Eastern Soybean Board Project Final Report

Developing Soybean Production Practices that Maximize Yield and Enhance Environmental Stewardship in Northern Climates

Heather Darby, UVM Extension, 278 S. Main Street, St. Albans, VT 05478

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Due to continued economic and climatic pressures, farmers in the Northeast are looking for ways to increase on-farm feed production and diversity in their operations to increase resilience and profitability. Soybeans could be grown for human consumption, animal feed, and biodiesel in Vermont. However, farmers face challenges due to the relatively short growing season and limited research-based information available in our area. The purpose of our trials is to evaluate soybean yield and quality under conventional and organic growing conditions, and to determine cover cropping management practices that enhance soil health while supporting high soybean yields. Understanding how soybeans perform under various cropping systems can help producers make important management decisions that lead to better crop success. With a growing concern of agriculturally related water quality implications in Vermont waterways, farmers are now required in some instances to cover crop their annually cropped fields. However, with this increase in cover cropping there is a need to investigate potential impacts on following cash crops and best practices for establishing cover crops into and following soybeans. Similarly, with the concerted effort to reduce nutrient loading in waterways due to soil erosion, farmers are becoming more interested in adoption reduced and no-till practices. Understanding how to best combine these two practices into soybean cropping systems specifically for the Northeast is critical to the success of soybean crops in Vermont.

This year we initiated several soybean trials at Borderview Research Farm in Alburgh, VT. These trials include a soybean variety trial, a cover crop termination study, and a soybean interseeding trial. This report will summarize our research and outreach activities around these trials during 2021.

Weather data was recorded with a Davis Instrument Vantage Pro2 weather station, equipped with a WeatherLink data logger at Borderview Research Farm in Alburgh, VT (Table 1). The season began with cooler than normal temperatures, but temperatures quickly increased and remained above normal for much of the season. Rainfall was below normal for much of the season with the region being designated as D0, abnormally dry or D1, moderate drought (Drought.gov) throughout the season. Much of the rain that fell throughout the season came in short duration storms. Temperatures remained above normal for much of the summer except for July which was over 4 degrees cooler than normal. These temperatures contributed to above normal Growing Degree Days (GDDs) accumulations of 2830 May through October, 143 above the 30-year normal.

Table 1. Weather data for Alburgh, VT, 2021.

Alburgh, VT	May	June	July	August	Sept	Oct
Average temperature (°F)	58.4	70.3	68.1	74.0	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 (50-86°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.

Objective 1 is to identify soybean varieties that produce maximum yields in the far north.

MATERIALS AND METHODS

The conventional variety trial included 19 varieties from four different seed companies spanning maturity groups 0.70 to 2.8. The trial was planted on 25-May 2021 into a Covington silty clay loam at a rate of 185,000 seeds ac^{-1} treated with soybean inoculant and with 5 gal ac^{-1} 9-18-9 liquid starter fertilizer. Plots were 20' long and consisted of two rows spaced at 30 inches. The plot design was a randomized complete block with three replications. Plots were sprayed with Roundup Power Max at a rate of 1 qt ac^{-1} on 14-Jun to control weeds. Plots were monitored for pest and disease pressure throughout the season. On 31-Aug, plots were assessed for severity of infection with downy mildew (*Peronospora manshurica)*, bacterial blight (*Pseudomonas syringae pv. glycinea*), brown spot (*Septoria glycines*), and frogeye leaf spot (*Cercospora sojina*). These were the only pests and diseases observed in the trial. Assessments were made by inspecting each plot and assigning a rating (0-10) where 0 equated to damage/infection not present and 10 equated to infection or damage present on 100% of leaf area (Figure 1). On 26-Oct, the soybeans were harvested using an Almaco SPC50 small plot combine. Seed was cleaned with a small Clipper M2B cleaner (A.T. Ferrell, Bluffton, IN). They were then weighed for plot yield and tested for harvest moisture and test weight using a DICKEY-John Mini-GAC Plus moisture and test weight meter.

Figure 1. Soybean leaf infected with downy mildew

RESULTS

Although above average precipitation fell in October, all soybean varieties were harvestable. However, the average moisture content of 21.5% indicated that supplemental drying would be required for safe storage (Table 2). Test weights ranged from 53.0 to 55.6 lbs bu^{-1}. All soybean varieties produced test weights below the industry standard of 60 lbs bu^{-1}. This was likely influenced by the drought conditions that persisted through the season, especially during critical developmental stages including pod formation and seed fill. Yields ranged from 2532 to 3959 lbs ac^{-1} or 46.9 to 73.7 bu ac^{-1} and averaged 3357 lbs ac^{-1} or 62.3 bu ac^{-1}. The highest yielding variety, Seedwayvariety SG 2055, performed statistically similarly to 8 other varieties across maturity groupings 1.2 to 2.8 (figure 2). These data suggest that soybeans from maturity groups 1-2 can produce high yields in northern climates. However, it is important to note some large differences between varieties even within similar relative maturities. For example, the three varieties with relative maturity 1.2 ranged in yield from 46.9 to 71.4 bu ac^{-1}. These data highlight the importance of utilizing local variety evaluation information in variety selection. Comparisons between all varieties can be seen in Figure 2 where varieties that share a letter yielded statistically similarly.

