

2021 Soybean Cyst Nematode (SCN) sampling in dry beans

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Project location(s): Genesee, Livingston, Monroe, Steuben, Wyoming, and Yates Counties

Abstract:

Soybean Cyst Nematode (SCN) is a minute roundworm like parasite that is a major pest of soybeans and is considered the pest of greatest economic concern. It has multiple hosts including dry beans and can cause comparable damage in dry beans. The presence of SCN is difficult to detect in fields without a soil test. The above ground symptoms are often not present but still result in a 10-30% loss in yield. When symptoms are present (yellowing and stunting), they can be confused as a nutrient deficiency, herbicide damage or attributed to drought. We surveyed thirteen dry bean fields in six different counties and detected SCN in nine of the fields. We also used an electrical conductivity (EC) meter to map three of the fields and target sampling based on those EC reading.

Background and justification:

Soybean Cyst Nematode (SCN), *Heterodera glycine*, is a plant-parasitic roundworm that is a major pest and considered the pest of greatest economic concern in soybeans. It has multiple hosts including dry beans and can cause comparable damage in dry beans. SCN can reduce yield by feeding inside the roots. The young nematodes cause nutrients to divert away from the plant and towards the nematode. This results in slowed root growth and decreased uptake of water and nutrients from the roots to the shoots. The typical aboveground symptoms caused by SCN are stunting of plants in irregular patches throughout the field, yellowing, and wilting. However, yield loss can occur without obvious aboveground symptoms and typically ranges from 10-30% but has exceeded 40%. Total yield loss depends on SCN population density, soil texture, fertility, and rainfall.

In addition to yield loss, SCN feeding allows for the entry of soil-borne pathogens into the root. Symptoms of SCN are often confused with other potential issues such as nutrient deficiencies, herbicide damage, and environmental stress. The symptoms are most severe when the plants are under stress, such as during times of drought, and are often misdiagnosed.

SCN spreads through movement of soil on farm equipment, by wind, through water, contaminated seed or plants, and even through animals such as birds. After feeding and mating, the body of a female SCN will develop into a cyst that houses 200+ eggs (Figure 1). The cyst can survive in the soil for more than 10 years. Once SCN is present in a field it is impossible to eradicate. Therefore, management to reduce the number below the economic threshold is the only option. There are several management options with crop rotation being the best. SCN has several host crops, but rotating away from a known host to corn or another non-host crop has shown to decrease the SCN levels by 50% the following year. Another option is to clean equipment before moving from a known SCN field to another field. Resistant varieties are only available in soybeans at the moment, but certain dry bean varieties are more tolerant to SCN and

can be planted in fields with known or suspected SCN presence. The final option is using seed treatments. This can be costly, with benefits seen mainly in areas with high SCN levels.

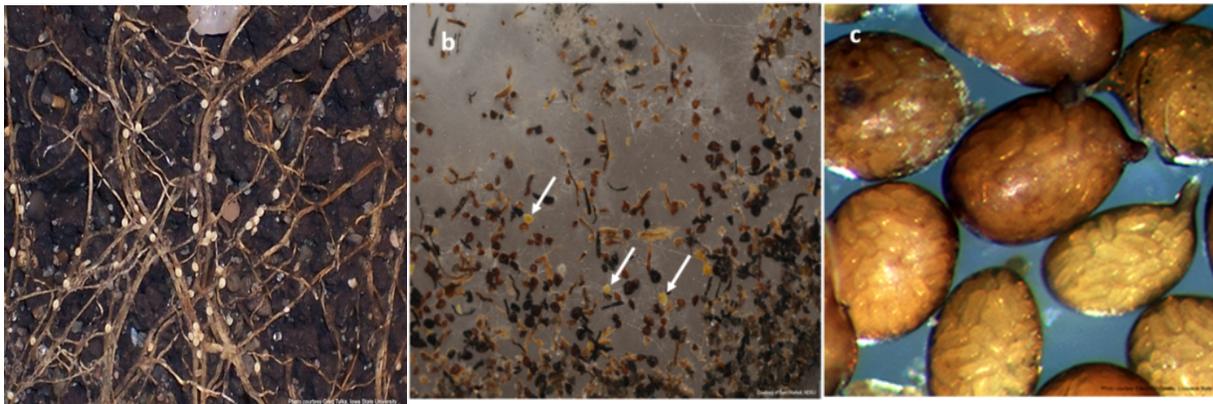


Figure 1. Female SCN produce ‘cysts’ on host roots, which contain eggs (a). Cysts are distributed within the soil (b) and contain ~200 eggs each (c). (Photos: G. Tylka^a, G. Yan, S. Markel and E. McGawley, via the SCN Coalition)

