



2017 Soybean Variety Trial



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In 2017, 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. Due to the short growing season in Vermont, little research has been conducted on soybeans and the insects and diseases that can affect their harvest yield and quality. Soybeans are grown for human consumption, animal feed, and biodiesel. 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 2017 to evaluate yield and quality of short season soybean varieties.

MATERIALS AND METHODS

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

Table 1. Participating companies and contact information.

Channel Bio, LLC	Dyna-Gro (Crop Protection Services)	King's Agriseed	Seedway, LLC	Syngenta
800 N. Lindbergh Blvd. St. Louis, MO 63167 (814) 571-8600	Tom Barber East Aurora, NY (716) 912-5494	1828 Freedom Rd. Lancaster, PA 17601 (717) 687-6224	171 Ledgemere Point Bomoseen, VT 05732 (802) 338-6930	PO Box 18300 Greensboro, NC 27419 (800) 334-9481

Table 2. Soybean varieties evaluated in Alburgh, VT, 2016.

Variety	Company	Traits	Maturity group
00717R2X	Channel Bio, LLC	RR2X	0.07
0317R2X	Channel Bio, LLC	RR2X	0.3
0518R2X	Channel Bio, LLC	RR2X	0.5
0616R2X	Channel Bio, LLC	RR2X	0.6
0916R2X	Channel Bio, LLC	RR2X	0.9
1017R2X	Channel Bio, LLC	RR2X	1.0
1117R2X	Channel Bio, LLC	RR2X	1.1
1318R2X	Channel Bio, LLC	RR2X	1.3
1517R2X	Channel Bio, LLC	RR2X	1.5
1816R2X	Channel Bio, LLC	RR2X	1.6
1818R2X	Channel Bio, LLC	RR2X	1.8
S09RY64	Dyna-Gro	RR2Y	0.9
S11XT78	Dyna-Gro	RR2X	1.1
S12RY44	Dyna-Gro	RR2Y	1.2

S12XT07	Dyna-Gro	RR2X	1.2
S16XT58	Dyna-Gro	RR2X	1.6
S18XT38	Dyna-Gro	RR2X	1.8
1218N	King's Agriseed	Conventional	1.2
S20-T6	Syngenta	RR2Y	2.0
SG0975	Seedway, LLC	RR2Y	0.9
SG1055	Seedway, LLC	RR2Y	1.0
SG1311	Seedway, LLC	RR2Y	1.3
SG1776	Seedway, LLC	RR2Y	1.7

RR2X – Roundup Ready 2 Xtend soybeans are glyphosate and dicamba herbicide tolerant.

RR2Y – Roundup Ready 2 Yield soybeans contain genes to increase the number of 3, 4, and 5-bean pods per plant.

The soil type at the Alburgh location was Benson rocky silt loam (Table 3). The seedbed was prepared using a moldboard plow and then disked prior to seeding. The previous crop was annual cover crop mixtures. Plots were planted on 1-Jun with a Monosem NG-Plus 2-row precision air planter (Edwardsville, KS). Starter fertilizer (10-20-20) was applied at a rate of 200 lbs ac⁻¹. Plots were 20' long and consisted of two rows spaced at 30 inches. The seeding rate was 185,000 seeds ac⁻¹. The plot design was a randomized complete block with three replications. The treatments were 23 varieties that ranged in maturity group from 0.07 to 2.0.

Table 3. Soybean trial specifics for Alburgh, VT, 2017.

	Borderview Research Farm Alburgh, VT
Soil types	Benson rocky silt loam 8-15% slope
Previous crop	Cover crop mixtures
Tillage operations	Moldboard plow and disc
Plot size (feet)	5 x 20
Row spacing (inches)	30
Replicates	3
Starter fertilizer (lbs ac ⁻¹)	200 lbs ac ⁻¹ 10-20-20
Planting date	1-Jun
Harvest date	20-Oct

The plots were also scouted for insect pests and disease symptoms on 20-Sep. An overall rating for aphid infestation was provided for each plot on a 0-5 scale where 0 is low infestation and 5 is high infestation. Presence of white mold, bacterial blight, frogeye leaf spot, and downy mildew was recorded and an overall disease infection score from 0-10 (where 0 is low infection and 10 is high infection) was assigned to each plot. On 20-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, tested for harvest moisture using a DICKEY-John Mini-GAC Plus moisture meter, and evaluated for test weight using a Berckes Test Weight Scale.

