



2023 Conventional Soybean Variety Trial



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2023 CONVENTIONAL SOYBEAN VARIETY TRIAL
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In 2023, the University of Vermont Extension Northwest Crops and Soils Team evaluated yield and quality of short season soybean varieties at Borderview Research Farm in Alburgh, VT. Soybeans can be grown for human consumption, animal feed, and biodiesel production. As farmers look to reduce feed costs or diversify markets, soybean acreage across Vermont is increasing. Local research is needed to identify varieties that are best adapted to this region. In an effort to support and expand the local soybean market throughout the northeast, the University of Vermont Extension Northwest Crop and Soils (NWCS) Program, as part of a grant from the Eastern Soybean Board, established a trial in 2023 to evaluate yield and quality of soybean varieties appropriate for the region.

MATERIALS AND METHODS

Four seed companies submitted varieties for evaluation (Table 1). Twenty-nine soybean varieties were evaluated from maturity groups 00, 0, 1, and 2. Details for the varieties including company, genetic traits, and relative maturity are listed in Table 2.

Table 1. Participating companies and contact information.

Asgrow Seed Co., LLC	Brevant	Nutrien Ag Solutions	Seedway, LLC
Nathan Holt Bayer Crop Science Canandaigua, NY	Claude Fortin St. Albans, VT 05478 802-363-2803	Tom Barber East Aurora, NY (716) 912-5494	Rachel Tomko Bomoseen, VT 05732 (802) 338-6930

The soil type at the Alburgh, VT location was a Benson rocky silt loam, over shaly limestone, 8-15% slopes (Table 3). The seedbed was prepared using a Pottinger Terra Disc prior to seeding. Soybeans were planted at a seeding rate of 185,000 seeds ac⁻¹ on 26-May with a 4-row cone planter with John Deere row units fitted with Almaco seed distribution units (Nevada, IA). Plots were 20 feet long and consisted of two rows spaced at 30 inches. The plot design was a randomized complete block with four replications and the treatments were 29 varieties that ranged in maturity group from 0.9 to 2.2. Plots were monitored for disease pressure throughout the season, and on 16-Aug, plots were assessed for severity of infection with downy mildew (*Peronospora manshurica*), bacterial blight (*Pseudomonas syringae* pv. *glycinea*), Septoria brown spot (*Septoria glycines*), frogeye leaf spot (*Cercospora soja*), Cercospora leaf blight (*Cercospora kikuchii*), and anthracnose (*Colletotrichum truncatum*). 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. On 10-Oct, the 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). 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.

Table 2. Soybean varieties evaluated in Alburgh, VT, 2023.

Company	Variety	Traits	Maturity
Brevant	B0090EE	ENLIST E3	0.9
Seedway, LLC	SG 0643XTF	XtendFlex	0.6
Seedway, LLC	SG 0720XT	RR2X	0.7
Asgrow	AG07XF4	XtendFlex	0.7
Brevant	B091EE	ENLIST E3	0.9
Seedway, LLC	SG 1023E3	ENLIST E3	1.0
Seedway, LLC	SG 1077	RR2X	1.0
Asgrow	AG10XF4	XtendFlex	1.0
Seedway, LLC	SG 1143XTF	XtendFlex	1.1
Brevant	B112EE	ENLIST E3	1.1
Seedway, LLC	SG 1320E3	ENLIST E3	1.3
Brevant	B131EE	ENLIST E3	1.3
Seedway, LLC	SG 1432XTF	XtendFlex	1.4
Nutrien Ag Solution	S14EN22	ENLIST E3	1.4
Nutrien Ag Solution	S14XF43	XtendFlex	1.4
Asgrow	AG14XF4	XtendFlex	1.4
Brevant	B152EE	ENLIST E3	1.5
Nutrien Ag Solution	S16EN42	ENLIST E3	1.6
Nutrien Ag Solution	S17XF02	XtendFlex	1.7
Seedway, LLC	SG 1708GT/LL	GT LL	1.7
Brevant	B173EE	ENLIST E3	1.7
Seedway, LLC	SG 1822XTF	XtendFlex	1.8
Nutrien Ag Solutions	S18EN52	ENLIST E3	1.8
Asgrow	AG18XF1	XtendFlex	1.8
Seedway, LLC	SG 1922E3	ENLIST E3	1.9
Asgrow	AG19XF3	XtendFlex	1.9
Asgrow	AG20XF1	XtendFlex	2.0
Asgrow	AG21XF1	XtendFlex	2.1
Asgrow	AG22XF3	XtendFlex	2.2

ENLIST E3- These soybeans are resistant to 2, 4-D, glyphosate, and glufosinate herbicides.

