2025 Soybean Cover Crop Termination Trial

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Northwest Crops and Soils Program

2025 SOYBEAN COVER CROP TERMINATION TRIAL

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The University of Vermont Extension Northwest Crops and Soils Program investigated the impact of winter rye cover crop termination method and timing at Borderview Research Farm on soybean crop yield and quality in Alburgh, VT. Soybeans are grown for human consumption, animal feed, and biodiesel, and can be a useful rotational crop in corn silage and grass production systems. Cereal or winter rye is commonly planted in this region as a cover crop. As soybean production expands throughout Vermont, it is important to understand the potential benefits, consequences, and risks associated with growing cover crops in these systems. To support the local soybean market and to gain a better understanding of cover cropping in soybean production systems, the University of Vermont Extension Northwest Crops and Soils (NWCS) Program, as part of a grant from the Eastern Region Soybean Board, conducted a trial in 2024-2025 to investigate the impacts of winter rye termination methods on the yield and quality of the subsequent soybean crop.

MATERIALS AND METHODS

The cover crop termination trial was conducted at Borderview Research Farm. Alburgh, VT in 2024-2025. Trial management details are described in Table 1. The experiment was a randomized complete block design with four replicates and five cover crop termination methods. There were two early termination methods: Plow and Early Spray, and three late termination methods: Late Spray, Roll & Plant, and Plant then Roll. Termination treatment details are included in Table 2. The previous fall, cereal rye (var. ND Gardner, Albert Lea Seed) was planted on 20-Sep 2024 with a Sunflower no-till grain drill at a rate of 3 million seeds ac^{-1}, approximately 160 lbs ac^{-1}. In the spring of 2025, cover crop biomass was measured prior to termination by collecting a $0.25m^2$ quadrat, clipping all above ground plant material, and placing samples in a dryer to remove all moisture before weighing to calculate the dry matter yield. Samples were collected on 7-May 2025 to capture rye biomass at the early termination and on 27-May 2025 to capture biomass at the late termination. Soil health samples were collected on the same days as the rye biomass to look for any differences in soil health characteristics. Soil samples were collected according to the Cornell Soil Health sampling protocol and sent to the Cornell Soil Health Laboratory to be analyzed (https://soilhealth.cals.cornell.edu/).

Table 1. Trial management details, Alburgh, VT, 2024-2025.

Location	**Borderview Research Farm-Alburgh, VT**
Soil type	Convington silty clay loam, 0-3% slopes
Previous crop	Corn silage
Plot size (feet)	10 x 40
Row spacing (inches)	30
Replicates	4
Cover crop planting date	20-Sep 2024

Cover crop variety	ND Gardner
Cover crop seeding rate	160 lbs ac^{-1}
Soybean variety	SG 1143XTF (maturity group 1.1, XtendFlex)
Soybean planting date	27-May 2025
Soybean seeding rate (seeds ac^{-1})	180,000
Soybean harvest date	10-Oct 2025

Table 2. Cover crop termination treatments, Alburgh, VT, 2025.

Treatment	Cover crop termination details
Plow	Rye plowed under 2 weeks before planting soybeans (7-May 2025)
Early Spray	Rye sprayed with herbicide 2 weeks before planting soybeans (7-May 2025)
Late Spray	Rye sprayed with herbicide at planting of soybeans (27-May 2025)
Roll & Plant	Rye roller crimped just before planting soybeans (27-May 2025)
Plant then Roll	Soybeans planted and then rye roller crimped after soybean emergence (11-Jun 2025)

Soybeans (var. SG1143XTF, Seedway LLC) were planted on 27-May 2025 using a John-Deere no-till planter at a rate of 180,000 seeds ac^{-1}. Plots were 40 ft long and consisted of four rows with 30-inch spacing. On 10-Oct 2025, soybeans were harvested using an Almaco SPC50 small plot combine and seed was cleaned with a small Clipper M2B cleaner (A.T. Ferrell, Bluffton, IN). Seed was weighed for plot yield and tested for harvest moisture and test weight using a DICKEY-John Mini-GAC Plus moisture and test weight meter.

Data were analyzed using a general linear model procedure of SAS (SAS Institute, 1999). Replications were treated as random effects, and treatments were treated as fixed. Mean comparisons were made using the Least Significant Difference (LSD) procedure where the F-test was considered significant, at $p<0.10$. 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 with a Davis Instruments Vantage Pro2 weather station, equipped with a WeatherLink data logger at Borderview Research Farm in Alburgh, VT (Table 3). Monthly average temperatures were near normal for most of the growing season, and there was a total of 2,717 Accumulated Growing Degree Days (GDDs). In the spring at the time of planting, soil conditions were quite wet following a couple of large rain events in May. However, there was a lack of precipitation for most of the season, with below average monthly rainfall from June to September. By September, Alburgh was experiencing moderate drought (D1) according to the U.S. Drought Monitor (droughtmonitor.unl.edu). Despite increasing precipitation in October, Alburgh is still under moderate drought, although other parts of the state remain in severe (D2) to extreme (D3) drought.

