NORTHWEST CROPS & SOILS PROGRAM

2020 Organic Soybean Variety Trial

Dr. Heather Darby, UVM Extension Agronomist
Sara Ziegler, Ivy Luke, and Rory Malone
UVM Extension Crops and Soils Technicians
(802) 524-6501

Visit us on the web at: http://www.uvm.edu/nwcrops

© January 2021, University of Vermont Extension

THE UNIVERSITY OF VERMONT EXTENSION

2020 ORGANIC SOYBEAN VARIETY TRIAL

Dr. Heather Darby, University of Vermont Extension
heather.darby[at]uvm.edu

In 2020, 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 can be 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 2020 to evaluate yield and quality of short season organic soybean varieties.

MATERIALS AND METHODS

Eight soybean varieties submitted by two participating seed companies (Table 1) were evaluated from maturity groups 0.6 to 1.8 Maturity group for the varieties are listed in Table 2.

Table 1. Participating companies and contact information.

Albert Lea Seed	Blue River Organic Seed
1414 W. Main Albert Lea, MN 56007 800-352-5247	2326 230th Street Ames, IA 50014 515-239-5925

Table 2. Soybean varieties evaluated in Alburgh, VT, 2020.

Company/Brand	Variety	Maturity
Albert Lea Seed/Viking	O.0654AT	0.6
Blue River Organic Seed	07DC8	0.7
Albert Lea Seed/Viking	O.MN0810	0.8
Blue River Organic Seed	12A2	1.2
Albert Lea Seed/Viking	O.1202N	1.2
Albert Lea Seed/Viking	O.1518N	1.5
Albert Lea Seed/Viking	O.1700	1.7
Blue River Organic Seed	18C7	1.8

The soil type at the Alburgh location was Covington silty clay loam (Table 3). The seedbed was prepared using a moldboard plow and then disked prior to seeding. The previous crop was winter rye. Plots were planted on 21-May with a 4-row cone planter with John Deere row units fitted with Almaco seed distribution cones (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 eight varieties that ranged in maturity group from 0.6 to 1.8.

Plots were monitored for pest and disease pressure throughout the season. On 17-Sep, plots were assessed for severity of infection from Downy mildew (*Peronospora manshurica)*, Septoria brown spot (*Septoria glycines*), Frogeye leaf spot (*Cercospora sojina)*, Sclerotinia white mold (*Sclerotinia sclerotiorum*) and

defoliation due to chewing insects. 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. Soybean oil was extruded on 16-Dec using an AgOil M70 oil press and the oil captured and measured to determine oil content and oil yield.

Table 3. Soybean trial details for Alburgh, VT, 2020.

	Borderview Research Farm Alburgh, VT
Soil types	Covington silty clay loam
Previous crop	Winter rye
Tillage operations	Moldboard plow and disc
Plot size (feet)	10 x 20
Row spacing (inches)	30
Replicates	4
Planting date	21-May
Harvest date	14-Oct

Image 1. Foliar disease infection scale increasing from 1 (left) to 4 (right). Rating of 5 not observed.

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

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

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 4). The season began with cooler than normal temperatures, but temperatures quickly increased and remained above normal for much of the season. Rainfall was below normal for much of the season with the region designated as D0 or abnormally dry throughout the season (Drought.gov). Much of the rain that fell throughout the season came in short duration storms. For example, in August there were only 6 rain events that accumulated at least 0.1". Of these, 2 events totaled 1.53" and 2.98", contributing 67% of the month's entire accumulation. Furthermore, temperatures remained above normal for much of the mid-summer. In July, 75% of the month saw temperatures climb above 80° F with some days reaching above 90° F. These temperatures contributed to above normal Growing Degree Day (GDD) accumulations of 2611, 134 above the 30-year normal.

Table 4. Weather data for Alburgh, VT, 2020.

Alburgh, VT	May	June	July	August	September	October
Average temperature (°F)	56.1	66.9	74.8	68.8	59.2	48.3
Departure from normal	-0.44	1.08	4.17	0.01	-1.33	0.19
Precipitation (inches)	2.35	1.86	3.94	6.77	2.75	3.56
Departure from normal	-1.04	-1.77	-0.28	2.86	-0.91	0.00
Growing Degree Days (base 50°F)	298	516	751	584	336	126
Departure from normal	6	35	121	2	-24	-6

