Participant List
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Accomplishments

Objective 1. Develop, evaluate, improve, and integrate management techniques for plant-parasitic nematodes in the north-central region to increase grower profitability.

a) Evaluate interactions of plant-parasitic nematodes with germplasm of economically important plants.

Participants from Iowa, North Dakota, Minnesota, and Illinois evaluated germplasm for resistance to soybean cyst nematode. In Iowa, the data collected included SCN egg population densities at planting and at harvest and grain yield. There were significant differences in yields and harvest SCN population densities in all nine experiments. The results of the field evaluations were compiled in a printed Iowa State University Extension publication that was direct mailed as a magazine insert to 52,000 Iowans and also made available online at www.isuscntrials.info. In Minnesota, common bean germplasm lines (*Phaseolus vulgaris* L.) were evaluated for SCN resistance, and in Illinois, wild *Glycine* spp were evaluated for resistance.

b) Assess intraspecific variability in nematode virulence and pathogenicity.

Ohio and Michigan are examining the prevalence of root knot nematodes on horticultural crops. North Dakota is examining the variability of stubby root nematode on potato.

c) Evaluation of new nematicidal seed treatments for management of SCN and corn-parasitic nematodes

Participants from South Dakota, Iowa, Illinois and Missouri examined seed treatments for the control of plant parasitic nematodes. Treatments tested were at various stages of commercial development. Illinois is examining treatments on soybean and corn against SCN and lesion nematodes using both field and microplot designs. In Iowa, 27 field experiments were conducted in Iowa to study the effects of three nematode-protectant

seed treatments on soybean yields and SCN soil population densities. The experiments were located in the same fields in which the SCN-resistant soybean variety evaluation experiments were conducted. There were nine experiments comparing Aveo plus a base seed treatment of insecticide and fungicide to the base alone, nine comparing Nemastrike plus a base seed treatment of insecticide and fungicide to just the base, and nine comparing Trunemco plus a base seed treatment of insecticide and fungicide to just the base alone. SCN population densities were determined from soil samples collected at planting and again at harvest, and yields were collected as well. Significant yield increases occurred in 2 of the 27 total experiments (one experiment with Aveo and one experiment with Nemastrike) and there were no significant effects on harvest SCN population densities in any of the 27 experiments. In addition, four field experiments are being conducted in Missouri to assess yield, 30-day SCN reproduction, and season-long SCN reproduction for 5 nematode-protectant seed treatment products versus a fungicide plus insecticide base treatment.

In Minnesota, fungi isolated from a field of long-term crop rotation study were tested in vitro for their ability to colonize SCN cysts and eggs, as well as their ability to produce toxic compounds against SCN egg hatch. Fungi (*Fusarium, Ilyonectria,Chloridium, Exophiala, Purpureocillium, Mortierella, Pochonia, Trichoderma, Alternaria, Cladosporium, Clonostachys,* and *Mariannaea*) having both high parasitism and toxicity were further evaluated in vivo in a greenhouse study for their efficacy to control SCN on soybeans.

D. Evaluation of rotational crops and cultural practices for SCN and corn-parasitic nematode management

Participants from Missouri, Iowa, and Michigan are examining the role of soil suppressiveness for the control of plant-parasitic nematodes. Illinois is examining the effect of nitrogen application and tile drainage on nematode communities. Iowa and North Dakota are examining the effect of cover crops on reproduction in SCN and other vermiform nematode species. In North Dakota all tested cover crops led to reductions in SCN, but were variable for the control of vermiform species on corn. Iowa has tested the mechanisms of cover crop suppression using in vitro, greenhouse and field experiments.

Objective 2. Determine interactions of nematodes with other pests and pathogens and the impact of nematodes on plant and soil health.

Illinois, Minnesota, and Michigan are investigating various aspects of the role of nematodes in soil health. These include but are not limited to the interaction of nematodes in a cover crop system and the interaction of SCN with endophytes of soybean and corn. Illinois is collaborating with an entomologist, a pathologist, and a soil scientist to examine the effect of nitrogen application on soil health in corn-soybean production.

In Missouri, the research conducted objective 1C also examines the relationship between SCN seed treatments and their impacts on foliar symptoms of soybean sudden death syndrome.

Objective 3. Develop and disseminate research-based information on the biology and management of plant-parasitic nematodes of economically important crops in the NCR.

Participants from Iowa, Missouri, and Illinois have given presentation to growers, crop consultants, and other ag industry representatives on the importance and management of plant-parasitic nematodes. A list of SCN-resistant soybean varieties was compiled for Iowa soybean growers in October 2018. The list was created as an Iowa State University Extension publication and made available free of charge on the Internet in PDF format. The 2018 list contained information on 830 soybean varieties in maturity groups 0, 1, 2, and 3 and it is available online here.

Participants from North Dakota, South Dakota, Minnesota, Wisconsin, Illinois, Missouri, Michigan, and Kansas are part of the SCN coalition funded by the United Soybean Board and the North Central Soybean Research Board.

Impact Statements

1. Surveys conducted by project scientists help soybean farmers assess the likelihood of SCN existing in their growing region.
2. Survey results by project participants indicate how well the SCN populations in the Midwest reproduce on resistant soybean varieties, which is useful information for guiding soybean breeding efforts and for giving farmers management recommendations.
3. Examination of new sources of SCN resistance from wild soybean by project participants have the potential to provide farmers with novel resistance for SCN management.
4. New molecular identification and quantification methods developed in the project will provide rapid and sensitive diagnostic methods, improve nematode detection efficiency, and are important for nematode management.
5. Results of field experiments conducted by project scientists illustrate the benefits and shortfalls of using nematode-protectant seed treatments, allowing farmers and crop advisors to decide whether the likelihood of gaining benefits from the products is greater than the costs of the products.
6. Information produced in this project on the distribution and host range of root-lesion nematode species will improve recommendations for reducing nematode losses in corn and wheat through crop rotation and cover crop selection.
7. Soil health research conducted in this project provides quantitative and integrated data that are critical to cropping systems decision-making and managing soil health to benefit growers and the environment. Also, research identified the role of conventional agronomic practices on nematode communities and soil health.

8. Examining of non-soybean inputs such as addition of nematode-inhibiting microbes or use of plants that alter nematode fate in the soil is showing some promise in adding new tools for SCN control.
9. New tools and techniques used by project scientists improved the basic understanding of nematode biology.

Publications

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