

2009-10 Soybean Cyst Nematode Survey Results

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Introduction

The soybean cyst nematode (*Heterodera glycines*) is the most limiting biotic factor of soybean production in Delaware. In 1993 and 1994 a major effort was made to survey the soybean acreage for the soybean cyst nematode (SCN) and determine the race composition of the SCN populations present at the time. The Delaware Soybean Board funded this project and the results demonstrated that roughly 60% of the populations that were race tested were race 3 and 30% race 1 and the remainder a mix of races 5, 7, and 9. Since that time Round-Up Ready soybeans were introduced with a single source of resistance to SCN derived from a soybean plant introduction referred to as PI88788. At the time of the first survey we demonstrated a significant yield reduction in one variety trial where race 3 resistant soybeans were planted in a field known to be infested with race 1. This was the first indication that not all race 1 populations could be controlled with a race 3 or 3, 14 resistant soybean variety. For the past 10 years SCN has not been identified as causing much yield loss because symptoms that were seen previously, namely severe stunting and chlorosis, only seem to be present when a susceptible variety is grown or high egg numbers combined with dry weather at planting occurs when a resistant variety is planted. During the 2008 growing season a small number of soybean fields had stunted plants, chlorosis, and SCN was present on the roots. All of these fields were planted with a Round-Up Ready variety with resistance to SCN. The difference in 2008 was that it was dry from planting through the first thirty days after planting. High SCN egg numbers and dry weather early are known to be very detrimental to early soybean growth and can produce stunting, chlorosis and yield loss.

Within the last 5 years there are indications that race 3 is no longer the predominant race. A small set of samples tested here and those sent to other institutions have tested as race 1. Since the majority of resistance in Round-Up Ready soybeans is from PI88788 which allows reproduction of race 1 populations, these varieties may have reduced effectiveness in suppressing current SCN populations. Other control measures may be needed if the current population structure is no longer predominately race 3. No surveys of SCN have been conducted in Delaware since 1996.

Materials and Methods

Sixty-three soil samples from fields with known history of soybean production with or without known SCN infestations were sampled during the spring summer and fall. Thirteen samples were taken from New Castle County, 22 from Kent and 28 from Sussex. Fields were sampled randomly by taking approximately 25 soil cores in a zigzag pattern to a four to six inch depth and within the row if soybean

stubble was present. Samples were placed in plastic bags and stored at 40°F until processed. *H. glycines* cysts were separated from the soil by the wet sieving method. A 250-cm³ sub-sample was taken from the well-mixed soil sample and suspended in water. The suspension was poured through nested 595-over 250-µm pore sieves. Cysts and debris retained on the 250 µm pore (60 mesh) sieve were washed into a large 100-ml polypropylene test tube and the water level increased to 40 ml. A stainless steel bit with 1-mm helical ridges attached to a variable speed stirrer was used to crush the cysts: the stirrer's rheostat was turned to 6,000 rpm while the test tube containing the cysts was held gently against the rotating bit for 60 seconds. Contents of the tube were washed through nested 75-µm-pore (200 mesh) over 25-µm-pore (500 mesh) sieves. Eggs collected on the 25-µm-pore sieve were stained with acid fuchsin. After staining, the egg suspensions were standardized to 100 ml, stirred, and a 5 ml subsample was removed with a pipette for counting. Results were reported as number of eggs per 250 cm³ soil.

For race and HG typing, 14 samples were selected from Kent (4) and Sussex (10) Counties where there were at least >1,000 eggs/250 cm³ of soil (except for one sample from Kent County). Samples were sent by 2-day express to the University of Missouri Extension Nematology Laboratory for analysis. Populations were reared on susceptible soybean for 30 to 40 days in a water bath at 27°C to increase egg numbers and break any egg dormancy. Plant root systems were removed from pots, cysts were collected, and eggs were extracted for use in race and HG Type test. Female Index (FI) was calculated for each soybean line as follows: FI = (mean number of females on test soybean line divided by the mean number of females on the susceptible variety 'Lee' X 100.

Results

In this study, 63 soil samples were processed for egg counts. In all, 35 (55.6%) of the samples had detectable populations of SCN. The highest number of eggs detected was 11,448 eggs/ 250cm³ soil, and the lowest was 72 eggs/ 250cm³ soil.

Table 1. Frequency distribution of soil samples among classes of egg counts per 250 cm³ soil (0.5 pt)

Egg Rating	NCC	%	Kent	%	Sussex	%	Statewide %
None 0 eggs	13	100	14	63.8	1	4.0	44.4 (28)
Low 1-499 eggs	0	0	2	9.0	3	10.7	8.0 (5)
Moderate 500-1,499	0	0	1	4.6	6	21.4	11.1 (7)
High 1,500-4,999	0	0	3	13.6	8	28.6	17.5 (11)
Very high 5,000-50,000	0	0	2	9.0	10	35.7	19.0 (12)

Fifteen soil samples(42.8%) of the 35 samples that had cysts were sent for race and HG Typing.

Table 2. Table of Race/HG Tests for SCN populations collected as part of the SCN Survey. 2009.

Sample #	Indicator Line – Female Index : FI = (mean number of females on test soybean line divided by the mean number of females on the susceptible variety ‘Lee 74’ X 100								HG type	Race
	HG 1	HG 2	HG 3	HG 4	HG 5	HG 6	HG 7			
	Peking	PI88788	PI90763	PI437654	PI209332	PI89772	PI548316	Pickett		
30	0%	70%	0%	0%	65%	0%	64%	7%	2.5.7	1
31	18%	65%	0%	0%	81%	0%	64%	73%	1.2.5.7	2
33	1%	67%	0%	0%	70%	0%	67%	15%	2.5.7	5
42	1%	63%	0%	0%	46%	0%	73%	18%	2.5.7	5
44	0%	59%	0%	0%	63%	0%	61%	0%	2.5.7	1
48	0%	80%	0%	0%	46%	0%	67%	1%	2.5.7	1
49	2%	68%	0%	0%	41%	1%	58%	10%	2.5.7	1
50	2%	76%	0%	0%	77%	0%	63%	9%	2.5.7	1
51	11%	75%	1%	0%	66%	0%	90%	27%	1.2.5.7	2
52	7%	62%	0%	0%	66%	0%	74%	29%	2.5.7	5
54	2%	70%	0%	0%	79%	0%	72%	12%	2.5.7	5
57	1%	75%	0%	0%	73%	0%	61%	8%	2.5.7	1
58	0%	63%	0%	0%	72%	0%	85%	3%	2.5.7	1
59	7%	44%	1%	0%	51%	0%	67%	36%	2.5.7	5
63	15%	67%	0%	0%	84%	0%	68%	52%	1.2.5.7	2

The race composition has changed dramatically since 1996. Seven race 1 populations (47%) have been identified, 5 race 5 populations (33%) and 3 race 2 populations (20%). The other alarming result is the high female index (FI) for these populations on PI88788. The range is from 44- 80% of the susceptible variety. The average FI is 67.

Discussion

These results indicate that under adverse growing conditions and high initial egg numbers, stunting and yield loss would be expected if a race 3, 14 resistant variety with PI88788 as its source of SCN resistance is grown here in Delaware. Consequently, growers may need to plant soybean cultivars derived from non-PI88788 resistance sources to successfully manage soybean cyst nematode in the future. This is a problem since there are none that are Round-Up Ready that can be planted at this time. There is little interest in growing conventional soybeans and the varieties that could be grown here are not available in sufficient quantities to satisfy the immediate need. Growers are going to have to manage SCN by judicious variety selection and rotations with non-host crops for the immediate future.

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