2019 Organic Soybean Variety Trial

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2019 ORGANIC SOYBEAN VARIETY TRIAL
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In 2019, the University of Vermont Extension Northwest Crops and Soils Program evaluated yield and quality of short season organic 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 established a trial in 2019 to evaluate yield and quality of short season organic soybean varieties.

MATERIALS AND METHODS

Seven soybean varieties submitted by Blue River Hybrids (Ames, IA) were evaluated from maturity groups 0 and 1. Maturity group for the varieties are listed in Table 1.

Table 1. Soybean varieties evaluated in Alburgh, VT, 2019.

Variety	Maturity
07DC8	0.7
08F6	0.8
12A2	1.2
13P8	1.3
1F44	1.4
15C6	1.5
18C7	1.8

The soil type at the Alburgh location was Benson rocky silt loam (Table 2). The seedbed was prepared using a moldboard plow and then disked prior to seeding. The previous crop was barley. 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). Plots were 20' long and consisted of four rows spaced at 30 inches. The seeding rate was 185,000 seeds ac^{-1}. The plot design was a randomized complete block with four replications. The treatments were 7 varieties that ranged in maturity group from 0.7 to 1.8.

Weeds were controlled by hand hoeing and mechanical row cultivation on 14-Jun, 17-Jun, and 24-Jun. Plots were monitored for pest and disease pressure throughout the season. On 22-Aug, plots were assessed for severity of infection from 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 (Image 1). On 14-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.

Table 2. Soybean trial specifics for Alburgh, VT, 2019.

	Borderview Research Farm Alburgh, VT
Soil types	Benson rocky silt loam 8-15% slope
Previous crop	Barley
Tillage operations	Moldboard plow and disc
Plot size (feet)	10 x 20
Row spacing (inches)	30
Replicates	4
Starter fertilizer (lbs ac^{-1})	5 gal ac^{-1} (9-18-9)
Weed control	Handing weed & row cultivation
Planting date	31-May
Harvest date	14-Oct

Image 1. Downy mildew infection scale increasing from 1 (left) to 4 (right).

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

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

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.

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 3). 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 above normal.

Table 3. 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 14-Oct. Harvest results are shown in Table 4. Despite cool early conditions and dry weather through much of the summer, the soybeans performed very well resulting in yields ranging 48.9 to 65.0 bu ac^{-1}. The top yielding variety was 07DC8 which produced 3902 lbs ac^{-1}. However, varieties did not vary statistically in terms of yield. Varieties did, however, differ in harvest moisture content and test weight. Moistures ranged from 12.5% to 13.4% at harvest and therefore indicate that all varieties had adequate time to reach maturity and dry down within the growing season. These soybeans did not require a lot of additional drying to reach storage safe moisture levels.

Table 4. Harvest characteristics of soybean varieties – Alburgh, VT, 2019.

Company	Variety	Maturity group	Population	Harvest moisture	Test weight	Yield @ 13% moisture	
			plants ac^{-1}	%	lbs bu^{-1}	lbs ac^{-1}	bu ac^{-1}
Blue River Hybrids	07DC8	0.7	148104	12.9*	56.5*	**3902**	**65.0**
Blue River Hybrids	08F6	0.8	132132	13.1	55.9	3190	53.2
Blue River Hybrids	12A2	1.2	152460	12.5*	56.4*	3163	52.7
Blue River Hybrids	13P8	1.3	152460	**12.5**	56.2*	3304	55.1
Blue River Hybrids	1F44	1.4	156816	13.6	55.6	2935	48.9
Blue River Hybrids	15C6	1.5	**161172**	13.1*	56.3*	3402	56.7
Blue River Hybrids	18C7	1.8	153912	13.4	**56.6**	3185	53.1
LSD ($p = 0.10$)			NS	0.537	0.583	NS	NS
Trial Mean			151008	13.0	56.2	3297	55.0

*Varieties that were not significantly different from the top performing variety shown in **bold** are indicated with an asterisk.

Test weights overall were slightly lower than ideal ranging from 55.6 to 56.6 lbs bu^{-1}. The target test weight for soybeans is 60 lbs bu^{-1}. Low test weights may have been caused by low rainfall at the time of pod formation and seed fill. Very little disease or insect pressure was observed throughout the season (Table 5). Despite dry conditions, which would limit fungal pathogen growth, some varieties had significant downy mildew infection. Soybean varieties differed statistically in their tolerance/resistance to downy mildew with the lowest infection, equating to a rating of 0.75, being observed in the variety 1F44. This was statistically similar to the variety 07DC8. Although bacterial blight infection did not vary significantly across varieties, 1F44 also had the lowest bacterial blight rating of 0.25. These data suggest that the soybean varieties in this trial may vary in their susceptibility to downy mildew, however downy mildew infection did not appear to impact yields.

Table 5. Insect and disease pressure of soybean varieties – Alburgh, VT, 2019.

Company	Variety	Maturity group	Downy mildew	Bacterial blight	Japanese beetle
				0-5 scale†	
Blue River Hybrids	07DC8	0.7	1.25*	0.500	1.000
Blue River Hybrids	08F6	0.8	1.50	0.500	1.000
Blue River Hybrids	12A2	1.2	3.00	0.500	1.000
Blue River Hybrids	13P8	1.3	2.50	0.500	1.000
Blue River Hybrids	1F44	1.4	**0.75**	**0.250**	**1.000**
Blue River Hybrids	15C6	1.5	2.00	0.500	1.000
Blue River Hybrids	18C7	1.8	3.50	0.500	1.000
LSD ($p = 0.10$)			0.562	NS	NS
Trial Mean			2.07	0.464	1.000

†0 to 5 scale; 0 = no infection and 5 = 100% of leaf area infected.
The top performing variety is indicated in **bold**.
*Varieties that were not significantly different from the top performing variety are indicated with an asterisk.

DISCUSSION

Despite dry conditions throughout much of the season, the soybeans performed well with an average yield of 3297 lbs ac^{-1} or 55.0 bu ac^{-1}, approximately 6 bu ac^{-1} higher than our last organic soybean trial in 2017. Yields ranged from 48.9 bu ac^{-1} to 65.0 bu ac^{-1} but did not differ statistically. Varieties did differ in susceptibility to downy mildew with variety 1F44 having the lowest rating of 0.75. However, downy mildew infection did not appear to impact soybean yields. These differences highlight the importance of varietal selection and monitoring to identify varieties that perform well in a variety of conditions on your farm. 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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