Table 2. Harvest characteristics of soybean varieties – Alburgh, VT, 2021.

Company	Variety	Relative Maturity	Harvest moisture	Test weight	Yield @ 13% moisture	
			%	lbs bu^{-1}	lbs ac^{-1}	bu ac^{-1}
Seedway, LLC	SG 0720	0.7	23.3	53.4	2660	49.8
Seedway, LLC	SG 1077	1.0	22.5	53.2	2583	48.6
Seedway, LLC	SGX10XTF	1.0	21.6	54.1	3221	59.6
Asgrow	AG11XF2	1.1	**19.2**	**55.6**	3309	59.6
Brevant	B119EE	1.1	21.9	53.5	3146	58.8
Dyna-Gro	S12EN72	1.2	22.2	53.6	3827*	71.4*
Dyna-Gro	S12XF92	1.2	21.9	53.9	3179	59.0
Seedway, LLC	12XTF	1.2	21.9	53.9	2532	46.9
Seedway, LLC	13E3	1.3	21.7	53.6	3098	57.8
Seedway, LLC	SG 1320	1.3	21.7	54.0	3332	61.7
Asgrow	AG14XF2	1.4	21.8	53.8	3242	60.3
Brevant	B149EE	1.4	20.8	54.6	3323	60.9
Seedway, LLC	1432XTF	1.4	20.7	53.0	3743*	70.5*
Dyna-Gro	S15XF82	1.5	21.7	53.3	3774*	70.9*
Asgrow	AG15XF2	1.5	21.7	54.0	3374	62.6
Dyna-Gro	S17XF02	1.7	19.4	55.6	3612*	64.8*
Seedway, LLC	SG 1708	1.7	22.2	53.8	3205	59.6
Seedway, LLC	SG 1776	1.7	22.4	53.0	3614	68.1
Asgrow	AG17XF2	1.7	20.3	54.7	3547	64.8
Brevant	B171EE	1.7	21.0	54.3	3217	59.2
Dyna-Gro	S18EN52	1.8	21.6	53.9	3577*	66.4*
Seedway, LLC	SG 1863	1.8	21.2	53.6	3041	56.8
Asgrow	AG18XF1	1.8	22.9	53.1	3662*	68.9*
Seedway, LLC	SG 1945	1.9	20.3	54.8	3930	71.7
Seedway, LLC	SG 2055	2.0	21.5	53.7	**3959**	**73.7**
Brevant	B210EE	2.1	22.5	53.6	3242	60.4
Seedway, LLC	SG 2120	2.1	21.0	54.4	3316	60.9
Seedway, LLC	SG 2217	2.2	21.5	53.4	3352	62.7
Seedway, LLC	SG 2832	2.8	21.3	53.6	3741*	69.8*
LSD (p = 0.10)			NS	NS	526	9.70
Trial Mean			21.5	53.9	3357	62.3

*Varieties that performed statistically similarly to the top performing variety, identified in **bold,** are indicated with an asterisk.
NS, no significant difference

