Soybean Cyst Nematode – Part I - Understanding the Problem

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Soybean cyst nematode (SCN) *Heterodera glycines,* is a serious yield-limiting problem most everywhere soybeans are grown, which, since 2003 includes North Dakota and northwestern Minnesota. Richland, Cass and Dickey counties in North Dakota and adjacent counties on the east side of the Red River in Minnesota have confirmed infestations of SCN (**Figure 1**). NDSU collaborated this fall with the National Agriculture Statistics Service and the North Dakota Soybean Council to conduct a survey of field in ND to determine the extent of SCN infestations. Soybean acres in ND have grown dramatically in the last decade and in some cases growers have been planting soybeans in successive years. The colder conditions in the north do not appear to limit the distribution of SCN and it's likely to continue traversing soybeans acres. SCN is forecast to spread rapidly based on several unique characteristics of crop production systems in the Red River Valley (RRV):

1. Frequent flooding of the Red River and tributaries and resulting movement of infested soil.
2. In southern states, warm fall and winter temperatures favor beneficial parasites of SCN but cold temperatures in the north significantly reduce their activity.
3. High soil pH is associated with a more rapid increase in nematode populations.
4. Management practices that favor movement of soil between fields, particularly in crops where equipment is used in many fields throughout the season.
5. Continuous planting of susceptible soybean varieties or other crops.

Because SCN is just getting a foothold in the RRV, it is essential to monitor fields to determine the presence of SCN and implement an integrated management approach to delay the severity and spread of SCN infestations. SCN are first visible on soybean roots beginning 4-5 weeks after planting but roots should be examined around flowering when female SCN are most abundant. Young female SCN are attached to roots and usually lemon-shaped with white or yellow color. SCN can be distinguished from nitrogen-fixing nodules (**Figure 2**) by size, shape and color (nodules have pink interior). Once the female dies, the body becomes a cyst, acquires a dark brown color and separates from the soybean root. The cyst provides protection for the eggs and serves as the survival mechanism in the soil. Eggs within a cyst have been shown to retain viability for more than 9 years. Juvenile nematodes are only able to move a few inches in the soil but cysts are moved with soil by equipment, vehicles, flood water, birds and other wildlife, wind &dust, etc. constituting the major dispersal mechanism for SCN.

Soil sampling to determine the presence and severity of SCN should occur as soon after soybean harvest as possible to help determine rotation or variety selection for the next season. SCN will be most prevalent in soybean rows and most likely in patches in the field. Sampling near field entry points and in a zigzag pattern throughout the field from 20 sites/10 acres should provide a reasonable evaluation of SCN status in a field. Sampling a field for the first time should focus on the field entrance, fence rows, areas with poor weed control or high pH or where soybean yield was low the last time soybeans were grown in the field. Soil sampling is critical to success and there are several of sources of information outlining the correct procedures (http://www.planthealth.info/pdf_docs/SCN_Management.pdf; http://www.soybeans.umn.edu/pdfs/DC3935.pdf;

http://www.extension.iastate.edu/Publications/PD32.pdf). Samples can be sent to the University of Minnesota Nematology Lab in Waseca, MN or other University and commercial labs that are capable of nematode analysis. SCN sample forms and soil sampling procedures are available at: http://sroc.cfans.umn.edu/FormsTrialResults/index.htm .

The University of Minnesota recommends a crop rotation that alternates susceptible soybean varieties with a non-host crop if SCN egg counts are less than 10,000 eggs/100cm^3 of soil. Once egg densities exceed this threshold, the recommendation is for use of SCN resistant soybean varieties in rotation with multiple years of non-host crops to reduce egg densities below the threshold (**Figure 3**). Keep in mind that SCN soil sampling results can be highly variable due the small size and clustering behavior of SCN which may be missed by a typical soil probe which has a one inch diameter. Slight differences in soil probe placement can dramatically change results. Samples in suspected hotspots should be taken in between healthy and severely damaged plants, primarily because dead or severely stunted plants won't support SCN or show artificially low numbers.

Frequently, SCN damage goes unnoticed, primarily because high fertility and adequate moisture mask symptoms of SCN or symptoms may represent other stress factors. Most often the only indication of damage is reduced yield. Chlorosis, stunting and lack of canopy closure may indicate the presence of SCN but could also be iron deficiency chlorosis, nitrogen or potassium deficiency, soybean aphid feeding, soil compaction, drought or herbicide stress or other soybean diseases. Aerial or remote sensing images can help identify areas of stress or concealed stress from SCN infestations. Severe SCN symptoms may appear as round or elliptical patterns in a field. In addition, symptoms may follow the direction of tillage, field entry points, fence rows or areas of flooding. Soil sampling after harvest is the best method to confirm the presence of SCN.

SCN create entry points for other diseases, reduce root growth which limits water & nutrient uptake or interfere with nodulation. Yield reduction can be compounded by the interaction between SCN with Fusarium root rots, Sudden Death Syndrome and Brown Stem Rot which increases the potential severity of these diseases. Soybean aphids have been shown to be attracted to soybeans with low leaf concentrations of potassium.

Soybean producers will have to face the continuing threat from SCN in the RRV and northwestern MN such that routine soil sampling for SCN every few years will become a standard practice to maintain a high yield environment and productivity. Managing SCN today requires sound crop rotation plans integrating non-host crops between susceptible crops like soybeans and monitoring vigilance to keep SCN at bay.

Figure 1. SCN distribution in November 2008.

