College of Agriculture, Food and Environment
Cooperative Extension Service

Plant Pathology Fact Sheet **PPFS-OR-W-33**

Soybean Cyst Nematode: A Potential Problem for Nurseries

Nicole Gauthier
Plant Pathology
Extension Specialist

Carl Bradley
Plant Pathology
Extension Specialist

Cheryl Kaiser
Plant Pathology
Extension Support

Introduction

Soybean cyst nematode (SCN) is the most serious pathogen of soybean in the United States and Kentucky, resulting in over $1 billion in losses annually nationwide. SCN is a microscopic roundworm *(Heterodera glycines)* that feeds on roots of soybean and other legume species; it reduces a plant's capacity to absorb water and nutrients. SCN is currently found in nearly every Kentucky county where soybean is grown commercially. Refer to the *Known Distribution of the Soybean Cyst* article in Additional Resources for the distribution of SCN in the United States and Canada as of 2020.

Importance to Field Nurseries

SCN is a problem for field production nurseries shipping stock out-of-state because of the potential presence of this nematode in production site soils. Canada and some states (e.g., California) have quarantines in place and do not permit balled-and-burlapped (B&B) planting materials to be imported without proof that the nursery stock comes from SCN-free production areas. Other states (e.g., Pennsylvania and New York) presume that the blanket statement "free from all pests" includes SCN. Quarantines are an attempt to limit the continued spread of the nematode to non-infested areas, as well as to prevent the more aggressive types of SCN from spreading to new sites.

SCN Survival, Spread & Zero-tolerance

SCN survives in soil as long-lived cysts (Figure 1), which can be spread from an infested field to previously non-infested soil by any means that moves soil particles. This can include windblown soil; soil attached to roots of host or non-host plants; soil peds in bird droppings, seed bags, or stock feed; flood water; and farm and construction equipment.

Soybean growers have learned to deal with SCN by tailoring their production practices to reduce nematode populations in fields, especially when soybean is grown. One year of planting a non-host crop can reduce the SCN population by as much as 50%; after 2 years, only 5% of the original population will remain. However, even after decades, some viable cysts will remain in the soil; it is not possible to eliminate SCN from a field using non-host crops or by any other method.

Unfortunately, simply reducing the SCN population is insufficient for nursery operators, who encounter zero-tolerance restrictions in quarantined and non-infested

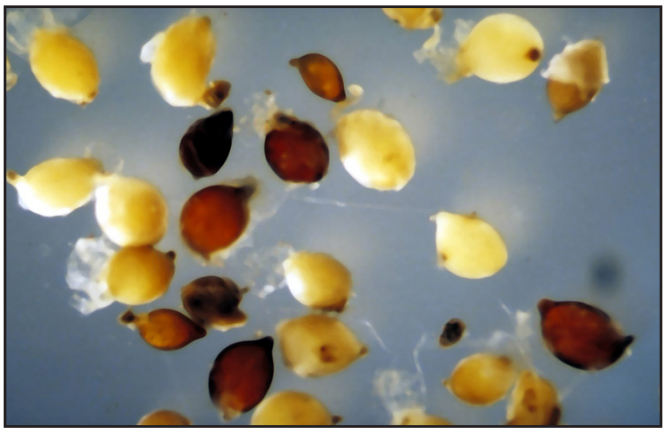

Figure 1. Cysts are the long-term survival structures of soybean cyst nematode (*Heterodera glycines*); they can survive in soil for more than a decade. Each cyst contains hundreds of eggs that eventually are released into the soil. Nematodes emerging from hatched eggs attack roots of susceptible host plants.

regions. Because SCN is so common in Kentucky and cannot be eliminated from fields, nursery operators must take proactive steps to ensure they can meet the zero-tolerance standard. Planting into SCN-free fields is the only way to guarantee SCN-free plant material can be shipped into restricted areas.

