NORTHWEST CROPS & SOILS PROGRAM

2018 Soybean Planting Date x Variety Trial

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THE UNIVERSITY OF VERMONT EXTENSION

2018 SOYBEAN PLANTING DATE X VARIETY TRIAL

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In 2018, the University of Vermont Extension Northwest Crops and Soils Program investigated the impact of soybean variety and planting date on yield and quality at Borderview Research Farm in Alburgh, VT. Soybeans can be grown for human consumption, animal feed, and biodiesel. Livestock farmers are interested in producing more of their own grains and as a result, soybean acreage in Vermont is increasing. Given the short growing season in Vermont, it is important to understand optimum planting dates to obtain the highest yields. 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 2018 to determine optimal planting dates for soybeans that maximize yield and quality in our northern climate.

MATERIALS AND METHODS

Two soybean varieties of varying maturity, 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 spaced approximately one week apart.

Table 1. Soybean varieties evaluated in Alburgh, VT, 2018.

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 corn silage. The plot design was a randomized block with split plots and four replications. The main plots were five planting dates and the split plots were two varieties with varying maturities.

Table 2. Soybean trial specifics for Alburgh, VT, 2018.

	Borderview Research Farm Alburgh, VT
Soil types	Benson rocky silt loam 8-15% slope
Previous crop	Corn silage
Tillage operations	Moldboard plow and disc
Plot size (feet)	5 x 20
Row spacing (inches)	30
Replicates	4
Starter fertilizer (gal ac^{-1})	5 gal ac^{-1} 9-18-9
Planting dates	18-May, 25-May, 1-Jun, 7-Jun, 15-Jun
Harvest date	17-Oct

Plots were planted on18-May, 25-May, 1-Jun, 7-Jun, and 15-Jun 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}. Soybean growth stage was recorded for each plot on 1-Aug and 16-Aug.

On 17-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.

Yield data and stand characteristics were analyzed using mixed model analysis using the mixed procedure of SAS (SAS Institute, 1999). Replications within trials were considered random effects, and treatments were treated as fixed. Treatment 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 hotter and dryer than normal. A total of 15" of rain fell during the soybean growing season. Precipitation was approximately 60% of normal. During the growing season, there were only six rain events that resulted in greater than 0.75 inches of accumulation. These six events constituted approximately 36% of the total rainfall. Consequently, there were several extended periods with very little to no rainfall. The longest period was approximately 25 days with less than 0.25 inches of accumulated rainfall. Temperatures were above normal Jul-Sep. Overall, 2731 growing degree days (GDDs) were accumulated May-October, 520 above the 30-year normal.

Table 3. Weather data for Alburgh, VT, 2018.

Alburgh, VT	May	June	July	August	September	October
Average temperature (°F)	59.5	64.4	74.1	72.8	63.4	45.8
Departure from normal	3.10	-1.38	3.51	3.96	2.76	-2.36
Precipitation (inches)	1.9	3.7	2.4	3.0	3.5	3.5
Departure from normal	-1.51	0.05	-1.72	-0.95	-0.16	-0.07

Growing Degree Days (base 50°F)	352	447	728	696	427	81
Departure from normal	154	-27	88	115	109	81

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

Impact of Variety x Planting Date Interactions

There was a significant variety x planting date interaction for test weight indicating that the maturities responded differently in terms of test weight when planted on different dates. 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. This trend was observed this year as the 1.0 maturity group variety produced soybeans with higher test weight than the 1.7 maturity group variety at the later planting dates (Figure 1). The highest test weight was obtained by planting the late maturing variety on the third date and the early maturing variety on the fourth planting. Both varieties eventually showed declining test weights with later planting dates, however the early maturing variety remained higher.

