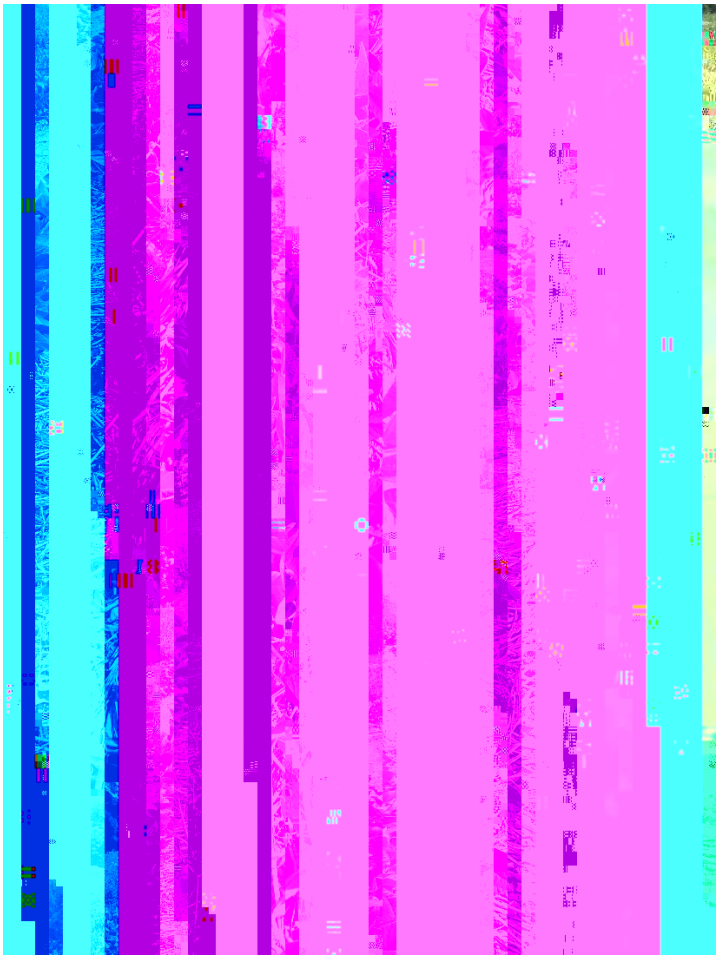
2021 Soybean Cover Crop Termination Trial



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2021 SOYBEAN COVER CROP TERMINATION TRIAL

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In 2021, the University of Vermont Extension Northwest Crops and Soils Program investigated the impact of a winter rye cover crop at Borderview Research Farm in Alburgh, VT. Soybeans are grown for human consumption, animal feed, and biodiesel, and can be a

Cover crop planting date	6-Oct 2020
Cover crop variety	Hazlet winter rye
Cover crop seeding rates (lbs. ac^{-1})	0, 50, 100, 150
Soybean variety	SG 1077 (maturity group 1.0, Roundup Ready®2Xtend)
Starter fertilizer	10-20-20 (250 lbs. ac^{-1})
Soybean planting date	21-May 2021
Soybean seeding rate (seeds ac^{-1})	200,000
Soybean harvest date	27-Oct 2021

Table 2. Cover crop termination treatments, Alburgh, VT, 2021.

Treatment	**Cover crop termination details**
Tillage	Tilled under with moldboard plow and disc harrow one week prior to soybean planting
Herbicide	Sprayed with Roundup PowerMAX® at 1qt ac^{-1} one week prior to soybean planting
Plant green	Soybeans were planted into living cover crop and sprayed with Roundup PowerMAX® at 1qt ac^{-1} at time of planting

