

Soybean Cyst Nematode in Maryland

What are nematodes?

Nematodes, worm-shaped animals containing most of the body systems found in higher animals, are found in many different environments. Ten percent of known nematode species are parasites of plants.

Plant-parasitic nematodes are thread-like, nearly microscopic, virtually invisible to the naked eye when in the soil or within plant material, and range from 1/50 to 1/8 of an inch (0.2 to 4.0 mm) long with a diameter of about 1/1000 of an inch (30 µm). Because of their size and “hidden” feeding activity, nematode damage cannot always be readily diagnosed.

About Soybean Cyst Nematode

Soybean cyst nematode, SCN (*Heterodera glycines*), first detected in the United States in 1954 in North Carolina, was found in Maryland for the first time in 1980. Since the first Maryland detection, soybean cyst nematode has been found damaging soybean fields in Kent, Queen Anne’s, Talbot, Caroline, Dorchester, Wicomico, Worcester, and Somerset counties on the

Eastern Shore and Charles and St. Mary’s counties west of the Chesapeake Bay.

Due to its severe injury to host plant roots, rapid reproduction and persistence in the soil, the soybean cyst nematode is considered a serious agricultural pest. Although this plant-parasitic nematode is known to survive and reproduce on a number of different hosts, including lespedeza, common vetch, snap beans, lupine and several weed species, soybean is by far the principal favored host.

Ordinarily, the pest population level in the soil increases over several years before it is large enough to cause visible symptoms on the soybean plant. Therefore, observable soybean damage is most likely the result of an infestation that began several years earlier. Rapid buildup of soybean cyst nematode populations is almost exclusively associated with producing successive crops of susceptible soybean varieties in the same fields.

Recognizing the Presence of Soybean Cyst Nematode

If a grower observes poor plant growth in a soybean field, the possibility of soybean

cyst nematode infestation should be considered.

In the field, plant damage is usually worse in light, sandy soils, and increases in soils with low fertility or when drought conditions exist. However, infestations may occur in a wide range of soil types; heavier soils do not necessarily preclude serious plant injury from soybean cyst nematode. Observable symptoms of soybean cyst nematode damage vary depending on the host plant, nematode population level, and certain environmental conditions.

Often, the first symptom of soybean cyst nematode infestation observed in the field is the appearance of more or less

circular patches of plants that exhibit much poorer growth than surrounding areas. These patches can vary in size from a few feet in diameter to an acre or more. If soybean cropping continues from year to year, the patches increase in size, particularly in the direction of cultivation. Typical above ground symptoms are similar to those of plants with a root system malfunction: stunting, yellowing, wilting under moisture stress, and significant reduction in yield.

Life Cycle

One of a group of cyst-forming nematodes (*Heterodera spp.* and related genera), soybean cyst nematodes are



Figure 1. Area of nematode damage in a soybean field. Patchy appearance of plants in a field is considered indicative of nematode injury.



Figure 2. Close-up of soybean cyst nematodes on soybean root.

endoparasites, which enter the root tissue of susceptible plants and feed internally.

The life cycle of the soybean cyst nematode is completed in about one month depending on temperature and host. The generation time (from egg to egg) under field conditions is approximately 24 to 40 days at temperatures of 23 and 18 degrees Celsius (73.4 and 64.4 degrees Fahrenheit) respectively. Therefore, it is possible to have three to six generations in a single cropping year, depending upon location.

After the female dies, the body remains intact and hardens into a tough, leathery sac known as a cyst. As the eggs inside mature and the cyst ages, a progressive color change occurs from white to yellow to light brown and finally to golden or dark brown.

Eggs and juveniles can persist in these cyst bodies for several years until they are stimulated to hatch in the presence of host plants.

Detecting Nematodes in Soil and Plant Samples

Should plant symptoms suggest that nematodes may be responsible for unsatisfactory plant growth, submit soil and plant samples for laboratory examination. Samples may be taken at any time of the year but preferably during active plant growth (May to October).