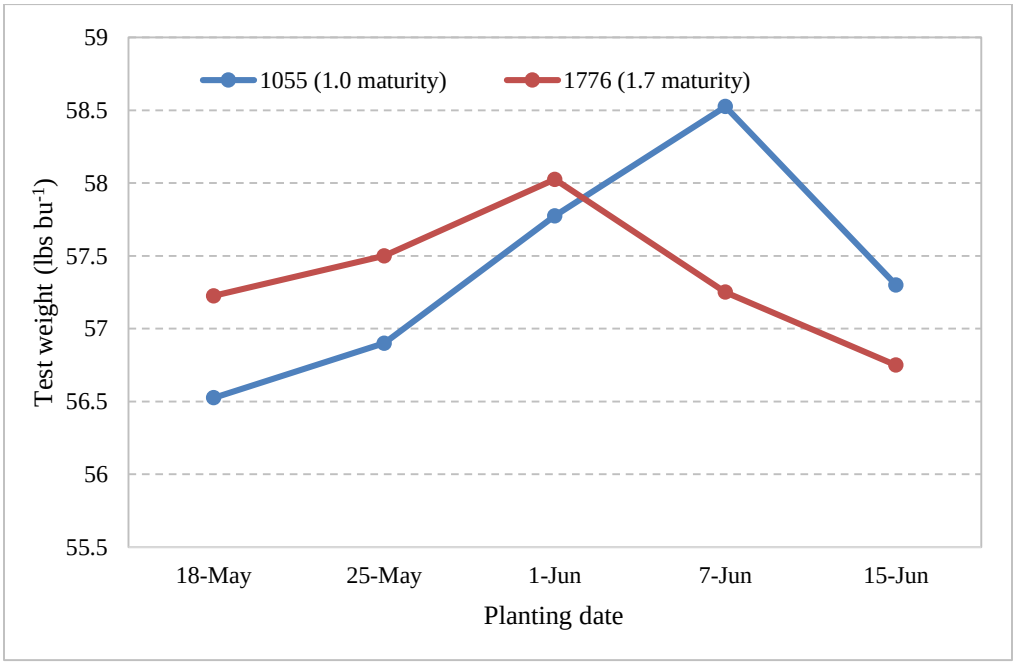

Figure 1. Soybean variety x planting date interaction for test weight, 2018.

Impact of Variety

The two soybean maturities performed significantly different in terms of yield but were statistically similar in moisture at harvest and test weight (Table 4). Moisture at harvest averaged 14.7% and did not differ statistically indicating that both the longer and shorter season varieties reached similar maturity by the time of harvest. Both required some drying prior to storage. Similarly, test weights average 57.4 lbs bu^{-1} for both varieties, which is below the industry standard of 60 lbs bu^{-1}. This is likely due to low rainfall throughout the growing season leading to reduced seed fill. Yields did vary statistically between the two varieties. The late maturing variety, 1776, yielded 3189 lbs ac^{-1} or 53.1 bu ac^{-1}. Overall, this was 475 lbs ac^{-1} more than the early maturing variety 1055.

Table 4. Harvest characteristics of soybeans by variety, 2018.

Variety	Maturity group	Harvest moisture	Test weight	Yield @ 13% moisture	
		%	lbs bu^{-1}	lbs ac^{-1}	bu ac^{-1}
SG1055	1.0	14.7	**57.4**	2714	45.2
SG1776	1.7	**14.6**	57.4	**3189**	**53.1**
LSD (p = 0.10)		NS	NS	388	6.47
Trial Mean		14.7	57.4	2951	49.2

The top performing variety is indicated in **bold**.
NS- Not statistically significant.

Impact of Planting Date

Planting date significantly impacted soybean yield (Table 5). Harvest moistures ranged from 14.2% for the first two planting dates to 15.9% for the fifth planting date. Statistically, the first four planting dates produced soybeans with statistically similar moisture contents at harvest. Test weights ranged from 56.9 to 57.9 lbs bu^{-1}. The third and fourth planting dates produced soybeans with the highest test weights of 57.9 lbs bu^{-1}. Although these differed statistically, all planting dates produced soybeans with test weights below the industry standard of 60 lbs bu^{-1}. This was likely due to the drought conditions throughout the growing season. Soybean yields ranged from 2408 to 3362 lbs ac^{-1} or 40.1 to 56.0 bu ac^{-1}. Earlier planting dates produced significantly higher yields than later planting dates. Statistically, the first three planting dates produced similar yields, which were almost 1000 lbs ac^{-1} or 16 bu ac^{-1} higher than the fourth and fifth planting date yields (Figure 2).

