NORTHWEST CROPS & SOILS PROGRAM

2019 Conventional Soybean Variety Trial

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2019 CONVENTIONAL SOYBEAN VARIETY TRIAL

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In 2019, 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 are grown for human consumption, animal feed, and biodiesel. 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 2019 to evaluate yield and quality of soybean varieties appropriate for the region.

MATERIALS AND METHODS

Several seed companies submitted varieties for evaluation (Table 1). Twenty-five 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.

Dyna-Gro (Crop Protection Services)	Mycogen	Seedway, LLC	Syngenta
Tom Barber East Aurora, NY (716) 912-5494	6383 Ethan Allen Hwy. St. Albans, VT 05478 802-363-2803	171 Ledgemere Point Bomoseen, VT 05732 (802)-338-6930	PO Box 18300 Greensboro, NC 27419 1-800-334-9481

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 corn grain. Plots were planted on 31-May with a 4-row cone planter with John Deere row units fitted with Almaco seed distribution units (Nevada, IA). Starter fertilizer (9-18-9) was applied at a rate of 5 gal 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 25 varieties that ranged in maturity group from 0.9 to 2.4. Plots were sprayed with Roundup Power Max at a rate of 1 qt ac^{-1} on 23-Jun to control weeds. Plots were monitored for pest and disease pressure throughout the season. On 22-Aug plots were assessed for severity of infection with downy mildew (*Peronospora manshurica),* bacterial blight (*Pseudomonas syringae pv. glycinea*), and damage from Japanese beetles. These were the only pests and diseases observed in the trial. Assessments were made by inspecting each plot and assigning a rating (0-5) where 0 equated to damage/infection not present and 5 equated to infection or damage present on 100% of leaf area. On 24-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. Soybean oil was extruded from the seeds with an AgOil M70 oil press on 14-Nov and the amount of oil captured was measured to determine oil content and oil yield.

Table 2. Soybean varieties evaluated in Alburgh, VT, 2019.

Company	Variety	Traits	Maturity
Syngenta	S09-D4X	RR2X	0.9
Dyna-Gro	S09XT50	RR2X	0.9
Syngenta	S10-H7X	RR2X	1
Dyna-Gro	S11XT78	RR2X	1.1
Seedway, LLC	SG 1194XT	RR2X	1.1
Dyna-Gro	S13XT89	RR2X	1.3
Syngenta	S14-B2X	RR2X	1.4
Dyna-Gro	S14EN90	Enlist E3	1.4
Syngenta	S14-U9X	RR2X	1.4
Seedway, LLC	SG 1455E3	Enlist E3	1.4
Seedway, LLC	SG 1543XT	RR2X	1.5
Mycogen	MY1602RX	RR2X	1.6
Dyna-Gro	S17EN80	Enlist E3	1.7
Seedway, LLC	SG 1776	RR2Y	1.7
Seedway, LLC	SG1780E3	Enlist E3	1.7
Syngenta	S18-H3X	RR2X	1.8
Dyna-Gro	S18XT38	RR2X	1.8
Seedway, LLC	SG 1863XT	RR2X	1.8
Mycogen	5N206R2	RR2Y	2
Syngenta	S20-J5X	RR2X	2
Seedway, LLC	SG 2017E3	Enlist E3	2
Seedway, LLC	SG 2055XT	RR2X	2
Syngenta	S21-W8X	RR2X	2.1
Mycogen	5N245R2	RR2Y	2.4
Dyna-Gro	S11EN40	Enlist E3	1.1

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

Table 3. Soybean trial specifics for Alburgh, VT, 2019.

	Borderview Research Farm Alburgh, VT
Soil types	Benson rocky silt loam 8-15% slope
Previous crop	Corn grain
Tillage operations	Moldboard plow and disc
Plot size (feet)	5 x 20
Row spacing (inches)	30
Starter fertilizer (lbs ac^{-1})	5 gal ac^{-1} (9-18-9)
Weed control	Roundup Power Max 1 qt ac^{-1}
	23-Jun
Planting date	31-May
Harvest date	24-Oct

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 (Table 4). Overall, the season began cooler and wetter than normal but became hot and dry in the middle of the summer. July brought above normal temperatures and little rainfall. The longest period without rainfall in July lasted 12 days. This dry period, which occurred around the time of pod formation, may have negatively impacted soybean plant growth and productivity. However, these warm conditions did provide optimal Growing Degree Days (GDDs) through the season with a total of 2211 GDDs accumulated Jun-Sep, 197 GDDs above normal.

Table 4. Weather data for Alburgh, VT, 2019.

