Integrated Approach to Enhance Durability of SCN Resistance for Long-Term Strategic Management

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Principal Investigators

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Overview of project objectives

Soybean cyst nematode (SCN) is the most economically damaging pathogen for U.S. soybean farmers. Current annual yield losses top $1.2 billion. Sometimes the symptoms are so subtle, farmers don't even know they're losing yield and money. And that's why NCSRP continues to provide sustained investments in ongoing, multi-year SCN research that delivers progress and results.

While SCN-resistant varieties are available to protect soybeans and minimize yield loss, farmers face limited options for rotation once resistance-breaking SCN populations set up in their fields. The predominant SCN resistance genes in commercial soybean varieties have been used effectively for many years but lack genetic diversity. Effectiveness is reduced due to SCN population selection pressures.

To develop more efficient management practices that address resistance challenges, soybean molecular geneticists and breeders are working to understand the molecular mechanisms of soybean-SCN interactions and identify new SCN resistance genes. The goal is to increase genetic diversity of SCN resistance in commercial varieties and to determine the most effective rotation practices to preserve known sources of SCN resistance. Nematologists are working to identify SCN genes responsible for the adaptation to reproduce on resistant varieties, as well as monitor nematode population shifts in fields where soybeans with older resistance genes have been grown. After determining the basic genetics and mechanisms for how some populations grow, reproduce and thrive on resistant soybeans, researchers can share data and new resistant gene sources with plant breeders to develop new SCN-resistant varieties.

The integrated approach project began in 2019. Specific project objectives for 2021 include:

- Identify SCN virulence genes to better understand how the nematode adapts to reproduce on resistant varieties and identify new SCN gene targets for host plant resistance.
- Determine combinations of resistance genes beneficial in variety rotations to enhance SCN resistance durability.
- Translate results to the SCN Coalition to increase the profitability of soybean farmers.
- Organize tests of experimental lines developed by public breeders in the north central United States and Ontario.

Key results

The multi-state team has developed an SCN reference genome and a centralized, web-based repository called SCNBase (SCNBase.org). The portal is home to all bioinformatic, genetic, genomic and molecular data generated for SCN. Researchers and breeders worldwide can use the public bioinformatic data to help develop and provide nematode materials for genome sequencing efforts. Researchers are close to having eight full assemblies of SCN lines that correspond to all major HG types (specific SCN populations) that will further discovery. In addition, as possible SCN virulence genes are identified, gene function studies allow researchers to understand how they work and evaluate gene targets as the vulnerable points of disruption in the SCN life cycle and use them to enhance resistance. Field trials continue to evaluate low and high SCN population densities among susceptible varieties and varieties with specific SCN resistance. To help educate farmers, the SCN Coalition created the "Let's Talk Todes" Research Collection video series online this year (thescncoalition.com). Videos explain checkoff-funded research underway to bring new tools to the fight against nematodes.

Benefit to farmers

This project will use knowledge and soybean germplasm development to create a long-term SCN management strategy.

USB National Soybean Checkoff Research Database link

An integrated approach to enhance durability of SCN resistance for long-term strategic SCN management (Phase II)