VARIATION AMONG WISCONSIN SCN POPULATIONS[1]

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The soybean cyst nematode (SCN), *Heterodera glycines*, is a chronic problem for soybean production in Wisconsin. The distribution of SCN expands every year. This nematode rarely disappears from a field once an infestation is detected, even if SCN-resistant soybean varieties are incorporated into the rotation. Host resistance is the most effective and economical management strategy available for this soybean pest, but even this tactic must be thoughtfully deployed to achieve full yield potential. The most serious threat to SCN-resistant varieties is the tremendous genetic variation among the individual nematodes that comprise a SCN population. Somewhere "in the crowd" lurks nematodes not affected by the host chemistry that confers resistance to nematode reproduction. The fact that the majority of nematodes are affected explains why host resistance is successful in boosting yields; the fact that some are not explains why it is difficult to maintain high yields if the same soybean genotype is planted season after season.

Planting resistant varieties does not eliminate a SCN problem and in some cases may increase SCN levels. Our research showed that SCN populations significantly ($P \leq 0.05$) decreased in four fields, increased in six fields, and remained statistically unchanged in seven fields planted with an SCN-resistant variety during 1999-2001. Our experience is not unique; similar findings have been reported for Iowa, Illinois, and other North Central states.

Almost all SCN-resistant varieties sold in Wisconsin derive their resistance from P.I. 88788. This source of resistance is effective for most, but not all populations of SCN. The accepted means of describing genetic variation among SCN populations is the Hg (*Heterodera glycines*) Type Test. The Hg Type Test compares the growth of SCN on seven different soybean indicator lines to that achieved on a standard susceptible variety. We tested nematodes from some of our research sites as well as from other fields across the state for their Hg Type designation.

Procedures

The Hg Type Test involves planting soybean seed of seven indicator lines that represent the resistance genes currently used in soybean breeding programs: "Peking", PI 88788, PI 90763, PI 437654, PI 209332, PI 89772, and PI 548316. New indicator lines are added to the HG Type Test once the germplasm is available in commercial seed. Five replicate pots were planted for each line as well as a standard susceptible variety 'Lee 74'. The plants were maintained in a growth chamber at 27 C for 30 days. Cysts were dislodged from roots, collected, and counted. The number of cysts recovered was averaged for each soybean line and then divided by the average number of cysts collected on the susceptible variety to compute a FI (female index) value. If the FI was greater than 10%, the soybean line was considered to be susceptible to SCN.

Results and Implications

To date, we've conducted Hg tests on fourteen populations of SCN from 13 counties. The FI {(average number of females produced on the test variety/average number of females produced on the susceptible variety) x 100} for 10 populations is presented in Table 1. Four populations infected and matured (FI > 10) on P.I. 88788, the source of resistance in most commercial

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infected and matured (FI > 10) on P.I. 88788, the source of resistance in most commercial varieties developed for Wisconsin. Based on the Hg Type Test results, we predict that the Grant population would diminish the yield potential of soybean varieties with PI 88788-derived resistance only slightly. The yield benefit of using PI 88788-derived resistance could be substantially compromised by the Juneau, Sauk, and Buffalo populations.

County	FI on P.I. 88788	Hg type
Waushara	1	0
Waupaca	5	1
Racine	7	0
Columbia	7	7
Shawano	7	7
Dunn	9	5.7
Grant	14	2.7
Juneau	30	2.5.7
Sauk	35	2.5.7
Buffalo	43	2.5.7

Table 1. Results of Hg Type tests on SCN populations collected from 10 counties in Wisconsin.

Knowing the Hg Type of a SCN population is important, but it may not provide all the information that produces need. The indicator lines used in the Hg Type Test are in the linage of commercial varieties, but are not the varieties themselves. This is an important distinction because even two varieties that share the same source of resistance, such as PI 88788, may support quite different levels of SCN reproduction. The reason is that the two varieties have many other genes that may contribute to the success of SCN (e.g., root architecture) or because not all the resistance genes in PI 88788 are present. Some companies provide resistance rankings (i.e. high, moderate, slight) and producers can take advantage of this information by planting varieties with only the highest level of resistance into fields with populations known to have a FI value greater than 10.

Results of these tests underscore the inherent variability among SCN populations and the importance of this fact to soybean variety selection. None of the populations we tested had ever been exposed to an SCN-resistant variety, yet some nematodes in the population were not affected by soybean defense responses. Planting a resistant variety will eliminate all but these nematodes and they will produce offspring that inherit the same successful characteristics.

The “CystX” source of resistance is now available to Wisconsin producers. Varieties carrying these resistance genes, derived from PI 437654, are reported to be effective against most populations of SCN. Hopefully, this source of resistance will be effective for a long time, but almost certainly not forever. The existence of “Cyst X” can be attributed to the incredible range of genetic variability that exists within populations of soybeans. It is inconceivable that SCN, which depend on soybean plants for food, are any less diverse. No single host genotype is likely to provide the “magic bullet” to eliminate SCN; so Wisconsin producers should continue to monitor what is happening in their fields. Our recommendation is to plant a variety with PI 88788 resistance once SCN is detected in a field. There are many high-yielding varieties available with a range of resistance to other diseases. The soil should be tested every two soybean crops and alternative sources of resistance, such as ‘CystX’ should be planted if SCN population densities have increased. Practicing crop rotation and managing resistant soybean varieties will enable producers to maintain high yields in SCN-infested fields.