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Heather Darby

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NORTHWEST CROPS & SOILS PROGRAM



2019 Oat Variety Trial



Dr. Heather Darby, UVM Extension Agronomist
Hillary Emick, Haley Jean, and Ivy Luke
UVM Extension Crops and Soils Technicians
(802) 524-6501

Visit us on the web: <http://www.uvm.edu/nwcrops>

2019 OAT VARIETY TRIAL

Dr. Heather Darby, University of Vermont Extension
heather.darby[at]uvm.edu

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 2017 census, about 80 acres of land in Vermont is cultivated for oat grain production, with an average yield of 1956 lbs ac⁻¹. With the exception of hull-less varieties, oats need to be de-hulled before they can be used for human consumption and even further processing is required to make oatmeal, steel cut oats, or oat flour. Since 2009, the University of Vermont Extension Northwest Crops and Soils 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 twenty-three oat varieties.

MATERIALS AND METHODS

In 2019, an oat variety performance trial was conducted at Borderview Research Farm in Alburgh, VT. Twenty-three oat varieties were evaluated for yield and quality (Table 1).

Table 1. Oat varieties planted in Alburgh, VT, 2019.

Variety	Seed source
AAC Richmond	Semican
AC Gehl	Semican
Antigo	Albert Lee seed
Betagene	Albert Lee seed
Canmore	Semican
CDC Orrin	Semican
Corral	Seedway
Deon	Albert Lee seed
Hayden	Seedway
Jerry	Welter seed & honey co.
Jim	Welter seed & honey co.
Kame	Lakeview organics
Keuka	Lakeview organics
Leonard	Lakeview organics
Marin	Atlantic Maritime Heirloom Oat
MS-19OT1	Meridian Seeds
Pringles Progress	VT heirloom oat
Reins	Albert Lee seed
Richmond	Seedway

Shelby 427	Albert Lee seed
Streaker (hullless)	Albert Lee seed
Sumo	Albert Lee seed
VNS (lot# 18-6034)	Seedway

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 cool season annuals and soybeans. The research plots were 5' x 20' and the seedbed was prepared by conventional tillage methods including spring plow, disc and spike tooth harrow. The oats were planted on 30-Apr 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 5-Aug with an Almaco SPC50 plot combine.

Table 2. Agronomic practices for the 2019 oat variety trial, Borderview Research Farm, Alburgh, VT.

Location	Borderview Research Farm, Alburgh VT
Soil type	Benson rocky silt loam
Previous crop	Cool season annuals and soybeans
Tillage operations	Spring plow, disc, and spike tooth harrow
Row spacing (in)	6
Plot size (ft)	5 x 20
Seeding rate	125 lbs ac ⁻¹
Replicates	3
Planting date	30-Apr
Harvest date	5-Aug

An approximate one pound grain sample per plot was collected for quality analysis. 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 at this time, flour was evaluated for its crude protein content (CP), falling number, and mycotoxin levels. Grains were analyzed for CP using the Perten Inframatic 8600 Flour Analyzer. CP is reported at 12% flour moisture. The determination of falling number (AACC Method 56-81B, AACC Intl., 2000) was measured on the Perten FN 1500 Falling Number Machine. The falling number is related to the level of sprout damage that has occurred in the grain. It is measured by the time it takes, in seconds, for a stirrer to fall through a slurry of flour and water to the bottom of the tube. 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 are 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. 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 725, 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 shown in bold.

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

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). During the time of this trial, temperatures were below average for every month except July. The season started out with above average precipitation in April and May, but dropped below average from June through August. There were 4387 growing degree days (GDDs) across the whole season, 104 growing degree days less than the historical average.

Table 3. Temperature and precipitation summary for Alburgh, VT, 2019.

Alburgh, VT	April	May	June	July	August
Average temperature (°F)	42.7	53.3	64.3	73.5	68.3
Departure from normal	-2.11	-3.11	-1.46	2.87	-0.51
Precipitation (inches)	3.65	4.90	3.06	2.34	3.50
Departure from normal	0.83	1.45	-0.63	-1.81	-0.41
Growing Degree Days (base 32°F)	346	660	970	1286	1125
Departure from normal	-38	-96	-44	88	-14

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

Height and lodging were recorded for each oat variety before harvest (Table 4). Oat varieties were significantly different in terms of height and lodging. The variety ‘AC Gehl’ was the tallest variety (130 cm) and ‘Marin’ and ‘VNS (lot# 18-6034)’ were statistically similar with heights of 126 cm and 122 cm respectively. ‘Corral’ was the shortest variety with a height of 85 cm. Overall lodging for the trial was low, with 10 varieties experiencing no lodging at harvest. The variety ‘AAC Richmond’ had the most lodging, 48.3%, which was statistically higher than all other varieties. The three tallest varieties also had little to no lodging; ‘AC Gehl’ 1.7%, ‘Marin’ 0%, and ‘VNS (lot# 18-6034)’ 0%.