GT LL- These soybeans are resistant to glyphosate and glufosinate herbicides.

RR2X – Roundup Ready 2 Xtend soybeans are resistant to glyphosate and dicamba herbicides.

XtendFlex- These soybeans are resistant to dicamba, glyphosate, and glufosinate herbicides.

Table 3. Soybean trial specifics for Alburgh, VT, 2023.

	Borderview Research Farm Alburgh, VT
Soil type	Benson rocky silt loam, over shaly limestone, 8-15% slope
Previous crop	Winter wheat
Tillage operations	Pottinger Terra Disc
Plot size (feet)	5 x 20
Row spacing (inches)	30
Weed control	1 qt ac ⁻¹ Cornerstone® (19-Jun)
Planting date	26-May
Harvest date	10-Oct

Yield and stand characteristic data were analyzed using the mixed model procedure of SAS (SAS Institute, 1999). Replications within trials were treated as random effects, and hybrids were treated as fixed. Hybrid mean comparisons for harvest characteristics and disease data were made using the Least Significant Difference (LSD) procedure when the F-test was considered significant ($p < 0.10$). Hybrid mean pairwise comparisons for yield were made using the Tukey-Kramer adjustment. Treatments were considered different at the 0.10 level of significance.

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 hybrids 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 hybrids 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 hybrids. In this example, hybrid C is significantly different from hybrid A but not from hybrid 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 hybrids 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 hybrids were significantly different from one another.

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

RESULTS

Weather data were recorded with a Davis Instrument Vantage Pro2 weather station, equipped with a WeatherLink data logger at Borderview Research Farm in Alburgh, VT (Table 4). Temperatures were cooler than average for most of the soybean growing season. August was particularly cool with an average temperature of 67°F which is 3.73 degrees cooler than the 30-year average. Temperatures were much warmer later in the season, especially in October where the monthly average temperature, 54.4°F, was 4.11 degrees warmer than normal. The biggest challenge during the 2023 growing season was excessive precipitation. Below average rainfall in May resulted in a dry seedbed at soybean planting, but heavy rainfall during the remainder of the season resulted in a total of 31.2 inches of rain. Precipitation during the 2023 soybean growing season was 4.73 inches higher than in 2022 and 8.06 inches higher than the 30-year average. Several large storm events occurred during the month of July and that accounted for one third (10.8 inches) of the total rainfall during the season. The average amount of rain for these large storms was

1.5 to 2.0 inches per event. There was a period of dry weather in September, but heavy rainstorms continued in October. Two days prior to the soybean harvest, Alburgh, VT received 3.26 inches of rain. There was a total of 2711 Growing Degree Days (GDDs), which is slightly above the 30-year average of 2686 GDDs.

Table 4. Weather data for Alburgh, VT, 2023.

Alburgh, VT	May	Jun	Jul	Aug	Sep	Oct
Average temperature (°F)	57.1	65.7	72.2	67.0	63.7	54.4
Departure from normal	-1.28	-1.76	-0.24	-3.73	1.03	4.11
Precipitation (inches)						
Precipitation (inches)	1.98	4.40	10.8	6.27	2.40	5.38
Departure from normal	-1.78	0.14	6.69	2.73	-1.27	1.55
Growing Degree Days (50-86°F)						
Growing Degree Days (50-86°F)	303	483	712	540	449	225
Departure from normal	1	-41	17	-101	62	87

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.

Harvest characteristics of soybean varieties are shown in Table 5. The average harvest moisture was 14.6%. SG 1143XTF had the lowest harvest moisture, 13.8%, and twenty-one varieties had harvest moisture that were not statistically different from the top performer. AG22XF3 had the highest moisture at harvest, 18.8%. Average test weight for the 2023 varieties was 56.0 lbs bu⁻¹, and B131EE had the highest test weight, 57.8 lbs bu⁻¹. Fifteen varieties performed statistically similar to B131EE. AG22XF3 produced the highest yield at 13% moisture, 4622 lbs ac⁻¹ (77 bu ac⁻¹). Eleven varieties had yields that were statistically similar to AG22XF3.

