2011 ORGANIC SOYBEAN VARIETY TRIAL

In 2011, the University of Vermont Extension conducted a soybean variety trial in Alburgh, VT. The purpose of this trial was to provide yield comparisons of food- and feed-grade soybeans in Vermont's climate. Varietal selection is one of the most important aspects of crop production and significantly influences yield potential. It is important to remember, however, that the data presented are from replicated research trials from only one location in Vermont and represent only one season. Crop performance data from additional tests in different locations and over several years should be compared before making final varietal selections.

MATERIALS AND METHODS

In 2011, an organic soybean variety performance trial was conducted at Borderview Farm in Alburgh, VT. Several seed companies submitted varieties for evaluation (Table 1). The soybean varieties were considered early maturing, with maturity groupings between 0.6 and 1.8. Soybeans with maturities above early group 2 cannot typically be grown in Vermont. Both dark hilum and light or clear hilum varieties were included in the study (Figure 1). Light hilum varieties are typically grown for culinary uses, since the dark hilum can stain food and oil products and render yields unmarketable. Both types can be used for livestock feed, and food-grade soybeans that do not meet standards often become feed.

Figure 1. Dark-hilum soybeans.

Table 1. Seed varieties and grouping followed by company.

Variety	Maturity group	Seed company
11A1	1.1	Blue River Organic
16C1	1.6	Blue River Organic
1F44	1.4	Blue River Organic
Boyd	1.8	Lakeview Organic
CL968413	1.3	Syngenta
Dares	0.8	La Coop Fédérée
MT9206166	0.6	Syngenta
PB5B080R2	0.8	Mycogen
PB5B130R	1.3	Mycogen
PB5N090R2	0.9	Mycogen

The trial was planted at Borderview Farm in Alburgh, VT on a rocky silt loam (Table 2). Treatments were ten soybean varieties, including both conventional and organic varieties, which were grown organically and evaluated for yield and oil content. The experimental design was a randomized complete block with four replications. The research plots were 5' x 25'. The previous crop was rye followed by soybeans, and the seedbed was plowed and disked. The soybeans were planted in 30" rows on 1-June at a rate of 200,000 seeds per acre. Mechanical strategies were implemented to control weeds in the plots. Plots were harvested on 1-Nov with an Almaco SP50 plot combine. Moisture was measured with a Dickey-John M20P moisture meter; test weight was measured with Berckes test weight scale.

Table 2. Agronomic & trial information for the 2011 soybean variety trial.

Location	Alburgh, VT Borderview Farm
Soil type	Silt loam
Previous crop	Rye, soybeans
Tillage operations	Spring plow and disk
Plot size (ft)	5 x 25
Seeding rate	200,000 seeds acre^{-1}
Replicates	4
Planting date	1-June 2011
Weed control	3-June, tineweed; 27-June, row cultivation
Harvest date	1-Nov 2011
Pressing date	8-Feb 2012

Figure 2. Kern Kraft KK40 press used for soybeans.

On 8-Feb 2012, subsamples from each plot were pressed with a Kern Kraft KK40 oil press (Figure 2). The press was fitted with "hard seed screws" and operated at a constant high temperature (175° F) and approximately 45 RPM. Oil content was calculated based on seed sample weight and final oil weight.

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 treatments is real or whether it might have occurred due to other variations in the field. All data was analyzed using a mixed model analysis where replicates were considered random effects. The LSD procedure was used to separate treatment means when the F-test was significant. At the bottom of each table a LSD value is presented for each variable (e.g. yield). Least Significant Differences (LSD's) at the 10% level (0.10) of probability are shown. Where the difference between two treatments within

a column is equal to or greater than the LSD value at the bottom of the column, you can be sure in 9 out of 10 chances that there is a real difference between the two values. Treatments that were not significantly lower in performance than the highest value in a particular column are indicated with an asterisk. In the example at right, treatment A is significantly different from treatment C but not from treatment B. The difference between A and B is equal to 400, which is less than the LSD value of 500. This means that these treatments did not differ in yield. The difference between A and C is equal to 650, which is greater than the LSD value of 500. This means that the yields of these treatments were significantly different from one another.

