NORTHWEST CROPS & SOILS PROGRAM

2017 Oat Variety Trial

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UNIVERSITY OF VERMONT EXTENSION
CULTIVATING HEALTHY COMMUNITIES

2017 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 ac^{-1}. 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 thirteen oat varieties.

MATERIALS AND METHODS

In 2017, an oat variety performance trial was conducted at Borderview Research Farm in Alburgh, VT. Thirteen oat varieties were evaluated for yield and quality (Table 1).

Table 1. Oat varieties planted in Alburgh, VT, 2017.

Variety	Seed source
Keuka	Lakeview Organics
Leonard	Lakeview Organics
Jim	Welter Seed & Honey Co.
Kame	Lakeview Organics
Jerry	Welter Seed & Honey Co.
Reins	Albert Lea Seed House
Marin	Atlantic Maritime Heirloom Oat
Pringles Progress	Vermont Heirloom Oat
AC Gehl	Semican
Goliath	Welter seed & Honey Co
Betagene	Albert Lea Seed House
Deon	Albert Lea Seed House
Shelby	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 three replications. The previous crops were summer annuals and sunflowers. 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 5-May with 6" row spacing at a rate of 125 lbs ac^{-1}. Pre-harvest plant measurements of, heights and lodging were taken to better understand how factors affect yield. Plots were harvested on 8-Aug with an Almaco SPC50 plot combine.

Table 2. Agronomic practices for the 2017 oat variety trial, Borderview Research Farm, Alburgh, VT.

Location	Borderview Research Farm, Alburgh VT
Soil type	Benson rocky silt loam
Previous crop	Summer annuals and Sunflowers
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)	125 lbs/ac
Replicates	3
Planting date	5-May
Harvest date	8-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 Least Significant Difference (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). 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 2017 growing season (Table 3). The 2017 growing season had below average temperature and above average precipitation. Growing Degree Days (GDDs) were calculated at a base temperature of 32°F. From planting to harvest, there was an accumulation of 3981 GDDs. This is 126 less GDDs than the 30-year average.

Table 3. Temperature, precipitation, and growing degree days (GDD's) for Alburgh, VT in 2017.

Alburgh, VT	May	June	July	August
Average temperature (°F)	55.7	65.4	68.7	67.7
Departure from normal	-0.75	-0.39	-1.90	-1.07
Precipitation (inches)	4.1	5.6	4.9	5.5
Departure from normal	0.68	1.95	0.73	1.63
Growing Degree Days (base 32°F)	733	1002	1138	1108
Departure from normal	-23	-12	-60	-31

Weather data was collected from Wunderground.com via the West Berkshire weather station.
When daily weather data was unavailable from this weather station, the station at Highgate Center Dam was used.
Historical averages are for 30 years of NOAA data (1981-2010) for Enosburg Falls, VT.

Height and lodging were recorded for each oat variety before harvest (Table 4). The variety '*Goliath*' was the tallest variety (118 cm), but was not significantly different from '*Pringles Progress'* (113 cm*)*. The varieties *'Kame*' and '*Reins'* had no recorded lodging while '*Goliath*' had the most lodging (3.00%).

Table 4. Populations, height, and lodging at harvest, Alburgh, VT, 2017.

Variety	**Height cm**	**Lodging %**
AC Gehl	106	0.67
BetaGene	96.6	1.33
Deon	103	0.33
Goliath	**118***	**3.00***
Jerry	106	2.33*
Jim	93.0	1.00
Kame	83.2	0.00
Keuka	99.1	1.67*
Leonard	97.9	1.67*
Marin	96.2	2.00*
Pringles Progress	113*	2.67*
Reins	73.8	0.00
Shelby	104	0.667
LSD (0.10)	10.6	1.37
Trial mean	99.2	1.33

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

The 2017 oat variety trial showed that '*BetaGene'* was the highest yielding variety but was not statistically different from any of the other varieties (Table 5, Figure 1). There was no statistical difference in test weight between the varieties. '*Shelby'* had the highest test weight of 33.5 lbs bu^{-1}. Three varieties, '*Shelby'*, '*Jerry'*, and '*Pringles Progress'* met or exceeded industry standards of 32 lbs bu^{-1} for oats. There was a significant difference between harvest moisture of the varieties. The ideal storage moisture of oats is 14%, which none of the varieties reached in 2017 and therefore all varieties had to be dried down before storing. '*Marin*' had the lowest harvest moisture at 14.3% and the highest harvest moisture was '*Pringles Progress*' (22.5%).

Table 5. Harvest and quality measures, Alburgh, VT, 2017.