Recommendations for Nurseries

The following program is recommended for new and established nursery operations:

- Sample and test production fields for the presence of SCN (see next section).
- Avoid host crops susceptible to SCN.
- Inspect roots and soil of introduced plants to assure that intact soil is free of SCN.
- Rigorously control weeds that may also serve as SCN hosts (Table 1).
- Diligently follow a sanitation program:
  - Prevent movement of equipment that may be contaminated with soil/cysts from other farms or fields.
  - Clean equipment when moving it from one field or farm to another.
  - Clean used equipment, whether borrowed or purchased, before bringing it to the nursery.

Sampling

Field-Grown Nursery Sites & Plants

Before establishing a field-grown nursery, growers should have the soil tested for SCN; avoid planting sites that test positive. For established field nurseries, plants that are to be shipped to SCN-quarantined areas should be screened prior to shipment; screening nursery stock will require a one-month lead time.

How to collect samples

New fields: The best time to sample fields is late fall or early spring. Field soil should be moist, but not saturated. Divide the field into quadrants of roughly equal size. Then, collect 20 soil cores, 6 inches deep, from each quadrant using a zigzag sampling pattern (Figure 2). Mix soil from each quadrant into a bucket (one bucket per quadrant). Take a sub-sample from each bucket and place it in its own sealed plastic bag. Thus, for each field, there will be four samples, one for each quadrant. Label each bag with a field number/name and location for reference.

Established fields: Collect a soil core from the root zone of 20 arbitrarily selected plants from a potential shipment. Mix the 20 core samples together, sub-sample, and place it into a plastic bag. Label the bag with reference information.

Samples should not be allowed to dry out and/or be exposed to high temperatures (more than 90° F).

Where to send samples

There are a number of university labs, as well as private facilities, that offer SCN testing services for a fee. An internet search can be used to locate one of these labs. For example, the University of Illinois Plant Clinic and the University of Missouri SCN Diagnostics Lab are located in nearby states and have nematode testing facilities. Contact the selected lab in advance for information regarding their submission requirements and fees.

Results

If cysts are detected at any level, growers will have the option to confirm whether cysts are SCN or some other cyst-forming nematode of lesser importance. If confirmation is needed or desired, the samples can be subjected to a DNA-based diagnostic test to verify that the cysts are SCN. Nematode labs will charge an additional fee for this second test.

State Entomologist Certification

Submit the SCN test results to the Kentucky State Entomologist, who will use the test results to certify shipments of nursery stock from that field if:

- SCN were determined to be absent when the sample is screened (no cysts were found in original sample)
  OR
- DNA-based diagnostic test results were negative for SCN, even though the original screening detected cysts.

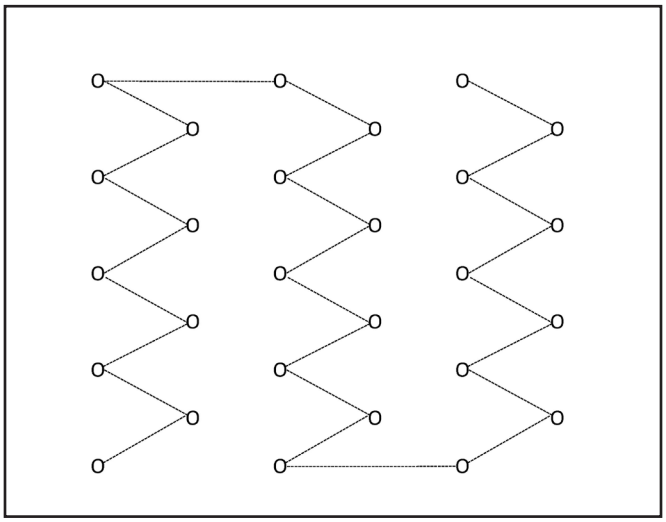

Figure 2. Collect soil for SCN analysis following a zigzag pattern in a field. Circles represent sites where soil cores are taken, and the lines respresent the walking path between sampling sites.

Table 1. Selected plants known to serve as hosts of soybean cyst nematode.