Yield data and stand characteristics were analyzed using mixed model analysis using the mixed procedure of SAS (SAS Institute, 1999). Replications within trials were treated as random effects, and hybrids were

treated as fixed. Hybrid mean comparisons were made using the Least Significant Difference (LSD) procedure when the F-test was considered significant ($p < 0.10$).

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 hybrids is real or whether it might have occurred due to other variations in the field. At the bottom of each table a 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 was recorded with a Davis Instrument Vantage Pro2 weather station, equipped with a WeatherLink data logger at Borderview Research Farm in Alburgh, VT. Overall, the season was cooler and wetter than normal. Almost 1.5 inches of rain fell immediately following planting. Unseasonably cool temperatures and above average rainfall persisted through August followed by above average temperatures and below average rainfall in September and October. The dry warm weather in the fall provided excellent conditions for the soybeans to be able to reach maturity and be harvested at optimal moisture content. Overall, a total of 2335 growing degree days (GDDs) were accumulated June-October, 209 above the 30-year normal.

Table 4. Weather data for Alburgh, VT, 2017.

Alburgh, VT	June	July	August	September	October
Average temperature (°F)	65.4	68.7	67.7	64.4	57.4
Departure from normal	-0.39	-1.90	-1.07	3.76	9.2
Precipitation (inches)	5.64	4.88	5.54	1.84	3.30
Departure from normal	1.95	0.73	1.63	-1.80	-0.31
Growing Degree Days (base 50°F)	468	580	553	447	287
Departure from normal	-7	-60	-28	129	175

Based on weather data from a Davis Instruments Vantage Pro2 with WeatherLink data logger. Historical averages are for 30 years of NOAA data (1981-2010) from Burlington, VT.

Due to the complexity of identifying and quantifying all of the diseases present on the soybean leaves and pods, only presence was noted for the four major diseases seen throughout the majority of the trial: Bacterial Leaf Blight (*Pseudomonas syringae* pv. *glycinea*) (Image 2), Downy Mildew (*Peronospora manshurica*) (Image 1), Frogeye Leaf Spot (*Cercospora sojina*), and White Mold (*Sclerotinia sclerotiorum*). The

percentage of total plots for each variety that were infected with each of these diseases is summarized in Table 5. The entire plot was then rated on a 0-10 scale for overall disease infection where 0 was low infection. Concurrently, plots were rated for infestation with soybean aphid (*Aphis glycines* Matsumura) on a 0-5 scale where 0 was low infestation.

Table 5. Soybean disease and aphid incidence and severity of 23 varieties in 2017, Alburgh, VT.

Variety	Bacterial Leaf Blight	Downy Mildew	Frogeye Leaf Spot	White Mold	Aphids	Disease
	-----% of plots infected-----				0-5 [†]	0-10 [‡]
00717R2X	100	0.00	66.7	0.00	1.00*	3.00
0317R2X	100	33.3	66.7	33.3	1.00*	3.33
0518R2X	100	0.0	66.7	33.3	1.67*	2.33
0616R2X	66.7	16.7	66.7	16.7	1.67*	2.67
0916R2X	100	16.7	66.7	50.0	1.00*	2.33
1017R2X	33.3	0.00	66.7	0.00	1.00*	3.00
1117R2X	66.7	33.3	66.7	33.3	1.33*	3.00
1318R2X	0.00	66.7	100	100	1.00*	5.00
1517R2X	100	100.	66.7	66.7	1.00*	3.33
1816R2X	33.3	66.7	33.3	66.7	1.00	2.67
1818R2X	66.7	33.3	100	33.3	1.67*	2.67
S09RY64	66.7	0.00	100	33.3	1.00*	4.33
S11XT78	100	0.00	66.7	66.7	1.33*	3.00
S12RY44	33.3	33.3	66.7	66.7	1.33*	4.00
S12XT07	100	66.7	100	66.7	1.33*	6.33
S16XT58	66.7	33.3	66.7	33.3	1.00*	3.00
S18XT38	66.7	0.0	66.7	33.3	2.00	2.67
1218N	66.7	66.7	66.7	33.3	1.00*	2.33
S20-T6	66.7	100	0.00	66.7	2.00	3.00
SG0975	66.7	66.7	66.7	66.7	1.33*	3.33
SG1055	66.7	66.7	100	66.7	1.00*	5.00
SG1311	66.7	33.3	66.7	66.7	1.00*	4.00
SG1776	100	0.00	100	66.7	2.00	4.67
LSD ($p = 0.10$)	N/A	N/A	N/A	N/A	0.706	NS
Trial Mean	71.0	36.2	71.0	47.8	1.29	3.43

*Varieties that performed statistically similarly to the top performer shown in **bold** are indicated with an asterisk.