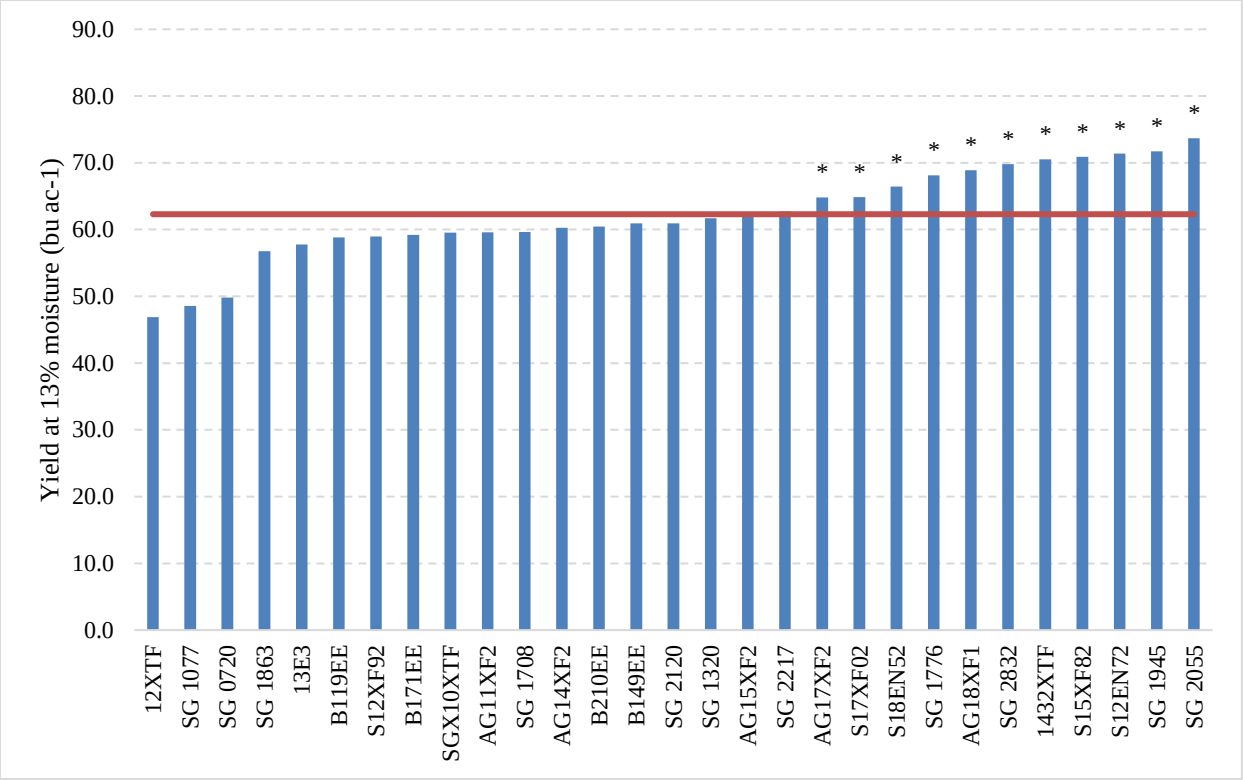

Figure 2. Seed yield at 13% moisture for 19 soybean varieties. The red line indicates the average yield.
**Varieties that are marked with an asterisk performed statistically similarly to the top performer.*

Soybeans experienced little pest and disease pressure throughout the season (Table 3). Bacterial blight was observed on some varieties; however, differences were not statistically significant. Infections of frogeye leaf spot and Septoria brown spot were low ranging from 0-2 and averaged less than 1. Severity of downy mildew infection ranged widely from 0-6.67 and averaged 1.63. Unlike in 2020, in the trial this year downy mildew infection severity varied across all maturities and was not limited to longer season varieties. These apparent differences in disease susceptibility are important to consider when selecting a variety as performance may be more severely impacted in wetter years with more disease pressure.

Overall, soybean varieties performed well averaging over 62 bu ac^{-1} despite very droughty conditions through much of the season. Under these conditions, all soybean varieties, ranging in relative maturity from 0.7 to 2.8, reached maturity and a harvestable moisture, but all required additional drying in order to be stored safely. Although little pest and disease pressure was observed, some differences were still observed and highlight the importance of local variety evaluation in soybean variety selection. Overall, these data suggest that soybeans in maturity groups 0, 1, and 2 can produce high yields under conventional management in Vermont's northern climate.

Table 3. Disease and stand characteristics of soybean varieties – Alburgh, VT, 2021.

Company	Variety	Relative Maturity	Bacterial blight	Downy mildew	Frogeye leaf spot	Septoria brown spot
				0-10 scale†		
Seedway, LLC	SG 0720	0.7	0.667	3.000	0.333*	1.67
Seedway, LLC	SG 1077	1.0	0.333	2.000	0.333*	0.667*
Seedway, LLC	SGX10XTF	1.0	0.333	0.667*	1.00	1.00
Asgrow	AG11XF2	1.1	0.333	1.00*	0.667	1.00
Brevant	B119EE	1.1	0.00	1.33*	0.667	0.667*
Dyna-Gro	S12EN72	1.2	0.00	1.33*	0.333*	0.333*
Dyna-Gro	S12XF92	1.2	0.00	0.333*	2.00	1.67
Seedway, LLC	12XTF	1.2	0.00	0.00*	1.33	0.000*
Seedway, LLC	13E3	1.3	0.333	1.00*	0.333*	0.333*
Seedway, LLC	SG 1320	1.3	0.333	2.33	0.333*	0.000*
Asgrow	AG14XF2	1.4	0.00	2.00	0.667	1.33
Brevant	B149EE	1.4	0.00	4.67	0.667	0.000*
Seedway, LLC	1432XTF	1.4	0.00	1.00*	0.667	0.333*
Dyna-Gro	S15XF82	1.5	0.333	1.00*	1.00	0.667*
Asgrow	AG15XF2	1.5	0.333	0.333*	1.00	0.667*
Dyna-Gro	S17XF02	1.7	0.00	1.67	0.333*	0.667*
Seedway, LLC	SG 1708	1.7	0.00	1.00*	0.333*	0.667*
Seedway, LLC	SG 1776	1.7	0.00	0.333*	0.333*	0.333*
Asgrow	AG17XF2	1.7	0.667	1.00*	1.00	0.000*
Brevant	B171EE	1.7	0.333	2.00	0.000*	0.333*
Dyna-Gro	S18EN52	1.8	0.00	6.67	0.000*	1.00
Seedway, LLC	SG 1863	1.8	0.00	**0.000**	0.667	0.333*
Asgrow	AG18XF1	1.8	0.00	2.00	1.00	1.00
Seedway, LLC	SG 1945	1.9	0.333	4.33	0.000*	0.333*
Seedway, LLC	SG 2055	2.0	0.00	0.000*	1.00	0.667*
Brevant	B210EE	2.1	0.333	0.000*	1.00	0.667*
Seedway, LLC	SG 2120	2.1	0.00	2.33	0.000*	0.667*
Seedway, LLC	SG 2217	2.2	**0.00**	3.33	**0.000**	**0.000**
Seedway, LLC	SG 2832	2.8	0.00	0.667*	0.333*	0.333*
LSD (p = 0.10)			NS	1.36	0.563	0.741
Trial Mean			0.161	1.63	0.598	0.598

