The Yields II Project: Research-Based Management Information

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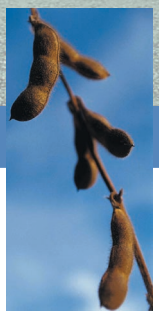

So Many Choices, So Much Potential: Soybean Cyst Nematode-Resistant Soybean Varieties

Don't let its size fool you. The tiny soybean cyst nematode (SCN) can stunt roots, disrupt food and water uptake, and slow growth of nitrogen-fixing nodules in your soybean crop, all of which could reduce yield. Planting SCN-resistant soybean varieties provides the foundation for management strategies to protect yield potential and maximize profit.

Soybean cyst nematode (SCN) is a widespread pest of soybean in Iowa. The nematode is a serious threat to soybean production because it reproduces very quickly, survives in the soil for many years in the absence of a soybean crop, and causes substantial yield losses, particularly in dry years.

Resistance is a very effective strategy for managing SCN, producing acceptable yields yet suppressing reproduction of the nematode. The number of soybean varieties with genetic resistance to SCN available in maturity groups I, II, and III has increased dramatically since the early 1990s (Figure 1). Today, most soybean seed companies have SCN-resistant soybean varieties available for Iowa producers.

Choosing an SCN-resistant variety

With more than 600 SCN-resistant varieties available to Iowa soybean producers, selecting the appropriate variety may seem difficult. A good starting point is to consider a variety's yield potential in SCN-infested soils; effectiveness in suppressing nematode reproduction, and thus population density; and defensive traits against stressful abiotic conditions.

Yield potential. The most important characteristic of SCN-resistant soybean varieties is yield potential in SCN-infested fields. The yield of SCN-resistant varieties can vary greatly. Each year, many SCN-resistant soybean varieties are evaluated in the Iowa State University (ISU) SCN-resistant soybean variety trials. The results of these variety trials are published in ISU Extension publication IPM 52, which can be obtained at county extension offices, the ISU Extension Distribution Center (515-294-5247), or on the Web at www.isuscnvarietytrials.info. Iowa soybean growers are encouraged to refer to IPM 52 for guidance on the relative performance of SCN-resistant soybean varieties. However, the variety trial data are from a limited number of locations and should be used only as a beginning for developing an SCN management program for a specific field. The performance of individual SCN-resistant soybean varieties can vary

among locations and years, so growers are encouraged to evaluate several SCN-resistant soybean varieties at their own locations to determine the best varieties for their local conditions.

Effect on SCN populations. In addition to yield, growers should consider the effectiveness of the varieties in suppressing reproduction of SCN. SCN-resistant varieties (even top varieties that yield comparably) can vary considerably in how well they control nematode reproduction, and thus population densities. For example, the yields of the top three conventional (non-Roundup Ready®) soybean varieties (evaluated in the north central Iowa location of the ISU SCN-resistant soybean variety trials in 2001) are shown in Figure 2. There is no significant difference among the yield of these three varieties. However, one of the varieties did not control the nematode as well as the other two, as illustrated by the end-of-season SCN egg population densities (Figure 3). Such a large difference in nematode control among high and comparably yielding soybean varieties is not unusual. Consequently, growers should consider how well SCN-resistant soybean varieties control SCN population densities in addition to how well they yield to ensure maximum soybean productivity of their land over time.

Defensive traits. SCN population densities tend to be greater as soil pH increases from 5.5 to 8.0, and iron chlorosis can be a problem once soil pH rises above 7.4. Soybean varieties vary in their sensitivity to high pH soils and iron chlorosis. Because high population densities of SCN frequently occur in high pH soils, many growers need SCN-resistant soybean varieties that also have good tolerance to iron chlorosis. Minimizing the effects of iron chlorosis decreases the overall stress of the soybean crop and thereby the yield-reducing effect of SCN. The soybean varieties evaluated in the ISU SCN-resistant soybean variety trials also are evaluated for iron chlorosis tolerance (see Extension publication IPM 52; ordering information on page 1).