NS- Not statistically significant.

N/A- Statistical analysis was not performed for this parameter.

[†] 0 indicates no aphid presence and 5 indicates severe aphid infestation.

[‡] 0 indicates no disease presence and 10 indicates severe disease infection.

Differences in presence of these four major diseases were not statistically analyzed. Overall, aphid severity was low for all varieties; however, aphids were present in nearly every plot. The varieties S18XT38, SG1776, and S20-T6 had statistically higher levels of aphids compared to all other varieties. Overall, disease ratings ranged from 2.33 to 6.33. However, plots with high overall disease incidence did not

necessarily have high levels of any one particular disease. As Table 5 shows, most of the varieties were infected with at least two diseases. These data are intended to provide some insight into relative disease and aphid susceptibility of the varieties.

Table 6. Harvest characteristics of soybean varieties – Alburgh, VT, 2017.

Variety	Company	Maturity group	Harvest population	Harvest moisture	Test weight	Yield @ 13% moisture	
			plants ac ⁻¹	%	lbs bu ⁻¹	lbs ac ⁻¹	bu ac ⁻¹
00717R2X	Channel Bio, LLC	0.07	137456	12.0	57.7*	3322	55.4
0317R2X	Channel Bio, LLC	0.3	152944	11.1*	58.3*	3059	51.0
0518R2X	Channel Bio, LLC	0.5	160688*	11.9	57.3*	3605	60.1
0616R2X	Channel Bio, LLC	0.6	151008	11.3*	58.0*	3469	57.8
0916R2X	Channel Bio, LLC	0.9	133584	11.5*	56.9*	3667	61.1
1017R2X	Channel Bio, LLC	1.0	158752*	11.2*	58.7*	3514	58.6
1117R2X	Channel Bio, LLC	1.1	154880*	11.5*	58.5*	3618	60.3
1318R2X	Channel Bio, LLC	1.3	160688*	11.6*	57.9*	3623	60.4
1517R2X	Channel Bio, LLC	1.5	145200	11.8	57.5*	3563	59.4
1816R2X	Channel Bio, LLC	1.6	137456	11.4*	58.6*	4107*	68.5*
1818R2X	Channel Bio, LLC	1.8	156816*	11.7*	58.8*	3928*	65.5*
S09RY64	Dyna-Gro	0.9	158752*	11.3*	57.7*	3577	59.6
S11XT78	Dyna-Gro	1.1	131648	11.5*	59.0*	3475	57.9
S12RY44	Dyna-Gro	1.2	164560*	11.8	57.9*	3920*	65.3*
S12XT07	Dyna-Gro	1.2	141328	11.6*	57.1*	3776	62.9
S16XT58	Dyna-Gro	1.6	154880*	11.3*	59.4*	3981*	66.3*
S18XT38	Dyna-Gro	1.8	172304*	11.9	59.1*	3932*	65.5*
1218N	King's Agriseed	1.2	121968	14.0	56.8	2285	38.1
S20-T6	Syngenta	2.0	149072	11.6*	58.4*	4296*	71.6*
SG0975	Seedway, LLC	0.9	152944	11.1*	59.2*	3896*	64.9*
SG1055	Seedway, LLC	1.0	143264	11.5*	59.8*	3300	55.0
SG1311	Seedway, LLC	1.3	139392	12.2	52.3	3906*	65.1*
SG1776	Seedway, LLC	1.7	158752*	11.2*	58.9*	4123*	68.7*
LSD ($p = 0.10$)			18671	0.621	2.90	516	8.60
Trial Mean			149493	11.7	58.0	3650	60.8

*Varieties that performed statistically similarly to the top performer shown in **bold** are indicated with an asterisk.
N/A- Statistical analysis was not performed for this parameter.



Image 1. Downy mildew on soybean leaf.



Image 2. Bacterial blight on soybean leaf.