†0 to 10 scale; rating of 0 = no infection or damage and rating of 10 = 100% infection or damage.
*Varieties that performed statistically similarly to the top performing variety, identified in **bold,** are indicated with an asterisk.
NS, no significant difference.

Objective 2 is to investigate the impact of cover crop termination method and cover crop biomass level on soybean yield and soil health.

MATERIALS AND METHODS

In the fall of 2020, four cover crop seeding rate treatments, summarized in Table 4 below, were planted at Borderview Research Farm in Alburgh, VT on 6-Oct. Rates ranging from 50 to 150 lbs ac^{-1} of winter rye and a no cover crop control were used to produce varying levels of cover crop biomass leading to varying levels of residue that precedes soybean planting the following spring. These four treatments were replicated four times each within three termination systems: conventional tillage, pre-plant herbicide application with no tillage, and an herbicide application at planting with no tillage. Termination methods are described in Table 5 below.

Table 4. Winter rye seeding rate treatments, 2020.

Treatment	Seeding rate (lbs ac^{-1})
No residue (control)	0
Low residue	50
Moderate residue	100
High residue	150

Establishment of the cover crop was later than normal due to overly dry conditions extending field preparation and delaying planting. Due to this later planting, no biomass was collected in the fall of 2020. In the spring of 2021, soil health samples were taken from four replications from each of the seeding rate treatments including the control. Samples were collected according to the Cornell Soil Health Laboratory protocol and were submitted to that laboratory for analysis. At this time, biomass was collected in each plot within a $0.25m^2$ quadrat on 12-May in the plow and herbicide blocks, and on 21-May in the plant green block. Ground cover was also captured at this time using the Canopeo smartphone application. Soil moisture and temperature were measured in each plot at approximately 6" soil depth prior to planting and every other week following planting. To understand the nutrient release rates of the winter rye, soil samples were collected and analyzed for soil nitrate (NO_3) nitrogen at the UVM Agricultural and Environmental Testing Laboratory (Burlington, VT). On 27-Oct 2021, the soybeans were harvested using an Almaco SPC50 small plot combine and then weighed for plot yield and tested for harvest moisture and test weight using a DICKEY-John Mini-GAC Plus moisture/test weight meter.

Table 5. Cover crop termination treatments, 2021.

Termination system	Cover crop termination details
Tillage (12-May)	Tilled under with moldboard plow and disc harrow one week prior to soybean planting
Herbicide (12-May)	Sprayed with Roundup PowerMAX® at 1qt ac^{-1} one week prior to soybean planting
Plant green (21-May)	Soybeans were planted into living cover crop and sprayed with Roundup PowerMAX® at 1qt ac^{-1} at time of planting

RESULTS

There was a significant cover crop termination method by date interaction for soil nitrate-N ($p<.0001$), as show in Figure 3 below. Prior to termination, soil nitrate-N levels were similar in the three treatment blocks. Plots where the winter rye was tilled and incorporated had higher nitrate levels overall, likely because the

rye decomposed quickly and released nitrogen back into the soil. The plant green plots were terminated a week after the other two treatments, and that resulted in a much slower release of nitrogen. By the end of June, the plant green block had higher levels of soil nitrate-N than the herbicide block. The earlier termination of the rye may have resulted in more available nitrogen initially, but the slow release of nitrogen in the plant green block may provide additional nitrogen later in the season.