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 5. Despite the extremely dry and warm season, the soybeans yielded quite well achieving an average of 3350 lbs ac^{-1} or 55.8 bu ac^{-1}. These yields are similar to both the organic and conventional trials conducted at the site in 2019. The onset of somewhat wetter and cooler weather towards the end of the season may have delayed maturity and contributed to the higher harvest moistures. One variety, O.1202N, had a lower harvest moisture than all other varieties. However, this variety only reached 15.1%, which still required additional drying to reach a safe storage moisture. Test weights ranged from 54.0 to 56.6 lbs bu^{-1} and did not vary statistically across varieties. All test weights were slightly below the industry standard of 60 lbs bu^{-1}. The dry conditions, especially surrounding the time of seed fill, likely contributed to the lower test weights. Overall, yields ranged from 2609 to 3777 lbs ac^{-1} or 43.5 to 63.0 bu^{-1}. The top yielding variety was 07DC8, which performed statistically similarly to four other varieties. Interestingly, this variety 07DC8, with one of the lowest relative maturities in the trial, performed as well as the longer season varieties with relative maturities close to 2.0. Similarly, the lowest yielding variety in the trial, O.0654AT is also a shorter season variety with a similar relative maturity to the top performer. Oil content did not differ statistically across varieties and averaged 10.6%. However, significant differences in oil yield were observed between

varieties. Oil yield ranged from 224 to 474 lbs ac^{-1} which equates to approximately 29.4 to 62.1 gal ac^{-1}. The top oil yielding varieties produced approximately twice as much as the lowest yielding varieties. Comparisons between each variety for seed and oil yield can be seen in Figure 1 as varieties that share a letter yielded statistically similarly. These data highlight the importance of local variety evaluation and varietal selection on farms to maximize productivity.

Table 5. Harvest characteristics of soybean varieties – Alburgh, VT, 2020.

Company	Variety	Maturity group	Harvest moisture	Test weight	Yield @ 13% moisture		Oil content	Oil yield	
			%	lbs bu^{-1}	lbs ac^{-1}	bu ac^{-1}	%	lbs ac^{-1}	gal ac^{-1}
Albert Lea/Viking	O.0654AT	0.6	16.1	**56.6**	2609	43.5	9.10	224	29.4
Blue River Hybrids	07DC8	0.7	16.1	54.8	**3777**	**63.0**	10.6	401*	52.5*
Albert Lea/Viking	O.MN0810	0.8	16.4	54.9	3069	51.1	9.90	315	41.2
Blue River Hybrids	12A2	1.2	16.3	55.1	3134	52.2	**15.1**	468*	61.3*
Albert Lea/Viking	O.1202N	1.2	**15.1**	55.1	3519*	58.7*	8.80	307	40.2
Albert Lea/Viking	O.1518N	1.5	16.1	54.0	3369*	56.2*	7.10	231	30.3
Albert Lea/Viking	O.1700	1.7	16.1	54.5	3608*	60.1*	11.5	422*	55.2*
Blue River Hybrids	18C7	1.8	16.3	56.2	3714*	61.9*	12.8	**474**	**62.1**
LSD (p = 0.10)			0.608	NS	494	8.24	NS	158	20.7
Trial Mean			16.1	55.1	3350	55.8	10.6	355	46.5

Varieties with an asterisk* performed statistically similarly to the top performer in **bold.**
NS- Not statistically significant.

