2017

Soybean Planting Date x Variety Trial

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NORTHWEST CROPS & SOILS PROGRAM

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UNIVERSITY OF VERMONT EXTENSION
CULTIVATING HEALTHY COMMUNITIES

2017 SOYBEAN PLANTING DATE X VARIETY TRIAL

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In 2017, the University of Vermont Extension Northwest Crops and Soils Team investigated the impact of planting date and variety on soybean yield and quality 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 determine optimal planting dates for soybeans that maximize yield and quality in our northern climate.

MATERIALS AND METHODS

Two soybean varieties, whose characteristics are listed in Table 1, were obtained from Seedway, LLC (Hall, NY). The two soybean varieties (early and late maturity) were planted across five planting dates which were spaced approximately one week apart.

Table 1. Soybean varieties evaluated in Alburgh, VT, 2017.

Variety	Company	Traits	Maturity group
SG1055	Seedway, LLC	RR2Y	1.0
SG1776	Seedway, LLC	RR2Y	1.7

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 2). The seedbed was prepared using a moldboard plow and then disked prior to seeding. The previous crop was annual cover crop mixtures. The plot design was a randomized block with split plots and four replications. The main plots were four planting dates and the subplots were two varieties.

Table 2. 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	4
Starter fertilizer (lbs ac^{-1})	200 lbs ac^{-1} 10-20-20
Planting dates	20-May 28-May 2-Jun 10-Jun
Harvest date	28-Oct

Plots were planted on 20-May, 28-May, 2-Jun, and 10-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 plots were also scouted for insect pests and disease symptoms on 19-Sep. 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)*, Downy Mildew *(Peronospora manshurica)*, Frogeye Leaf Spot *(Cercospora sojina)*, and White Mold *(Sclerotinia sclerotiorum)*. The entire plot was then rated on a 1-10 scale for overall disease severity where 1 was low infection. Concurrently, plots were rated for severity of infestation with soybean aphid *(Aphis glycines Matsumura)* on a 1-5 scale where 1 was low infestation.

On 28-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 and test weight using a DICKEY-John Mini-GAC Plus moisture and test weight meter.

Prior to oil extrusion, the moisture was measured again with the DICKEY-John Mini-GAC Plus moisture meter. An approximate 500g sample from each plot was weighed and extruded using an AgOil M70 expeller oilseed press (Mondovi, WI). The oil was collected and weighed to determine seed oil content and calculate oil yield.

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 3). Overall, the season was cooler and wetter than normal. Almost 1.5 inches of rain fell within the first week of June 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 good weather for the soybeans to mature and to be harvested at optimal moisture content. Overall, a total of 2580 growing degree days (GDDs) were accumulated May-October, 256 above the 30-year normal. Despite these unusual growing conditions, the soybeans appeared relatively unharmed and produced very well.

Table 3. Weather data for Alburgh, VT, 2017.

Alburgh, VT	May	June	July	August	September	October
Average temperature (°F)	55.7	65.4	68.7	67.7	64.4	57.4
Departure from normal	-0.75	-0.39	-1.90	-1.07	3.76	9.2
Precipitation (inches)	5.6	5.64	4.88	5.54	1.84	3.3
Departure from normal	1.95	1.95	0.73	1.63	-1.80	-0.31
Growing Degree Days (base 50°F)	245	468	580	553	447	287
Departure from normal	47	-7	-60	-28	129	175

Historical averages are for 30 years of NOAA data (1981-2010) from Burlington, VT.

Impact of Variety x Planting Date Interactions

There was no variety x planting date interactions indicating that the variety responded the same regardless of planting date. Generally, as planting dates become later, farmers must modify varieties to fit the length of the growing season. Hence, with later planting dates generally shorter season varieties begin to outperform longer season types. During the 2017 growing season this was not the case, long and short season varieties were able to mature regardless of planting date. This may have been due to the well above average temperatures received during September and October.

Impact of Variety

Downy mildew and white mold were the primary diseases observed in the planting date trial (Table 4). The two varieties appear to have different levels of tolerance or resistance to these diseases with a higher incidence of SG 1055 than SG 1776, however, these differences have not been statistically analyzed. Overall disease severity was significantly higher for SG 1055 compared to SG 1776. Aphid severity rating did not differ between the two varieties both averaging 1.72.

Table 4. Incidence of four diseases and overall disease and aphid severity by variety, 2017.

