Rye Seeding Method and Seeding Rate

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Introduction

The use of cover crops has numerous environmental benefits. However, farmers remain hesitant to change their current production practices mainly due to cost of implementation and potential yield drag. Aiming to design best management practices (BMPs) for the adoption of cereal rye between soybean and corn cropping system, this trial was conducted to learn about the effects of different seeding methods and rates of a cereal rye cover crop.

Materials and Methods

These trials started with planting of Elbon cereal rye in the fall of 2018. For the broadcast treatment, plots were planted before soybean harvest, while drilled plots occurred after harvest. For broadcast plots, seeding rates were 1.0 (low), 1.33 (medium), and 1.67 (high) million seeds/acre. For drilled plots, seeding rates were 0.33 (low), 0.67 (medium), and 1.0 (high) million seeds/acre. Termination occurred 14 days before corn planting. This trial is part of a larger trial with locations near Ames and Sutherland, Iowa.

Results and Discussion

Cereal rye biomass accumulation was very different between years due to weather. The fall of 2018 and 2019 were both cooler and wetter falls that limited fall growth (data not shown). Cereal rye broke dormancy about 30 days earlier in spring 2020 (early March) compared with spring 2019 (early April). These extra 30 days of growth accumulated about 900 heat units (GDD50), approximately 150 higher than the previous year.

The drilled plots accumulated much lower cereal rye biomass (595 lb/acre) in 2019. However, in 2020, biomass accumulation was not significantly different (Table 1 and 2). In 2019, cereal rye seeding rate did not influence biomass accumulation, although in 2020, the higher the seeding rate the more the biomass accumulation. This was attributed to the 2019 seeding method difference and the 2020 seeding rate differences due to weather conditions. In the fall of 2018, the drill seeding method did not germinate, resulting in delayed and lower biomass accumulation in the spring of 2019. This also negated the influence of seeding rate. However, in 2020, when there was fall biomass germination and growth, the result was no seeding method difference in spring biomass accumulation and seeding rate differences became more evident.

Corn grain yields were responsive to only seeding method in 2019, where broadcast seeding was significantly lower than the drill seeding and no cereal rye control (Table 3). However, in 2020, when cereal rye biomass was higher, corn grain yield was statistically different for both cereal rye seeding method and seeding rates (Table 4). The broadcast method yielded less than the drilled, which was lower yielding than the no cereal rye check. Additionally, while the low cereal rye seeding rate had similar corn yields to the no cereal rye check, the medium and high cereal rye seeding rates had lower corn grain yields.

Effect of year was significant for incidence of rot on the radicle and the seminal roots ($P < 0.05$). Greater root rot incidence was observed in 2020 growing season compared with 2019.

No effect of seeding method and seeding rate were detected on root rot incidence in both 2019 and 2020 (Table 5 and 6). The incidence of radicle root rot in seedlings from no-rye check was about 4 and 7 percent in 2019 and 2020, respectively. Seminal root rot incidence was less than 2 percent in both 2019 and 2020 (data not shown).

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Table 1. Cereal rye biomass accumulation for broadcast and drill seeding method at low, medium, and high seeding rate spring 2019, Crawfordsville, IA.[1]

	Broadcast	Drill	Low	Medium	High
	Biomass accumulation (lb/acre)[2]				
Broadcast	736.2				
Drill		141.2			
	P = 0.0003				
Low	566.4	84.4	325.4		
Medium	780.0	123.0		461.5	
High	842.4	216.1			592.2
	P = 0.8480		P = 0.5069		

[1]P-values within boxes are used to compare biomass of the main effects or interaction effects within each box.
[2]Biomass accumulation that are significantly different at P < 0.05 have different letters following the yield values within each box.

Table 2. Cereal rye biomass accumulation for broadcast and drill seeding method at low, medium, and high seeding rate spring 2020, Crawfordsville, IA.[1]

	Broadcast	Drill	Low	Medium	High
	Bbiomass accumulation (lb/acre)[2]				
Broadcast	907.1				
Drill		881.9			
	P = 0.8930				
Low	355.3	485.0	420.2 B		
Medium	1027.6	1068.4		1048.0 A	
High	1338.5	1092.4			1215.4 A
	P = 0.6914		P = 0.0075		

[1]P-values within boxes are used to compare biomass of the main effects or interaction effects within each box.
[2]Biomass accumulation that are significantly different at P < 0.05 have different letters following the yield values within each box.

Table 3. Corn grain yields following cereal rye cover crops with broadcast and drill seeding method at low, medium, and high seeding rate in 2019, Crawfordsville, IA.

	Broadcast	Drill	Low	Medium	High
	Corn yield (bushels/acre)				
Broadcast	206 B				
Drill		214 A			
	P = 0.0390				
Low	213	213	213		
Medium	202	214		208	
High	203	214			209
	P = 0.3164		P = 0.5185		
No rye check	214				

[1]P-values within boxes are used to compare grain yields of the main effects or interaction effects within each box.
[2]Corn yields that are significantly different at P < 0.05 have different letters following the yield values within each box.

Table 4. Corn grain yields following cereal rye cover crops with broadcast and drill seeding method at low, medium, and high seeding rate in 2020, Crawfordsville, IA.

	Broadcast	Drill	Low	Medium	High
	Corn yield (bushels/acre)				
Broadcast	195 B				
Drill		206 A			
	P = 0.0119				
Low	214	219	216 A		
Medium	197	201		199 B	
High	174	197			185 C
	P = 0.3021		P = 0.0004		
No rye check	219				

[1]P-values within boxes are used to compare grain yields of the main effects or interaction effects within each box.
[2]Corn yields that are significantly different at P < 0.05 have different letters following the yield values within each box.

Table 5. Effect of seeding method on corn seedlings root rot incidence sampled at V2 to V4 in 2019 and 2020, Crawfordsville, IA.

Year	Seeding method	Radicle rot incidence (%)[x]	Seminal rot incidence (%)[y]
2019	Broadcast	10.6[z]	3.7
	Drill	5.6	3.7
	P value	0.078	0.9995
2020	Broadcast	17.6	6.5
	Drill	25.5	7.9
	P value	0.0986	0.5901

[x]Radicle rot incidence was calculated as the percentage of seedlings with lesions on the radicle.
[y]Seminal rot incidence was calculated as the percentage of seedlings with lesions on the seminal.
[z]Mean value was compared based on LSD with P value 0.05.

Table 6. Effect of seeding rate on corn seedlings root rot incidence sampled at V2 to V4 in 2019 and 2020, Crawfordsville, IA.

Year	Seeding rate	Radicle rot incidence (%)[x]	Seminal rot incidence (%)[y]
2019	High	6.9[z]	4.2
	Low	10.4	4.2
	Medium	6.9	2.8
	P value	0.5065	0.7899
2020	High	25.7	8.3
	Low	15.3	5.5
	Medium	23.6	7.6
	P value	0.1672	0.6515

[x]Radicle rot incidence was calculated as the percentage of seedlings with lesions on the radicle.
[y]Seminal rot incidence was calculated as the percentage of seedlings with lesions on the seminal.
[z]Mean value was compared based on LSD with P value 0.05.