The Impact of Cover Crops on Soybean Cyst Nematode Population Densities After One Year in Northern Iowa

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Introduction

Soybean cyst nematode (SCN) is the top yield-suppressing pathogen in soybean production in the United States. Farmers are struggling to effectively manage populations of SCN, which are developing increased reproduction on the commonly used source of resistance. Seed treatments for SCN management are a relatively new option, but performance often is inconsistent. There is increasing interest in the possibility of using cover crops to manage SCN in soybean fields.

Some companies are promoting certain cover crop species and varieties for decreasing or even eradicating nematodes. But the results of past scientific studies on the impacts of cover crops on SCN have been inconsistent or mixed. Data from an unpublished study conducted in the 2000s in Illinois suggest that cereal rye and annual ryegrass significantly decrease SCN population densities in the field. However, this work has not been reproduced elsewhere. More replicated and peer-reviewed studies are warranted to determine whether cover crops could be used to help manage SCN in Iowa. Field studies are being conducted at Iowa State University research and demonstration farms to assess the effects of cover crops on SCN population densities over a three-year period.

Materials and Methods

Experiments are being conducted at the Northern Research and Demonstration Farm, Kanawha, Iowa, and the Muscatine Island Research and Demonstration Farm, Fruitland, Iowa. The studies were initiated in the fall of 2016 and will conclude in the spring of 2019. Each farm has two experiments defined by their rotation, either corn-soybean-corn (CSC) or soybean-corn-soybean (SCS). For the experiments described in this report that were conducted in Fruitland, fields were bulk seeded in 2016 with soybean variety Pioneer 93M11 (SCS) and Dekalb corn hybrid 54-38 (CSC). Once the crops were established, 3-ft alleys were cut in the fields to make 60, 10-ft wide (four rows) by 17-ft long plots in each experiment. On August 31, 2016, nine different cover crop treatments were sown into standing corn and soybean plots using a fertilizer spreader. There were 10 treatments (including a no-cover-crop control). The cover crop treatments included two cultivars of each of the following: annual ryegrass (*Lolium multiflorum*), cereal rye (*Secale cereale*), and mustard (*Brassica juncea*), as well as one oilseed and one Daikon-type radish cultivar, and one cover crop mix (cereal rye, Daikon-type radish, and crimson clover). Each treatment was replicated six times in each experiment.

To assess the effects of cover crops on SCN population densities over time, soil samples were collected from the center two rows in each plot at the time of cover crop seeding in late August, in late November before the soil froze, and in early May following cover crop termination but prior to the planting of the cash crop. SCN egg population densities were determined from 100-cc subsamples of the soil samples collected from each plot.

A percent change factor (PCF) was calculated to determine the effects of cover crops on the

SCN population densities between sampling times. Specifically, PCF values were calculated for each plot by dividing the population density in November by the population density in late August, and also by dividing the population density in May by the population density in November. These PCF values were used in the statistical analyses. Results are presented for species types and not for specific cultivars in this report. A PCF less than one means the SCN population density decreased between the two sampling times. A PCF greater than one indicates the population density increased between two sampling dates.

Results and Discussion

To date, samples have been processed for September and November 2016 and April 2017. There were no significant differences in PCF for either pair of sampling dates in either experiment (Table 1). That is, the cover crops had neither a positive or negative effect on the population densities of SCN in those two experiments at those sampling dates.

These results are from one location in Iowa and one year of a three-year study. It is possible the effects of cover crops could take longer to accrue and were not yet detected in first year results. As more data are collected in the last two years of the study, more conclusions will be drawn.

Regardless of whether or not there is an effect of cover crops on SCN population densities, the agronomic benefits of cover crops are indisputable. A broader conclusion on the impacts of cover crops on SCN over multiple years of these experiments will be available within the next year.

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Table 1. The population change factors (PCF) of soybean cyst nematode (SCN) during the first season of cover crop growth at Kanawha, IA.*

Sample interval	Cover crop	PCF following 2016 soybean	PCF following 2016 corn
Pre-winter:	Annual ryegrass	1.47	1.39
Seeding	Cereal rye	1.69	2.18
	Mustard	1.94	1.51
	Radish	1.22	1.02
	Mix	1.05	1.85
	No cover crop	1.11	1.19
Spring:	Annual ryegrass	0.64	0.98
Pre-winter	Cereal rye	0.50	0.97
	Mustard	0.70	1.19
	Radish	0.57	1.67
	Mix	0.92	0.78
	No cover crop	0.34	0.98

*PCF values are the ratios of SCN population densities in soil samples collected from each plot at three time points: at the time of cover crop seeding in late August ("seeding"), after cover crop establishment but before the soil froze in late November ("pre-winter"), and after cover crop termination but prior to cash crop planting in early May ("spring"). There were no significant differences in PCF values among cover crop treatments for either experiment after one complete year of soil sampling.