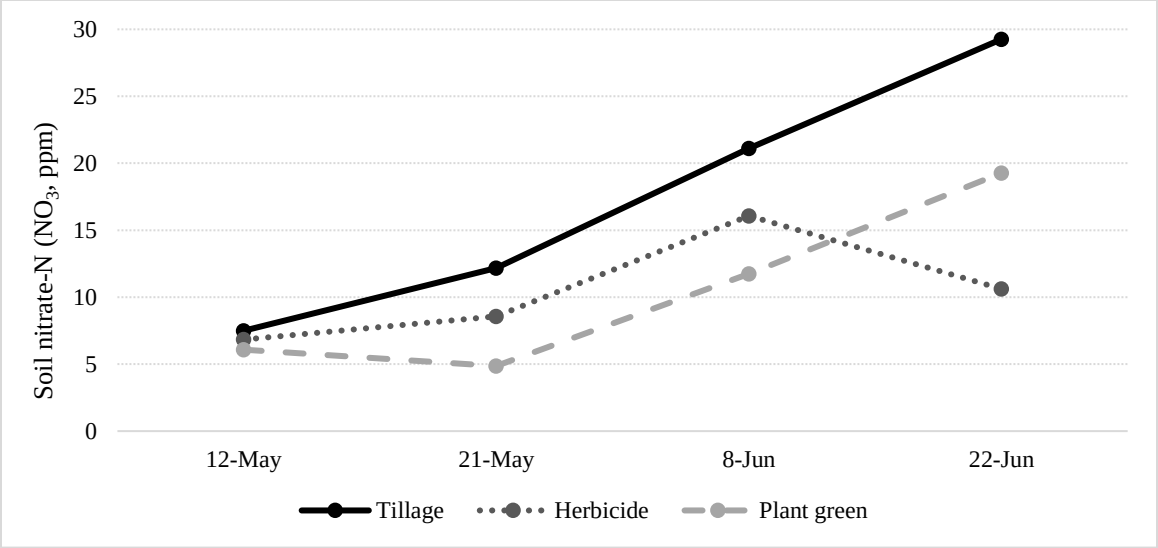

Figure 3. Cover crop termination x date interaction for soil nitrate-N.

The rye seeding rate had minimal impact on soil health prior to termination. Spring soil coverage however was statistically impacted by seeding rate (Table 6). Prior to termination, all three seeding rates had soil coverage greater than the control. The 100 and 150 lbs. ac^{-1} treatments were statistically similar and had soil coverage of 86.3% and 88.8% respectively. There were slight differences in soybean harvest yield and test weight by seeding rate. The 50 lbs. ac^{-1} treatment had statistically lower yields than the control and the other two seeding rates. There was no statistical difference between the 100 lbs. ac^{-1}, 150 lbs. ac^{-1}, and the control. The trial average test weight, 52.9 lbs. ac^{-1}, was well below the industry standard of 60 lbs. bu^{-1}. The 50 lbs. ac^{-1} treatment had the highest test weight, but it was only statistically different from the control. Soil nitrate-N and temperature were impacted by seeding rate (Table 7). On average, soil nitrate-N was greater in the control plots than the three seeding rates, which were not statistically different from one another. Winter rye could be tying up nitrogen and making it less available to the subsequent crop. The average soil temperature was also greater in the control than the 100 and 150 lbs. ac^{-1} treatment, but not the 50 lbs. ac^{-1}.

Table 6. 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	Yield at 13% moisture		Test weight
lbs. ac^{-1}	%	tons ac^{-1}	lbs. ac^{-1}	bu. ac^{-1}	lbs. bu^{-1}
Control	0.52[c]	--	2910[a]	48.5[a]	52.6[b]
50	67.8[b]	1.79	2493[b]	41.6[b]	53.0[a]
100	86.3[a]	1.86	2895[a]	48.2[a]	52.9[ab]
150	88.8[a]	1.99	2882[a]	48.0[a]	52.9[ab]
LSD (p = 0.10)	13.1	NS	385	64.2	0.342
Trial mean	60.9	1.88	2795	46.6	52.9

Within a column, treatments marked with the same letter are statistically similar.
NS- not statistically significant.

Table 7. Soil nitrate-N (NO_3), temperature and moisture by seeding rate-Alburgh, VT, 2021

Seeding rate	Soil nitrate-N (NO_3)	Soil temperature	Soil moisture
lbs. ac^{-1}	Ppm	°F	%
Control	16.9[a]	66.9[a]	16.0
50	11.2[b]	66.8[ab]	15.7
100	11.6[b]	66.5[bc]	15.3
150	11.7[b]	66.4[c]	15.1
Level of significance	***	**	NS
Trial mean	12.8	66.6	15.5

Within a column, treatments marked with the same letter are statistically similar.
Treatments were significantly different at the following p values *0.1< p >0.05; ** 0.05 < p > 0.01; ***p < 0.01.
NS- not statistically significant.

Prior to cover crop termination there was statistically less ground cover in the tillage block compared to the other two, likely due to germination issues of the winter rye in the fall (Table 8). However, average cover crop yield was not statistically different between the tillage and herbicide treatments. The plant green treatment was terminated a week later and produced statistically higher biomass than the other two treatments. Soybean yield was also impacted by termination method. The plant green treatment had statistically lower yields, about 1.3X less, than the tillage and herbicide treatments, which were not statistically different. This suggests that the plant green treatment had greater biomass due to the later termination and that contributed to soybean yield loss (Figure 4).

Table 8. Cover crop and soybean harvest characteristics by termination method, Alburgh, VT, 2021.

