NORTHWEST CROPS & SOILS PROGRAM

2021 Interseeding Winter Rye in Soybeans

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THE UNIVERSITY OF VERMONT EXTENSION

2021 INTERSEEDING WINTER RYE IN SOYBEANS

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Soybeans are grown for human consumption, animal feed, and biodiesel and can be a useful rotational crop in corn silage and grass production systems. As cover cropping expands throughout Vermont, it is important to understand the potential benefits, consequences, and risks associated with growing cover crops in various cropping systems. Establishing a good cover crop in the fall can be a challenge due to the later harvest date of soybeans in Vermont. To support the local soybean market and to gain a better understanding of interseeding cover crops in soybean production systems, the University of Vermont Extension Northwest Crop and Soils (NWCS) Program, as part of a grant from the Eastern Soybean Board, conducted a trial in 2021 to investigate the impact of winter rye planting date on cover crop establishment and soybean yield.

MATERIALS AND METHODS

The trial was conducted at Borderview Research Farm, Alburgh, VT in the 2021 growing season. The experimental design was a complete randomized block with four replications and the treatments were four winter rye planting dates (Table 1). Plots were 10' x 40'. On 6-Apr, 300 lbs. ac^{-1} of 19-19-19 was applied to all the plots. The soybean variety, SG 0720XT (maturity group 0.7) was obtained from Seedway LLC (Hall, NY) for this trial. Soybeans were planted on 26-May using a John Deere 1750 four-row planter fitted with bean cups at a rate of 200,000 seeds ac^{-1}. Annual ryegrass (var. Centurion) was interseeded into soybeans on four different planting dates: 14, 21, 28-Sep, and 4-Oct. Soybeans were harvested on 27-Oct using an Almaco SPC50 small plot combine. They were then weighed for plot yield and tested for harvest moisture and test weight using a DICKEY-John Mini-GAC Plus moisture/test weight meter. A week after soybean harvest, percent ground cover from the ryegrass was measured by processing photographs using the Canopeo© smartphone application on 3-Nov. The same day, the annual ryegrass was harvested by collecting and weighing the biomass within a 0.25m^2 quadrat. A representative sample was collected, weighed, dried, and re-weighed to calculate percent dry matter of the ryegrass.

Table 1. Trial management details, Alburgh, VT, 2021.

	Borderview Research Farm-Alburgh, VT
Soil type	Covington silty clay loam, 0-3% slopes
Previous crop	Corn silage
Tillage operations	Moldboard plow and disc
Plot size (feet)	10 x 40
Fertilizer	300 lbs. ac^{-1} (19-19-19) on 6-Apr
Soybean planting date	26-May
Soybean variety	SG 0720XT (maturity group 0.7, Roundup Ready®2Xtend)
Soybean seeding rate (seeds ac^{-1})	200,000
Soybean harvest date	27-Oct
Annual ryegrass variety	Centurion annual ryegrass
Annual ryegrass seeding rate (lbs. ac^{-1})	25
Annual ryegrass planting dates	14-Sep, 21-Sep, 28-Sep, and 4-Oct
Annual ryegrass harvest date	3-Nov

Yield data and stand characteristics were analyzed using mixed model analysis using the mixed procedure of SAS (SAS Institute, 1999). Replications within trials were treated as random effects, and treatments were treated as fixed. Treatment mean comparisons were made using the Least Significant Difference (LSD) procedure when the F-test was considered significant ($p<0.10$).

Variations in yield and quality can occur because of variations in genetics, soil, weather, and other growing conditions. Statistical analysis makes it possible to determine whether a difference among treatments is real or whether it might have occurred due to other variations in the field. At the bottom of each table an LSD value is presented for each variable (i.e. yield). Least Significant Differences (LSDs) at the 0.10 level of significance are shown. Where the difference between two treatments within a column is equal to or greater than the LSD value at the bottom of the column, you can be sure that for 9 out of 10 times, there is a real difference between the two treatments. In this example, treatment C is significantly different from treatment A but not from treatment B. The difference between C and B is equal to 1.5, which is less than the LSD value of 2.0. This means that these treatments did not differ in yield. The difference between C and A is equal to 3.0, which is greater than the LSD value of 2.0. This means that the yields of these treatments were significantly different from one another.