Table 4. Height and lodging by oat variety at harvest, Alburgh, VT, 2019.

Variety	Height cm	Lodging %
AAC Richmond	114	48.3
AC Gehl	130	1.7
Antigo	99	18.3
Betogene	115	0.0
Canmore	117	10.3
CDC Orrin	110	19.0
Corral	85	0.0
Deon	113	0.0
Hayden	112	7.7
Jerry	117	2.7
Jim	95	0.7
Kame	97	1.7
Keuka	115	6.0
Leonard	97	0.0
Marin	126*	0.0
MS-19OT1	104	0.0
Pringles Progress	119	3.3
Reins	100	0.0
Richmond	118	0.0
Shelby 427	105	10.0
Streaker (hulless)	106	6.7
Sumo	103	0.0
VNS (lot# 18-6034)	122*	0.0
<i>LSD (0.10)</i>	9.8	14.2
<i>Trial mean</i>	110	5.9

Top performer treatment is shown in **bold**.

There were significant differences in harvest and quality measures between varieties (Table 5). The variety ‘Hayden’ was the highest yielding (4958 lbs ac⁻¹) and ‘Streaker’ had the lowest yield, 2225 lbs ac⁻¹ (Table 5, Figure 1). The top yielding variety was statistically similar to 17 other varieties. The ideal storage moisture of oats is 14%, which eight of the varieties reached in 2019. Varieties above 14% harvest moisture had to be dried down before storing. ‘Kame’ had the lowest harvest moisture at 12.6% and the highest

harvest moisture was ‘AAC Richmond’ (31.0%) which was significantly higher than all other varieties. ‘Streaker’ had the highest test weight of 42.0 lbs bu⁻¹. The average test weight for the trial was 35.0 lbs bu⁻¹ and all but three varieties (*CDC Orrin*, *AAC Richmond*, and *Canmore*) met or exceeded industry standards of 32 lbs bu⁻¹ for oats.

Table 5. Harvest and quality measures, Alburgh, VT, 2019.

Variety	Yield @ 13.5% moisture	Harvest moisture	Test weight	Falling number	Crude protein @ 12% moisture
	lbs ac ⁻¹	%	lbs bu ⁻¹	Sec	%
AAC Richmond	4051*	31.0	31.7	66.0	15.2
AC Gehl	3602	14.5	34.0	67.7	12.4
Antigo	3511	12.9	36.3	77.0	11.9
Betogene	3891*	15.8	34.4	64.0	12.1
Canmore	4832*	19.1	32.0	66.7	13.8*
CDC Orrin	4358*	18.2	30.7	62.0	13.7*
Corral	4517*	13.2	36.8	115	12.2
Deon	4649*	23.2	34.6	70.7	14.4*
Hayden	4958	12.7	38.2	125	11.7
Jerry	4699*	15.0	36.7	69.0	12.7
Jim	3873*	16.2	35.9	160	12.9
Kame	4014*	12.6	33.9	76.0	12.1
Keuka	3871*	24.1	32.7	73.3	14.8*
Leonard	3607	13.6	32.5	74.7	12.4
Marin	4759*	15.8	34.0	71.3	12.8
MS-19OT1	4596*	13.8	35.4	67.3	11.9
Pringles Progress	3950*	17.6	34.5	90.7	12.8
Reins	4519*	15.2	35.3	79.3	13.2
Richmond	3756	18.7	34.3	62.3	13.7
Shelby 427	4061*	15.5	37.8	161	12.4
Streaker (hulless)	2225	13.7	42.0	265	13.0
Sumo	3628	13.2	38.2	130	12.8
VNS (lot# 18-6034)	4355*	16.1	33.6	64.7	13.0
<i>LSD (0.10)</i>	1141	4.93	1.8	61.5	1.54
<i>Trial mean</i>	4099	16.6	35.0	93.9	12.9

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

Falling number ranged from 62 seconds (*CDC Orrin* and *Richmond*) to 265 seconds (*Streaker*). '*Streaker*' had a falling number that was statistically higher than the other varieties. This was likely due to the fact that *Streaker* was a hullless variety. The variety '*AAC Richmond*' had the highest crude protein level when adjusted to 12% moisture at 15.2% protein (Table 5, Figure 1). The variety with the lowest crude protein was '*Hayden*' at 11.7%. DON concentrations for all varieties were below the FDA 1 ppm recommendation.

