

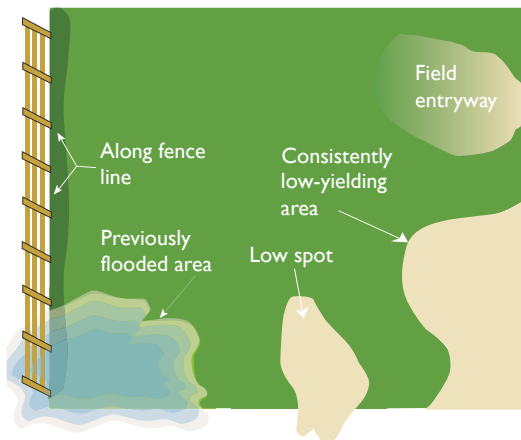
SCOUTING

A photograph showing a person's legs and feet in a soybean field. The person is wearing dark shorts, white socks, and white sneakers with orange accents. They are using a shovel to dig in the dark soil between rows of young green soybean plants. The word "SCOUTING" is overlaid in large white letters across the center of the image.

Scouting for SCN by checking soybean roots or collecting soil samples is the first step in managing SCN.

There are areas where SCN is more likely to be first discovered in a field. These are:

- Near a field entrance
- Areas that have been flooded in the last decade or so (had soil introduced)
- Alkaline areas (soil pH greater than 7)
- Areas where weed control isn't good
- Areas where yield seemed to be low when soybeans were last grown
- Along fence lines where wind-blown soil accumulates



Checking these “high risk” areas may be an efficient way to focus initial scouting efforts.

LOOKING FOR SCN FEMALES

Digging roots to look for SCN females is very simple. Just dig – don't pull. Pulling plants from the soil will strip the SCN females from the young roots.

The first SCN females usually will appear on roots four to six weeks after planting. Females may take longer to appear on roots if spring weather is cool and/or wet.

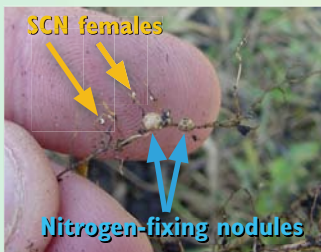
Once a clump of plants with roots and soil has been removed through digging, carefully shake or crumble off much of the adhering soil and look closely on fine roots for adult SCN females. As the season progresses, dig deeper and farther from the soybean row to get to young, healthy roots.

The adult SCN females will appear as small, round objects on the younger roots. SCN females are creamy white, but turn yellow to tan to brown over the course of several days.



Adult SCN females on root.

Adult SCN females are about the size of a period at the end of a sentence, and are much smaller and lighter colored than nitrogen-fixing nodules. Nitrogen-fixing nodules are the same color as the roots and will grow to be much larger than SCN females.

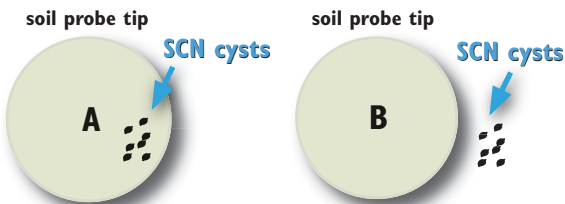


COLLECTING SOIL SAMPLES

Exactly when and how to collect a soil sample for SCN analysis depends on your specific purpose. Soil samples can be collected to determine if SCN is present in a field or to determine if SCN is causing stunting and/or yellowing of a soybean crop. You can also use soil sample results to determine if your SCN management plan has kept the SCN population in check.

SCN cysts are very small and are usually clustered in the soil, making soil sample results notoriously variable.

With a typical 1-inch-diameter soil probe, random placement of the probe into the soil can have a tremendous effect on how many egg-filled SCN cysts are recovered, as illustrated below.



In the diagram above, soil probe A captures a cluster of seven SCN cysts (not drawn to scale) that may contain 1,500 eggs. The placement of soil probe B is only 1/2-inch different than the placement of soil probe A and it misses the seven SCN cysts, resulting in up to 1,500 fewer eggs being present in the soil core.

Soil must be collected from many different places within the sampling area. Limit the area represented in a single sample, ideally, to no more than 20 acres.