Table 3. Weather data for Alburgh VT, 2025.

	2025					
Alburgh, VT	May	Jun	Jul	Aug	Sep	Oct
Average temperature (°F)	57.5	67.8	73.2	69.0	62.9	52.4
Departure from normal	-0.93	0.35	0.82	-1.67	0.18	2.09
Precipitation (inches)	5.78	2.38	3.76	1.50	2.50	5.67
Departure from normal	2.02	-1.88	-0.30	-2.04	-1.17	1.84
Growing Degree Days (50-86°F)	280	545	706	583	410	193
Departure from normal	-21	21	12	-59	23	55

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

Prior to termination, winter rye biomass was measured to understand the impact of delayed termination on spring biomass production. Unsurprisingly, cover crop biomass was statistically greater at the late termination time (Table 4). Soil health characteristics at the early and late cover crop termination times are summarized in Table 5. There were no statistical differences in soil health characteristics at either of the cover crop termination times.

Table 4. Winter rye spring biomass by termination timing, Alburgh, VT, 2025.

Termination timing	Winter rye DM yield
	lbs ac^{-1}
Early	1633[b]
Late	**4470[a]**†
LSD (p = 0.10) ‡	1031
Trial mean	3052

†Within a column, treatments marked with the same letter were statistically similar (p=0.10). The top performer is in **bold.**

‡LSD; Least significant difference at the p=0.10.

Table 5. Soil health characteristics by cover crop termination timing, Alburgh, VT, 2025.

Termination timing	Predicted water capacity	Aggregate stability	Organic matter	Soil organic carbon	Total carbon	Total nitrogen	Soil proteins	Soil respiration	Active carbon
	g H_2O g soil^{-1}	%	%	%	%	%	mg protein g soil^{-1}	mg CO_2 g soil^{-1}	ppm
Early	0.227	26.3	4.10	2.36	2.66	0.268	6.64	0.713	746
Late	0.236	24.7	4.30	2.48	2.68	0.281	7.06	0.737	813
LSD (*p*=0.10) †					NS‡				
Trial mean	0.231	25.5	4.20	2.42	2.67	0.275	6.85	0.725	779

†LSD; Least significant difference at the p=0.10.
‡NS; No significant difference between treatments.

Soybean harvest results are summarized in Table 6. Soybean harvest moisture was lowest in the Roll & plant treatment, 14.0%, and that was not statistically different from all other termination methods except the Plow treatment, where the soybean harvest moisture was 16.5%. The average yield for the trial was 1,697 lbs or 28.3 bu ac^{-1}. The average test weight was 56.0 lbs bu^{-1}. There were no statistical differences in soybean yield or test weight.

Table 6. Soybean harvest characteristics by cover crop termination method, Alburgh, VT, 2025.

Termination method	Harvest moisture	Yield at 13% moisture		Test weight
	%	lbs ac^{-1}	bu ac^{-1}	lbs bu^{-1}
Plow	16.5^{b}	1466	24.4	56.3
Early Spray	15.2^{ab}	1598	26.6	57.9
Late Spray	15.0^{ab}	1828	30.5	54.7
Roll & plant	**14.0^{a}**†	2010	33.5	56.5
Plant then Roll	14.5^{a}	1583	26.4	54.6
LSD (*p* = 0.10)‡	1.77	NS§	NS	NS
Trial mean	15.0	1697	28.3	56.0

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

DISCUSSION

The University of Vermont Extension Northwest Crops & Soils Program conducted a research trial in 2024-2025 to investigate the impact of cover crop termination method and timing on subsequent soybean yields. Five cover crop termination methods were selected, two represented early termination strategies and three represented a late cover crop termination. Drought conditions during the season led to low soybean yields in this trial, and there were no statistical differences between cover crop termination treatments. Soybean yields were higher in the 2023 and 2024 research trials (Figure 1), despite extreme rainfall events that resulted in above average precipitation for both growing seasons. In 2024, soybean yields were not statistically different between cover crop termination treatments, like what was observed in 2025. But in 2023, planting into standing rye and rolling and crimping the cover crop after soybean emergence significantly reduced soybean yields compared to all other termination methods. This was likely due to delayed soybean germination from cool temperatures that persisted for the first couple of months of the growing season, and the competition for resources with the living winter rye cover crop. In 2024, the average temperature in May was nearly 3.5 degrees above average, and warm temperatures persisted through July, so soybeans had good germination across the treatments and adequate soil moisture. Winter rye can be riskier in droughty conditions like 2025 because it will compete with the crop for soil moisture and could lead to yield reductions. But in a year like 2024, the winter rye helped mitigate excessive soil moisture.

