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Sustaining Iowa soybean production through education about soybean cyst nematode

Abstract
Soybean cyst nematode (SCN) is a major limiting factor in soybean production throughout Iowa and elsewhere. SCN-resistant varieties are the only management strategy currently available; while they work well in preventing rapid increases of SCN, they do not reduce existing SCN densities effectively. Early detection of SCN infestations is key in managing this pest. This project developed a slide set and began work on a videotape to educate Iowa growers about SCN biology and symptoms, along with strategies that can be employed when infestations are detected in early stages.

Keywords
Plant Pathology, Biocontrol and Integrated Pest Management, Models and assessment tools

Disciplines
Agricultural Science | Agriculture | Plant Pathology

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Background
Soybean cyst nematode (SCN), *Heterodera glycines*, is the most important factor limiting soybean production throughout much of Iowa. SCN now has been identified in more than two-thirds of Iowa counties. Yield losses due to SCN can vary from 5% to 80% or greater per field depending on environmental conditions, SCN population densities, and the presence of other pests.

Hundreds of grower-submitted samples are analyzed for SCN in the Plant Disease Clinic at Iowa State University (ISU) each year. Since 1989, more than 2,600 samples tested were infested with the nematode. Additionally, a majority of the infested samples contained SCN population densities greater than 1,000 eggs per 100 cubic centimeters of soil (about one-half cup). Other researchers have shown that SCN densities of 10 to 50 eggs per 100 cc soil can significantly reduce the yield of SCN-susceptible soybean varieties in Iowa.

Although SCN has been confirmed in only 69 of 99 Iowa counties, it is believed to be present in many other counties as well. Prior to 1991, only 48 infested counties were known. Extensive efforts by research, extension, and agribusiness personnel have resulted in identification of new SCN-infested counties each year. Anything that moves soil has the potential to spread SCN, including wind, water, and farm machinery. The above-ground symptoms of SCN damage generally do not appear until years after initial infestation, and significant yield depression can occur in the absence of any above-ground symptoms. This is particularly true in nutrient-rich soils found throughout much of Iowa. Consequently, new infestations are generally not discovered until many years after the introduction of the nematode. To identify these new infestations while the SCN densities are still relatively low, growers must actively search for SCN by examining roots of growing soybean plants or by collecting representative soil samples. Growers in most of the “noninfested” counties are not actively searching for the pest.

Chemical control of SCN through the use of nematicides often is ineffective and economically and environmentally unacceptable. Currently, the use of SCN-resistant soybean varieties in conjunction with nonhost crops such as corn in a crop rotation program is the only effective management strategy available. This rotation works well in preventing rapid increases of low or moderate SCN infestations to unmanageable levels, but it will not decrease existing SCN densities effectively or consistently. The only effective management strategy available for reducing high SCN densities to an acceptable level is through repeated planting of nonhost crops—
a practice that is undesirable and often unfeasible for growers because of other agricultural or economic considerations.

Lack of grower interest in identifying SCN is understandable but unfortunate, for it is much more difficult to manage SCN populations once the nematode population has developed and increased over several years. The greatest chance for managing SCN successfully and maintaining acceptable soybean yields is to identify SCN infestations shortly after they become established in the field. Most Iowa growers identify SCN infestations through observation of stunted and/or yellowed plants, the classic symptoms of SCN damage. Unfortunately, these symptoms often do not appear until nematode numbers have increased to a high and relatively unmanageable density.

The key to identifying low to moderate SCN infestations is for growers not to wait for the appearance of above-ground symptoms but to carefully observe roots for the presence of the telltale cysts and/or to collect representative soil samples for analysis by a competent laboratory.

This project was initiated to educate growers on general aspects of SCN biology, identification, sampling, and management. This project will increase early detection of SCN infestations by Iowa's soybean growers and facilitate use of proper soil sampling procedures for obtaining accurate SCN density information on which to base rational management decisions. As a direct result of these benefits, management efforts aimed at SCN will be more effective, and yields of soybeans grown on SCN-infested land can be maximized, which will sustain the economic viability of soybean farming operations with SCN.

Specific objectives of this project were to:
1. educate Iowa growers about the biology and symptomatology of SCN through the development and distribution of an informational slide set; and
2. educate Iowa's soybean growers about identification of SCN on roots of soybeans in the field and proper procedures for obtaining diagnostic and predictive soil samples through development and distribution of a videotape.

**Approach and findings**

A comprehensive set of slides and an accompanying detailed script were developed to illustrate the biology and symptomatology of SCN, along with recommended management strategies. The slide set contains computer-generated word slides integrated with high-quality photographic slides. Field biology, epidemiology, and identification of the nematode are illustrated using normal and close-up photographic slides; photomicrographs of the various SCN life stages are used to illustrate the SCN life cycle. SCN management tactics are addressed; photographs and figures showing actual results of field experiments augment this section. Although all available management options are presented, environmentally benign strategies are emphasized.

In conjunction with the slide set, a videotape is being developed to illustrate proper field identification procedures for SCN infestations. The first segment will include footage illustrating classic above-ground symptoms and the characteristic SCN females and cysts on infected roots dug from an SCN-infested field. The second segment of the videotape will include a demonstration and discussion of timing, strategy, and procedures for obtaining representative diagnostic and predictive soil samples to determine SCN egg population densities.

**Implications**

Although the full impact of these educational materials on sustainable agriculture cannot be assessed until the videotape is completed and distributed, it is expected that the agricultural education community will welcome these informational materials to educate growers about this nematode pest. Education on proper sampling for SCN offers growers and crop advisors another tool to use in an integrated crop management system. Through such education, Iowa soybean production can be made both more efficient and more sustainable, even when SCN is present.
**Education and outreach:** The slide set described above has not been widely distributed, and the videotape (as of early 1996) has not yet been completed. An education program evaluation plan devised as part of the original project proposal will be implemented upon completion and dissemination of the educational materials. Responses to the evaluation will be used to modify the slide set and videotape to better meet the needs of Iowa farmers. The following evaluation questions will be compiled into written questionnaires distributed to audience members each time the educational materials are used:

1. How many slide set audience members learned something *new* about SCN biology, identification, and management?
2. How many . . . learned something *useful* about SCN . . . ?
3. How many . . . feel less apprehensive about SCN in Iowa?
4. Did the videotape help clarify proper and accurate procedures for field identification of SCN infestations?
5. Did the videotape help clarify proper and accurate procedures for collecting soil samples for SCN analysis?
6. How many audience members will begin actively looking for SCN infestations rather than waiting for the appearance of classic above-ground symptoms?

Criteria to be used to judge success of the educational materials are as follows:

1. Fifty percent of slide set viewers will have learned something new and/or useful about SCN biology, identification, and management.
2. 25 percent of slide set audience members will feel less apprehensive about SCN in Iowa.
3. 25 percent of videotape audience members will begin looking for SCN infestations rather than waiting for the appearance of classic above-ground symptoms.

ISU Cooperative Extension communications staff, who were involved in production of the video, will assist in distributing it to Extension, high school, community college, and private business personnel for use in educating students and soybean farmers throughout Iowa.

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