To ensure proper collection and handling of samples submitted for nematode analysis, refer to the Nematode Diagnostic Laboratory "Sampling Procedures." Forms are available at

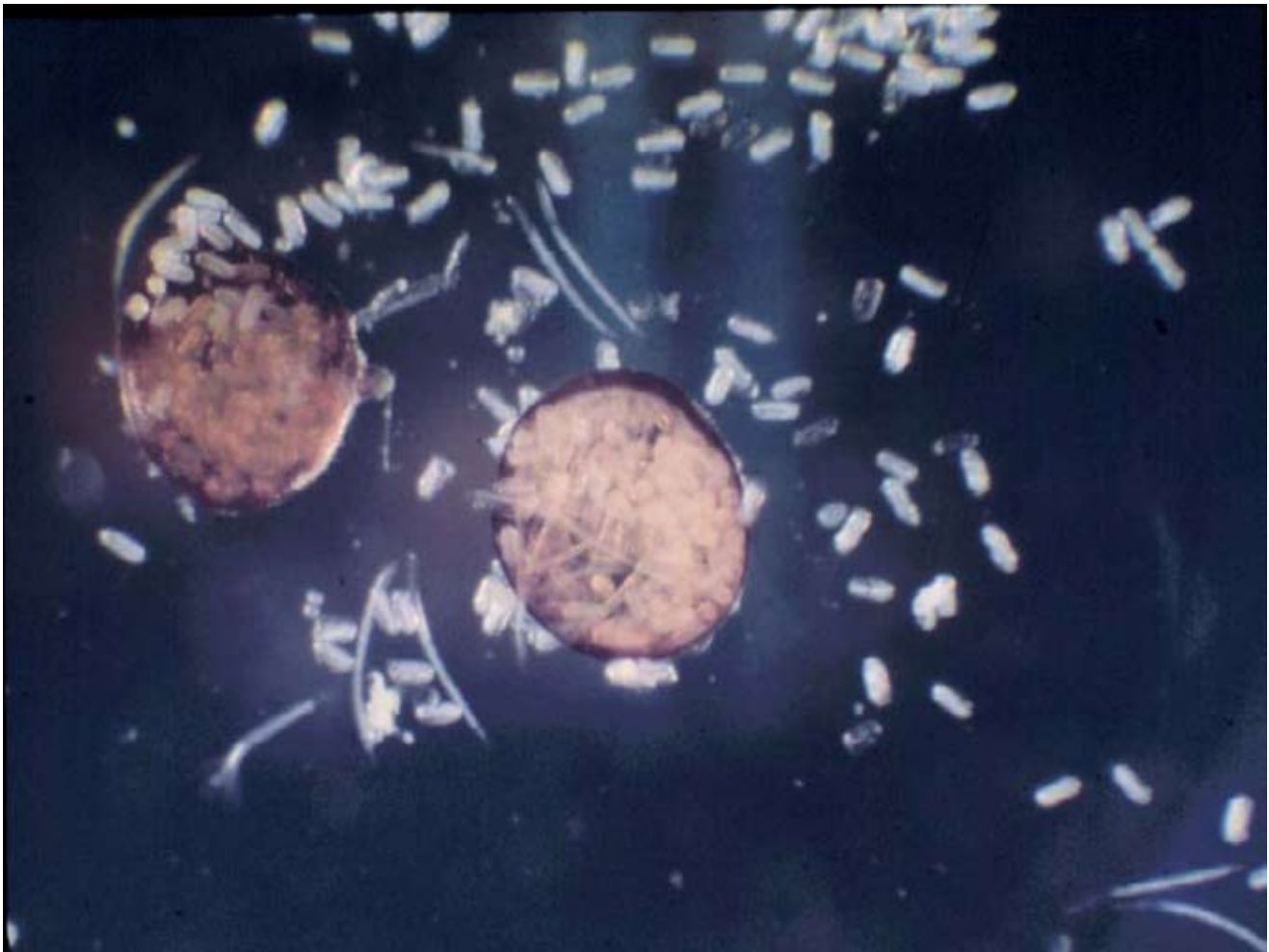


Figure 3. Cyst nematode female bodies surrounded by expressed eggs and juveniles.

county University of Maryland Extension offices.

Samples can be mailed directly to the Nematode Diagnostic Laboratory for analysis.

Soybean Cyst Nematode Management

Management strategies for SCN will be most successful when they are initiated soon after the presence of SCN is detected in a field. The existence of the cyst, containing viable eggs and juveniles, is the single factor that makes the soybean cyst nematode so difficult to control.

Soybean cyst nematode migrates short distances within infected roots or infested soil during the mobile juvenile stage. However, the tough cyst body, besides providing long-term protection for eggs and juveniles, also provides the possibility of long distance dispersal.