Termination method	Prior to cover crop termination		Soybean harvest		
	Spring soil coverage	Cover crop DM yield	Yield at 13% moisture		Test weight
	%	tons ac^{-1}	lbs. ac^{-1}	bu. ac^{-1}	lbs. bu^{-1}
Tillage	50.6^{b}	1.46^{b}	3060^{a}	51.0^{a}	53.0^{a}
Herbicide	65.2^{a}	1.36^{b}	3030^{a}	50.5^{a}	52.6^{b}
Plant green	66.7^{a}	2.82^{a}	2296^{b}	38.3^{b}	52.9^{a}
LSD (p = 0.10)	11.3	0.399	334	5.56	0.296
Trial mean	60.9	1.88	2795	46.6	52.9

Within a column, treatments marked with the same letter are statistically similar.

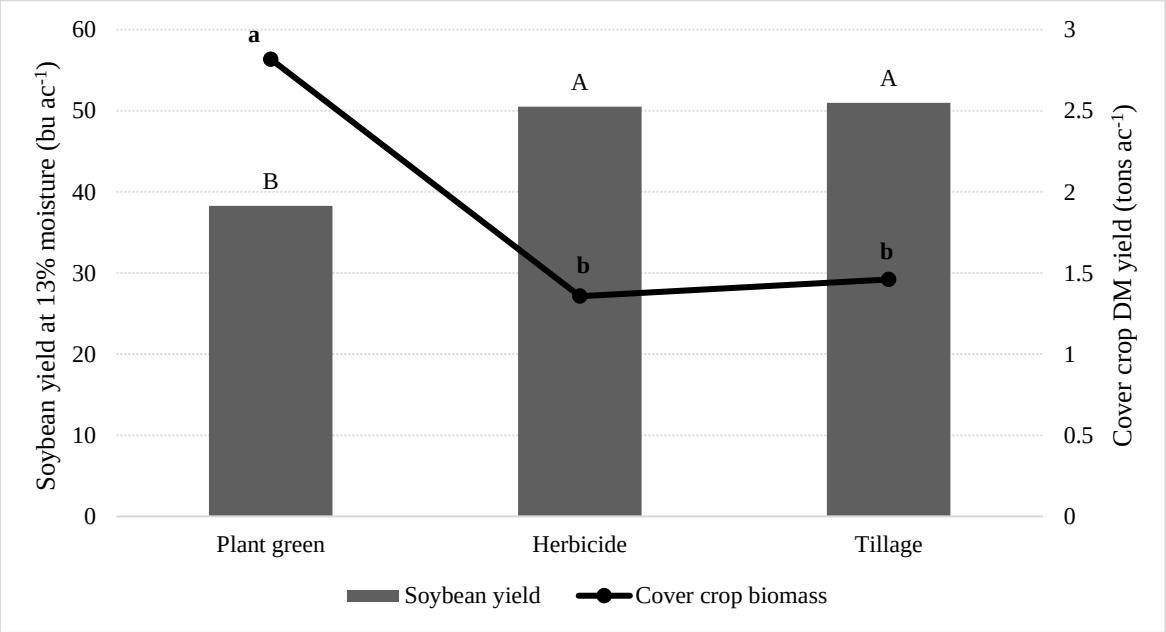

Figure 4. Soybean yield and spring cover crop biomass by cover crop termination method, Alburgh, VT, 2021. Different letters indicate a statistically significant difference between treatments (p=0.10).

The C:N ratio of the winter rye was impacted by termination method. All three treatments had high C:N ratios, which is characteristic of winter rye, especially if allowed to grow to maturity. The plant green had a statistically higher C:N ratio than the herbicide treatment but not the tillage treatment. The winter rye in the plant green treatment had an additional week to mature and produce more biomass before termination. Soil nitrate-N was significantly greater in the tillage block than the herbicide and plant green blocks. Soil temperature was statistically higher in the herbicide treatment than the other two treatments. Soil moisture

was greatest in the tillage treatment, but statistically similar to the herbicide treatment. Results are displayed in Table 9 below.

Table 9. C:N content of cover crops and soil characteristics by termination method, Alburgh, VT, 2021.

Termination method	Total nitrogen	Total carbon	C:N ratio	Soil nitrate-N (NO3)	Soil temperature	Soil moisture
	%			ppm		°F
Tillage	0.42^{ab}	47.0^{b}	116^{ab}	17.5^{a}	66.5^{b}	16.5^{a}
Herbicide	0.46^{a}	47.0^{b}	102^{b}	10.5^{b}	67.0^{a}	16.4^{a}
Plant green	0.38^{b}	47.7^{a}	125^{a}	10.5^{b}	66.4^{b}	13.7^{b}
Level of significance	*	*	*	***	**	***
Trial mean	0.42	47.2	114	12.8	66.6	15.5

Within a column, treatments marked with the same letter are statistically similar.
Treatments were significantly different at the following p values *0.1< p >0.05; ** 0.05 < p > 0.01; ***p < 0.01.
NS- not statistically significant.