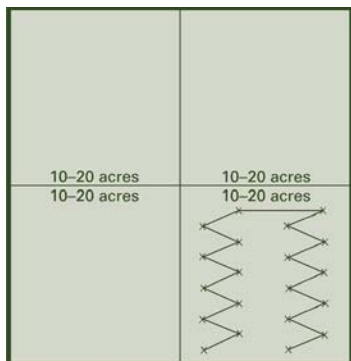
- Use a soil probe or soil tube to collect cores.
- Mix multiple soil cores very well before placing mixed soil into a bag.
- Keep soil samples at room temperature or cooler until shipped.
- Send samples to a private soil testing laboratory for analysis or send to:

Plant and Insect Diagnostic Clinic
327 Bessey Hall, Iowa State University
Ames, IA 50011

Laboratories may report SCN sample results as the number of cysts, eggs or juveniles (refer to pages 24-25) per 100, 250 or 500 cm³ of soil. When comparing SCN soil sample results from different laboratories, be sure the same volumes of soil and the same SCN life stages are compared. A result of 500 cysts per 100 cm³ is a much greater SCN population density than 1,000 eggs per 250 cm³ soil (each cyst may contain as many as 200 or more eggs; 250 cm³ is 2½ times more soil than 100 cm³).

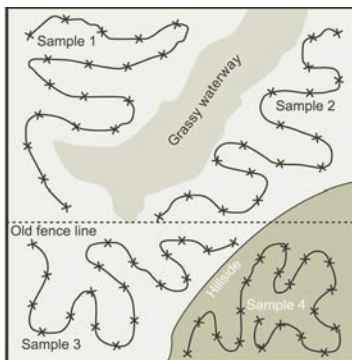
Determining if SCN is present in a field:

- Collect soil samples anytime in the fall or spring.
- The more soil collected and the smaller the area sampled, the more accurate the results.
- Soil cores should be collected from the upper eight inches of soil.
- If corn or another nonhost crop was last grown in the field, it doesn't matter if soil cores are collected from underneath the previous crop rows or not.
- It is better to collect soil cores after a previous corn crop's rows have been destroyed by tillage.
- If soybeans were last grown in the field, collect soil cores from under the old crop rows if possible.



- If sampling conventionally (not grid sampling), collect 15 to 20 soil cores in a zig-zag pattern from no larger than a 20-acre parcel of land.
- If grid sampling, collect one or two soil cores from every grid cell sample and combine these extra cores from the number of cells that represent approximately 20 acres.

The parcels of land represented by the soil cores need not be square or rectangular areas. Divide fields for sampling according to obvious agronomic features.



Determining if SCN is responsible for stunting and/or yellowing:

- Angle the soil probe underneath the row of soybeans into the root zone.
- Soil cores should be collected from the upper eight inches of soil underneath the row.
- Collect 15 to 20 soil cores from underneath stunted and/or yellow plants.



Collecting a soil core from under a soybean row.



Multiple soil cores representing an area must be mixed thoroughly.

Assessing SCN population densities to monitor management:

- Collect soil samples in the spring, before soybeans are planted, or in the fall after the previous crop has been harvested.
- Take note of specific sampling details to refer back to when samples are again collected (areas sampled, numbers of cores, sampling time, before or after a soybean crop, laboratory that processed the samples, etc.).
- The more soil collected and the smaller the area sampled, the more accurate results you can expect.
- Soil cores should be collected from the upper eight inches of soil.
- If corn or some other nonhost crop was last grown in the field, it doesn't matter if



Sampling a harvested soybean field for SCN.



Soil cores should be eight inches deep.

soil cores are collected in the previous crop's row.

- It is better to collect soil cores after the previous corn or other nonhost crop's rows have been destroyed by tillage.
- If soybeans were last grown in the field, collect soil cores from under the old crop rows.
- If sampling conventionally (not grid sampling): collect 15 to 20 soil cores in a zig-zag pattern from no larger than 20 acres.
- If grid sampling: collect one or two soil cores from every grid cell sample and combine these extra cores from the number of cells that represent approximately 20 acres.



Multiple soil cores representing an area must be mixed thoroughly before filling a bag to send to a processing laboratory.

SOIL SAMPLE RESULTS

Cysts vs. eggs

It is important to know what life stage of SCN is reported when a soil sample is analyzed. The Iowa State University Plant and Insect Diagnostic Clinic and most other soil test labs in Iowa count and report the number of SCN eggs. But some labs report numbers of SCN cysts or juveniles in the soil (Page 25).

Cyst and egg counts generally correlate well and cyst counts can be loosely converted to egg counts by multiplying the cyst count by 125, which is the average number of eggs per cyst in naturally infested field soil. Juveniles typically are short lived and their numbers are not as informative as numbers of cysts or eggs.

