Nematode Management in Soybeans and Corn

Introduction
Nematode activity in row crops varies throughout the northern Corn Belt. Nematode species can often affect multiple crop species with the exception of soybean cyst nematodes, which are restricted to feeding on soybeans, and needle nematodes, which affect corn. Several species, such as dagger, lesion, stunt, lance, stubby root, and root-knot nematodes, can damage both corn and soybeans. This Field Facts will discuss effects of nematodes in row crops, focusing on soybean cyst nematodes, as well as management options currently available.

Infection and Symptoms
Nematode species differ in how they infect the host plant. Certain species will invade the root tissue (endoparasites), whereas other species only feed on the external root tissue (ectoparasites). Both types of nematodes can damage crop plants by:

- taking nutrients
- interrupting root function (reducing moisture and nutrient uptake)
- providing an area for pathogen entry (e.g., sudden death syndrome) and increase in severity
- in soybeans, reducing the number and functionality of nodules
- diminishing growth

Though nematodes are relatively host specific, they can sustain on secondary hosts. Needle-nematodes generally use corn as the host; soybean cyst nematodes rely on soybeans (as well as other legumes like dry beans) as the host crop. However, populations can often maintain or increase slightly even when crop rotation is part of the management system. In addition to the various species of nematodes, there are often different biotypes within species.

It is important to sample for nematodes. Fred Warner, Michigan State University Nematologist, recommends sampling on a regular basis, similar to soil sampling. This will help to identify the issue before it becomes a significant factor to soybean yields.

Soybean Cyst Nematodes
Soybean cyst nematodes (SCN) are a major soybean pest in the northern Corn Belt. Although common throughout the Corn Belt, SCN survive winters more readily than other nematode species that are common further south. SCN move through the roots to the vascular tissue where they start to feed on nutrients. The secretions that they inject as they feed modify the root cells, converting them to feeding sites. As they feed on the root, their body swells; females swell beyond the root tissue, making the cyst exposed on the surface of the root.

SCN Management
Fred Warner, Michigan State University nematologist, states that the most serious error a soybean grower can make is planting an SCN-susceptible soybean variety in a field where a resistant variety should have been sown. That mistake can result in a 50% or greater yield loss. What complicates variety selection even further is that SCN exists as different “types” (formerly known as races). These different types of SCN endure differently based on the type of soybean they use as a host.

SCN-resistant varieties are available for management of soybean cyst nematodes. There are two main sources of resistance available in the northern region, PI88788 and PI548402 (Peking). Other sources are available, though limited in top-yielding varieties. A test (HG-type test) identifies how the type of SCN affects the different resistant varieties. In this test, the varieties are grown in the infected soil. The variety that has a 10 percent or more increase in population of SCN is then associated with the type (Table 1). For instance, if there is a 10 percent increase on just the variety with PI88788 resistance, the soil sample is given a “2” for type. This means that the population of soybean cyst nematode in the soil is something other than races 3 or 14 and will damage soybeans with PI88788 source of resistance. Therefore, the PI88788 should not be grown.
Table 1. Types of soybean cyst nematode resistance and associated types with variety recommendations.

<table>
<thead>
<tr>
<th>Type of Resistance</th>
<th>SCN Races Managed</th>
<th>Use This Source For HG-type:</th>
<th>Brand/Varieties* to Use</th>
</tr>
</thead>
<tbody>
<tr>
<td>PI88788</td>
<td>3, 14</td>
<td>0,1,3,4,5,6,7</td>
<td>P09T74r2, P15T46r2, P15T83r, P18T31r, P19T01r, P19T39r2, P24T05r, 92Y55, P25T51r, P28T08r, 93Y05, P33T72r, P09T29x, P10T41x, P22T24x, P24T84x, P28T71x, P31T52x, P33T19x</td>
</tr>
<tr>
<td>PI548502 (Peking)</td>
<td>1, 3, 5</td>
<td>0,2,3,4,5,6,7</td>
<td>P22T69r, P28T62r</td>
</tr>
</tbody>
</table>

SCN Sampling

Sampling is the key to knowing the kind and race of nematodes that are present in production fields. According to nematologist Fred Warner, sampling is best done when soil temperatures are below 75°F. The sample should consist of soil cores taken throughout a field. Adequate soil is needed to identify and possibly type-test for the pest. A sample of 2 gallons of soil is needed to type-test for soybean cyst nematodes. Including an intact root for assessment of nematodes may be necessary depending on nematode populations. For the type-test, the process involves growing out soybean plants that are type-resistant varieties. The nematodes are allowed to feed and develop on these plants for 35 days. The roots are then scrubbed, releasing the females so they can be counted. Based on the results, recommendations regarding variety selection will be provided.