It is important to remember that these data only represent one year and one trial location. Cover cropping can be a beneficial management strategy, but it is important to understand the potential benefits, consequences, and risks associated with growing cover crops in soybean production systems.

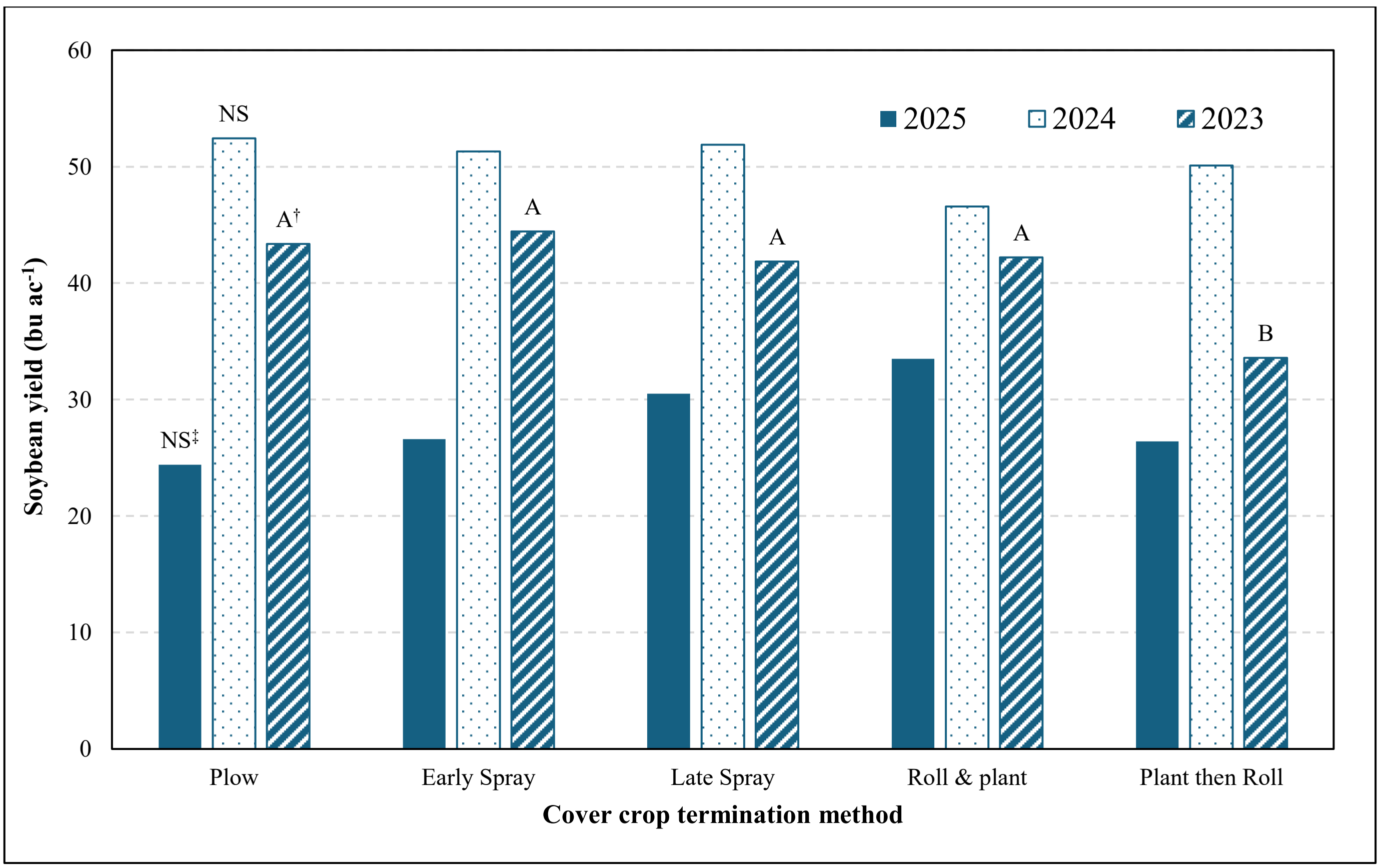

Figure 1. Soybean yield by cover crop termination method in 2023-2025.
†For 2023, treatments with the same letter were not statistically different (p=0.10).
‡NS; No significant difference between treatments in 2024 or 2025.

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