



2016 Oat Variety Trial



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Oats (*Avena sativa* L.) have a long history of production in the Northeast. Although most oats are planted for a cover crop or forage, grain oats are a potential revenue source for farmers. According to the 2007 census, about 200 acres of land in Vermont is cultivated for oat grain production, with an average yield of 1747 lbs per acre. With the exception of hull-less varieties, oats need to be de-hulled before being used for human consumption and further processing is required to make oatmeal, steel cut oats, or oat flour. Since 2009, the University of Vermont Extension Program has conducted oat variety trials to provide yield comparisons 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. The goal of this project was to evaluate yields and protein of eleven oat varieties.

MATERIALS AND METHODS

In 2016, an oat variety performance trial was conducted at Borderview Research Farm in Alburgh, VT. Eleven oat varieties were evaluated for yield and quality (Table 1).

Table 1. Oat varieties planted in Alburgh, VT, 2016.

Variety	Seed source
AC Gehl	Semican
BetaGene	Albert Lea Seed House
Deon	Albert Lea Seed House
Goliath	Welter Seed & Honey Co.
Jerry	Welter Seed & Honey Co.
Jim	Welter Seed & Honey Co.
Keuka	Lakeview Organics
Leonard	Lakeview Organics
Marin	Atlantic Maritime Heirloom Oat
Pringles Progress	Vermont Heirloom Oat
Shelby427	Albert Lea Seed House

The trial was planted at Borderview Research Farm in Alburgh, VT on a Benson rocky silt loam (Table 2). The experimental design was a randomized complete block with four replications. The previous crop was forage brassica. The research plots were each 5' x 20' and the seedbed was prepared by conventional tillage methods including fall plow, disc and spike tooth harrow. The oats were planted on 28-Apr with 6" row spacing at a rate of 350 live seeds per square meter. Pre-harvest plant measurements of flowering date, heights, lodging, and populations were taken to better understand how factors affect yield. Plots were harvested on 3-Aug with an Almaco SPC50 plot combine.

Table 2. Agronomic practices for the 2016 oat variety trial, Borderview Research Farm, Alburgh, VT.

	Borderview Research Farm Alburgh, VT
Soil type	Benson rocky silt loam
Previous crop	Forage brassicas
Tillage operations	Spring plow, disc, and spike tooth harrow
Row spacing (in)	6
Plot size (ft)	5 x 20
Seeding rate (live seeds per m ²)	350
Replicates	4
Planting date	28-Apr
Harvest date	3-Aug

Plot samples were collected to perform quality measurements on them. Quality measurements included standard testing parameters used by commercial mills. After combining, harvest moisture was determined for each plot using a Dickey-john M20P. Test weight was measured using a Berckes Test Weight Scale, which weighs a known volume of grain. Plot samples were ground into flour with hulls on, using the Perten LM3100 Laboratory Mill, and were evaluated for crude protein (CP) content. Grains were analyzed for CP using the Perten Inframatic 8600 Flour Analyzer. CP is reported at 12% flour moisture. Deoxynivalenol (DON) analysis was analyzed using Veratox DON 5/5 Quantitative test from the NEOGEN Corp. This test has a detection range of 0.5-5 ppm. Samples with DON values greater than 1 ppm are considered unsuitable for human consumption.

All data were analyzed using a mixed model analysis where replicates were considered random effects. The LSD procedure was used to separate cultivar means when the F-test was 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 varieties 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 (e.g. yield). Least Significant Difference (LSD) at the 10% level of probability is shown. Where the difference between two varieties 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 varieties. Oat varieties that were not significantly lower in performance than the highest variety in a particular column are indicated with an asterisk. In the example, variety A is significantly different from variety C but not from variety B. The difference between A and B is equal to 729 which is less than the LSD value of 889. This means that these varieties did not differ in yield. The difference between A and C is equal to 1454 which is greater than the LSD value of 889. This means that the yields of these varieties were significantly different from one another. The asterisk indicates that variety B was not significantly lower than the top yielding variety.