Source - North Central Soybean Research Program (NCSRP) Plant Health Initiative.

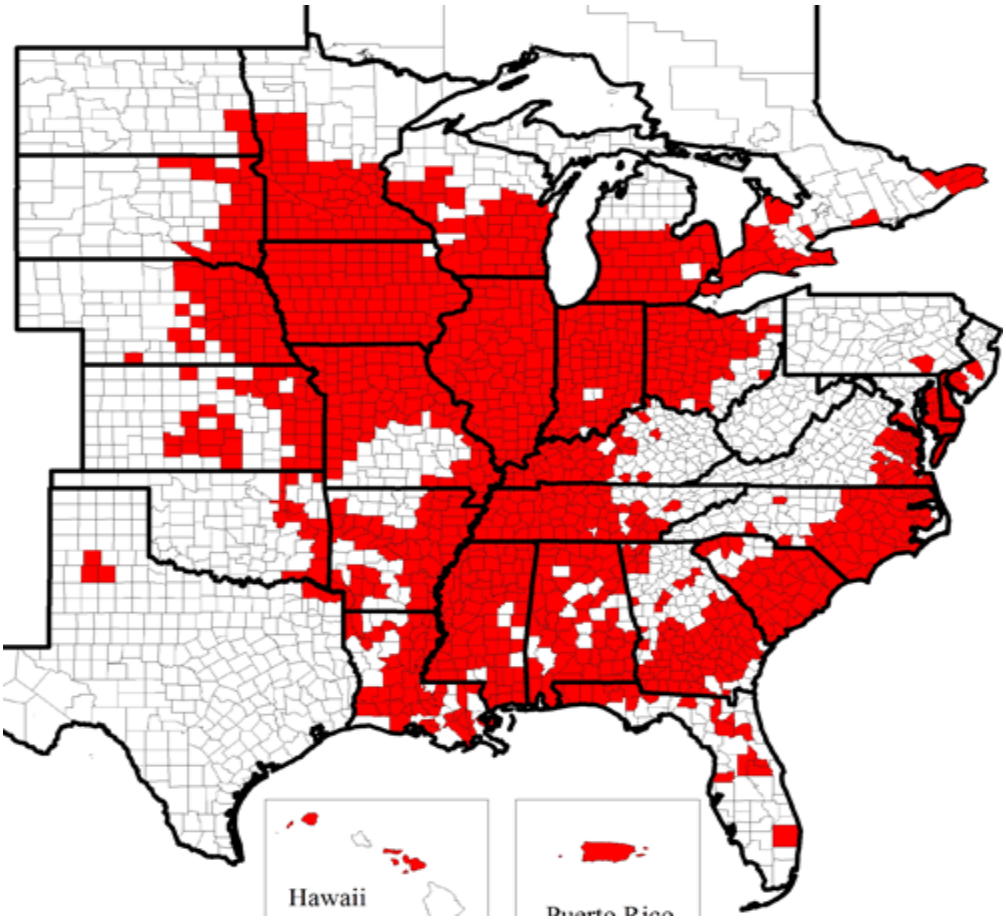
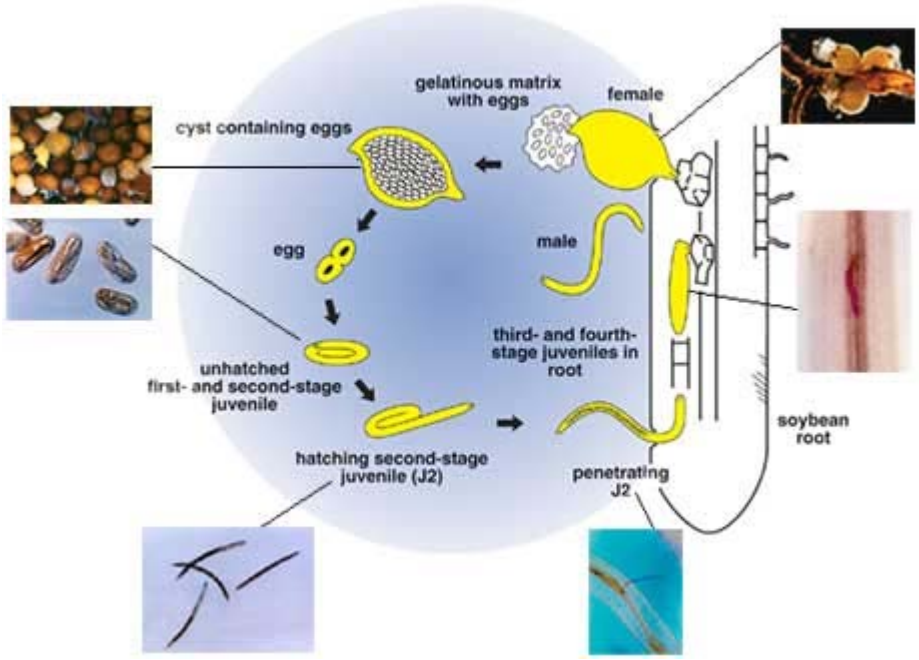


Figure 2. Soybean plant with Rhizobium root nodule and female nematodes

Photo by J. Obermeyer Purdue University

http://extension.entm.purdue.edu/fieldcropsipm/insects/nematode.php

Figure 3. Lifecycle of the soybean cyst nematode. (Sketch by Dirk Charlson, Iowa State University).



Source – The Soybean Cyst Nematode UMN Extension publication FO-03035-S by S. Chen, J.E. Kurle & D.A. Reynolds.

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