Cysts are found in “soil-peds” (aggregates of soil), which adhere to anything that moves through an infested field. Therefore, in order to restrict the spread of soybean cyst nematode to uninfested areas, and to control populations in known infested fields, the following control practices are necessary:

Sanitation measures. Farm machinery and clothing, especially footwear, should be cleaned before moving from a known

infested area to an uninfested site. The movement of contaminated materials, such as nursery plants, root crops and poorly cleaned seed, including any containers used in transport, from an infested area is a primary means of spread for soybean cyst nematode. Because this nematode has a number of weed species as hosts, weed control is an aid in control of nematode population buildup.

Crop rotation. To reduce nematode numbers, a nonhost crop should be planted for several years between the planting of susceptible crops. A non-host crop, particularly corn and small grains minimizes the risk of SCN problem development. The duration nonhost crops should be grown before the next soybean crop is dependent on the nematode population density.

For control of soybean cyst nematode, two, or preferably three years between soybean crops is recommended. However, the value of crop rotation is reduced by the fact that some plants that are resistant to one form of nematode may be completely susceptible to another. Also, the fact that rotation may not be economically acceptable to the grower must be considered. Therefore, any plan for the use of crop rotation as a control method must be designed with the knowledge of the existing nematode population(s) in the field to be planted and the specific crop to be grown.

Resistant varieties. Soybean varieties with resistance to soybean cyst nematode have been developed and are available to growers. These resistant varieties are not severely damaged by the nematode and can reduce the population by literally starving the nematode. Therefore, planting these varieties in problem fields is the most effective and least expensive way to avoid losses. Resistant varieties

will not eradicate the cysts but their use will eliminate the necessity of lengthy rotations and allow the grower to produce crops for which his agricultural operations were designed.

Most available SCN-resistant varieties were developed using the black-seeded line Peking or PI 88788. Some newer resistant varieties are derived from the highly resistant PI437654, which was first available in the public variety 'Hartwig'. Varieties with resistance derived from one source should not be grown continuously in the same field. When resistant varieties are over-used, new strains or races of nematodes may begin to appear. Plant a different SCN-resistant variety each time an SCN-resistant soybean is grown in an infested field.

A list of varieties with resistance to SCN should be available from seed companies. To keep new races from increasing in numbers, susceptible varieties should occasionally be used in rotational plans when SCN populations are low rather than growing resistant varieties continuously. An alternative would be to use a resistant variety for one or two seasons only and rotate with a nonhost crop when feasible.

Crop Hosts

Soybeans, cultivated and wild (*Glycine* spp.)

Beans, green (snap), bush, or kidney (*Phaseolus* spp.)

Birdsfoot-trefoil (*Lotus* spp.)

Clovers, crimson, scarlet, or alsike (*Trifolium* spp.)

Cowpea or black-eyed pea (*Vigna* spp.)

Crownvetch (*Coronilla* spp.)

Lespedezas (*Lespedeza* spp.)

Lupines, white (ornamental species)
(*Lupinus* spp.)
Pea, garden (*Pisum* spp.)
Sweetclover (*Melilotus* spp.)
Vetch, common, hairy, or winter (*Vicia*
spp.)

Weed Hosts

Beggarweed or tick clover (*Desmodium nudiorum*, *D. marilandicum*, *D. viridiflorum*)
Bittercress (*Cardamine* spp.)
Burclover or toothed medic (*Medicago* sp.)
Chickweed, common (*Stellaria media*)
Corn cockle (*Agrostemma githago*)
Dalea (*Dalea alopecuroides*)
Digitalis penstemon (*Penstemon digitalis*)
Field pennycress (*Thlaspi arvense*)
Hemp sesbania (*Sesbania exaltata*)
Henbit (*Lamium amplexicaule*)
Hogpeanut (*Amphicarpa bracteata*)
Hop clovers (*Trifolium* spp.)
Milkpea (*Galactia volubilis*)
Milkvetch, canadia (*Astragalus canadensis*)
Mullein, common (*Verbascum thapsus*)
Pigweed, winged (*Cycloloma atriplicifolium*)
Pokeweed (*Phytolacca americana*)
Purple deadnettle (*Lamium purpureum*)
Purslane (*Potulaca oleracea*)
Rocky Mountain beeplant (*Cleome serrulata*)
Shepherd's-purse (*Capsella bursa-pastoris*)
Sicklepod (*Cassia obtusifolia*)
Spotted geranium (*Geranium maculatum*)
Toadflax, old-field (*Linaria canadensis*)
Vetch, American, Carolina, or wood (*Vicia micrantha*)
Wildbean (*Strophostyles helvola*)