On average, disease severity was relatively low in the 2023 soybean variety trial (Table 6). For each of the diseases observed, none of the varieties had a severity rating greater than 5. Downy mildew and frogeye leaf spot were the most prevalent, being observed in all of the plots in this trial. The average severity of downy mildew was 1.88, but severity ranged from 0.25 to 4.75. SG 1023E3 was most affected by downy mildew and only one other variety, SG 0720XT, was statistically similar. The average severity of frogeye leaf spot was 2.19 and ranged from 1.00 to 4.50. AG07XF4 had the highest severity of frogeye leaf spot and was statistically similar to just one other variety, S14XF43. All other diseases had an average severity rating less than 1, which means that on average, no more than 10% of the leaf area in each plot was affected.

Table 5. Harvest characteristics of soybean varieties – Alburgh, VT, 2023.

Company	Variety	Relative maturity	Harvest moisture	Test weight	Yield @ 13% moisture	
			%	lbs bu ⁻¹	lbs ac ⁻¹	bu ac ⁻¹
Brevant	B0090EE	00.9	14.3*	56.2*	3179	53.0
Seedway, LLC	SG 0643XTF	0.6	14.4*	57.3*	2958	49.3
Seedway, LLC	SG 0720XT	0.7	14.2*	56.1*	3067	51.1
Asgrow	AG07XF4	0.7	13.9*	57.2*	3466	57.8
Brevant	B091EE	0.9	14.3*	55.1	3857*	64.3*
Seedway, LLC	SG 1023E3	1.0	14.4*	55.3	3720	62.0
Seedway, LLC	SG 1077	1.0	14.4*	56.4*	3380	56.3
Asgrow	AG10XF4	1.0	14.1*	56.2*	3583	59.7
Seedway, LLC	SG 1143XTF	1.1	13.8 ¥	56.4*	3743	62.4
Brevant	B112EE	1.1	14.2*	56.6*	3834*	63.9*
Seedway, LLC	SG 1320E3	1.3	14.3*	54.9	4276*	71.3*
Brevant	B131EE	1.3	14.3*	57.8	3520	58.7
Seedway, LLC	SG 1432XTF	1.4	14.2*	56.7*	3728	62.1
Nutrien Ag Solution	S14EN22	1.4	13.9*	57.5*	4189*	69.8*
Nutrien Ag Solution	S14XF43	1.4	14.4*	54.8	3724	62.1
Asgrow	AG14XF4	1.4	13.9*	57.7*	3447	57.4
Brevant	B152EE	1.5	14.4*	55.9	4397*	73.3*
Nutrien Ag Solution	S16EN42	1.6	14.2*	55.9	3483	58.0
Nutrien Ag Solution	S17XF02	1.7	14.1*	56.7*	3535	58.9
Seedway, LLC	SG 1708GT/LL	1.7	14.1*	57.5*	3842*	64.0*
Brevant	B173EE	1.7	15.4	55.6	3661	61.0
Seedway, LLC	SG 1822XTF	1.8	15.8	55.9	3545	59.1
Nutrien Ag Solutions	S18EN52	1.8	13.9*	54.7	4420*	73.7*
Asgrow	AG18XF1	1.8	14.0*	56.6*	4487*	74.8*
Seedway, LLC	SG 1922E3	1.9	15.1	55.3	4205*	70.1*
Asgrow	AG19XF3	1.9	14.8	56.0*	3616	60.3
Asgrow	AG20XF1	2.0	16.4	53.7	4354*	72.6*
Asgrow	AG21XF1	2.1	15.8	55.8	4394*	73.2*
Asgrow	AG22XF3	2.2	18.8	53.2	4622	77.0
LSD ($p = 0.10$) ‡			0.84	1.77	820	1.37
Trial mean			14.6	56.0	3801	63.4

¥ Values in **bold** indicate the top performer for the production metric and varieties with an asterisk * performed statistically similarly to the top performer.

‡LSD –Least significant difference at $p=0.10$.

Table 6. Disease characteristics of soybean varieties – Alburgh, VT, 2023.