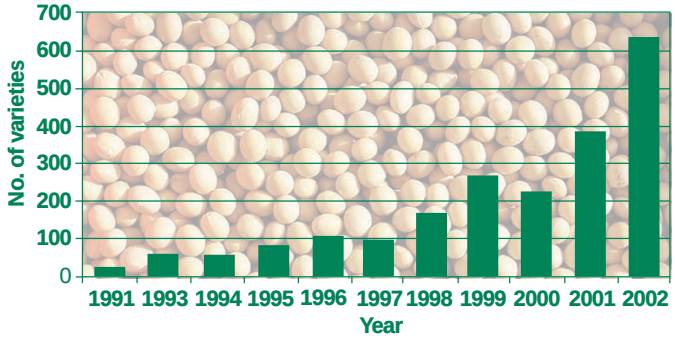

Figure 1. Number of maturity group I, II, and III SCN-resistant soybean varieties available to Iowa soybean growers, 1991–2002.

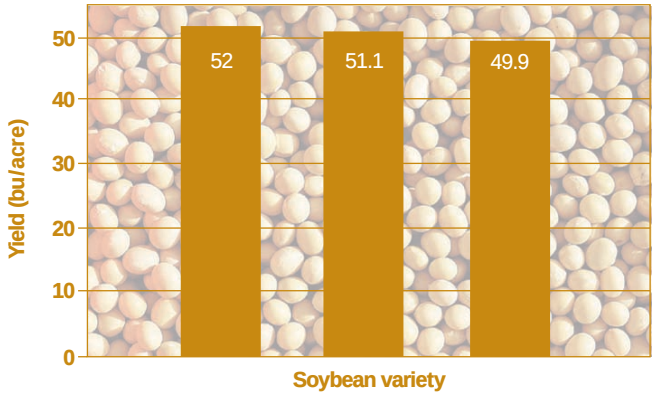

Figure 2. Yield of the three best-yielding conventional (non-Roundup Ready®) varieties in a north central Iowa SCN-resistant soybean variety trial location in 2001.

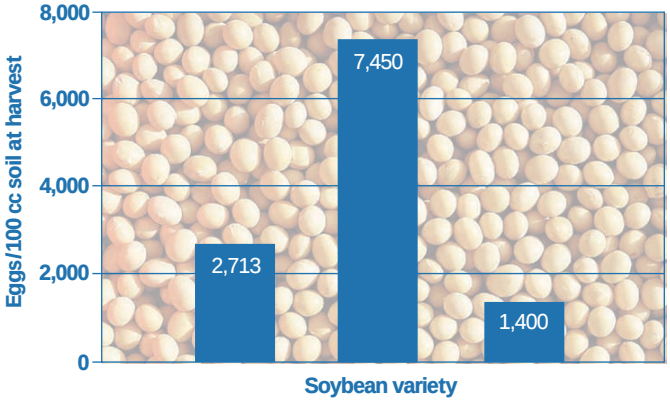

Figure 3. End-of-season SCN egg population densities in plots of the three best-yielding conventional (non-Roundup Ready®) varieties in a north central Iowa SCN-resistant soybean variety trial location in 2001.

SCN is not the only soybean pathogen that occurs in Iowa soybean fields. Other common soybean diseases in Iowa include brown stem rot, Phytophthora stem and root rot, sudden death syndrome, and white mold. Consequently, a soybean variety with multiple disease resistance is often needed. Some diseases, such as brown stem rot and sudden death syndrome, are made more severe by SCN. Growers must observe their soybean fields for the presence of all common soybean diseases and then decide which of the diseases causes the most severe and consistent yield loss from year to year. SCN is among the most damaging and persistent soybean pathogens that occur in Iowa.

