AGRONOMIC Spotlight

Technology Development by MONSANTO

Soybean Cyst Nematode

Soybean cyst nematode (SCN) has been estimated to have reduced soybean yields on average in the United Stated by over 159 million bushels annually. Yield loss can occur with or without visual symptoms. Soil sampling can help identify population levels and management options.

Symptoms

Yield loss is one of the primary symptoms of SCN and under good growing conditions it can occur without many visual symptoms. Symptoms such as stunted plants, yellow ovals in fields, and stand loss are more common with poor growing conditions such as drought, heat, poor fertility, or other conditions causing plant stress (Figure 1). If soybean roots are dug carefully, adult females may be visible (Figure 2). They are considerably smaller than nitrogen fixing nodules.

Figure 1. Severity of visual symptoms from SCN varies greatly from none (upper left), to areas of chlorotic (yellow) and stunted soybean plants (lower right), to stand loss (upper right).

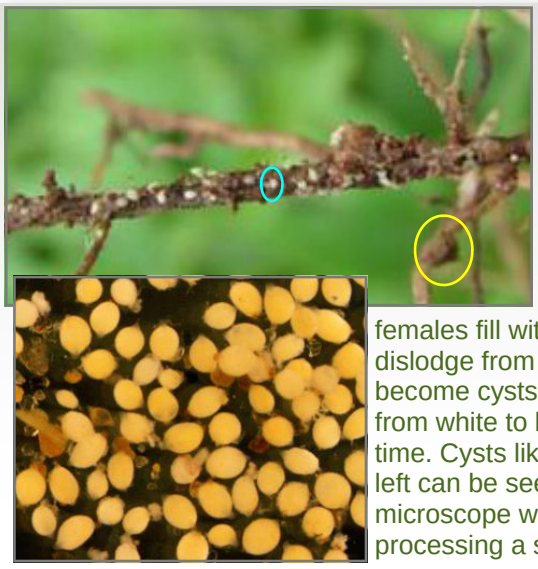

Figure 2. SCN white females (circled in blue) are smaller than nitrogen nodules (circled in yellow). White females fill with eggs, dislodge from the root, become cysts and darken from white to brown over time. Cysts like those to the left can be seen under a microscope when processing a soil sample.

How Does SCN Cause Loss of Soybean Yield Potential?

SCN limits yield potential by demanding energy and nutrients that are needed for plant and seed development and also by inhibiting root growth, which further limits moisture and nutrient availability. There are also interactions between SCN and other soil-borne diseases. SCN creates additional entry points for soil-borne pathogens that cause diseases such as Sudden Death Syndrome (SDS), Brown Stem Rot (BSR), Pythium, Rhizoctonia, Phytophthora, and Charcoal Rot. Plant diseases and SCN can exist independently, and because one is present does not dictate that the other will become an issue. Soybean roots inherently have cracks or fissures and other entry points for soil-borne pathogens. SCN simply makes more entry points and creates stress on the soybean plant that can make it more susceptible to other pathogens. If SCN is present, diseases such as SDS and BSR tend to affect the soybean plants earlier and to a greater degree compared to in the absence of SCN.

Between competing for energy and nutrients, limiting water and nutrients, and the interactions with other pathogens, loss of yield potential can be significant. Figure 3 outlines potential yield loss of a soybean variety susceptible to SCN under different SCN populations.

Figure 3. Potential yield loss of an SCN susceptible variety exposed to various SCN population levels.

Eggs per 1/2 Pint of Soil	Eggs per 100 cc of Soil	Potential Yield Loss of Susceptible Variety
0	0	0%
1-500	1-182	0% to 5%
501-1000	183-363	5% to 15%
1001-3000	364-1090	15% to 20%
3001-5000	1091-1816	20% to 40%
5000+	1816+	25 to 60%

The information for eggs per 1/2 pint of soil are from '2010 SCN Management Recommendations for Kentucky', while the conversion for eggs per 100 cc of soil were done for the purpose of this publication.

Sampling for SCN

Timing. Samples can be taken any time the ground is not frozen.

to pg. 2

from previous page

Soybean Cyst Nematode

Ideally the ground should not be muddy or extremely moist either. Samples should be taken as close to harvest as possible to allow time for processing and making management decisions. For efficiency, SCN samples can be taken at the same time as soil fertility samples; however, they should not be treated the same after they are taken. Generally, soil fertility and SCN soil samples should be taken every 3 to 4 years.