To determine if the seeding rate of the fall planted cover crop had an impact on any soil properties, soil samples were collected on 12-May prior to cover crop termination and were submitted to the Cornell Soil Health Laboratory for the Comprehensive Assessment of Soil Health analysis (Ithaca, NY). Soils were also analyzed for soil nitrate-N (NO3) content at the UVM Agricultural and Environmental Testing Laboratory in Burlington, VT. Approximately 10 soil cores at a 12 were taken using a soil probe, then immediately dried and transported to the lab for analysis. To understand the nutrient release rates of the winter rye and how this was impacted by termination method and seeding rate, soil samples were collected at four key times: one week prior to soybean planting, at soybean planting, two weeks after 05000055 27.84

RESULTS

Weather data were recorded throughout the season with a Davis Instrument Vantage Pro2 weather station,

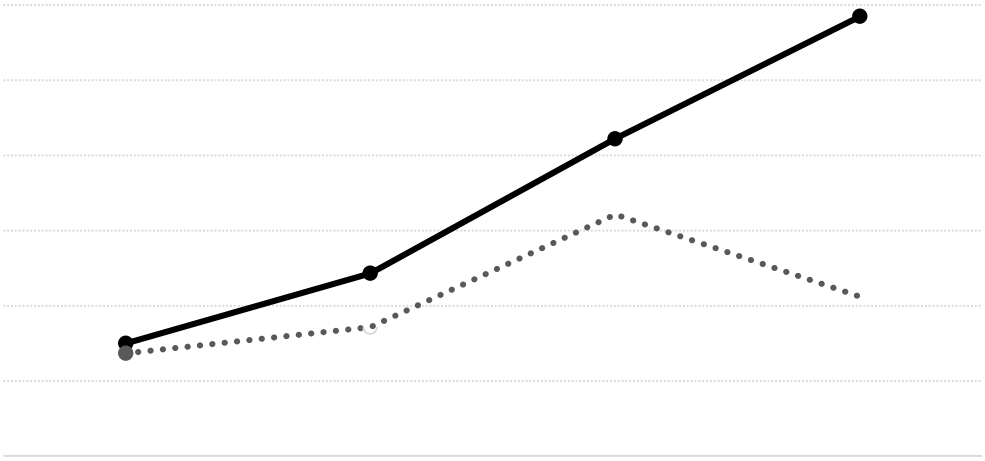

Figure 1. Cover crop termination x sample date interaction for soil nitrate-N.

Impact of Seeding Rate

To see if the winter rye seeding rate had an impact on the soil characteristics, soil health samples were taken before the cover crops were terminated. There were very few differences in soil characteristics between the seeding rates (Table 4). Soil respiration was the only metric in which there was a statistical difference between the control and one of the treatments (50 lbs. ac^{-1}); the 100 and 150 lbs. ac^{-1} treatments were not significantly different from the control. This difference may be the result of past management practices on the field.

Table 4. Spring soil health by winter rye seeding rate for Alburgh, VT, 2021.

Seeding rate	Organic matter	Active carbon	Total carbon	Total nitrogen	Aggregate stability	Available water capacity	Soil proteins	Soil respiration	pH	Overall score
(lbs. ac^{-1})	%	ppm	%	%	%	g/g	N mg/soil g	CO2 mg/soil g		
Control	6.20	940	3.94	0.343	34.3	0.253	12.3	0.835[b]	7.17	83.0
50	6.00	937	3.94	0.338	41.2	0.257	12.6	**0.930[a]**	7.32	85.3
100	6.12	947	3.94	0.337	39.0	0.262	12.2	0.868[ab]	7.34	85.3
150	6.20	963	3.87	0.330	42.4	0.259	13.0	0.927[ab]	7.25	84.9
LSD (0.10)	NS[§]	NS	NS	NS	NS	NS	NS	0.0942	NS	NS
Trial Mean	6.13	947	3.92	0.337	39.2	0.258	12.5	0.890	7.27	84.6

e at the p=0.10.

§NS; No significant difference between treatments.