Variety	Yield
A	**1600***
B	1200*
C	950
LSD (0.10)	500

RESULTS

Weather data was summarized using data from a nearby weather station in South Hero, VT (Table 3). The 2011 growing season was wetter than normal, with above-average precipitation in the early spring and late summer, and several severe storms during the growing season. Overall, the season accumulated 2,530 GDDs at a base temperature of 50°F. There were 399 more GDDs than the 30-year average (Table 3).

Table 3. Temperature, precipitation, and Growing Degree Days (GDD) data by month for Alburgh, VT.

South Hero, VT (Alburgh)	June	July	August	September	October
Average temperature (°F) ±	67.1	74.4	70.4	63.8	51.5
Departure from normal	1.3	3.3	1.6	5.8	4.5
Precipitation (inches)*	3.52	3.68	10.23	5.56	2.68
Departure from normal	0.09	-0.29	6.38	2.1	0.1
Growing Degree Days (base 50°F)	513	732	563	392	330
Departure from normal	39	79.5	-27	79.5	227.7

± Average temperatures for August – October are taken from Burlington, VT.
* Average precipitation levels for June and July are taken from Burlington, VT.
Based on National Weather Service data from observation stations in South Hero, VT. Historical averages are for 30 years of data (1971-2000).

Average harvest moisture was 12.5%, with the highest moisture (13.1%) in ‘1F44 (Blue River Organic) and the lowest moisture (12.0%) in ‘Boyd’ (Lakeview Organic). The variety ‘16C1’ (Blue River) had the highest yield at 2700 lbs or 45.0 bushels per acre. Interestingly, 16C1 yielded statistically the same as ‘11A1’ (Blue River), 1F44, Boyd, ‘Dares’ (La Coop Fédérée), ‘MT9260166’ (Syngenta), and ‘PB5N090R2’ (Mycogen). The variety ‘PB5B080R2’(Mycogen) had the lowest yield at 1452 lbs or 24.2 bushels per acre (Table 4; Figure 3).

Table 4. Soybean harvest and oil content data by variety.

Variety	Harvest moisture	Yield @ 13% moisture			Test weight	Pressing moisture	Oil content	Oil yield	
	%	lbs ac^{-1}	bu ac^{-1}	tons ac^{-1}	lbs bu^{-1}	%	%	lbs ac^{-1}	gal ac^{-1}
11A1	12.5	2238*	37.3*	1.1*	55.5	12.3	9.8	444*	58.1*
16C1	12.8*	**2700***	**45.0***	**1.4***	**58.3**	12.3	7.9	429*	56.2*
1F44	**13.1***	2190*	36.5*	1.1*	58.0	11.9	9.4	419*	54.9*
Boyd	12.0	2550*	42.5*	1.3*	57.5	12.0	8.9	461*	60.4*
CL968413	12.8*	1530	25.5	0.8	58.0	12.0	8.3	261	34.2
Dares	12.4	2658*	44.3*	1.3*	56.3	**12.6**	**10.1**	**530***	**69.4***
MT9206166	12.2	2382*	39.7*	1.2*	57.3	12.4	7.6	362	47.4
PB5B080R2	12.4	1452	24.2	0.7	58.0	12.0	8.4	244	31.9
PB5B130R	12.2	2544*	42.4*	1.3*	58.0	12.2	10.0	518*	67.8*
PB5N090R2	13.0*	1902	31.7	1.0	57.5	12.4	9.5	368	48.2
LSD (0.10)	0.4	522	8.7	0.3	NS	NS	NS	120	15.7
Trial mean	12.5	2214	36.9	1.1	57.4	12.2	9.0	403	52.8

*Treatments that did not perform significantly lower than the top-performing treatment in a particular column are indicated with an asterisk.
NS- Treatments were not significantly different from one another. Treatments shown in **bold** are top-performing.