Pattern vs. Targeted Location. If the goal is to get a general evaluation of SCN levels in a field, it is often recommended to collect sub-samples in a zig zag pattern. The number of acres that each sample should represent depends on the variability of the field. Different soil types or field conditions should be sampled separately.

If the goal of sampling is to target an area where there is a suspected high level of SCN damage, it is recommended to sample near the edge of the area. The center of the high damaged areas can produce lower than expected SCN numbers since the SCN may have injured the soybean plants to the point that SCN could not sustain life, thereby increasing the odds for an artificially low number of SCN in the lab results.

Care of the Samples. Once the sample is taken, it should be placed in a plastic bag and labeled. It should be kept cool and out of direct sunlight. If the samples are mailed, they should be sent at the beginning of the week to avoid hot storage conditions over the weekend.

Interpreting SCN Sample Results

It is important to determine if the results are in terms of eggs, juveniles, or cysts. Additionally, it is important to make sure that the soil test results and recommendations for management options are both based on the same volume of soil.

Management Options Discussed

- SCN eradication is not likely. Once present, the goal becomes to manage the populations to help minimize loss of yield potential.
- If SCN is present, several management tools (such as crop rotation, alternating resistant varieties, weed control, and good general agronomics to help minimize stress) should be used to help manage the population.
- Planting resistant varieties is an essential tool to manage SCN (Figure 5). However, it is important to remember that SCN resistance does not mean the varieties are unaffected by SCN.
- If populations are greater than 10,000 eggs per 100 cc of soil, corn (or other non-host crop) should be planted.
- When a non-host crop is planted, SCN populations can decrease 10% to 40% in northern geographies, 50% to 80% in southern Midwest, and up to 90% in southern geographies.
- Rotating sources of resistance is often recommended but is generally not feasible due to the lack of alternative sources of resistance. More than 95% of SCN resistant varieties are derived from PI 88788. Other sources of resistance, such as Peking are often associated with unfavorable agronomics and yield potential. Some University extension agents even recommend alternating varieties derived from PI 88788.
- The increased knowledge of the biology of SCN has encouraged the adoption of categorizing SCN populations by HG Types instead of races.
- Most seed guides still describe SCN resistance of commercial varieties in terms of races to which they are resistant for ease of communication.
- If the SCN populations in a field shift and the most predominant populations are not managed with PI 88788, the options for productively growing soybeans are limited at this point and corn or another non-host crop is likely the best option.

Figure 4. The susceptible variety is on the left and the resistant variety is on the right. Note the oval area in the susceptible variety where the soybeans are stunted and chlorotic due to SCN pressure.

Sources:

Wrather, J.A. and S. R. Koenning. 2009. Effects of diseases on soybean yields in the United States 1996 to 2007. Plant Health Progress doi:10.1094/PHP-2009-0401-01-RS.

Wrather, J.A. and Koenning, S. R. Compile Estimates of Soybean Yield Suppression by Diseases in the U.S. during 2009. United Soybean Board Domestic Programs Final Report. Word file from Aaron Robinson.

Niblack, T.L. et. al. Soybean Cyst Nematode Management Guide. Fifth Edition. United Soybean Board.

Chen, S. et. al. 2001. The Soybean Cyst Nematode. University of Minnesota Extension. FO-03935-S. http://mn4h.com (verified 8/11/2010).

Hershman, D.E. 2010. 2010 Soybean Cyst Nematode (SCN) Management Recommendations for Kentucky. University of Kentucky Extension. PPFS-AG-S-24. http://www.ca.uky.edu/ (verified 8/11/2010).

Niblack, T.L., P.R. Arelli, G. R. Noel, C.H. Opperman, J.H. Orf, D.P. Schmitt, J. G. Shannon, And G. L. Tylka. 2002 A revised classification scheme for genetically diverse populations of Heterodera glycines. Journal of Nematology 34:279-288.

Riggs, R. D., and D. P. Schmitt. 1988 Complete characterization of the race scheme for Heterodera glycines. Journal of Nematology 20:392-395.