Low vs. medium vs. high egg counts

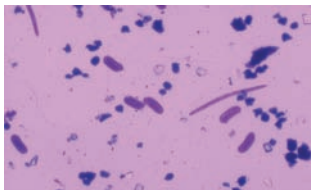
Egg counts can vary greatly depending on the extraction procedure used by the laboratory. There are no industry standards for procedures to extract SCN from soil samples. Never compare numbers from samples processed by different laboratories.

Also, the numbers of eggs considered to be low, medium or high depend on whether soybeans will be grown as the next crop.

Life Stages of SCN Counted from Soil Samples

Stained SCN eggs

SCN egg counts are an important indicator of the level of infestation. Almost all SCN field research is based on SCN egg counts.



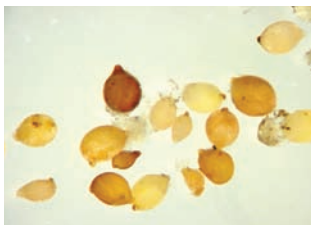
SCN juveniles

SCN juvenile counts fluctuate greatly and are not as informative as cyst or egg counts.



SCN cysts

Cysts are dead females full of eggs. Cyst counts correlate well with egg counts.



For soil samples processed by the Iowa State University Plant and Insect Diagnostic Clinic:

If soybeans are the next crop to be grown

Low	= 1 – 2,000 eggs per 100 cm ³ soil
Medium	= 2,001 – 12,000 eggs per 100 cm ³ soil
High	= >12,000 eggs per 100 cm ³ soil

If soybeans are NOT the next crop to be grown

Low	= 1 – 4,000 eggs per 100 cm ³ soil
Medium	= 4,001 – 16,000 eggs per 100 cm ³ soil
High	= >16,000 eggs per 100 cm ³ soil

Warning: Fields may be infested with SCN even if soil sample results are zero.

Up to 25 percent of soil samples with zero egg counts are infested with SCN. Two possible explanations for “false negative” soil sample results are:

- Soil cores were not collected from spots in the field where cysts were present.
- Cyst and egg extraction procedures were not 100 percent effective.

If soil sample results are zero, follow-up soil sampling is recommended to check for SCN infestations in future years.

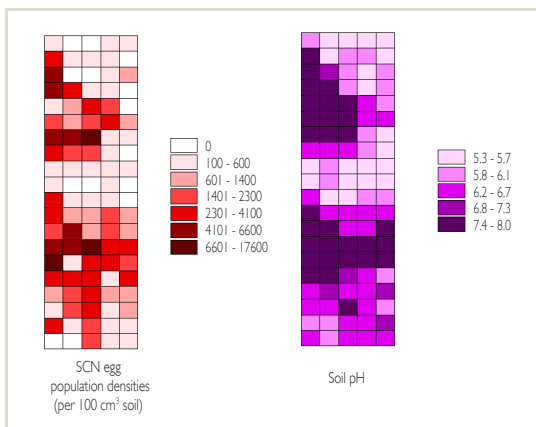
SCN AND SOIL FACTORS

It is possible that many soil factors may affect SCN reproduction and soybean yield loss, but only two soil factors are commonly associated with SCN damage and population densities – soil texture and soil pH.

SCN is capable of infesting soils of all textures, but symptoms and yield loss generally are greater in sandy soils than medium- and fine-textured soils. SCN-infected roots are stunted and lack fine roots and, thus, can explore much less soil for water and nutrients than healthy roots. Also, coarse-textured soils do not hold water and some nutrients as well as medium- or fine-textured soils, and SCN seems to cause greater damage to plants stressed by other factors, such as lack of water and/or minerals. There is no scientific evidence that SCN reproduces better in sandy soils.

Soybean damage due to SCN is frequently misdiagnosed. Reduce your risk of loss by submitting soil samples for professional diagnosis.

In the mid 1990s, it was discovered that there is a consistent relationship between SCN population densities and soil pH. Greater SCN population densities are consistently found in areas of fields with higher pH. The relationship occurs over a wide range of soil pH – from pH 5.5 to 8.0. It is not clear if SCN population densities would decline if soil pH was lowered.



SCN egg population densities (per 100 cm³ soil, left) and soil pH (right) in 100 half-acre cells in a soybean field in Dallas County, Iowa. Note the consistent occurrence of higher SCN population densities in cells with higher soil pH.