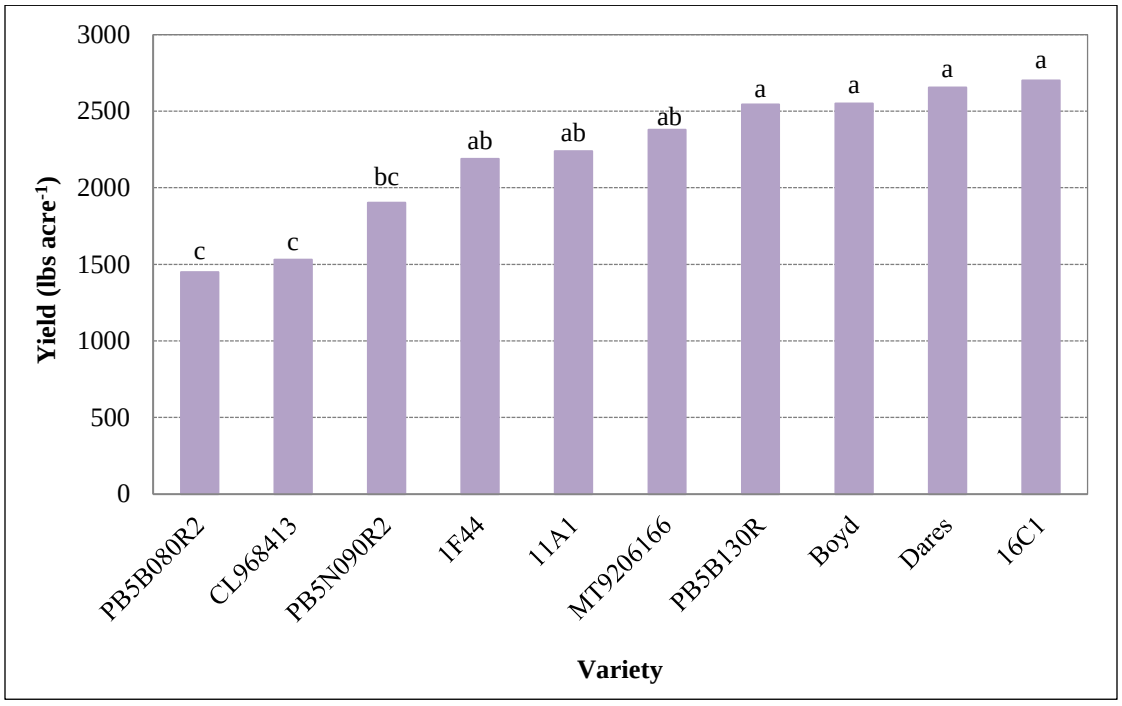

Figure 3. Yields for ten soybean varieties trialed in Alburgh, VT. Varieties with the same letter did not differ statistically in yield (p=0.10).

There was no significant difference among varieties for test weight, which is a measure of the amount of debris and plant material in the harvest, as well as an indicator of quality. The average test weight for the trial was 57.4 lbs per bushel. The variety 16C1 had the highest test weight, though no statistically significant.

At the time of pressing, the average moisture content of the stored soybeans was 12.2%, slightly lower than the average harvest moisture. Pressing moisture of the beans did not differ significantly by variety (Table 4). The oil content was not statistically significant by variety. However, total oil yield did differ statistically by variety, with the highest yield in the variety Dares (69.4 gal per acre). Five other varieties were statistically similar to this highest yield, including 'PB5B130R' (Mycogen), Boyd, 11A1, 16C1, and 1F44 (Figure 4). The lowest oil yield was in the variety 'PB5B080R2.'