Variety	Yield
A	4615*
B	3886*
C	3161
LSD	889

RESULTS

Using data from an onsite Davis Instruments Vantage Pro2 weather station at Borderview Research Farm in Alburgh, VT, weather data was summarized for the 2016 growing season (Table 3). The 2016 growing season had below average temperature for the month of April and above average temperatures in May and

August. Precipitation was well below average, accumulating 6.36 inches below the historical average. Growing Degree Days (GDDs) were calculated at a base temperature of 32°F. From planting to harvest, there was an accumulation of 2183 GDDs. This is 148 more GDDs than the 30-year average.

Table 3. Temperature, precipitation, and growing degree days (GDD's) for Alburgh, VT in 2016.

Alburgh, VT	April	May	June	July	August
Average temperature (°F)	39.8	58.1	65.8	70.7	71.6
Departure from normal	-4.90	1.80	0.00	0.10	2.90
Precipitation (inches)	2.60	1.50	2.80	1.80	3.00
Departure from normal	-0.26	-1.92	-0.88	-2.37	-0.93
Growing Degree Days (base 32°F)	59	340	481	640	663
Departure from normal	-16	74	7	1	82

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. Alburgh precipitation data from 8/17/16-8/31/16 was missing and was replaced by data provided by the NOAA for Highgate, VT.

Flowering date, populations, height, and lodging were recorded for each oat variety before harvest (Table 4). Flowering dates ranged between 24-Jun and 1-Jul; there is no optimal date for flowering. Pringles Progress had the highest population with 407 live seeds per m²; this was not significantly different from seven other varieties in the trial. The variety Goliath was the tallest of the varieties, but was not significantly different from Pringles Progress. There was very little lodging in this trial, only one variety, Pringles Progress, had significantly higher lodging than the rest of the varieties in the trial.

Table 4. Populations, height, and lodging at harvest, Alburgh, VT, 2016.

Variety	Flowering date	Population live seeds per m ²	Height cm	Lodging %
AC Gehl	1-Jul	221	88.2	0.00*
BetaGene	26-Jun	239	77.7	0.00*
Deon	26-Jun	335*	88.2	0.00*
Goliath	24-Jun	350*	101*	0.00*
Jerry	24-Jun	330*	82.2	0.00*
Jim	24-Jun	165	78.9	5.00*
Keuka	28-Jun	289*	91.6	5.00*
Leonard	28-Jun	359*	84.2	0.00*
Marin	25-Jun	296*	90.9	0.00*
Pringles Progress	27-Jun	407*	96.3*	15.0
Shelby427	24-Jun	357*	83.8	00.0*
LSD (0.1)	2.48	127	5.47	8.73
Trial mean	26-Jun	304	87.5	2.27

*Treatments with an asterisk are not significantly different than the top performer in **bold**.

There is no set value for optimal flowering date.

LSD – Least significant difference.

The oat varieties trialed showed a range in yield, harvest moisture, and test weight (Table 5). The highest yielding variety was Goliath, but was not significantly different from Deon or Keuka. The optimal oat moisture is 12%; Pringles Progress was harvested at this ideal moisture, but was not significantly different from BetaGene, Deon, Jerry, or Shelby427. AC Gehl had the highest test weight, which was statistically greater than the other varieties in the trial. This is likely due to the fact that the AC Gehl is a hullless variety.

Table 5. Harvest measures, Alburgh, VT, 2016.

Variety	Yield		Harvest moisture %	Test weight lbs bu ⁻¹
	lbs ac ⁻¹	tons ac ⁻¹		
AC Gehl	1168	0.584	19.6	43.0*
BetaGene	2431	1.22	14.3*	35.3
Deon	3576*	1.79*	14.0*	36.4
Goliath	4093*	2.05*	18.9	37.4
Jerry	2950	1.48	13.3*	36.4
Jim	2556	1.28	14.5	36.5
Keuka	3831*	1.92*	18.1	34.3
Leonard	3211	1.61	15.5	32.9
Marin	2448	1.22	15.7	34.8
Pringles Progress	3144	1.57	12.0*	32.4
Shelby427	3130	1.57	13.1*	37.8
LSD (0.1)	663	0.332	2.46	2.36
Trial mean	2958	1.48	15.0	36.1

*Treatments with an asterisk are not significantly different than the top performer in **bold**.

LSD – Least significant difference.