Company	Variety	Relative Maturity	Bacterial blight	Downy mildew	Anthracnose	Frogeye leaf spot	Cercospora leaf blight	Septoria brown spot
Brevant	B0090EE	00.9	1.50 ¥	3.00	0.50	1.25	1.75	1.50
Seedway, LLC	SG 0643XTF	0.6	0.00	0.75	0.75	3.00	0.00	0.25
Seedway, LLC	SG 0720XT	0.7	0.25	3.75*	1.50*	3.00	0.00	0.25
Asgrow	AG07XF4	0.7	0.00	1.00	1.25*	4.50	0.25	0.00
Brevant	B091EE	0.9	0.50	1.50	0.75	1.75	0.00	0.25
Seedway, LLC	SG 1023E3	1.0	0.25	4.75	0.25	1.50	0.00	0.50
Seedway, LLC	SG 1077	1.0	0.00	1.25	0.25	2.00	0.50	0.50
Asgrow	AG10XF4	1.0	0.00	2.00	1.75	2.25	0.00	0.00
Seedway, LLC	SG 1143XTF	1.1	0.00	1.50	1.50*	2.00	0.25	0.00
Brevant	B112EE	1.1	0.25	3.25	0.25	1.50	0.00	0.00
Seedway, LLC	SG 1320E3	1.3	0.25	1.25	0.25	1.25	0.25	0.00
Brevant	B131EE	1.3	0.50	1.25	0.75	2.25	0.00	0.25
Seedway, LLC	SG 1432XTF	1.4	0.00	1.75	1.25*	3.50	0.00	0.25
Nutrien Ag Solution	S14EN22	1.4	0.75	2.75	0.25	1.75	0.00	0.00
Nutrien Ag Solution	S14XF43	1.4	0.50	2.00	1.25*	3.75*	0.25	0.75
Asgrow	AG14XF4	1.4	0.25	2.00	1.75	2.75	0.25	0.25
Brevant	B152EE	1.5	0.00	1.00	0.75	1.25	0.00	0.00
Nutrien Ag Solution	S16EN42	1.6	0.25	1.75	1.00*	3.00	0.00	0.00
Nutrien Ag Solution	S17XF02	1.7	0.00	2.00	0.75	2.25	0.00	0.50
Seedway, LLC	SG 1708GT/LL	1.7	0.25	0.50	0.50	1.75	0.00	0.00
Brevant	B173EE	1.7	0.00	1.50	0.75	1.50	0.00	0.00
Seedway, LLC	SG 1822XTF	1.8	0.00	0.75	1.25*	2.50	0.00	0.00
Nutrien Ag Solutions	S18EN52	1.8	1.25*	2.75	0.50	1.00	0.50	0.00
Asgrow	AG18XF1	1.8	0.00	2.25	1.50*	2.75	0.00	0.00
Seedway, LLC	SG 1922E3	1.9	0.75	2.50	1.50*	2.50	0.50	0.50
Asgrow	AG19XF3	1.9	0.25	3.50	0.75	3.00	0.00	0.00
Asgrow	AG20XF1	2.0	0.00	0.25	0.50	1.00	0.75	0.00
Asgrow	AG21XF1	2.1	0.00	0.50	1.25*	1.00	0.50	0.25
Asgrow	AG22XF3	2.2	0.00	1.50	0.75	2.00	0.00	0.25
LSD ($p = 0.10$) ‡			0.59	1.03	0.81	0.97	0.53	0.61
Trial Mean			0.27	1.88	0.90	2.19	0.20	0.22

† 0 to 10 scale; rating of 0 = no infection or damage and rating of 10 = 100% infection or damage.

¥ Values in **bold** indicate the top performer for the production metric and varieties with an asterisk * performed statistically similarly to the top performer.

‡LSD –Least significant difference at $p=0.10$.

DISCUSSION

The 2023 soybean growing season was challenging due to a number of unfavorable weather conditions. Lack of precipitation in May resulted in a very dry seed bed at the time of soybean planting. Cool temperatures persisted from May through August. Excessive rainfall, however, was the biggest challenge during this season. In July alone, Alburgh, VT received 10.8 inches of rain. Mild downy mildew and frogeye leaf spot infections were common due to the cool and wet conditions, but there were a few varieties of soybeans that had particularly greater severity ratings compared to the rest. SG 1023E3 and SG 0720XT had statistically higher downy mildew infection than all other varieties. And frogeye leaf spot infection was statistically highest in AG07XF4 and S14XF43. Other diseases like bacterial blight, anthracnose, Cercospora leaf blight, and Septoria brown spot were present but overall severity was low.

Even with the poor weather conditions, overall soybean yields were good with a trial average of 3801 lbs or 63.4 bu ac⁻¹. Soybean yields were 473lb or 78bu ac⁻¹ lower this year compared to 2022. The average moisture at harvest was 14.6%, so little additional drying was needed to attain a safe storage temperature. The average test weight was 56 lbs bu⁻¹, which is less than the industry standard of 60 lbs bu⁻¹. AG22XF3 had the highest yield, but eleven varieties performed statistically similar. These top performing varieties ranged in maturity from 0.9 to 2.2. These results suggest that good soybean yields can be achieved from varieties within a range of relative maturities (0, 1, and 2) under conventional management in northern Vermont. Although it is important to note that six of the twelve top performing varieties had a relative maturity of 1.8 to 2.2, and only one had a relative maturity of less than 1. Also, some of the earliest maturing varieties (0.9 to 0.7) had some of the lowest yields in this year's trial.