Ornamental Plant Hosts

Locust, black (*Robinia* spp.)
Bells of Ireland (*Molucella laevis*)
Borage (*Borago* spp.)
Canarybird flower (*Tropaeolum* spp.)
Caraway (*Carum* spp.)
Chinese Lanternplant (*Physalis* spp.)
Coralbells (*Heuchera* spp.)
Cup-flower (*Nierembergia* spp.)
Delphinium (*Delphinium* spp.)
Foxglove (*Digitalis* spp.)
Geranium (*Geranium* spp.)
Geum (*Geum* spp.)
Horehound, common (*Marrubium vulgare*)
Poppy (*Papaver* spp.)
Sage (*Salvia* spp.)
Snapdragon (*Antirrhinum* spp.)
Sweet basil (*Ocimum* spp.)
Sweet pea (*Lathyrus* spp.)
Verbena (*Verbena* spp.)

Resistant Varieties

*See University of Maryland Soybean Breeding Program Variety Trials

<http://www.psla.umd.edu/extension/crops/soybeans/>

Nonhost Crops

Alfalfa
Barley
Canola
Clover (red, white, ladino)
Corn
Forage grasses
Oats
Potato

Rye
Sorghum
Wheat

Chemical Control

Chemical control involves the application of certain volatile (fumigants) and non-volatile nematicides to the soil to reduce nematode populations. Nematicides are not commonly recommended to manage SCN in the northern soybean growing areas. In general, they are not as effective or as economical as other control methods. Nematicides can provide early season protection, but not season-long control.

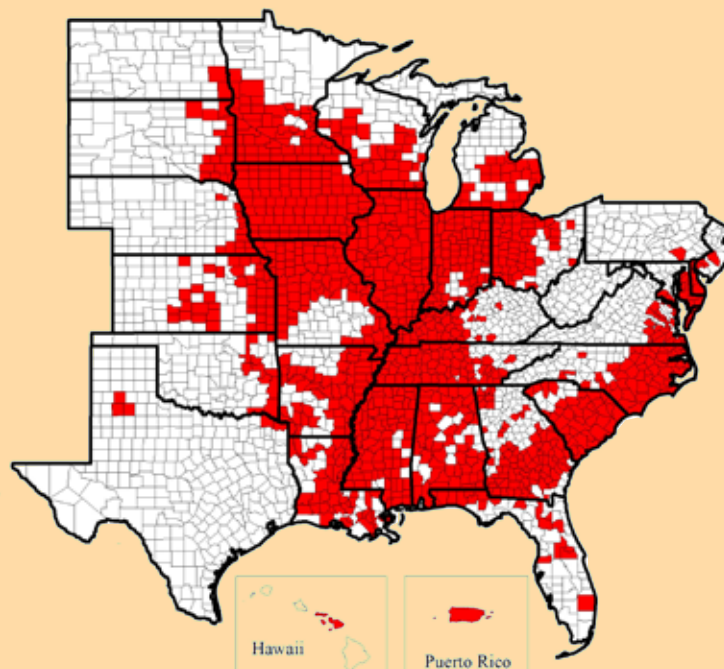
Always determine if chemicals are registered for use in your state

before attempting to use on a crop. Recommendations for the application of nematicides may be found in the University of Maryland's current Extension publications. For "Field Crops in Maryland" see EB 237, <http://www.agnr.umd.edu/MCE/Publications/EB237online/index2.cfm>

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2008 U. S. SCN Distribution map



2009 Maryland SCN Distribution

SCN, first detected in the United States in 1954 in North Carolina, was found in Maryland for the first time in 1980.

Since the first Maryland detection, soybean cyst nematode has been found infesting soybean fields in:

- Kent, Queen Anne's, Talbot, Caroline, Dorchester, Wicomico, Worcester and Somerset counties on the Eastern Shore.
- Charles and St. Mary's counties west of the Chesapeake Bay.

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Soybean Cyst Nematode. Publication of the Soybean Industry Resource Committee.

For more extensive coverage on particular nematode species and their hosts, management references, and links to additional resources:

<http://www.nematology.umd.edu/>

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Reviewer

Carol A. Holko
Chief, Plant Protection and
Weed Management Section
Maryland Department of Agriculture

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by

Sandra Sardanelli, Director
Plant Nematology Laboratory

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