Table 5. Harvest characteristics of soybeans by planting date, 2018.

Planting Date	Harvest moisture	Test weight	Yield @ 13% moisture	
	%	lbs bu^{-1}	lbs ac^{-1}	bu ac^{-1}
18-May	14.2a	56.9c	3344a	55.7a
25-May	**14.2a**	57.2b	**3362a**	**56.0a**
1-Jun	14.4a	**57.9a**	3171a	52.8a
7-Jun	14.7a	57.9a	2473b	41.2b
15-Jun	15.9b	57.0bc	2408b	40.1b
LSD (p = 0.10)	0.793	0.643	613	10.2
Trial Mean	14.7	57.4	2951	49.2

The top performing planting date is indicated in **bold**.
Within a column, planting dates with the same letter performed statistically similar.

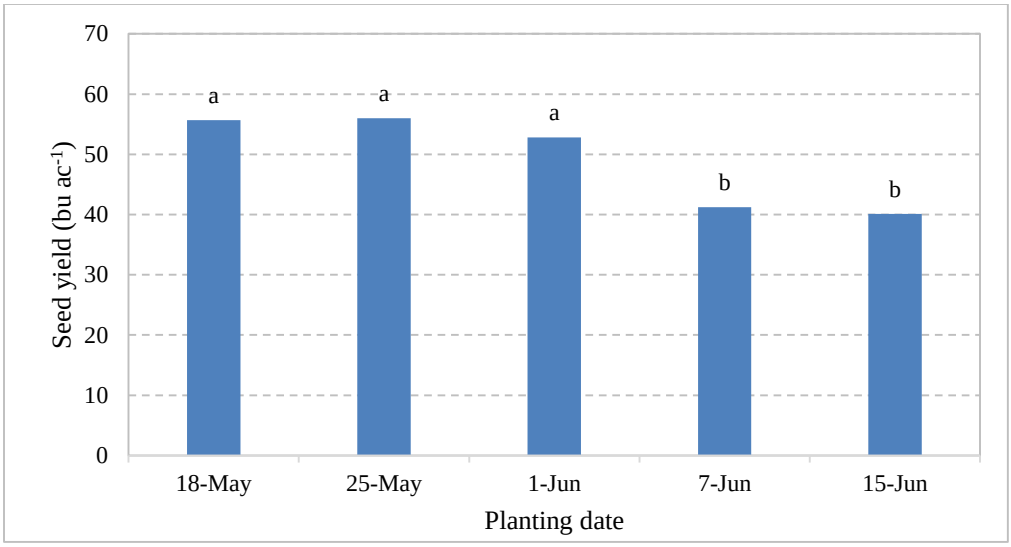

Figure 2. Soybean yield across five planting dates, 2018.
Treatments that share a letter were statistically similar.

DISCUSSION

Soybean yields were significantly impacted by planting date with the highest yields observed when soybeans were planted in the last 2 weeks of May. Interestingly in 2017, soybeans planted in May yielded lower than those planted in mid-June. Cool and wet weather during May likely led to yields compared to the June planting dates. In 2018, the sparse rainfall through the middle of the summer this year likely impacted the yields and test weights of soybeans overall but especially impacted later plantings as the driest period of the year corresponded to growth stages with high water demand for these planting dates. Overall, these data indicate that a soybean maturity range from 1.0 to 1.7 can mature in Vermont even when planted into mid-June. Further research over additional years and environments will help develop optimum planting date ranges for Vermont.

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