Soybeans were harvested on 20-Oct, harvest results are shown in Table 6. Despite wet weather through most of the season, soybean yields were quite high this year ranging from 2285 to 4296 lbs ac⁻¹ which equate to 38.1 to 71.6 bu ac⁻¹. Fourteen of the 23 varieties in the trial yielded greater than 60 bu ac⁻¹. The highest yielding variety was S20-T6, which yielded 71.6 bu ac⁻¹. This was statistically similar to eight other varieties (Figure 1). Test weight ranged from 52.3 to 59.8 lbs bu⁻¹. All varieties except for two, produced beans with test weights that were statistically similar to the top performer, SG1055. None of the varieties trialed reached the target test weight for soybeans which is 60 lbs bu⁻¹. This may have been due to weather conditions during pod development and seed fill. Plant populations also varied statistically. The highest population of 172,304 plants ac⁻¹ was observed in variety S18XT38 which was similar to nine other varieties. Interestingly, the highest yielding variety had one of the lower plant populations of 149,072 plant ac⁻¹.

Soybeans were pressed for oil using an AgOil M70 expeller press on 15-Feb 2018. A known amount of soybean seed at a known moisture was extruded and the resulting oil captured and weighed to determine oil content and calculate oil yield (Table 7). Average oil content for the trial was 8.07% but ranged from 6.56 to 14.9%. The highest oil content and yield was produced by variety S16XT58, a 1.6 maturity group soybean variety from Dyna-Gro which produced 607 lbs ac⁻¹ or 79.5 gal ac⁻¹. The lowest yielding variety, 1218N from King's Agriseed, produced only 234 lbs ac⁻¹ or 30.6 gal ac⁻¹. However, statistically, soybean varieties did not differ in oil content or oil yield. Soybeans produced in the Midwestern U.S. typically contain approximately 20% oil, therefore the oil contents observed in this trial are quite below average. However, these levels are consistent with those observed in previous years' trials from this area.

Table 7. Oil yield of soybean varieties – Alburgh, VT, 2017-2018.

Variety	Company	Maturity group	Oil content	Oil yield @ 13% moisture	
			%	lbs ac ⁻¹	gal ac ⁻¹
00717R2X	Channel Bio, LLC	0.07	7.95	260	34.0
0317R2X	Channel Bio, LLC	0.3	8.33	255	33.4
0518R2X	Channel Bio, LLC	0.5	7.59	274	35.9
0616R2X	Channel Bio, LLC	0.6	8.12	289	37.8
0916R2X	Channel Bio, LLC	0.9	8.52	285	37.3
1017R2X	Channel Bio, LLC	1.0	8.61	305	39.9
1117R2X	Channel Bio, LLC	1.1	6.56	236	30.9
1318R2X	Channel Bio, LLC	1.3	7.05	256	33.6
1517R2X	Channel Bio, LLC	1.5	8.34	270	35.4
1816R2X	Channel Bio, LLC	1.6	6.72	279	36.6
1818R2X	Channel Bio, LLC	1.8	7.48	289	37.8
S09RY64	Dyna-Gro	0.9	8.08	286	37.4
S11XT78	Dyna-Gro	1.1	7.80	271	35.5
S12RY44	Dyna-Gro	1.2	7.89	306	40.1
S12XT07	Dyna-Gro	1.2	7.87	295	38.7
S16XT58	Dyna-Gro	1.6	14.9	607	79.5
S18XT38	Dyna-Gro	1.8	7.21	283	37.1
1218N	King's Agriseed	1.2	10.3	234	30.6
S20-T6	Syngenta	2	7.13	305	39.9
SG0975	Seedway, LLC	0.9	8.30	323	42.4
SG1055	Seedway, LLC	1.0	7.11	235	30.8
SG1311	Seedway, LLC	1.3	7.16	281	36.8
SG1776	Seedway, LLC	1.7	6.70	276	36.2
LSD (<i>p</i> = 0.10)		N/A	NS	NS	NS
Trial Mean		N/A	8.08	291	38.1

*Varieties that performed statistically similarly to the top performer shown in **bold** are indicated with an asterisk.

N/A- Statistical analysis was not performed for this parameter.