As noted earlier, the entire growing season was dry. The additional cover crop biomass and longer period of growth in the plant green treatments likely dried out the soil more than the other cover crop treatments (Figure 5). Since rainfall was in a deficit all season, the plant-green plots may have been more water stressed than the other treatments. Average, across the season soil moisture was significantly lower in the plant green plots. This additional moisture stress may have contributed to lower yields.

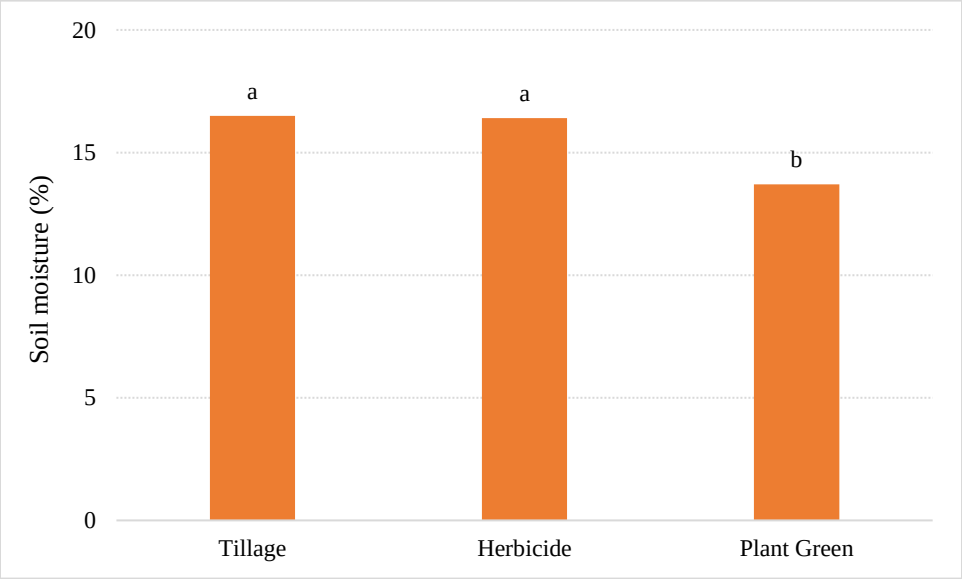

Figure 5. Average soil moisture by cover crop termination method.
Columns with the same letter were statistically similar (p=0.10).

Objective 3 is to develop interseeding strategies for soybean production systems that protect soil health while supporting high soybean yields.

MATERIALS AND METHODS

In 2021, the UVM Northwest Crops and Soils Program initiated a trial to investigate the impact of annual ryegrass planting date on cover crop establishment and soybean yield. The experimental design was a complete randomized block with four replications and the treatments were four annual ryegrass planting dates. Plots were 10' x 40'. On 6-Apr, 300 lbs. ac^{-1} of 19-19-19 was applied to all plots. Soybeans were planted on 26-May at a rate of 200,000 seeds ac^{-1}. Annual ryegrass (var. Centurion) was interseeded into soybeans at four different planting dates: 14-Sep, 21-Sep, 28-Sep, and 4-Oct. (Figure 6) Soybeans were harvested on 27-Oct using an Almaco SPC50 small plot combine and 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 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.

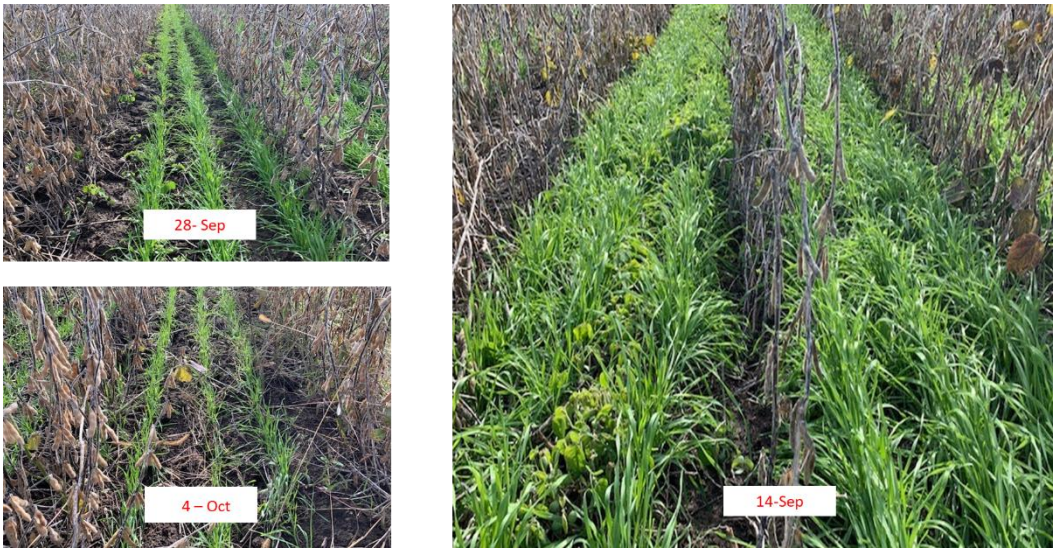

Figure 6. Annual ryegrass cover crop interseed on 14-Sep, 28-Sep, and 4-Oct into soybeans (photos taken on 27-Oct).

