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

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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 Iowa. In Iowa, 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, field experiments continued 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 in Ames 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 October 2018, germinated in the spring (March 2019), and terminated late June as rye was 3 ft tall and wheat was 18 in. tall. Spring oats were drilled just prior to soybean planting in early June and terminated in July 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). 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). SDS foliar disease symptoms developed late in the growing season at the Curtiss Farm location. SDS incidence was very low (1.8 to 3.7% of plants) in the SDS-tolerant AG28X9 and ranged from 18.3 to 36.2 percent in subplots with the moderately-susceptible AG2733 at the Curtiss Farm. Within each variety, there were no treatment differences in SDS disease incidence or disease index at either location. At both locations, AG28X9 plots with fall wheat had higher yields than plots with other cover crops or no cover crops. Yields for AG2733 were lower in the fall rye treatment at both locations but similar across all other treatments at both locations.

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.

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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 at the Curtiss and Hinds Farms, Ames, IA.*

		IDC Location - Curtiss Farm				SDS Location - Hinds 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	52.1 a[5]	2.1	34.2	22.5	42.9 a	0.4	0.14
	fall wheat	60.9 b	2.0	36.2	24.1	37.2 b	0	0
	spring oats	61.3 b	2.1	24.3	14.6	32.9 b	0	0
	none	64.3 b	1.9	18.3	8.2	35.5 b	0.03	0.01
AG28X9	fall rye	58.3 a	2.1	3.67	0.8	43.7 a	0	0
	fall wheat	70.5 b	1.9	1.83	0.5	45.1 a	0	0
	spring oats	69.5 b	2.0	3.17	0.8	35.8 b	0	0
	none	69.2 b	1.9	2.67	0.8	37.1 b	0.03	0.01

*Curtiss Farm and Hinds 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 1 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.