Figure 1 below summarizes soybean yields by variety compared to the trial average and data are organized in order of relative maturity. Environmental stress during the reproductive stages of development can result in reduced soybean yields. Plants are particularly susceptible, especially during pod formation and seed fill. Depending on the variety, pod formation occurs around late-July through mid-August and seed fill from around early-August to mid-September. It is possible that the very early maturing varieties were more vulnerable to the excessive rain and cool temperatures in July and August compared to later maturing varieties that did not reach those growth stages until September when conditions were warmer and drier. Plant lodging later in the season because of saturated soils and wind can also lead to decreased yields, especially in those early maturing varieties. It is important to remember that these data only represent one year at one location and therefore should not solely be used to make management decisions.

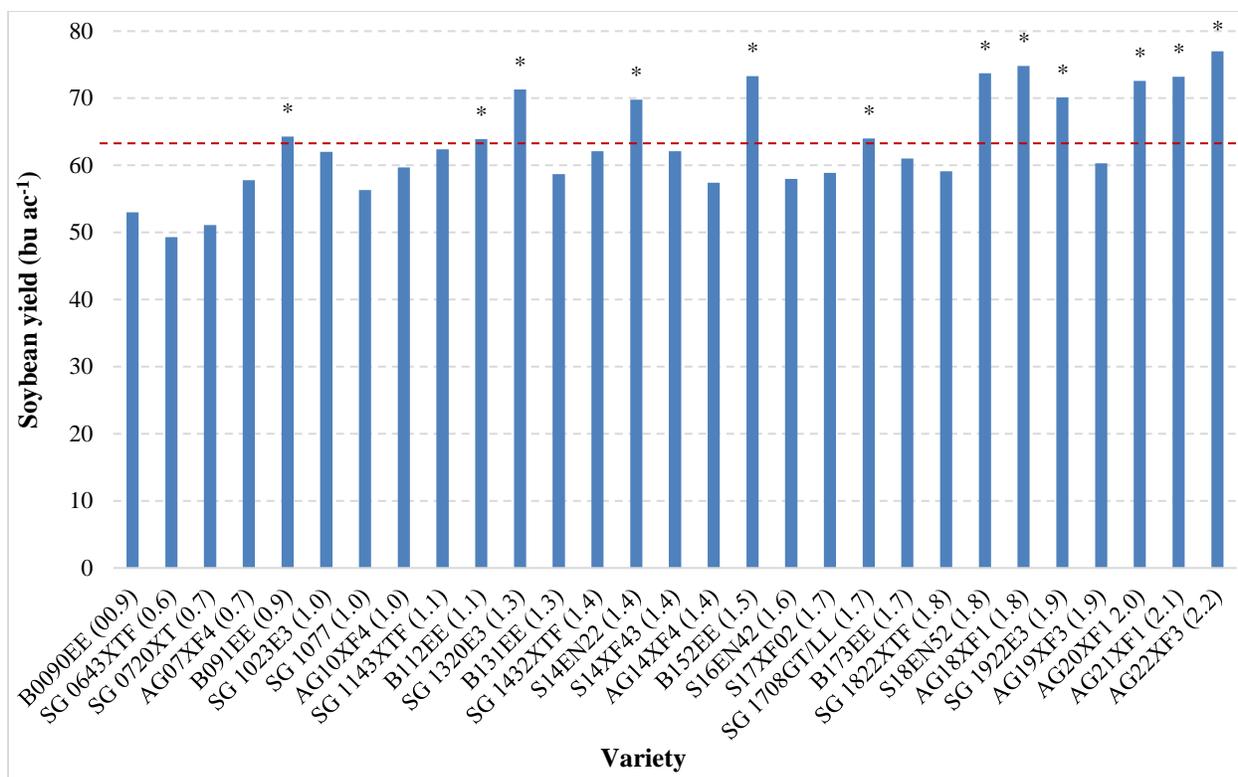


Figure 1. Soybean yields by variety, Alburgh, VT, 2023.

Relative maturity for each variety is shown in parentheses next to the variety name. The dashed red line indicates the trial average yield. Varieties marked with an asterisk (*) performed statistically similar to the top performer.

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