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# Soybean Cyst Nematode: A Potential Problem for Nurseries

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Soybean cyst nematode (SCN) is the most serious disease pest of soybean in the United States (and Kentucky) and results in an estimated $1 billion in losses annually. SCN is a microscopic roundworm *(Heterodera glycines)* that feeds on root of soybean and reduces its capacity to absorb water and nutrients. Yield losses of 30% or more are common where SCN-susceptible soybean varieties are grown and SCN levels are high. SCN was first discovered in Kentucky in 1957 in Fulton County but is now found in every Kentucky county in which soybean is grown commercially.

SCN causes a problem for field production nurseries because Canada and some states—for example, California—do not allow soils (in ball-and-burlapped materials) to be imported without proof that the nursery stock comes from SCN-free counties. Other states, including Pennsylvania and New York, assume that the blanket statement "free from all pests" includes SCN.

SCN survives in soil as long-lived cysts (Figure 1). The cysts can be spread by any means that spreads soil particles, including windblown soil; soil attached to roots of host or non-host plants; soil peds in bird droppings, seed bags, or stock feed; flood water; or farm and construction equipment. Essentially anything that causes soil to be moved from one place to another can spread SCN cysts into previously un-infested soil. Quarantine restrictions are an attempt to limit the continued spread of the nematode or more aggressive types of SCN in places like Ontario, Canada, that already have an SCN problem.

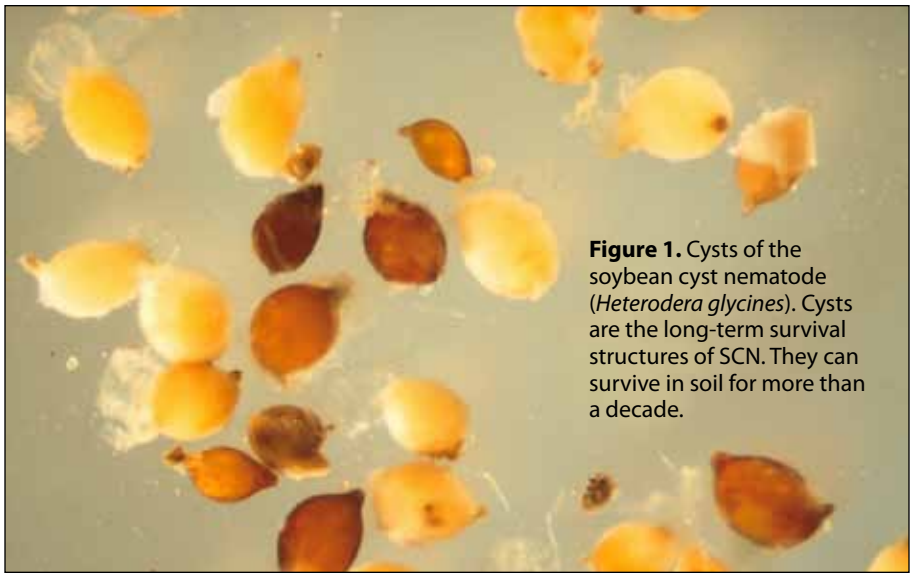


**Figure 1.** Cysts of the soybean cyst nematode (*Heterodera glycines*). Cysts are the long-term survival structures of SCN. They can survive in soil for more than a decade.

Soybean growers have learned to deal with SCN by tailoring their production practices so that SCN populations are kept low in fields, especially when soybean is grown. Nursery operators, however, will not be able to follow similar production practices because they have to deal with a zero tolerance when shipping into both quarantined and currently un-infested areas. Figure 2 shows distribution of SCN in the United States.

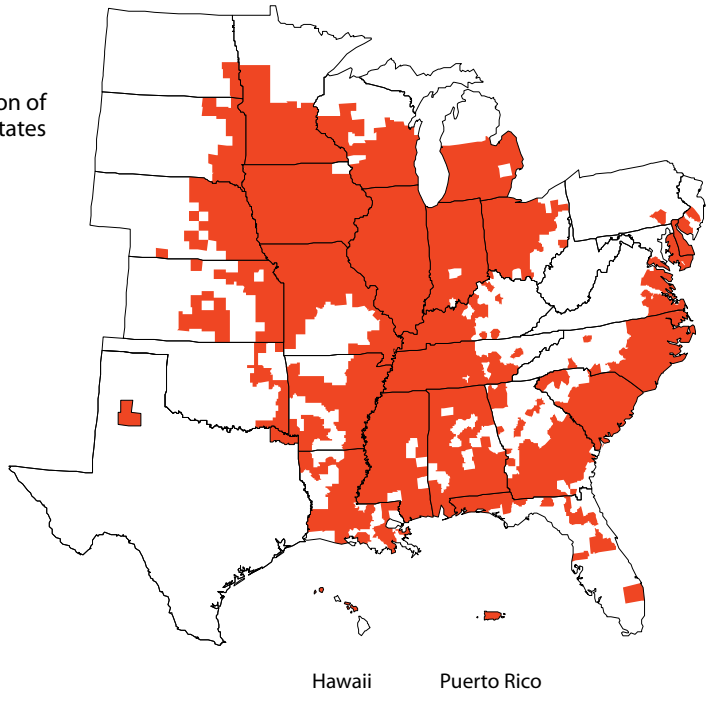



**Figure 2.** Distribution of SCN in the United States as of 2008.

## Reality Check

One year of planting in a non-host crop can reduce the SCN population by as much as 90%. After two years, only 5% of the original population will remain. However, some cysts remain viable in the soil for decades, so it is not possible to eliminate SCN from a field using non-host crops or any other means. Avoiding the problem is the only way to ensure your future ability to ship into areas that require assurance that shipments are free of SCN.