Variety	**Bacterial Leaf Blight**	**Downy Mildew**	**Frogeye Leaf Spot**	**White Mold**	**Overall Disease**	**Overall Aphid**
	----------% of plots infected----------				0-10	0-5
SG1055	0.00	44.4	5.56	44.4	4.31	1.75
SG1776	11.1	5.56	5.56	27.8	**2.94**	1.75
LSD (p = 0.10)	N/A	N/A	N/A	N/A	1.22	NS
Trial Mean	5.56	25.0	5.56	36.1	3.64	1.72

Varieties with an asterisk performed similarly to the top performer in **bold**.

N/A – statistical analysis was not performed for these parameters. NS- Not statistically significant.

Soybean varieties differed significantly in terms of yield, but performed similarly in all other harvest characteristics (Table 5). The variety SG 1776 yielded 3535 lbs ac^{-1} or 58.9 bu ac^{-1}. Soybeans averaged 14.5% moisture at harvest, slightly above the optimum storage moisture of 13.0%, but did not differ by variety. Oil contents were low averaging just under 10.0% which led to low oil yields averaging 44.2 gal ac^{-1}. Test weights were also lower than ideal averaging 56.5 lbs bu^{-1}, well below the target of 60 lbs bu^{-1}.

Table 5. Harvest characteristics of soybeans by variety, 2017.

Variety	Maturity group	Harvest moisture	Test weight	Yield @ 13% moisture		Oil content	Oil yield @ 13% moisture	
		%	lbs bu^{-1}	lbs ac^{-1}	bu ac^{-1}	%	lbs ac^{-1}	gal ac^{-1}
SG1055	1.3	14.5	56.5	3263	54.4	10.0	329	43.1
SG1776	1.7	14.6	56.5	**3535**	**58.9**	9.79	346	45.4
LSD (p = 0.10)		NS	NS	207	3.44	NS	NS	NS
Trial Mean		14.5	56.5	3399	56.6	9.92	338	44.2

The top performing variety are shown in **bold.**
NS- Not statistically significant.

Impact of Planting Date

Soybean planting date significantly impacted aphid severity but not disease (Table 6). Aphid severity was significantly higher in the 2-Jun planting date than any other date with an average rating of 2.50.

Table 6. Soybean disease and aphid incidence by planting date, 2017.

Planting Date	Bacterial leaf blight	Downy mildew	Frogeye leaf Spot	White mold	Overall disease	Overall aphid
	----------% of plots infected----------				0-10	0-5
20-May	12.5	12.5	0.00	50.0	4.38	**1.13***
28-May	12.5	12.5	25.0	25.0	3.50	1.63*
2-Jun	0.00	0.00	0.00	37.5	2.88	2.50
10-Jun	0.00	50.0	0.00	50.0	3.75	1.75*
LSD (p = 0.10)	N/A	N/A	N/A	N/A	NS	0.791
Trial Mean	5.00	22.5	5.00	32.5	3.63	1.75

*Planting dates that did not perform significantly lower than the top performer shown in **bold** are indicated with an asterisk.
N/A – statistical analysis was not performed for these parameters.
NS- Not statistically significant.

Planting date also significantly impacted soybean yields (Table 7, Figure 1). The 2-Jun planting date produced the highest yields of 3713 lbs ac^{-1} which equates to 61.9 bu ac^{-1}. This was statistically similar to the 10-Jun planting date. The lowest yield was observed in the 20-May planting date which only produced 3131 lbs ac^{-1} or 52.2 bu ac^{-1}. These data suggest that delaying planting until June in this region could lead to increased yields. It should also be noted that May was unseasonably cool and wet which may have impacted soybean performance for these treatments. Additional years and environments of research are required to develop planting date recommendations for the region.

Table 7. Harvest characteristics of soybeans by planting date, 2017.

Planting Date	Harvest moisture	Test weight	Yield @ 13% moisture		Oil content	Oil yield @ 13% moisture	
	%	lbs bu^{-1}	lbs ac^{-1}	bu ac^{-1}	%	lbs ac^{-1}	gal ac^{-1}
20-May	14.8	56.3	3131	52.2	10.2	324	42.4
28-May	14.4	56.5	3280	54.7	10.1	329	43.1
2-Jun	14.4	56.5	**3713***	**61.9***	9.87	367	48.1
10-Jun	14.5	56.7	3472*	57.9*	9.51	332	43.4
LSD (p = 0.10)	NS	NS	292	4.87	NS	NS	NS
Trial Mean	14.5	56.5	3399	56.6	9.92	338	44.2

*Planting dates that did not perform significantly lower than the top performer shown in **bold** are indicated with an asterisk.
NS- Not statistically significant.