Alburgh, VT	June	July	August	September	October
Average temperature (°F)	64.3	73.5	68.3	60.0	50.4
Departure from normal	-1.46	2.87	-0.51	-0.62	2.22
Precipitation (inches)	3.06	2.34	3.50	3.87	6.32
Departure from normal	-0.63	-1.81	-0.41	0.23	2.72
Growing Degree Days (base 50°F)	446	716	568	335	146
Departure from normal	-29	76	-13	17	146

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.

Soybeans were harvested on 24-Oct. Harvest results are shown in Table 5. Despite cool early conditions and dry weather through much of the summer, the soybeans performed very well resulting in yields ranging 47.4 to 71.1 bu ac^{-1}. The top yielding variety was S11XT78 which produced 4264 lbs ac^{-1}. This variety was

also the top performer in 2018 yielding 4764 lb ac^{-1}. This variety performed statistically similarly to fourteen other varieties. Varieties also differed in moisture content at harvest with the lowest moisture of 18.7% being observed in variety S13XT89. This was statistically similar to thirteen other varieties, and all varieties required additional drying to reach proper storage moistures. Test weights were slightly below the target of 60.0 lbs bu^{-1} with test weights averaging 57.2 lbs bu^{-1}. The lack of moisture during pod formation and seed fill may have contributed to these low test weights. Soybean oil content and yield were also determined. Oil content ranged from 6.47% to 9.36% with the highest content being observed in variety SG 1543XT. This was statistically similar to nine other varieties. These differences in seed yield and oil content led to a significant range of oil yields from 211 lbs ac^{-1} or 27.6 gal ac^{-1}, to 339 lbs ac^{-1} or 44.4 gal ac^{-1}. The highest oil yield was obtained from variety MY160RX which was statistically similar to fourteen other varieties.

Table 5. Harvest characteristics of soybean varieties – Alburgh, VT, 2019.

Company	Variety	Maturity group	Population	Harvest moisture	Test weight	Yield @ 13% moisture		Oil content	Oil yield	
			plants ac^{-1}	%	lbs bu^{-1}	lbs ac^{-1}	bu ac^{-1}	%	lbs ac^{-1}	gal ac^{-1}
Syngenta	S09-D4X	0.9	165528	21.8	58.3	2989	49.8	8.22*	246	32.2
Dyna-Gro	S09XT50	0.9	168432	20.1	56.9	2842	47.4	7.38	211	27.6
Syngenta	S10-H7X	1.0	181500	19.1*	57.3	3719*	62.0	9.10*	339*	44.3*
Dyna-Gro	S11EN40	1.1	143748	19.9*	57.0	3235	53.9	8.51*	272	35.6
Dyna-Gro	S11XT78	1.1	126324	19.6*	56.7	**4264**	**71.1**	7.99	327*	42.8*
Seedway, LLC	SG 1194XT	1.1	187308	21.2	57.7	3315	55.3	7.02	232	30.4
Dyna-Gro	S13XT89	1.3	139392	**18.7**	56.8	3151	52.5	8.67*	273	35.8
Syngenta	S14-B2X	1.4	**196020**	20.0*	57.1	3446	57.4	8.36*	290*	37.9*
Dyna-Gro	S14EN90	1.4	155364	19.9*	57.1	3856*	64.3*	7.85	304*	39.8*
Syngenta	S14-U9X	1.4	177144	18.9*	57.4	3826*	63.8*	7.29	280	36.7
Seedway, LLC	SG 1455E3	1.4	164076	21.0*	57.4	4251*	70.9*	7.86	334*	43.8*
Seedway, LLC	SG 1543XT	1.5	175692	19.0*	57.6	3523	58.7	**9.36**	333*	43.6*
Mycogen	MY1602RX	1.6	121968	21.8	56.8	3980*	66.3*	8.54*	**339**	**44.4**
Dyna-Gro	S17EN80	1.7	168432	21.0*	**58.5**	4075*	67.9*	7.78	317*	41.6*
Seedway, LLC	SG 1776	1.7	135036	21.7	57.6	3867*	64.4*	8.74*	335*	43.9*
Seedway, LLC	SG1780E3	1.7	188760	19.9*	57.4	3649*	60.8*	7.79	285*	37.3*
Syngenta	S18-H3X	1.8	166980	21.4	56.9	3115	51.9	8.23*	253	33.1
Dyna-Gro	S18XT38	1.8	169884	22.3	57.0	3691*	61.5*	8.58*	314*	41.1*
Seedway, LLC	SG 1863XT	1.8	139392	19.2*	57.3	3729*	62.2*	7.85	292*	38.2*
Mycogen	5N206R2	2.0	148104	21.3	56.8	3707*	61.8*	7.80	292*	38.2*
Syngenta	S20-J5X	2.0	143748	21.6	57.2	3785*	63.1*	8.07	301*	39.5*
Seedway, LLC	SG 2017E3	2.0	130680	22.7	56.6	3382	56.4	7.85	265	34.7
Seedway, LLC	SG 2055XT	2.0	182952	20.6*	57.2	3580	59.7	6.77	243	31.8
Syngenta	S21-W8X	2.1	161172	19.8*	57.3	4193*	69.9*	6.47	271	35.4
Mycogen	5N245R2	2.4	164076	26.4	57.4	3840*	64.0*	8.07	311*	40.8*
LSD (p = 0.10)			33954	2.49	NS	661	11.0	1.21	62.4	8.17
Trial Mean			160069	20.8	57.2	3640	60.7	8.01	290	38.0