Because SCN is so common in Kentucky and cannot be eliminated from a field once it has been introduced, we recommend that nursery operators take proactive steps to limit potential problems relating to the shipment of ball-and-burlapped plants out of Kentucky.

## Recommendations for Established Nursery Operations

In established nursery operations, the following program is recommended:

- No planting of host plants of SCN (Table 1)
- No plants brought in from surrounding areas without some assurance that soil coming with the plant material is free of SCN
- Rigorously controlling weeds that may also serve as hosts of the pest
- Rigorous sanitation, which includes:
  - Bringing in no equipment that could be contaminated with soil/cysts from other farms and fields
  - Cleaning of equipment when moving from one field or farm to another
  - Cleaning of used equipment, whether borrowed or purchased, before bringing it to your nursery

**Table 1.** Plants known to be hosts of soybean cyst nematode (SCN).

| **Plant** | **Latin Name** |
|---|---|
| *Crops and Ornamental Plants* | |
| Soybeans, cultivated and wild | *Glycine* spp. |
| Beans, green snap, bush, or kidney | *Phaseolus* spp. |
| Lespedezas | *Lespedeza* spp. |
| Vetch, common, hairy, or winter | *Vicia* spp. |
| Lupines, white ornamental species | ornamental *speciesLupinus* spp. |
| Clovers, crimson, scarlet, or alsike | *Trifolium* spp. |
| Sweetclover | *Melilotus* spp. |
| Birdsfoot-trefoil | *Lotus* spp. |
| Crownvetch | *Coronilla* spp. |
| Pea, garden | *Pisum* spp. |
| Cowpea or black-eyed pea | *Vigna* spp. |
| 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. |
| *Weeds* | |
| Henbit | *Lamium amplexicaule* |
| Hop clovers | *Trifolium* spp. |
| Chickweed, common | *Stellaria media* |
| Mullein, common | *Verbascum thapsus* |
| Sicklepod | *Cassia obtusifolia* |
| Digitalis penstemon | *Penstemon digitalis* |
| Pokeweed | *Phytolacca americana* |
| Purslane | *Potulaca oleracea* |
| Bittercress | *Cardamine* spp. |
| Rocky Mountain beeplant | *Cleome serrulata* |
| Spotted geranium | *Geranium maculatum* |
| Toadflax, old-field | *Linaria canadensis* |
| Pigweed, winged | *Cycloloma atriplicifolium* |
| Vetch, American, Carolina, or wood | *Vicia micrantha* |
| Burclover or toothed medic | *Medicago* spp. |
| Dalea | *Dalea alopercuroides* |
| Milkvetch, canadia | *Astragalus canadensis* |
| Beggarweed or tick clover | *Desmodium nudiorum, D. marilandicum, D. viridiflorum* |
| Corn cockle | *Agrostemma githago* |
| Hogpeanut | *Amphicarpa bracteata* |
| Milkpea | *Galactia volubilis* |
| Wildbean | *Strophostyles helvola* |
| Hemp sesbania | *Sesbania exaltata* |

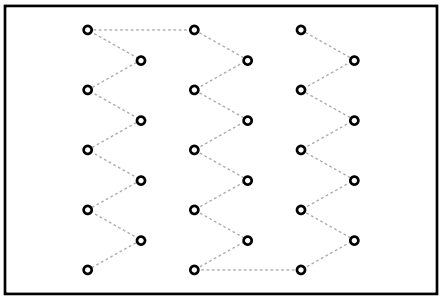
## Soil Sampling before Establishing a Field-Grown Nursery

Using the services of the SCN laboratory at the UK Research and Education Center in Princeton, you can test fields to determine if they are SCN-infested before you establish a field-grown nursery operation.

Following is how to obtain and prepare your samples:

Divide the field into quadrants of roughly equal size. Then, in late fall or early spring, collect 20 soil cores, 6 inches deep, from each quadrant using a zigzag sampling pattern (Figure 3). Mix soil collected from each quadrant in a bucket (one bucket per quadrant). Take a sub-sample from each bucket and place it in its own soil box (use a box commonly used for soil fertility testing). Thus, for each field, there will be four samples, one for each quadrant. Make sure to label each box with a field number or field name and location. The cost for processing each sample at UK's SCN laboratory is $8.50 ($34 for four). Take soil samples to your county extension office for shipment to Princeton. You will be asked to complete an SCN analysis form to accompany your sample(s).

**Figure 3.** Sampling pattern for collecting soil cores.



## Screening Already-Planted Stock

To prepare for shipping to SCN-quarantined areas from fields already planted to nursery stock, screening for SCN requires a one-month lead time. Collect soil cores (20) from the root zones of 20 arbitrarily selected plants that are going to be shipped, place them in a soil box, then submit a sub-sample of the soil collected. Samples will be screened free of charge for the presence of SCN. If cysts are detected at any level, you will be informed and asked if you want confirmation that the cysts found were SCN and not some other cyst-forming nematode of lesser importance.

If you do want that confirmation, the samples will be subjected to a DNA-based diagnostic test to verify that the cysts are in fact SCN. The cost is $100. The Kentucky State Entomologist will use the test results to certify shipments of nursery stock from that field if:

- SCN is determined to be absent when the sample is screened—no cysts are found in original sample

or

- Test results are negative for SCN even though the original screening detected cysts of some cyst-forming nematode

Regardless of the reason for testing soil for SCN, samples should not be allowed to dry out and must not be exposed to high temperatures (more than 90° F) before submission. A refrigerator should be used for long-term storage of soil.

## Reference

UK SCN website: http://www.uky.edu/scn

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