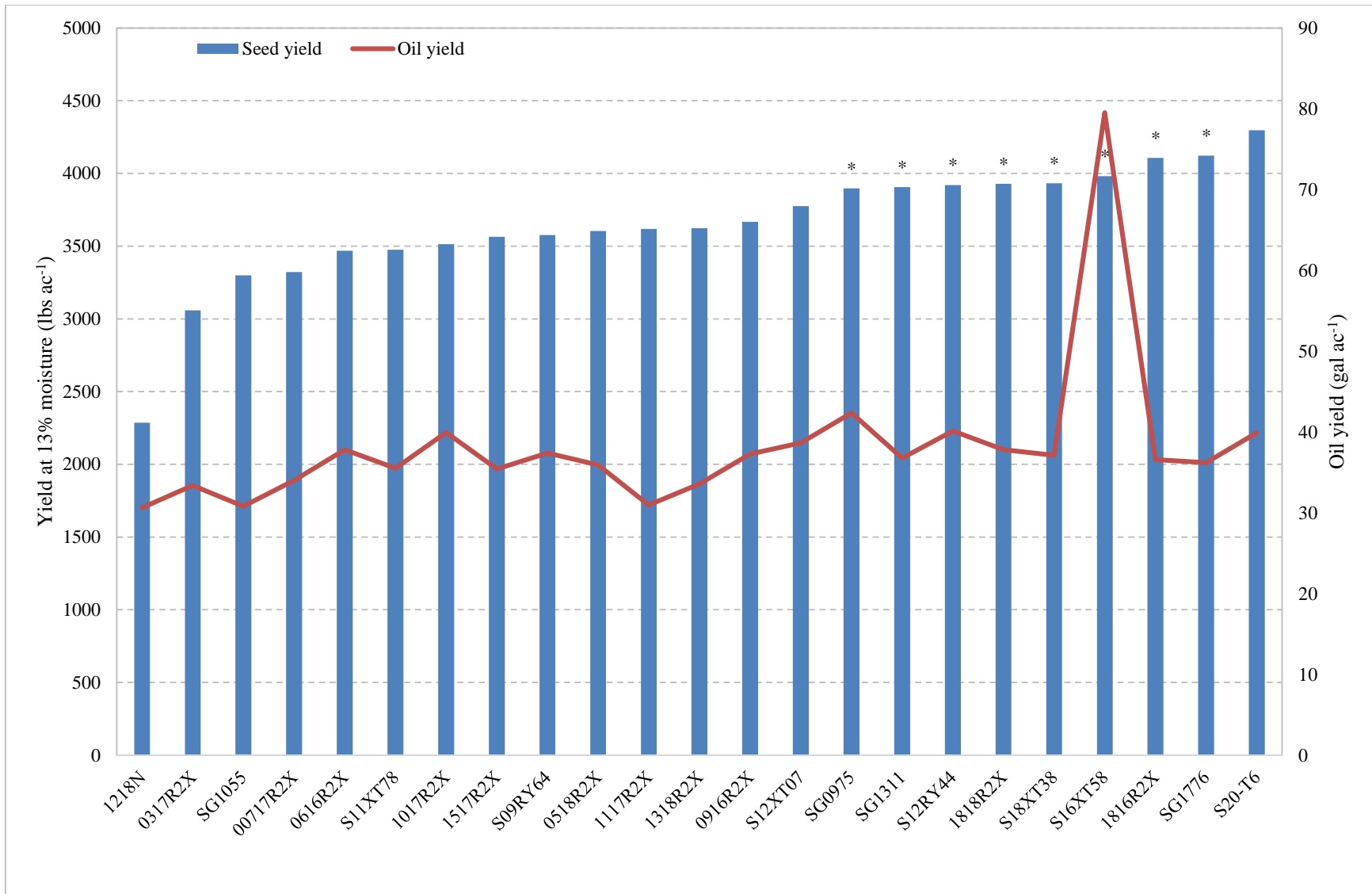


Figure 1. Seed and oil yield at 13% moisture for 24 soybean varieties. The red line indicates the average yield.

**Varieties that did not perform significantly lower than the top performing variety are indicated with an asterisk.*

Varieties did not differ statistically in terms of oil yield.

DISCUSSION

Soybean varieties performed extremely well despite the poor weather conditions throughout the growing season. Although insect and disease pressure was present, it did not appear to significantly impact performance. Further investigation would be needed to fully determine the impact of these pests on soybeans. Fourteen of the 23 varieties produced over 60 bu ac⁻¹ which is a considerable yield for this region. However, these yields were lower than last year's average yield of 3850 lbs ac⁻¹, or 64.3 bu ac⁻¹. Although yields did not appear to be impacted significantly by poor weather conditions this year, none of the varieties produced beans with the target test weight of 60 lbs bu⁻¹. This may have been due to cool and wet weather conditions during pod and seed development. A similar trend was observed last season likely due to dry conditions during seed fill. These data demonstrate that it is possible to grow high yielding soybeans in Vermont's northern climate. Furthermore, it is important to consider differences in performance across available varieties when deciding on a suitable variety.

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