Digging roots and looking for SCN females (top) is an effective way to identify which fields are infested with SCN. But once an SCN infestation is identified, growers should determine what level of infestation exists by collecting soil samples. Soil samples should consist of 15 to 20 soil cores, each 1 inch in diameter and 6 to 8 inches in depth (middle) collected from every 20 acres. The multiple soil cores should be mixed thoroughly in a bucket (bottom) before placing the soil in a bag. SCN egg population densities can be determined by laboratories with personnel trained in soil analyses, including the ISU Plant Disease Clinic (Room 323 Bessey Hall, Iowa State University, Ames, IA 50011).

Change can be good: managing SCN resistance through crop rotation

Currently, there are three main genetic sources for SCN resistance genes in commercial soybean varieties: PI88788, Peking, and PI437654 (also known as Hartwig resistance). Additionally, one variety with resistance genes from PI209332 is available. Each of these sources of SCN resistance contains several genes that confer resistance to the nematode. Consequently, soybean varieties developed from the various sources of resistance may not all contain the same genes in the same combinations.

All of these sources of SCN resistance allow limited reproduction of only a few nematodes. Limited reproduction by a few nematodes on a resistant soybean variety does not pose a problem in a single growing season. However, if soybean varieties containing the same source of resistance are grown repeatedly for many years, the potential for buildup of a population of nematodes that readily feed on such varieties exists. Thus, use of resistant soybean varieties, particularly any single SCN-resistant variety, should not be considered the sole solution for managing SCN.

Iowa State University recommends growing nonhost crops, such as corn, with soybean varieties with different sources of resistance in a crop rotation. Crop rotation discourages the buildup of nematode populations that reproduce readily on resistant soybean varieties. If growers cannot use soybean varieties with different sources of SCN resistance in successive soybean crops, they should try to grow different SCN-resistant varieties derived from the common source of SCN resistance, PI88788 (Figure 4).

Even if the SCN population density is low, so is the economic risk in planting SCN-resistant soybean varieties. Iowa State University recommends that SCN-resistant soybean varieties be grown in fields with low or moderate SCN population densities. Fields with very low levels of the nematode can benefit by planting SCN-resistant varieties because the nematode can reduce soybean yield significantly at low population densities in hot, dry weather. Furthermore, ISU SCN-resistant soybean variety trial data show that many currently available SCN-resistant soybean varieties have high yield potential, even when grown in fields with low population densities of the nematode, so there is not much of an economic risk in using an SCN-resistant soybean variety in a field with low population densities of the nematode. Using SCN-resistant soybean varieties immediately once an infestation is discovered can stop the increase in SCN population densities and allow for greater success in implementing the recommended crop rotation scheme (Figure 4).

Additional information about the biology and management of soybean cyst nematode can be obtained at www.soybeancyst.info.

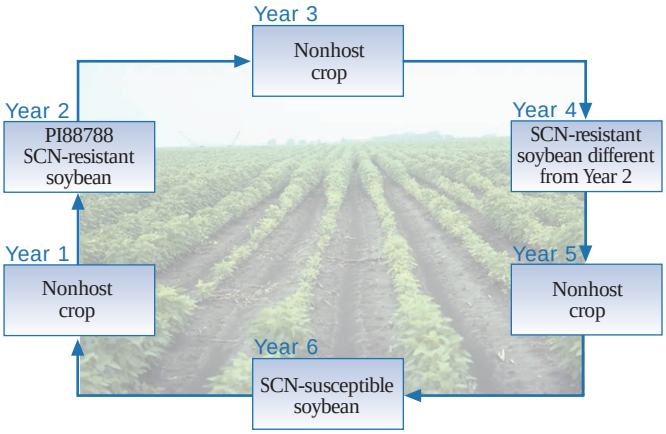

Figure 4. Recommended crop rotation for fields with *low* or *moderate* SCN population densities.

Photos on pages 1 and 2 courtesy of the USDA Natural Resources Conservation Service. The Soybean Research and Development Council (SRDC) funded this research project.

Prepared by