RESULTS

The annual ryegrass planting date had no significant impact on soybean harvest (Table 10). 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 for 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. 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. ac^{-1}.

Table 10. 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 are statistically similar.
NS- not statistically significant.

The 2021 growing season was very dry, and one concern with 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. 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 will be done to better understand the impact of interseeding into a soybean cropping system. This trial indicates that interseeding cover crops a month prior to soybean harvest will provide for timely seeding and adequate cover crop establishment with hopefully minimal impact on soybean yield (Figure 7).

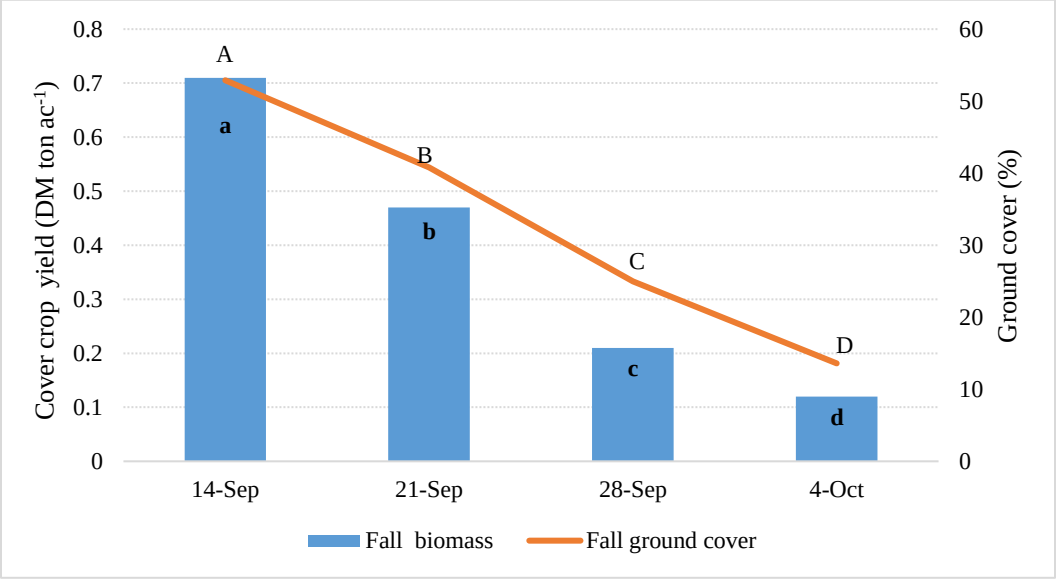

Figure 7. Cover crop yield and fall ground coverage by rye interseeding date.
Treatments with the same letter were statistically similar (p=0.10).

OUTREACH

Outreach this year has continued to be very difficult. Our main mode of outreach during the summer months typically are workshops and field days attracting hundreds of farmers, technical service providers, and other agricultural professionals. Similar to last year, with most in-person events still unable to occur, we continued to provide farmers with valuable, research-based, and season relevant information through other modes of communication. Reports summarizing our research have been posted to our website (links below) and shared through our blog and social media networks. However, in the fall of 2021 a field day was held drawing 126 stakeholders. Attendees were able to walk the research plots and learn about research results. Soybean cover cropping information was also shared with farmers and service providers at the annual NECCC Annual Conference (March 2022) with 185 attendees.

2021 Research Reports:

https://www.uvm.edu/sites/default/files/Northwest-Crops-and-Soils-Program/2021%20Research%20Rpts/2021_Conventional_Soybean_VT_Report_Final.pdf

https://www.uvm.edu/sites/default/files/Northwest-Crops-and-Soils-Program/2021%20Research%20Rpts/2021_Conv_Soybean_Performance_Trials_Summary.pdf

https://www.uvm.edu/sites/default/files/Northwest-Crops-and-Soils-Program/2021%20Research%20Rpts/2021_Organic_Soybean_Variety_Trial_Report.pdf

https://www.uvm.edu/sites/default/files/Northwest-Crops-and-Soils-Program/2021%20Research%20Rpts/2021_Organic_Soybean_Performance_Trials_Summary.pdf

https://www.uvm.edu/sites/default/files/Northwest-Crops-and-Soils-Program/2021%20Research%20Rpts/2021_Soybean_Interseed_Cover_Crop_ReportFinal.pdf

https://www.uvm.edu/sites/default/files/Northwest-Crops-and-Soils-Program/2021%20Research%20Rpts/2021_Soybean_Interseed_Cover_Crop_ReportFinal.pdf

Blogs:

https://blog.uvm.edu/outcropn/2022/01/14/impressive-oilseed-crops/

https://blog.uvm.edu/outcropn/2021/12/13/the-results-are-in-2021-conventional-soybean-variety-trial/

https://blog.uvm.edu/outcropn/2021/08/26/lets-talk-soybeans/