



Extension FactSheet

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Soybean Cyst Nematode

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Soybean cyst nematode (SCN) was first identified in Ohio on soybean in 1987. Subsequent surveys have found SCN in 47 counties as of August 1998. This nematode damages soybeans by feeding on plant roots, robbing the plants of nutrients, and providing wound sites for root rotting fungi to enter. The severity of symptoms and yield losses are dependent on several factors including the number of nematodes present in the field at planting, the soybean variety, soil texture, fertility, soil moisture, and tillage practices. Many fields in Ohio show no obvious above ground symptoms, but do have some yield reductions. Once soybean cyst nematode has become established in a field, it rarely is eradicated. The first step in management of soybean cyst nematode is to determine which fields have soybean cyst nematode present and how many nematodes are there.

Symptoms

Soybean cyst nematode injury can be easily confused with other crop production problems such as nutrient deficiencies, injury from herbicides, soil compaction, or other diseases. When there are high populations of nematodes present on lighter soils, symptom development can be quite severe. Circular to oval patches of stunted, yellowed plants develop in late July or August. Affected areas may increase in size each year, usually in the direction of tillage. In heavier soils, plants may appear stunted in patches or fields may produce less than the desired yields.

Field symptoms are usually not seen immediately following introduction of the nematode. As low levels of nematodes in the soil do not cause visible symptoms, several years may be necessary before populations are high enough to cause obvious injury. During July, young females can be found clinging to the sides of soybean roots. Roots must be gently dug from the soil; the soil gently

shaken off and the roots examined closely to see the bright white to yellow females on the roots. (Figure 1).

The Nematode Life Cycle

The soybean cyst nematode, *Heterodera glycines*, is a microscopic (1/64 inch long) roundworm that feeds on soybean roots. The cyst stage is the body of the dead, female nematode filled with eggs. This cyst is highly resistant to adverse conditions and serves to protect the eggs and young nematode larvae for many years.

There are three major life stages of cyst nematodes: egg, juvenile, and adult. Under favorable conditions the life cycle can be completed in 24 to 30 days. The juveniles hatch from eggs and search for soybean roots. However, the juveniles can move only short distances through the soil before entering the root, and if no root is found the nematode dies shortly from lack of food. After penetrating the root, the nematode feeds on cells in the vascular tissue. It secretes digestive enzymes that stimulate the development of enlarged cells, called syncytia, that the nematode feeds on.

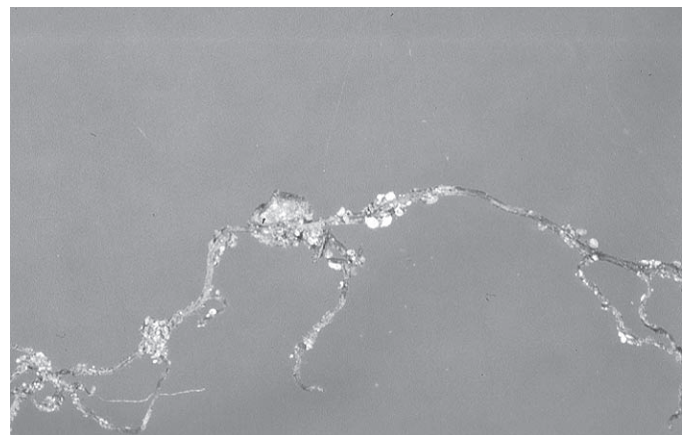


Figure 1. White soybean cyst nematodes feeding on soybean root near a Rhizobium nodule.

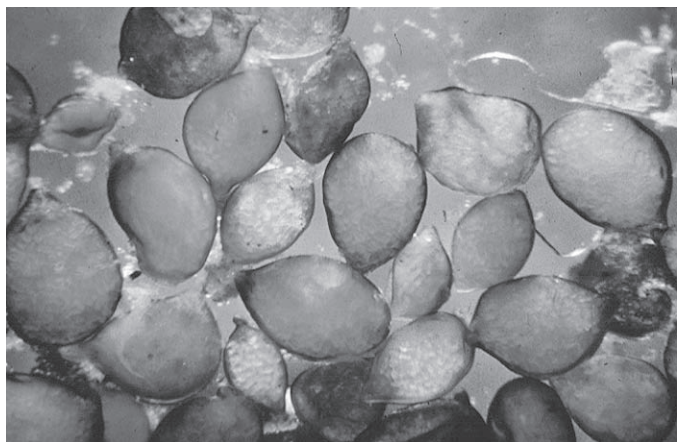


Figure 2. Soybean cyst nematode develops a hard protective covering over the eggs which helps the eggs to survive for a number of years in the soil. These hard cysts can also be transported in the wind and on farm machinery as SCN is spread from location to location.



Figure 3. Symptoms of soybean cyst nematode damage can include stunting as can be seen on susceptible soybean variety on the left compared to a resistant soybean variety on the right.

During this immobile phase, the nematode molts before reaching adulthood, at the last molt the nematode becomes either male or female. The female bodies swell and break through the root surface. The swollen, lemon shaped body is white at first, then it turns yellow and brown in a few days forming the cysts that subsequently

survive for long periods of time in the soil. Males on the other hand, remain slender or worm-like and are mobile. The adult male moves out of the root and mates with the female that has begun egg production.

A cyst may contain 150 to 500 eggs depending on how old the cyst is and how healthy the female was when it

Table 1. Potential population levels of soybean cyst nematode and suggested management strategies for Ohio soybean producers.