The only way to know for sure that SCN is in a field and at what level is to take a soil sample. For SCN as well as other nematodes, such as root knot nematode (*Meloidogyne incognita*), Columbia lance nematode (*Hoplolaimus columbus*), and reniform nematode (*Rotylenchulus reniformis*), a strong relationship exists between soil texture and nematode distribution within a field (Ref. 2, 4-6, 8). SCN population density, if present, has a strong positive correlation with the percent sand (Ref.1) because of increased mobility of SCN in looser, sandy soils (Ref. 3). To improve soil sampling for SCN, electrical conductivity (EC) measurements of the soil can be used to detect the variability in clay content in a field and thereby create a map of areas with higher likelihood of SCN (Ref. 7).

Objectives:

1. Map three dry bean fields for soil conductivity using an EM 38 prior to planting.
2. Collect targeted soil samples from the three mapped fields: collecting samples from areas with a high EC reading (high clay), a low EC reading (high sand), and an additional sample from throughout the field.
3. Collect soil samples from 10 additional fields (that were not mapped) in the major dry bean producing areas of Genesee, Livingston, Monroe, Steuben, Wyoming, and Yates Counties.
4. Send samples to the SCN diagnostic lab located at the University of Missouri.
5. Report results of soil tests to participating growers.
6. Present survey results to dry bean growers at the Annual dry bean meeting held in the spring 2022.

Procedures:

1. Prior to planting we collected EC data from three different dry bean fields using the EM 38. The EM 38 is an electromagnetic induction device that measures the strength of the induced magnetic field through the soil indicating the electrical conductivity of the soil. The EM 38 was placed in a sled and took EC measurements of the soil every few seconds as it was towed

behind a vehicle through the fields (Figure 2). The data were downloaded and read into a GIS program. EC field maps were created by dividing the data into quantiles to determine the low and high EC ranges of each field. These maps were then used to determine GPS coordinates of low and high EC measurements and used to target soil samples in the fall.

2. Targeted soil samples were collected from the three mapped fields (one in Wyoming and two in Genesee Counties). Sampling for SCN is best done after harvest, when the SCN populations are at their highest for the year. Samples were taken from the top eight inches of soil nearest the root zone and placed into labeled bags. Sampling for each field included: one soil sample (consisting of 10 subsamples) from the areas with high EC readings, one soil sample (consisting of 10 subsamples) from areas with low EC readings, and one sample (consisting of 10 subsamples) from throughout the field, for a total of three samples per field and nine total samples for all three fields.
3. We also sampled ten additional dry bean fields that were not mapped with the EC machine including one in Genesee, one in Livingston, three in Monroe, four in Steuben, and two in Yates Counties. Soil samples were taken around the time of harvest, when the SCN populations are at their highest for the year. We crisscrossed the field and took 10 soil subsamples from the top eight inches of soil nearest the root zone and place them into a labeled bag.
4. After mixing the contents of each bag, we took a pint-sized sample from each bag and placed it into a sealed, labeled plastic bag and shipped it to:

SCN Diagnostics
1054 East Campus Loop
University of Missouri
Columbia, MO 65211-5315
5. Once we received results from SCN Diagnostics, we contacted the participating growers via phone, text or email to inform them of their field results.
6. Results from the soil survey will be made available to other growers at the Annual Dry Bean Meeting scheduled for March 16, 2022.



Figure 2. Sled housing EM38 being pulled through field. (Photo: Farming Smarter)

Results and discussion:

In 2017 only one county in NY, Cayuga, was known to be positive for SCN in soybean. In 2020, after surveying eight dry bean fields and over 100 soybean fields, that number increased to 29 counties (Ref. 2). In 2021 an additional 13 dry bean fields and 86 soybean fields were surveyed bringing the total of positive counties to 36 of the 46 surveyed (Figure 3). Of those 36 counties, six are in the moderate or high range for SCN (<500 eggs is considered **low**, 500-10,000 eggs is considered **moderate**, >10,000 is considered **high** based on one cup of soil) and three of those, 50%, came from dry bean fields.

In dry beans specifically, we have now surveyed seven counties in the major dry bean producing areas including Genesee, Livingston, Monroe, Steuben, Wayne, Wyoming, and Yates Counties. (Figure 4). Six of the seven counties tested positive with three of them in the moderate range at which point crop rotation is recommended. Of the thirteen fields we surveyed in 2021, nine were positive for SCN with three in the moderate range.

SCN population density, if present, has a strong positive correlation with the percent sand in the soil (Ref.1). We used a EM38 (electrical conductivity meter) to create field maps of areas with higher and lower EC readings. This was done at three fields with mixed results. Only one field showed a strong relationship between EC readings and the SCN levels found in the samples. Further work with increased samples will be needed to determine if using EC measurements is a viable option to improve soil sampling and managing of SCN.