Plant	Scientific Name	Plant	Scientific Name
Crops & Ornamental Plants		***Weeds***	
Beans, green snap, bush, or kidney	*Phaseolus* spp.	Beggarweed or tick clover	*Desmodium* spp.
Bells of Ireland	*Molucella laevis*	Bittercress	*Cardamine* spp.
Birdsfoot-trefoil	*Lotus* spp.	Burclover or toothed medic	*Medicago* spp.
Borage	*Borago* spp.	Canada thistle	Cirsium arvense
Canarybird flower	*Tropaeolum* spp.	Chickweed, common	*Stellaria media*
Caraway	*Carum* spp.	Clover	*Trifolium* spp.
Chinese lanternplant	*Physalis* spp.	Cocklebur, common	*Xanthium strumarium*
Clover	*Trifolium* spp.	Corn cockle	*Agrostemma githago*
Coralbells	*Heuchera* spp.	Dalea	*Dalea alopercuroides*
Cowpea or black-eyed pea	*Vigna* spp.	Deadnettle, purple	*Lamium purpureum*
Crownvetch	*Coronilla* spp.	Digitalis penstemon	*Penstemon digitalis*
Cup-flower	*Nierembergia* spp.	Field pennycress	*Thlaspi arvense*
Delphinium	*Delphinium* spp.	Hemp sesbania	*Sesbania exaltata*
Foxglove	*Digitalis* spp.	Henbit	*Lamium amplexicaule*
Geranium	*Geranium* spp.	Hogpeanut	*Amphicarpa bracteata*
Geum	*Geum* spp.	Mallow, common	*Malva neglecta*
Horehound, common	*Marrubium vulgare*	Milkpea	*Galactia volubilis*
Lespedezas	*Lespedeza* spp.	Milkvetch, Canadian	*Astragalus canadensis*
Locust, black	*Robinia* spp.	Mullein, common	*Verbascum thapsus*
Lupines, white ornamental species	*Lupinus* spp.	Pigweed, winged	*Cycloloma atriplicifolium*
Pea, garden	*Pisum* spp.	Pokeweed	*Phytolacca americana*
Poppy	*Papaver* spp.	Purslane	*Potulaca oleracea*
Sage	*Salvia* spp.	Rocky Mountain beeplant	*Cleome serrulata*
Snapdragon	*Antirrhinum* spp.	Senna	*Senna* spp.
Soybeans, cultivated and wild	*Glycine* spp.	Shepherd's purse	*Capsella bursa-pastoris*
Sweet basil	*Ocimum* spp.	Sicklepod	*Cassia obtusifolia*
Sweet pea	*Lathyrus* spp.	Spotted geranium	*Geranium maculatum*
Sweetclover	*Melilotus* spp.	Toadflax, old-field	*Linaria canadensis*
Verbena	*Verbena* spp.	Wildbean	*Strophostyles helvola*
Vetch	*Vicia* spp.		

Additional Information

- An Overview of Soybean Cyst Nematode (Crop Protection Network)
https://cropprotectionnetwork.org/publications/an-overview-of-soybean-cyst-nematode
- Known Distribution of the Soybean Cyst Nematode, *Heterodera glycines*, in the United States and Canada in 2020 (Plant Health Progress)
https://apsjournals.apsnet.org/doi/epdf/10.1094/PHP-10-20-0094-BR
- Weeds Hosting the Soybean Cyst Nematode (Heterodera glycines Ichinohe): Management Implications in Agroecological Systems (see Table 1 in article) (Agronomy Journal)
https://www.mdpi.com/2073-4395/11/1/146

SCN Testing Facilities in Nearby States

- University of Illinois Plant Clinic
https://extension.illinois.edu/plant-clinic
- SCN Diagnostics Lab (University of Missouri)
https://scndiagnostics.com/

State Entomologist Certification

- Kentucky Office of the State Entomologist
https://ose.uky.edu/

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