The top performing variety is indicated in **bold**.
*Varieties that were not significantly different from the top performing variety are indicated with an asterisk.
NS – Not significant.

Despite dry conditions through the later part of the season, variable incidence of disease was observed throughout the trial (Table 6). Infections with downy mildew and bacterial blight were observed as well as defoliation due to Japanese beetles. Interestingly, varieties differed significantly in terms of downy mildew and Japanese beetle damage. Six varieties including S09-D4X, S17EN90, SG 1455E3, SG 1780E3, S18-H3X, and SG 2055XT experienced no downy mildew infection. The overall average infection rating for downy mildew in the trial was 0.605 indicating that infection, although present on almost all the varieties in the trial, did not affect more than 20% of the leaf area. Furthermore, the highest level of infection was 2.25 observed in variety MY1602RX. This was significantly higher than any other variety in the trial. Despite this infection and low plant populations, MY1602RX produced high seed and oil yields. Bacterial blight was observed in a few varieties but at very low levels.

Table 6. Disease and insect pressure of soybean varieties – Alburgh, VT, 2019.

Company	Variety	Maturity group	Downy mildew	Bacterial blight	Japanese beetle
				0-5 scale†	
Syngenta	S09-D4X	0.9	0.00*	0.250	1.50
Dyna-Gro	S09XT50	0.9	1.00	0.000	1.25
Syngenta	S10-H7X	1.0	0.25*	0.000	1.50
Dyna-Gro	S11EN40	1.1	0.75	0.000	1.25
Dyna-Gro	S11XT78	1.1	1.50	0.000	1.00*
Seedway, LLC	SG 1194XT	1.1	0.75	0.250	1.00*
Dyna-Gro	S13XT89	1.3	0.25*	0.000	1.25
Syngenta	S14-B2X	1.4	1.25	0.000	1.00*
Dyna-Gro	S14EN90	1.4	0.13*	0.000	1.13
Syngenta	S14-U9X	1.4	0.75	0.250	**0.75**
Seedway, LLC	SG 1455E3	1.4	0.00*	0.000	1.00*
Seedway, LLC	SG 1543XT	1.5	1.00	0.000	1.25
Mycogen	MY1602RX	1.6	2.25	0.000	1.25
Dyna-Gro	S17EN80	1.7	0.00*	0.000	1.00*
Seedway, LLC	SG 1776	1.7	0.75	0.000	1.25
Seedway, LLC	SG1780E3	1.7	0.00*	0.000	1.25
Syngenta	S18-H3X	1.8	0.25*	0.000	1.00*
Dyna-Gro	S18XT38	1.8	0.00*	0.000	1.00*
Seedway, LLC	SG 1863XT	1.8	0.50*	0.000	1.00*
Mycogen	5N206R2	2.0	0.75	0.000	1.50
Syngenta	S20-J5X	2.0	0.75	0.000	1.00*
Seedway, LLC	SG 2017E3	2.0	0.50*	0.000	1.50
Seedway, LLC	SG 2055XT	2.0	**0.00**	**0.000**	1.00*
Syngenta	S21-W8X	2.1	0.50*	0.000	1.00*
Mycogen	5N245R2	2.4	1.25	0.000	1.00*
LSD (p = 0.10)			0.671	NS	0.363
Trial Mean			0.605	0.030	1.145

†0 to 5 scale; rating of 0 = no infection or damage and rating of 5 = 100% infection or damage.
The top performing variety is indicated in **bold**.
*Varieties that were not significantly different from the top performing variety are indicated with an asterisk.
NS – Not significant.

Varieties also differed significantly in Japanese beetle defoliation. Variety S14-U9X had the lowest rating of 0.75 which was statistically similar to twelve other varieties. The highest level of damage was 1.50 observed on four varieties.