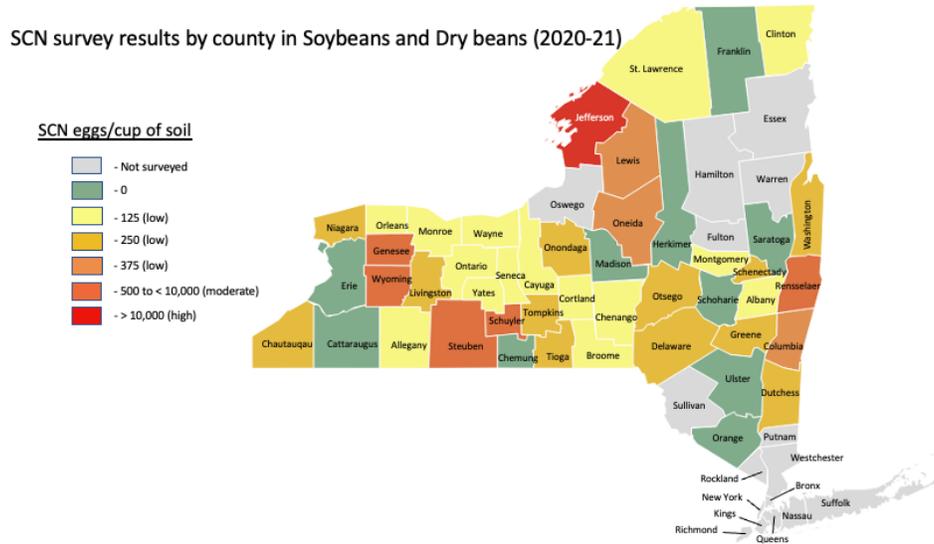


Figure 3. NY map showing the counties surveyed for SCN, in both dry beans and soybeans, and the highest reported egg count for each county.

SCN survey results by county in Dry beans (2020-21)

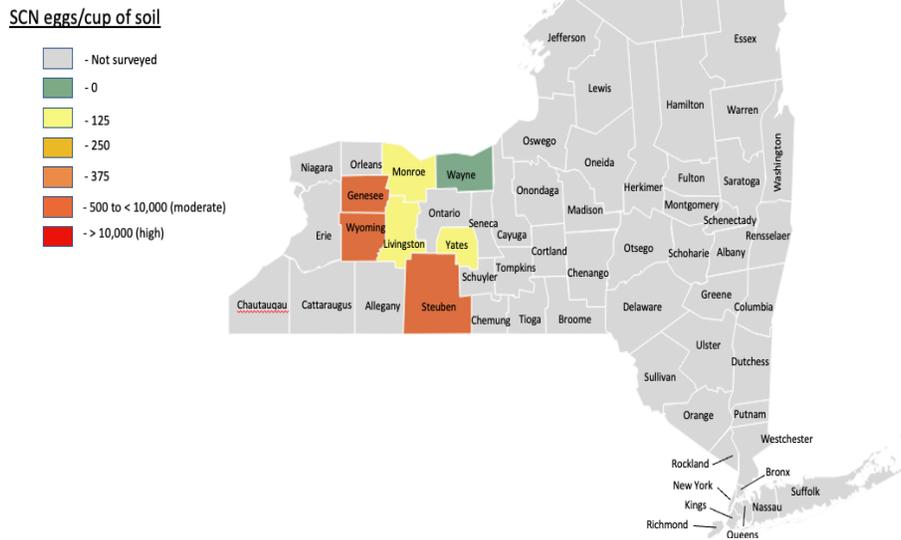


Figure 4. NY map showing the counties surveyed for SCN in dry beans and the highest reported egg count for each county.

Outcomes and Impacts:

SCN was detected in dry bean fields in seven of the eight counties sampled over the last two years. Of the 36 counties in NY that have tested positive, six are in the moderate to high range, however; three of those were in dry bean fields. We are using these results to educate dry bean growers of the potential risk to dry beans, how to test for SCN in their fields and how to manage their fields to minimize their risk.

Information on SCN and EC mapping was presented to dry bean growers at a twilight meeting held in LeRoy on September 9th and results from 2021 will be presented at the Annual dry bean meeting scheduled March 16, 2022.

Results from the last two years will be used to apply for funding to incorporate the use of an EC machine to map soil texture and thereby improve soil sampling and get a better understanding of the extent of SCN in dry beans.

Publications:

Zuefle, M.E., and M. Lund. 2021. [2020 Soybean Cyst Nematode Survey in Dry Beans](#). NYS IPM project report. August 9, 2021. Web.

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