Cover Crop Effects on Soybean Sudden Death Syndrome, Iron Deficiency Chlorosis, and Yield

RFR-A1980

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Introduction

More growers are utilizing cover crops in the Midwest, but the impact of cover crop practices on plant diseases is poorly understood. Cover crop plantings can alter soil moisture levels and microbial communities, and consequently may influence the development of soilborne diseases. Sudden death syndrome (SDS) and iron deficiency chlorosis (IDC) are soilborne diseases that affect soybean production in northern Iowa. In the North Central region, fall-sown rye and wheat are two winter-hardy options growers can use for erosion and weed control outside of the growing season. Research in Minnesota has shown oats, sown as a nurse crop in the spring, can mitigate IDC symptoms in soybean by taking up excess soil moisture and nitrates. In 2019, we continued field experiments to evaluate the effects of winter rye, winter wheat, and nurse-crop oat cover crops on development of SDS, IDC, and soybean yield.

Materials and Methods

In 2019, plots were established at Kanawha, Iowa, in two fields, one with previous history of SDS and one known to express IDC in soybean. There were four treatments: fall-sown winter rye, fall-sown wheat, spring-sown oats, and no cover crop, planted in a randomized complete block design with six replications. Plots were 6 rows wide by 30 ft long, with 30 in. between rows. Plots were split and planted with two soybean varieties, Asgrow AG2733 and AG28X9. Asgrow AG2733 is more susceptible to SDS, whereas AG28X9 is more susceptible to IDC. Fall rye and fall wheat were drilled in late October 2018, germinated in the spring (March 2019), and were terminated just before soybean planting June 5, 2019. Spring oats were drilled just prior to soybean planting in early June and terminated July 12, 2019, at soybean growth stage V3. Cover crop biomass, disease assessments, and yield data were collected. Results were analyzed separately by variety.

Results and Discussion

More cover crop biomass was produced before termination in the fall-sown treatments than in the spring-sown oats (data not shown). The IDC symptoms were observed at low levels in the field with a history of IDC, but there were no treatment differences in IDC disease severity or yield for either variety (Table 1). The SDS foliar disease symptoms developed late in the growing season at both locations. The SDS incidence was very low (0.1 to 6.7% of plants) in the SDS-tolerant AG28X9 and ranged from 5.3 to 16.3 percent in subplots with the moderately-susceptible AG2733. Within each variety, there were no treatment differences in SDS disease incidence or disease index at either location. At the SDS location, AG28X9 plots without cover crops had higher yields than plots with cover crops, but yields for all four treatments were similar at the IDC location. Yields for AG2733 were not affected by treatment at either location.

Overall, there was little disease pressure during the 2019 growing season. Rainfall was

slightly below average in June and August, but higher than average in July and September. This experiment will be repeated in 2020 to evaluate additional growing environments to understand how cover crops may influence soybean diseases.

Acknowledgments

This trial was funded by the Iowa Soybean Association. Thanks to Brandon Zwiefel and Stith Wiggs for assisting with plot maintenance, data collection, and analyses.

Table 1. Mean yield, iron deficiency chlorosis (IDC) disease score, soybean sudden death (SDS) disease incidence, and SDS disease index observed in Asgrow AG2733 and AG28X9 soybean planted in two field locations with cover crop treatments at the ISU Northern Research Farm, Kanawha, IA.*

		IDC location - South Farm				SDS location - North Farm			
Variety[1]	Cover crop	Yield (bu/ac)	IDC score[2]	SDS DI (%)[3]	SDS DX[4]	Yield (bu/ac)		SDS DI (%)	SDS DX
AG2733	fall rye	40.3	3.0	14.6	6.4	47.8		14.7	5.7
	fall wheat	42.7	2.8	7.6	3.2	44.8		16.3	6.9
	spring oats	44.1	2.8	6.8	2.6	43.5		9.0	3.2
	none	41.2	2.8	11.3	4.7	44.1		5.3	1.8
AG28X9	fall rye	50.2	2.7	0.22	0.06	45.5	b[5]	0.23	0.06
	fall wheat	50.7	2.8	6.70	3.00	46.2	b	0.80	0.25
	spring oats	46.4	2.5	0.19	0.06	47.2	b	0.23	0.07
	none	47.8	2.3	0.08	0.02	51.6	a	0.13	0.03

*The north and south farm locations had previous histories of SDS and IDC, respectively. Cover crop treatments included fall-sown wheat, fall-sown rye, or spring-sown oats. Fall-sown cover crops were terminated before soybean planting. Spring oats were terminated at soybean growth stage V3.

[1]AG2733 is moderately susceptible to SDS, but tolerant of IDC. AG28X9 is SDS-tolerant, but moderately susceptible to IDC.

[2]Mean IDC score (1 to 9) rated July 2 at soybean growth stage V1. A score of 1 = no chlorosis and 9 = plant death.

[3]SDS DI = incidence of plants with SDS foliar symptoms at the end of the growing season.

[4]SDS DX = foliar disease index score for plot, rated at the end of the growing season.

[5]Within varieties, means followed by the same letter are not significantly different ($P > 0.05$). Values displayed without mean separation letters are not different.