

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

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Introduction

More growers are using 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 2020, 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 were continued.

Materials and Methods

In 2020, plots were established in Boone and Story counties at three fields, one with previous history of SDS and two known to express IDC in soybean. There were five treatments: (1) fall-sown winter rye, (2) fall-sown wheat, (3) spring-sown oats, (4) spring-sown rye, and (5) 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. AG2733 is more susceptible to SDS, whereas AG28x9 is more susceptible to IDC. Fall rye and fall wheat were drilled in October 2019, germinated in the spring (March 2020), and terminated late (May 2020) as rye was 1.5 ft and wheat was 10 in. tall. Spring oats and rye were drilled just prior to soybean planting in early June and terminated June 2020, 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 both fields that had a history of IDC, but there were no treatment differences in IDC disease severity or yield for either variety (Table 1). Very few SDS foliar disease symptoms developed across all three locations. Within each variety, there were no treatment differences in SDS disease incidence or disease index at any location. Overall, there was little disease pressure during the 2020 growing season.

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Table 1. Effects of cover crop on yield, iron deficiency chlorosis (IDC) disease score, soybean sudden death (SDS) disease incidence, and SDS disease index in two varieties of soybean in central Iowa.¹

IDC and SDS location - Johnson Farm						
Variety²	Cover crop³	Yield (bu/ac)	IDC score⁴	SDS DI⁵ (%)	SDS DX⁶	
AG2733	fall rye	55.1	0	0	0	
	fall wheat	58.2	0	0	0	
	spring oats	59.2	1.5	1.5	0.35	
	spring rye	62.1	0.5	0.5	0.15	
	none	60.3	1.2	1.2	0.31	
AG28x9	fall rye	59.2	1.2	1.2	0.41	
	fall wheat	60.1	0	0	0	
	spring oats	58.3	0	0	0	
	spring rye	58.7	0	0	0	
	none	61.1	1.5	1.5	0.51	
IDC and SDS location – Bruner Farm						
AG2733	fall rye	52.9 a ¹	2.5	0	0	
	fall wheat	60.7 b	1.8	0	0	
	spring oats	61.3 b	2.2	0	0	
	spring rye	58.7 b	2.4	2.3	1.5	
	none	59.5 b	2.3	1.4	0.90	
AG28x9	fall rye	55.7	2.0	0	0	
	fall wheat	56.1	2.1	1.2	0.95	
	spring oats	54.8	1.9	0	0	
	spring rye	53.7	1.7	0	0	
	none	52.8	2.0	0.5	0.20	
SDS location – Hinds Farm						
AG2733	fall rye	45.4	-	2.5	1.5	
	fall wheat	46.5	-	0	0	
	spring oats	45.1	-	2.1	1.2	
	spring rye	46.5	-	1.5	1.6	
	none	47.1	-	1.5	1.7	
AG28x9	fall rye	46.3	-	1.5	3.1	
	fall wheat	45.3	-	1.4	1.2	
	spring oats	44.8	-	2.1	2.3	
	spring rye	47.4	-	2.3	3.4	
	none	46.2	-	1.5	1.7	

¹Within varieties, means followed by the same letter are not significantly different ($P > 0.05$). Values displayed without mean separation letters are not different.

²AG2733 is moderately susceptible to SDS, but tolerant of IDC. AG28X9 is SDS-tolerant, but moderately susceptible to IDC.

³Observed in two soybean varieties (Asgrow AG2733 and AG28X9) planted in three field locations at the ISU Johnson, Hinds, and Bruner Farms. Cover crop treatments included fall-sown wheat, fall-sown rye, spring-sown oats, or spring-sown rye. Fall-sown cover crops were terminated before soybean planting. Spring oats and rye were terminated at soybean growth stage V3.

⁴Mean IDC score (0 to 9) rated June 12 at soybean growth stage V1. A score of 0 = no chlorosis and 9 = plant death.

⁵SDS DI = incidence of plants with SDS foliar symptoms at the end of the growing season.

⁶SDS DX = foliar disease index score for plot, rated at the end of the growing season.