with brown stem rot, sudden death syndrome, and soybean aphids is occurring at Iowa State University and is supported by soybean checkoff funds from the Iowa Soybean Association

Summary

SCN continues to be a very widespread, prolific, long-lived, and damaging pest of soybeans that often does not cause obvious aboveground symptoms of damage. Nonhost crops, such as corn, and SCN-resistant soybean varieties are available for successful management of the pest. But SCN-infested fields need to be identified while SCN population densities are controllable, and management efforts must be sustained and focused on minimizing the build up of SCN population densities in addition to maximizing soybean yields. Additional information about SCN biology and management can be found on the Web at www.soybeancyst.info.

Greg Tylka is a professor of plant pathology with extension and research responsibilities in management of plant-parasitic nematodes.

This article originally appeared on pages 64-65 of the IC-498 (3) -- March 26, 2007 issue.

Updated 03/27/2007 - 3:00pm