DISCUSSION

Despite drought conditions throughout much of the season, the soybeans performed well with an average yield of 3640 lbs ac^{-1} or 60.7 bu ac^{-1}, approximately the same as our trials in 2018 and 2017. Four varieties including S11XT78, SG 1455E3, S21-W8X, and S17EN80, produced over 4000 lbs ac^{-1} or 66.7 bu ac^{-1}. Furthermore, five varieties including MY1602RX, S10-H7X, SG 1776, SG 1455E3, and SG 1543XT, produced oil yields of over 330 lbs ac^{-1} or 43.2 gal ac^{-1} (Figure 1). Varieties also differed significantly in susceptibility to downy mildew and defoliation from Japanese beetles. The levels of infection and damage observed in this trial did not appear to impact seed yields, however, under different weather conditions that would promote fungal growth or higher pest incidence, these differences may be important for soybean performance. These differences highlight the importance of careful varietal selection and monitoring to identify varieties that perform well in a variety of conditions on your farm and will meet your specific goals. This report presents data from only one year in one location and should not alone be used in making management decisions.

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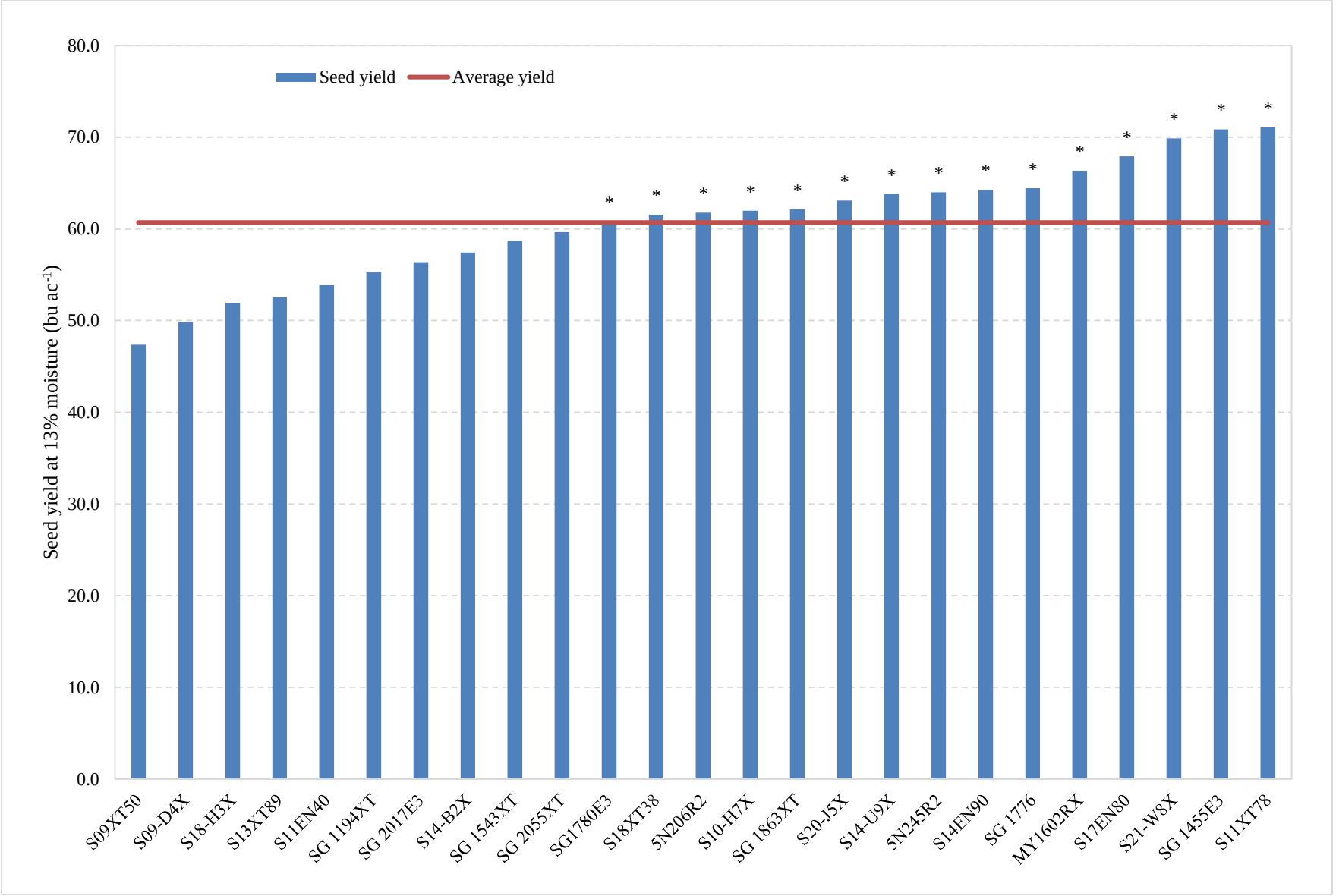

Figure 1. Seed yield at 13% moisture for 25 soybean varieties. The red line indicates the average yield.
**Varieties that did not perform significantly lower than the top performing variety are indicated with an asterisk.*