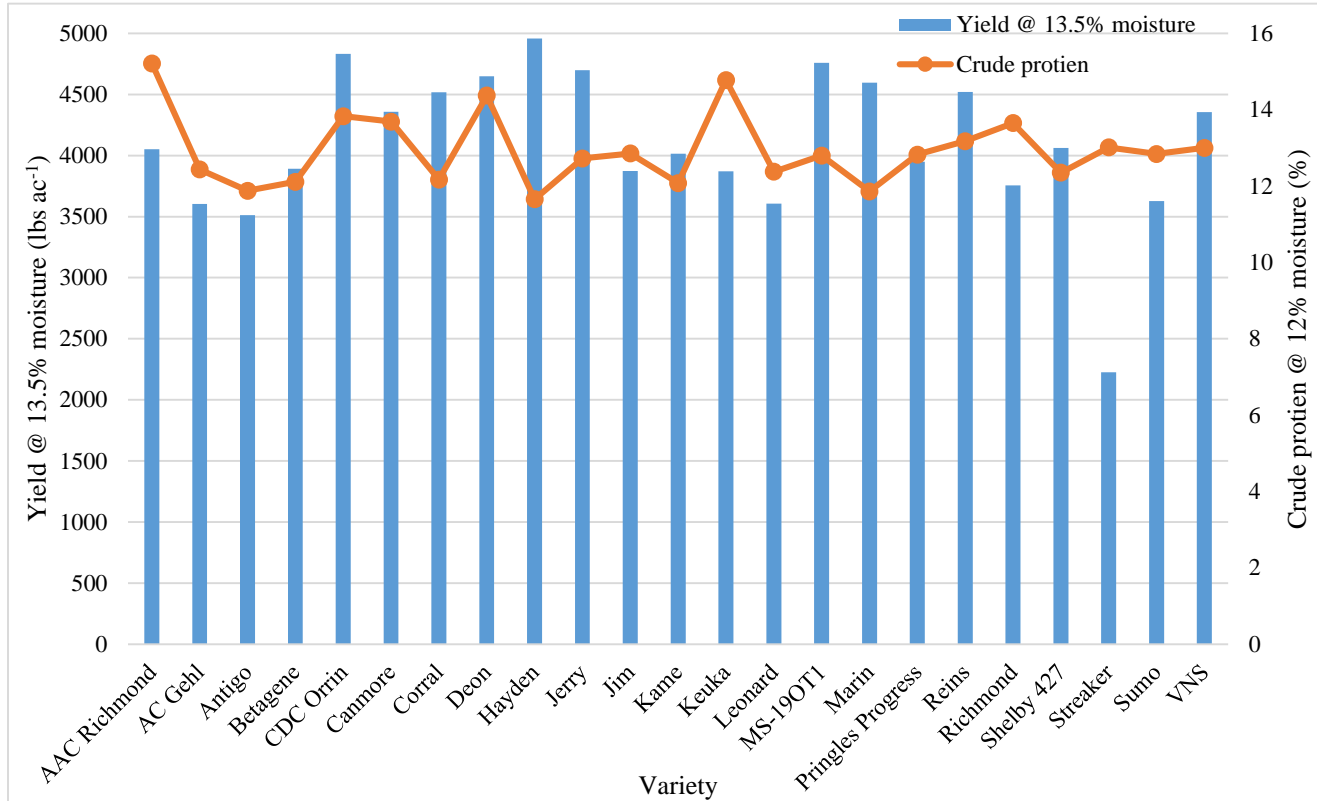


Figure 1. Yield and crude protein of 23 oat varieties evaluated in Alburgh, VT, 2019

DISCUSSION

It is important to remember that the results only represent one year of data. In the 2019 oat variety trial, the mean yield was 4099 lbs ac⁻¹, this is higher than the average yield in previous years. The difference in yield could be due to the below average precipitation that was observed in the latter half of the growing season. Overall, 2019 was a low DON year, with levels safe for human consumption in all grain trials at Borderview Research Farm. In past trials, oat varieties tested below the allowable level of DON, 1ppm, even in years when conditions were ideal for fungal growth and high DON levels were recorded in other grain trials from the same season. This might indicate that oats could be a good option if 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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