Variety	Yield @ 13.5% moisture lbs ac^{-1}	Harvest moisture %	Test weight lbs bu^{-1}	DON ppm	Crude Protein @ 12% moisture %
AC Gehl	1968	22.3	27.2	0.17*	10.3
BetaGene	**3228**	20.9	31.7	0.20*	10.1
Deon	3145	22.1	31.9	**0.10***	9.90
Goliath	3090	20.8	30.0	0.27*	10.4
Jerry	2668	16.6*	33.3	0.20*	10.5
Jim	2303	18.5	31.1	0.13*	10.4
Kame	2998	15.1*	29.4	0.20*	10.0
Keuka	1974	20.4	27.8	0.20*	9.61
Leonard	2675	17.5*	29.9	0.23*	9.65
Marin	2696	**14.3***	30.8	0.30*	9.58
Pringles Progress	2298	22.5	32.6	0.13*	9.02
Reins	2513	15.9*	31.8	0.63	9.90
Shelby	2635	20.4	**33.5**	0.23*	**10.7**
LSD (<0.1)	NS	3.38	NS	0.22	NS
Trial mean	2630	19.0	30.8	0.23	10.0

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

There was no statistically difference in crude protein amongst varieties. The variety '*Shelby'* had the highest crude protein level when adjusted to 12% moisture at 10.7% protein. The variety with the lowest crude protein was *'Pringles Progress'* at 9.02% adjusted to 12% moisture. DON concentrations between varieties were significantly different. *'Deon'* had the lowest DON concentration at 0.10 ppm. The oat variety '*Reins'* had the highest DON concentration of 0.63 ppm and was statistically higher than all other varieties. However, all varieties were below the FDA 1 ppm recommendation.

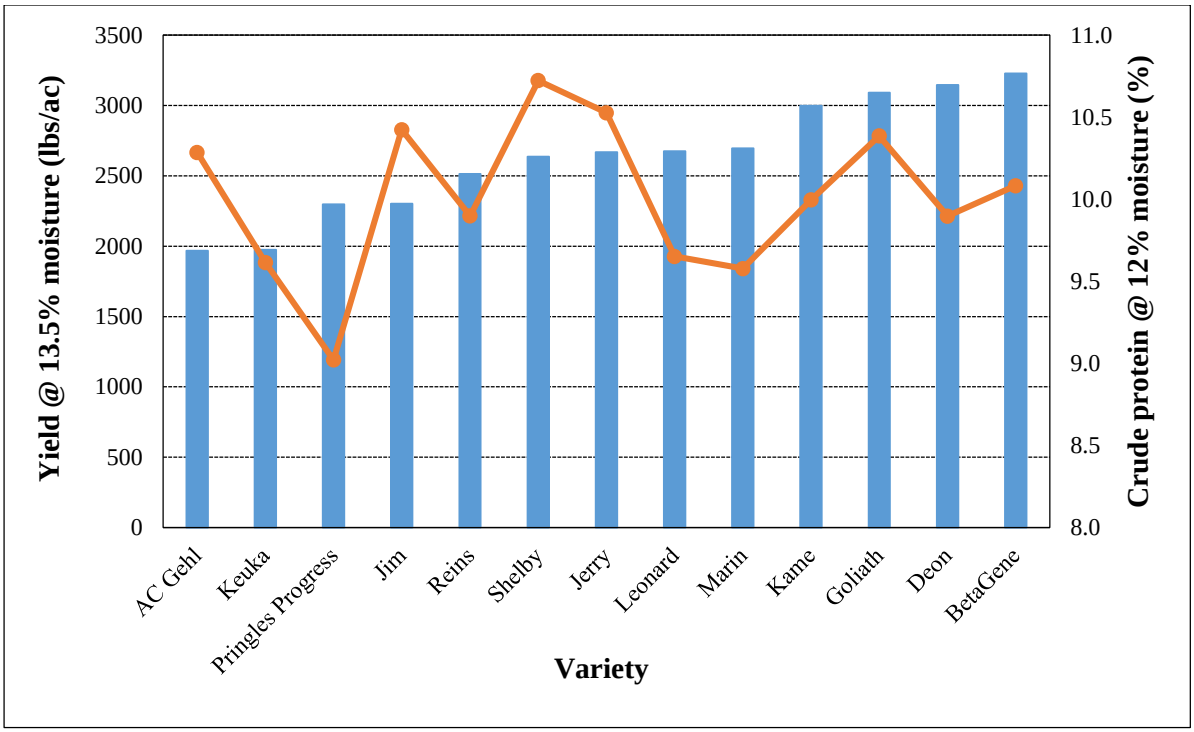

Figure 1. Yield of 13 oat varieties evaluated in Alburgh, VT, 2017.

DISCUSSION

It is important to remember that the results only represent one year of data. In the 2017 oat variety, trial '*Goliath'* was the tallest variety but also had the highest rate of lodging. The mean yield in 2017 was 328 lbs ac^{-1} lower than the mean yield in 2016, 2958 lbs ac^{-1}. The difference in yield could be due to the later planting date and the cool and wet conditions that persisted throughout much of the growing season. Interestingly, even though the conditions were ideal for fungal growth, as observed in high the DON concentrations in several other cereal grain trials, all oat varieties tested below 1 ppm. This might indicate that oats could be a good option in DON becomes more of an issue with highly variable climate. As you make variety choices on your farm, it is important that you evaluate data from test sites that are as similar to your region as possible.

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