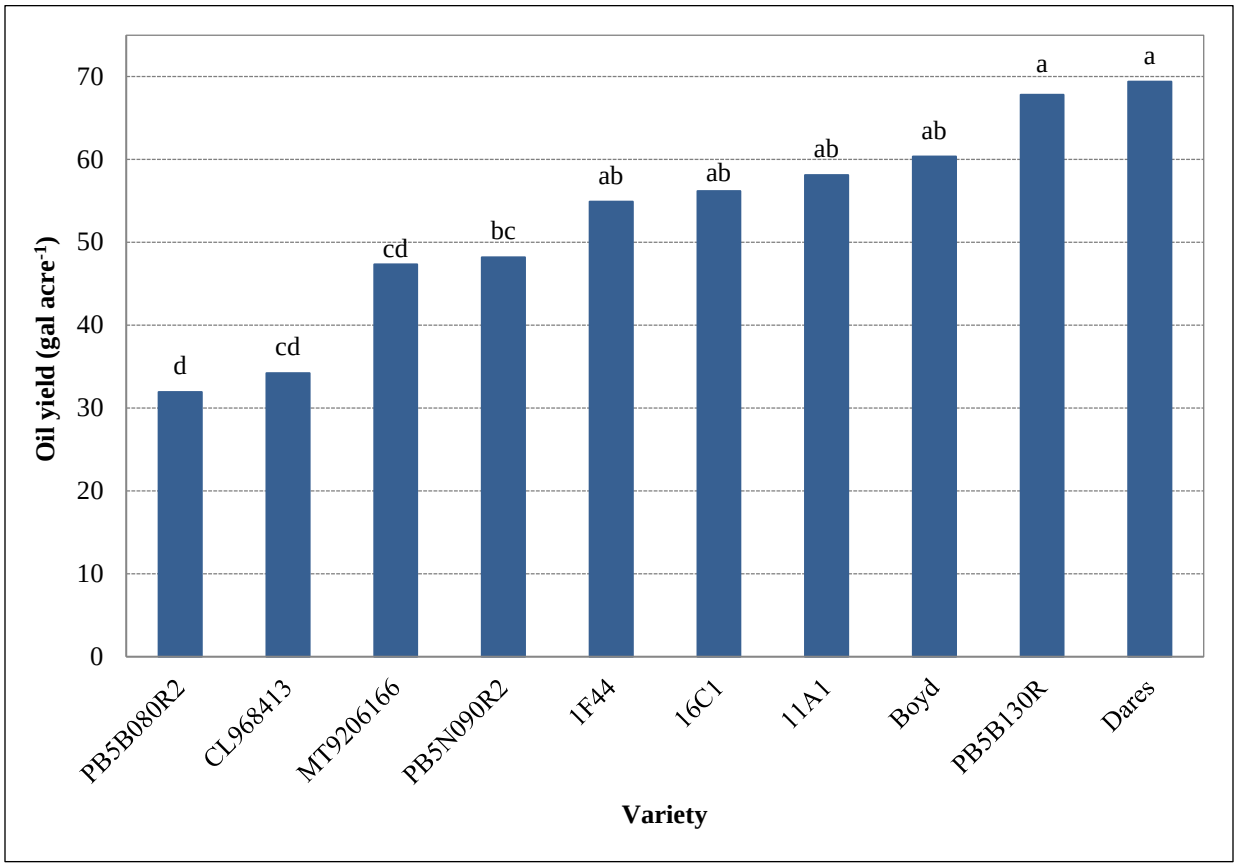

Figure 4. Oil yield by variety. The trialed soybean varieties with the same letter did not differ statistically in yield (p=0.10).

DISCUSSION

The average 2011 soybean yield was 2,214 lbs or 36.9 bushels per acre. Yields in previous years have been lower than this year's due to pest damage, including defoliation by turkeys and deer; this was not a problem in 2011. Yields differed significantly by variety, though the top-yielding variety, 16C1, did not yield significantly higher than six of the ten other varieties. 16C1 also had the highest test weight (58.3 lbs per bushel), though this was not statistically significant. High-quality soybeans general have a test weight of approximately 60 lbs per bushel.

Oil content was not significantly different by variety. The average oil content for this variety trial was 9.0%. Because of the significant variability among varieties in soybean yield, the oil yield did differ statistically by variety. The highest oil yield was in Dares (69.4 gallons per acre). It is important to note

here that a higher soybean yield is not necessarily correlated with a higher oil yield due to varying oil contents. For example, the variety 16C1 had the highest soybean yield but was outperformed in oil yield by four other varieties because of its low oil content (7.9%). The trial average for oil yield was 52.8 gallons per acre. The varieties Dares, PB5B130R, and Boyd were all among the top five performers for both soybean and oil yield. On a dry matter basis, the average yield of soybean meal, which is very valuable as high-protein, high-energy livestock feed, was 3,546 lbs per acre for this trial.

Variety selection should involve both high-yielding varieties and those with high oil content. Varieties must be selected based on the goals of the grower, and it should be recognized that these results are only from one location and one season. Growers should consider varietal performances from multiple seasons and locations before making decisions about which varieties will work for them.

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