Though results may seem low, populations can maintain and increase on alternate hosts. Weeds can also host nematodes, allowing populations to increase. Sampling fields after harvest, especially those that have winter annual weeds (brought on by good growing conditions in the fall), can give a good indication of populations for the next season. This allows time for proper crop management.

Nematode Management

Management of nematodes is necessary for increasing grain production. There are additional options available today, including resistant soybean varieties and seed treatments for corn and soybeans. Sampling to know the presence and type of nematode is necessary for proper management. Rotation does help manage populations by not providing the pest with an optimum host, therefore limiting the population. In addition to rotation, understanding the type of nematodes that are present will help in selecting the best management practice. In the case of SCN, varietal selection is key to keeping all biotypes managed. Seed treatments, such as Poncho® 1250 + VOTiVO® for corn and Poncho®/VOTiVO® for soybeans, can allow for additional protection. VOTiVO employs a biological mode of action with a unique bacteria strain that lives and grows with young roots, creating a living barrier that prevents nematodes from causing damage. Using technologies and best management practices, such as sampling and rotation, will help keep nematode populations in check. Understanding the scope of nematode populations in a farm operation will provide another tool in protecting maximum yield potential.

![Figure 2. Roots of a corn plant affected by corn nematodes. Symptoms of corn nematodes include root pruning, proliferation of fibrous roots, thickening or swelling of the smaller roots, and mild to severe discoloration.](image)

Special acknowledgement to Dr. Fred Warner, Nematologist, Michigan State University.

The foregoing is provided for informational use only. Please contact your Pioneer sales professional for information and suggestions specific to your operation. Pioneer® brand products are provided subject to the terms and conditions of purchase which are part of the labeling and purchase documents. Product performance is variable and depends on many factors such as moisture and heat stress, soil type, management practices and environmental stress as well as disease and pest pressures. Individual results may vary.

* All Pioneer products are varieties unless designated with LL, in which case LL are brands.

Always follow grain marketing, stewardship practices and pesticide label directions. Varieties with the glyphosate tolerant trait (including those designated by the letter “R” in the product number) contain genes that confer tolerance to glyphosate herbicides. Glyphosate herbicides will kill crops that are not tolerant to glyphosate. Varieties with the Genetix® Roundup Ready 2 Yield® (RR2Y) trait contain genes that confer tolerance to glyphosate, the active ingredient in Roundup® brand agricultural herbicides. Roundup® brand agricultural herbicides will kill crops that are not tolerant to glyphosate. Genetix®, Roundup® and Roundup Ready 2 Yield® are registered trademarks of Monsanto Technology LLC, used under license. Individual results may vary, and performance may vary from location to location and from year to year. This result may not be an indicator of results you may obtain as local growing, soil and weather conditions may vary. Growers should evaluate data from multiple locations and years whenever possible. ALWAYS READ AND FOLLOW PESTICIDE LABEL DIRECTIONS. Roundup® crops contain genes that confer tolerance to glyphosate, the active ingredient in Roundup® brand agricultural herbicides. Roundup® brand agricultural herbicides will kill crops that are not tolerant to glyphosate. Pioneer is a member of Excellence Through Stewardship® (ETS). Pioneer products are commercialized in accordance with ETS Product Launch Stewardship Guidance and in compliance with the Pioneer policies regarding stewardship of those products. Crops and materials containing biotech traits may only be exported to or used, processed, or sold in jurisdictions where all necessary regulatory approvals have been granted for those crops and materials. It is a violation of national and international laws to move materials containing biotech traits across borders into jurisdictions where their import is not permitted. Growers should discuss these issues with their purchaser or grain handler to confirm the purchaser or handler’s position on products being purchased. Excellence Through Stewardship® is a registered trademark of the Biotechnology Industry Organization.