2025 Soybean Nitrogen Fertility Trial

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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. Soybeans form a symbiotic relationship with nitrogen fixing bacteria. The symbiotic relationship supplies nitrogen to the soybean crop. However, it takes several weeks for nodulation to establish, and early season plant stress can slow the process. Adverse conditions are common in the spring, and it is unclear if a low rate of nitrogen applied as starter fertilizer may promote early growth of soybeans before nodulation. The University of Vermont Extension Northwest Crops and Soils (NWCS) Program, as a part of a grant from the Eastern Region Soybean Board, conducted a trial to investigate the impact of low rates of starter nitrogen fertilizer on the yield and quality of the subsequent soybean crop.

MATERIALS AND METHODS

The trial was conducted at Borderview Research Farm in Alburgh, VT in 2025, and the experimental design was a complete randomized block with five replications (Table 1). The soil type is Benson rocky silt loam, over shaly limestone, 3 to 8% slopes. Plots were 20 ft long and 10 ft wide, consisting of four rows planted 30 inches apart. There were five starter nitrogen fertilizer application rates, 5, 10, 15, 20, and 25 lbs N ac^{-1}, and a control where no nitrogen was applied. On 28-May, the soybean variety SG1143XTF (maturity group 1.1; Seedway, LLC) was planted at a rate of 180,000 seeds ac^{-1} using a John Deere 1750 four-row planter fitted with bean cups. The starter was applied as granular fertilizer (46-0-0) with the planter at 2 inches deep and 2 inches over from the row. On 10-Oct, 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.

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

Location	Borderview Research Farm, Alburgh, VT
Soil type	Benson rocky silt loam, over shaly limestone, 3 to 8% slopes
Previous crop	Corn silage
Plot size (feet)	10 x 20
Row spacing (inches)	30
Replicates	5
Soybean variety	SG 1143XTF (maturity group 1.1, XtendFlex)
Fertilizer	46-0-0 at planting 0, 5, 10, 15, 20, 25 lbs N ac^{-1}
Soybean planting date	28-May
Soybean seeding rate (seeds ac^{-1})	180,000
Soybean harvest date	10-Oct

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.

Variety	Yield
A	6.0
B	7.5*
C	**9.0**
LSD	2.0

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 between treatments is significant or whether it is due to natural variations in the plant or 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. This means that when the difference between two varieties within a column is equal to or greater to the LSD value for the column, there is a real difference between the varieties 90% of the time. Varieties that were not significantly lower in performance than the highest value in a particular column are indicated with an asterisk.

In the example above, variety C was significantly different from variety A, but not from variety B. The difference between C and B is 1.5, which is less than the LSD value of 2.0 and so these varieties were not significantly different 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 varieties were significantly different from one another. The asterisk indicates that variety B was not significantly lower than the top yielding variety, indicated in bold.

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 2). Monthly average temperatures were near normal for most of the growing season, and there was a total of 2,717 Growing Degree Days (GDDs). In the spring at the time of planting, soil conditions were quite wet following several large rain events in May. However, there was below average precipitation 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 2. Weather data for Alburgh VT, 2025.

Alburgh, VT	2025					
	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.

Nitrogen applied as starter fertilizer did not significantly impact soybean yields, harvest moisture, or test weight (Table 3). Soybean yields were good in this year's trial, with a trial average of 3,636 lbs ac^{-1} or 60.6 bu ac^{-1}. The average harvest moisture was 13.8% and the average test weight was 56.0 lbs bu^{-1}.

Table 3. Soybean harvest characteristics by nitrogen application rate, Alburgh, VT, 2025.

Nitrogen application rate	Harvest moisture	Yield at 13% moisture		Test weight
lbs N ac^{-1}	%	lbs ac^{-1}	bu ac^{-1}	lbs bu^{-1}
0 (control)	13.8	3729	62.2	55.3
5	13.7	3675	61.2	57.4
10	13.7	3474	57.9	57.4
15	14.1	3767	62.8	55.6
20	13.8	3685	61.4	55.5
25	13.7	3488	58.1	55.1
LSD ($p = 0.10$) †	---------------------------NS‡---------------------------			
Trial mean	13.8	3636	60.6	56.0

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

DISCUSSION

The 2025 growing season was challenging for farmers across the state due to the severe drought conditions. Soybean yields in this trial averaged 3,636 lbs or 60.6 bu ac^{-1}. The nitrogen application rates did not impact soybean yield, harvest moisture, or test weight in the 2025 trial. These results are consistent with previous trials done in 2023 & 2024 at Borderview Research Farm, Alburgh, VT. It is important to remember that these data only represent one year and one trial location. Continued research needs to be done to better understand the impact that nitrogen applications at planting can have on soybean yield and quality.

ACKNOWLEDGEMENTS

UVM Extension helps individuals and communities put research-based knowledge to work.

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