Egg Count per 200 cc* of soil	Cyst Count	Population Level	Management Strategies
0	0	None detected	Continue to monitor field after two crops of soybeans
40–200	1	Trace	May begin to measure some yield loss in susceptible varieties at or above 200 eggs/200cc
200–2000	1–4	Low	Plant SCN resistant variety or rotate to a non-host crop. At or above 2000 eggs some yield loss may result on SCN resistant lines
2000–5000	3–20	Moderate	Rotate to a non-host crop next year and return with SCN resistant soybeans the following year
5000 and over	15–20 and over	High	Rotate to a non-host crop for two to three years then sample the soil to determine nematode populations before planting SCN resistant varieties

*200 cc = approximately 1 cup

Table 2. Other hosts of soybean cyst nematode.

<i>Crop Plants</i>	<i>Weed Plants</i>
Aslike clover	Hemp sesbania
Bird's-foot trefoil	Common and mouse-eared chickweed
Green Beans, Dry Beans	Common mullien
Common and hairy vetch	Henbit
Cowpea	Milk and Wood vetch
Crimson clover	Pokeweed
Crown vetch	Purslane
Lespedezas	Spotted geranium
Pea	Wild mustard
White and yellow lupine	Purple deadnettle
Sweet clover	Field pennycress
	Shepherd's-purse

was feeding on its host. Before the female dies, some eggs are deposited outside the body in a jelly-like mass. These begin to hatch in a few days and may continue to hatch for the next several months to a year. Those remaining in her dead body (the cyst) are protected from the elements and may hatch up to 8 years later. Generally, 50 percent of the eggs produced by a female hatch each year, thus the population may drop significantly after several years if there are no susceptible host plants to infect. Eggs survive best under cool, moist conditions. Under moderate soil temperatures (70–80F) the life-cycle can be completed in 21 to 24 days. It is possible, therefore, to have three to five generations each growing season.

Disease Management of Cyst Nematode

1. Identify those fields that have cysts and monitor populations.

The best time to sample fields for soybean cyst nematode is in the fall after the soybeans are harvested. Soybean cyst nematode populations can increase as much as 10 to 30 fold per growing season so early soil sampling may give lower numbers. Soybean cyst nematodes will not be distributed evenly throughout a field. Techniques for sampling soil for SCN by the Soybean Cyst Nematode

Coalition are as follows:

1. Use a one inch diameter soil probe to collect samples (6–8 inches in depth)
2. Following a zig zag pattern, collect 10 to 20 soil cores per 10 to 20 acres
3. Collect cores from areas of similar soil type and crop history
4. Dump cores from each 10 to 20 acre area into a bucket or tub and mix thoroughly
5. Place 1 pint (2 cups) of mixed soil in a soil sample bag or plastic zippered bag and label with a permanent marker; and
6. Store sample in cool, dark place until shipped to lab doing SCN analysis.

This level of sampling is necessary to obtain relatively accurate counts of the nematode population and to make meaningful recommendations for management. Mail samples to:

C. Wayne Ellett Plant & Pest Diagnostic Clinic
Room 110, Kottman Hall
2021 Coffey Road
The Ohio State University
Columbus, OH 43210

The numbers of soybean cyst nematode cysts or eggs found in the soil sample will determine the best management plan for that field. Preplant soybean cyst nematode egg and cyst numbers can give an indication of the potential for yield reduction, but there is no way to predict annual yield loss precisely. Table 1 illustrates several outcomes.

2. Prevent introduction.

This is the first line of defense. Nematodes can move no more than a few inches a year on their own, so they depend on “hitching rides” on tillage, planting, or harvesting machinery, or in soil peds with seed. Clean machinery thoroughly with steam, hot water, or dry heat before moving from infested fields to noninfested fields and plant only seeds that have been thoroughly cleaned to remove soil particles or obtain seed from non-infested SCN locations. SCN can also be introduced into a field by wind-blown dust, animals, or flooding.

3. Rotate crops.

Rotating crops with non-host crops (corn, small grains, alfalfa) may be the most effective method of controlling soybean cyst nematode. Populations typically declined by 50% per year under non-host crops in Ohio. In fields where soybean cyst nematodes are high, grow at least

three years of non-host crops between soybean crops. It should be noted that the nematode will not be eliminated in these fields. If soybeans are repeatedly planted for several years, SCN will again become yield limiting. SCN populations can increase 10 to 30 fold per year on susceptible soybeans. The nematode can reproduce on many legume crops and weeds (see Table 2). Therefore, for the rotation to work, EXCELLENT weed management is vital. In fields with lower population of SCN, two years away from soybeans or a rotation including resistant soybean varieties may be successful.

4. Resistant varieties.

Resistant varieties should be used in crop rotation with non-host crops to prevent the buildup of soybean cyst nematodes in that field. The resistance that is utilized in commercial soybean varieties does not confer immunity. There can be some increase of soybean cyst nematode numbers through the growing season but not as much as if a susceptible variety was planted in that field. Resistant varieties should not be planted in fields with high numbers of nematodes. Doing so may select races of SCN which can reproduce on resistant varieties. Moreover, large

numbers of SCN juveniles will puncture and damage roots of resistant varieties even though they cannot reproduce in them. There are four major sources of resistance to soybeans. The same source of resistance should not be planted repeatedly in the same field to avoid the possibility of selecting races of SCN capable of reproducing on a given source of resistance.

5. Fertility.

Yield losses from SCN are usually greater in low fertility fields; maintain a balanced fertility program based on current soil test. Adequate amounts of potassium and phosphorus are necessary for good root growth and yields. Under high SCN populations, even the most fertile fields will be severely affected, so do not expect fertilization to eliminate the problem.

6. Early planting.

SCN is active in warm soil, so early planting in cool soil will allow establishment of roots before they are attacked by the soybean cyst nematode. This can help the plant withstand nematode damage later in the season during seed development.

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