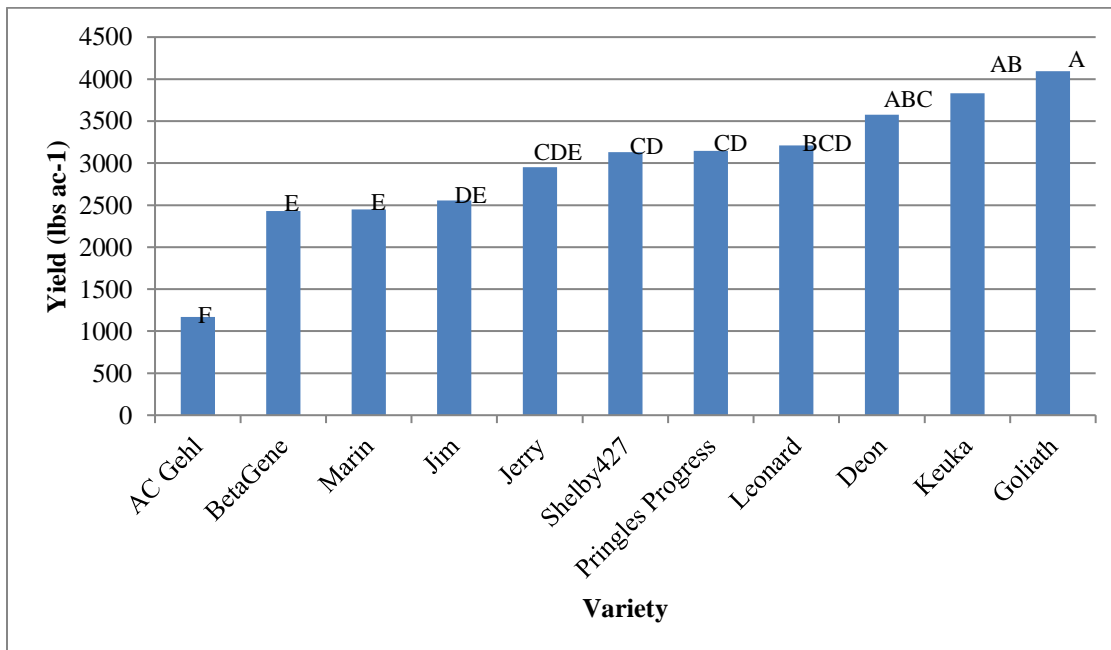


Figure 1. Yield of 11 oat varieties evaluated in Alburgh, VT, 2016. Treatments that share a letter are not statistically different from each other.

Quality differences between oat varieties are depicted in Table 6. Marin had the highest crude protein when adjusted to 12% moisture with 16.0% protein. The protein percentage in AC Gehl, BetaGene, Jerry, and Leonard were not significantly different from Marin. Optimal falling number for bread wheat is 250 seconds. Goliath was the only variety close to this value. Optimal falling number for oats has not been identified. There were no significant differences between DON levels in this trial. All varieties fell below the industry standard of 1 ppm.

Table 6. Harvest measures, Alburgh, VT, 2016.

Variety	Crude protein at 12% moisture %	Falling number seconds	DON ppm
AC Gehl	15.3*	309	0.175
BetaGene	14.8*	88.5	0.175
Deon	12.0	65.8	0.350
Goliath	13.3	224*	0.300
Jerry	15.2*	62.3	0.175
Jim	13.0	112	0.275
Keuka	13.0	110	0.325
Leonard	13.5*	122	0.225
Marin	16.0*	71.8	0.300
Pringles Progress	13.0	63.0	0.175
Shelby427	10.6	75.3	0.275
LSD (0.1)	2.58	47.5	NS
Trial mean	13.6	119	0.250

*Treatments with an asterisk are not significantly different than the top performer in **bold**.

LSD – Least significant difference.

NS – No significant difference.

DISCUSSION

It is important to remember that the results only represent one year of data. Despite the low rainfall, the oats trialed yielded well. Yields ranged from 1168 and 4093 lbs ac⁻¹ indicating the importance of proper varietal selection to maximize oat yields. Several varieties yielded well and produced a high quality product.

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