Treatment	Yield
A	6.0[b]
B	7.5[ab]
C	**9.0[a]**
LSD	2.0

RESULTS

Weather data were recorded throughout the season with a Davis Instrument Vantage Pro2 weather station, equipped with a WeatherLink data logger at Borderview Research Farm in Alburgh, VT (Table 2). Precipitation was much lower this season than normal. From May-Oct, there was a total of 19.25 inches of rain, nearly 4 inches below the 30-year average for that same time frame. Precipitation did increase by the end of the season, but the increased rainfall in October posed a challenge to timely soybean harvest. Warm temperatures in June were followed by unseasonably cool temperatures in July. The warm temperature persisted through October, which was over 4 degrees warmer than normal. These temperatures contributed to a total of 2830 accumulated Growing Degree Days (GDDs), which is 143 above average the 30-year average.

Table 2. Weather data for Alburgh, VT, 2021.

Alburgh, VT	May	Jun	Jul	Aug	Sep	Oct
Average temperature (°F)	58.4	70.3	68.1	74	62.8	54.4
Departure from normal	-0.03	2.81	-4.31	3.25	0.14	4.07
Precipitation (inches)	0.66	3.06	2.92	2.29	4.09	6.23
Departure from normal	-3.10	-1.20	-1.14	-1.25	0.42	2.40
Growing Degree Days (base 50°F)	334	597	561	727	394	217
Departure from normal	33	73	-134	85	7	79

Based on weather data from a Davis Instruments Vantage Pro2 with WeatherLink data logger.
Historical averages are for 30 years of NOAA data (1991-2020) from Burlington, VT.

The annual ryegrass planting date had no significant impact on soybean harvest (Table 3). The average harvest moisture for the trial was 24.7% and additional drying was required for safe storage. The trial yield average was 2560 lbs. or 42.7 bu. ac^{-1}. The average test weight was 51.7 lbs. bu^{-1} which is well below the industry standard of 60 lbs. bu^{-1}, but similar to the average test weight of this year's conventional soybean trial, 53.9 lbs. bu^{-1}. Ground cover and ryegrass yields were significantly impacted by planting date. The first planting date, 14-Sep, had statistically higher ground cover, 52.9%, and dry matter yield, 1426 lbs. or 0.71 tons ac^{-1}, compared to the other three planting dates. The latest planting date, 4-Oct, had the lowest ground cover, 13.6%, and dry matter yield, 235 lbs. or 0.12 tons ac^{-1}.

Table 3. Cover crop and soybean harvest characteristics, Alburgh, VT, 2021

Rye planting date	Soybean harvest				Cover crop harvest		
	Harvest moisture	Yield at 13% moisture		Test weight	Ground cover	Dry matter yield	
	%	lbs. ac^{-1}	bu. ac^{-1}	lbs. bu^{-1}	%	lbs. ac^{-1}	tons ac^{-1}
14-Sep	23.6	2703	45.1	52.0	52.9[a†]	1426[a]	0.71[a]
21-Sep	25.5	2670	44.5	51.7	40.8[b]	948[b]	0.47[b]
28-Sep	25.2	2465	41.1	51.5	25.0[c]	421[c]	0.21[c]
4-Oct	24.5	2403	40.1	51.5	13.6[d]	235[d]	0.12[d]
LSD (p = 0.10)[‡]	NS[§]	NS	NS	NS	6.54	174	0.09
Trial mean	24.7	2560	42.7	51.7	33.1	758	0.38

†Within a column, treatments marked with the same letter were statistically similar (p=0.10).
‡LSD; Least significant difference at the p=0.10.
§NS; No significant difference between treatments.

DISCUSSION

Incorporating cover crops into soybeans can be challenging because the crop is harvested so late in the season. Often, there is limited time to plant a cover crop following soybean harvest. Interseeding soybeans prior to canopy closure has led to highly variable cover crop stands. Soybeans form a dense canopy before drying down and interseeding equipment may cause damage to the developing plants as well. Waiting to interseed until later in the season may also result in damage to the cash crop. Once soybeans have dried down, interseeding equipment might cause pod shatter and loss of yields right before harvest. The goal of this project was to interseed a cover crop into soybeans at later development stages. Often this time frame also coincides with optimum planting dates for cover crops. One concern about interseeding into any cash crop is that if the cover crop is planted too early, it may produce a lot of biomass and compete for water and nutrients. This could be particularly challenging in a very dry year like 2021. However, there was no statistical difference in yield, test weight, or harvest moisture between any of the planting dates. Interestingly, the annual ryegrass did get mowed-off by the combine indicating that the ryegrass could interfere with harvest. These trade-offs must be considered when making management decisions, and more research needs to be done to better understand the impact of interseeding into a soybean cropping system. It is important to remember that these data represent only one year of research at one location. UVM Extension NWCS Program will repeat this trial again in 2022.

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