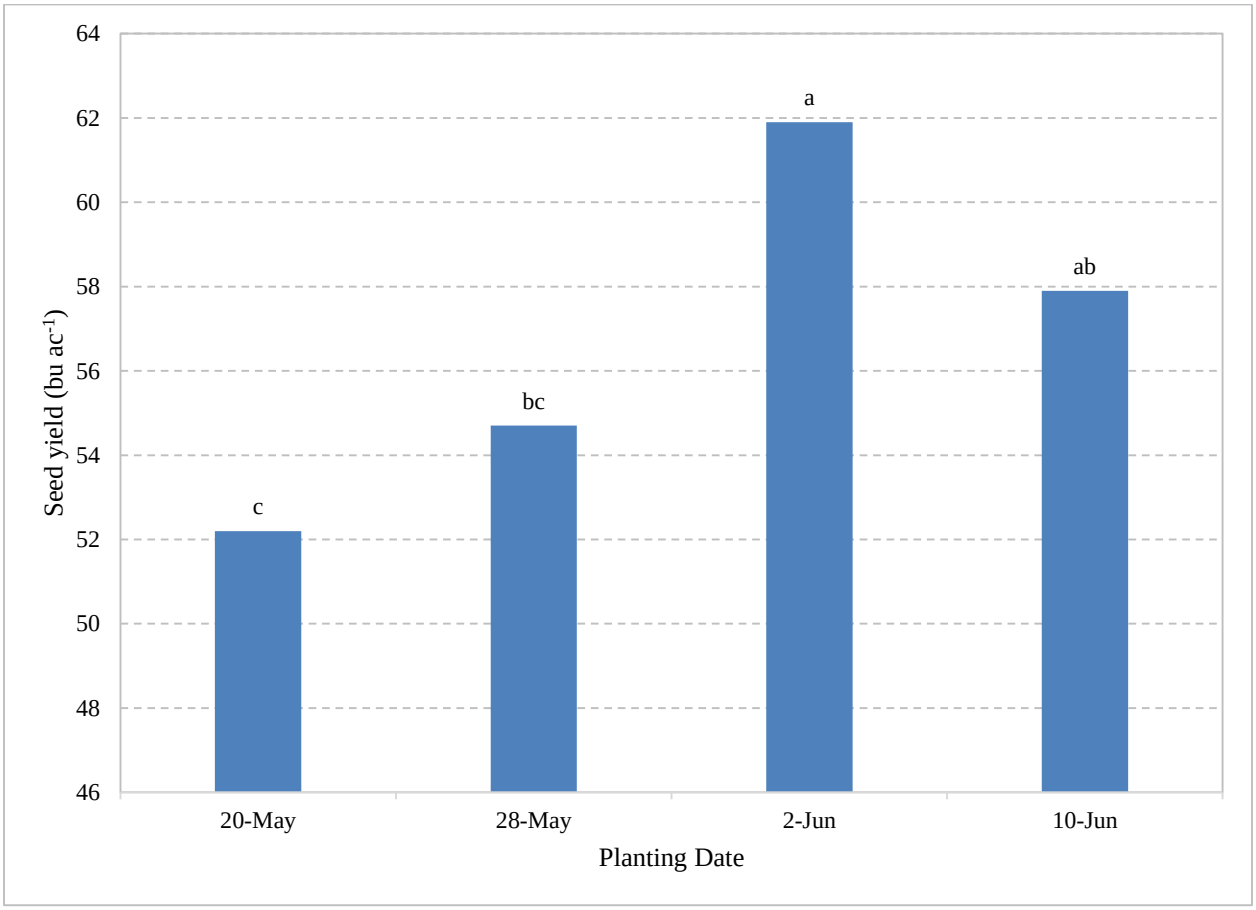

Figure 1. Soybean seed yield by planting date, 2017.
Treatments that share letters performed statistically similarly.

DISCUSSION

Soybean yields were significantly impacted by both variety and planting date with the highest yields observed in variety SG 1776 and the third planting date, 2-Jun. These data suggest that planting a later season soybean variety and delaying planting until early/mid-Jun may support higher soybean yields. Although maturity differences were significant between the planting dates throughout the season, later planted soybeans were still able to reach maturity and produce significant yields. However, these data only represent one year and additional information should be considered before selecting soybean varieties and shifting planting dates.

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