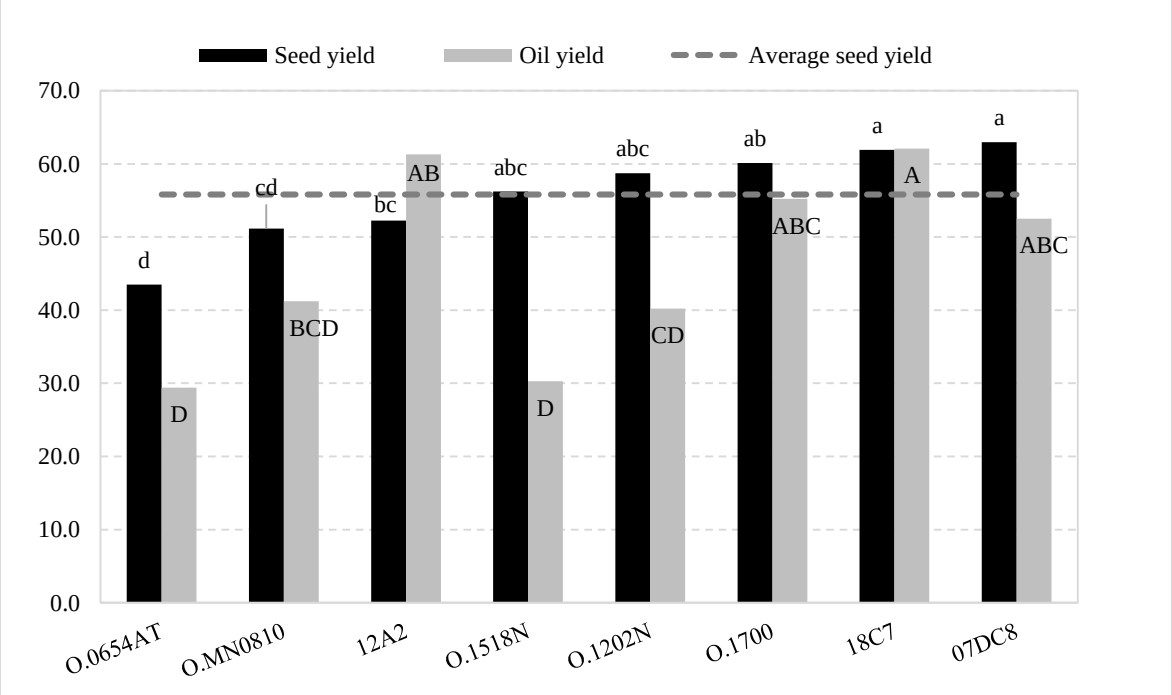

Figure 1. Yield of eight organic soybean varieties.
Varieties that share a letter performed statistically similarly to one another.
The trial mean seed yield is indicated by the line.

Hot dry weather also contributed to very little disease or insect pressure observed throughout the season (Table 6). The two varieties without data had significant leaf discoloration or loss at the time the assessment was conducted and therefore these data were not collected. The only disease that was observed and varied across varieties was downy mildew, which was present in all varieties evaluated. The lowest incidence of downy mildew occurred in the variety O.1700, which averaged 1.25 on the 0-5 scale. This was statistically similar to three other varieties. The variety 12A2 had significantly higher downy mildew incidence averaging 3.75 on the 0-5 scale. Very few cases of Frogeye leafspot and Sclerotinia white mold were seen in the entire trial and thus these data are not presented here. All plots had similar leaf defoliation ratings due to damage caused by chewing insects such as Japanese beetles. These incidences of pest damage and disease did not appear to significantly impact soybean performance.

Table 6. Insect and disease pressure of soybean varieties – Alburgh, VT, 2020.

Company	Variety	Relative maturity	Downy mildew	Brown spot	Leaf defoliation
				0-5 scale†	
Albert Lea Seed/Viking	O.0654AT	0.6	N/A	N/A	N/A
Blue River Organic Seed	07DC8	0.7	2.00*	1	2
Albert Lea Seed/Viking	O.MN0810	0.8	N/A	N/A	N/A
Blue River Organic Seed	12A2	1.2	3.75	1	2
Albert Lea Seed/Viking	O.1202N	1.2	1.75*	1	2
Albert Lea Seed/Viking	O.1518N	1.5	1.50*	1	2
Albert Lea Seed/Viking	O.1700	1.7	**1.25**	1	2
Blue River Organic Seed	18C7	1.8	3.00	1	2
LSD (p = 0.10)			1.08	NS	NS
Trial Mean			2.21	1	0.042

†0 to 5 scale; 0 = no infection and 5 = 100% of leaf area infected.
Varieties with an asterisk* performed statistically similarly to the top performer in **bold**.
N/A- data not collected for the variety.
NS- Not statistically significant.

DISCUSSION

Overall, organic soybean yields were very good for the region despite the unusually hot and dry weather. Although test weights were all below the industry standard of 60 lbs bu^{-1}, yields were comparable to both the organic and conventional soybean yields in our 2019 evaluations. Low-test weight may have been a result of dry conditions. Varieties with a range of relative maturities in both groups 0 and 1 yielded statistically similar to the top performing variety. These data highlight the importance of local varietal evaluations and the impact varietal selection on farms can have on feed or product availability and economics. Furthermore, these data demonstrate that soybeans can be a viable crop in our northern region under organic management. It is important to remember that these data only represent one year from one location. Additional data should be considered prior to making management decisions.

ACKNOWLEDGEMENTS

We would also like to acknowledge Roger Rainville and the staff at Borderview Research Farm for their generous help with this research trial as well as Henry Blair, John Bruce, Catherine Davidson, Hillary Emick, Scott Lewins, and Lindsey Ruhl for their assistance with data collection and entry. We would also like to thank the seed companies for their seed and cooperation in this study. The information is presented with the understanding that no product discrimination is intended and no endorsement of any product mentioned or criticism of unnamed products is implied.

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

Issued in furtherance of Cooperative Extension work, Acts of May 8 and June 30, 1914, in cooperation with the United States Department of Agriculture. University of Vermont Extension, Burlington, Vermont. University of Vermont Extension, and U.S. Department of Agriculture, cooperating, offer education and employment to everyone without regard to race, color, national origin, gender, religion, age, disability, political beliefs, sexual orientation, and marital or familial status.