Spring soil coverage differed by winter rye seeding rate (Table 5). The 50, 100, and 150 lbs. ac^{-1} treatments all had greater soil cover than the control. The 100 and 150 lbs. ac^{-1} treatments were not statistically different. Spring biomass was not measured in the control plots and there was no statistical difference in cover crop yield between the three seeding rates; the trial average was 1.88 tons ac^{-1}. Soybean population and harvest moisture were not different between treatments. The 50 lbs. ac^{-1} treatment resulted in statistically lower soybean yields (2493 lb. ac^{-1}; 41.6 bu. ac^{-1}) than the other seeding rates and the control. The control had the greatest soybean yield (2910 lb. ac^{-1}; 48.5 bu. ac^{-1}), but was not statistically different from the 100 and 150 lbs. ac^{-1} treatments. The 50 lbs. ac^{-1} treatment had the highest test weight, 53.0 lbs. bu^{-1}, but all samples were below the industry standard of 60 lbs. bu^{-1}.

Table 5. Cover crop and soybean harvest characteristics by seeding rate, Alburgh, VT, 2021.

Seeding rate	Prior to cover crop termination		Soybean harvest				
	Spring soil coverage	Cover crop DM yield	Soybean population	Harvest moisture	Yield at 13% moisture		Test weight
Lbs. ac^{-1}	%	tons ac^{-1}	plants ac^{-1}	%	lbs. ac^{-1}	bu. ac^{-1}	lbs. bu^{-1}
Control	0.52[c]	--	166012	23.5	2910[a]	48.5[a]	52.6[b]
50	67.8[b]	1.79	135036	23.4	2493[b]	41.6[b]	53.0[a]
100	86.3[a]	1.86	146168	23.4	2895[a]	48.2[a]	52.9[ab]
150	88.8[a]	1.99	158268	23.2			

Table 7. Cover crop and soybean harvest characteristics by termination method, Alburgh, VT, 2021.

	Prior to cover crop termination		Soybean harvest	
Termination method	Spring soil coverage	Cover crop DM yield	Population	Harvest moisture

nitrogen, making it unavailable in the soil for the subsequent crop. This may have contributed to lower soybean yields in the plant green treatment compared to the other two treatments.

Table 8. Cover crop carbon and nitrogen content by termination method, Alburgh, VT, 2021.

Termination method	Total nitrogen	Total carbon	C:N ratio
	%		
Tillage	0.42[ab]	47.0[b]	116[ab]
Herbicide	0.46[a]	47.0[b]	102[b]
Plant green	0.38[b]	47.7[a]	125[a]
Level of significance	*¥	*	*
Trial mean	0.42	47.2	114

reatments marked with the same letter performed statistically similar.
¥Treatments were significantly different at the following p values *0.1< p >0.05; ** 0.05 < p > 0.01; ***p < 0.01.

Soil nitrate-N was significantly higher in the tillage treatment than in the herbicide or plant green treatments, with soil nitrate-N values of 17.5, 10.5, and 10.5 ppm respectively (Table 9). This makes sense because the winter rye in the tillage treatment was plowed down and incorporated, which released more nitrogen into the soil than winter rye that had been sprayed. Soil temperature was statistically higher in the herbicide treatment (67.0° F) than the other two treatments. Soil moisture was greatest in the tillage treatment (16.5%) but was statistically similar to the herbicide treatment (16.4%). Soil moisture was the lowest in the planting green treatment indicating that allowing the winter rye to grow longer in the spring may have depleted soil moisture and caused season long stress on the soybean crop.

Table 9. Soil nitrate-N (NO_3), temperature, and moisture by termination method, Alburgh, VT, 2021.

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Spring soil coverage was positively correlated with seeding rate. Interestingly, there was no impact of seeding rate on cover crop dry mater yield. The cover crop termination method had a greater impact on cover crop biomass production and subsequent soybean harvest. Prior to treatment implementation, spring soil cover was comparable in the herbicide and plant green blocks, but was significantly lower in the tillage block. This is likely due to germination issues in the tillage block in the fall. Regardless of the differences in spring ground cover, the tillage and herbicide treatments produced statistically similar cover crop biomass