NORTHWEST CROPS & SOILS PROGRAM

2021 Oat Variety Trial

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THE UNIVERSITY OF VERMONT EXTENSION

2021 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 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 and quality comparisons for oats grown 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-five oat varieties.

MATERIALS AND METHODS

In 2021, an oat variety performance trial was conducted at Borderview Research Farm in Alburgh, VT. Twenty-five oat varieties were evaluated for yield and quality (Table 1).

Table 1. Oat varieties planted in Alburgh, VT, 2021.

Variety	Seed source
AAC Richmond	Semican
AC Gehl	Semican
Antigo	Albert Lea seed
Betagene	Albert Lea seed
Canmore	Semican
CDC Orrin	Semican
Corral	Seedway
Deon	Albert Lea seed
Esker2020	Albert Lea 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-19O71	Meridian Seeds
Pringles Progress	VT heirloom oat
Reins	Albert Lea Seed

Richmond	Seedway
Saddle	Albert Lea Seed
Shelby 427	Albert Lea Seed
Streaker (hulless)	Albert Lea Seed
Sumo	Albert Lea Seed
VNS (lot# 18-6034)	Seedway

The trial was planted at Borderview Research Farm in Alburgh, VT on a Benson rocky silt loam, over shaly limestone, 0 to 3% slope (Table 2). The experimental design was a randomized complete block with four replications. The previous crop was 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 9-Apr with 6" row spacing at a rate of 125 lbs. ac^{-1}.

Table 2. Agronomic practices for the 2021 oat variety trial, Alburgh, VT.

Location	Borderview Research Farm, Alburgh VT
Soil type	Benson rocky silt loam, over shaly limestone, 0-3% slope
Previous crop	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	4
Planting date	9-Apr
Harvest date	27-Jul

On 26-Jul, plant measurements of heights and lodging were taken prior to harvest. Plots were harvested on 27-Jul with an Almaco SPC50 plot combine**.** After combining, oats were cleaned with a small Clipper cleaner (A.T. Ferrell, Bluffton, IN). Harvest moisture was determined for each plot using a Dickey-john Mini GAC moisture and test weight meter. An approximate one-pound grain sample per plot was collected for quality analysis. Quality measurements included standard testing parameters used by commercial mills. 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) and mycotoxin levels. 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. DON testing was performed on 1 replicate of each variety, and all varieties were below the detectable limit for the test (data not shown).

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). Temperatures in April, May and June were slightly warmer than normal, resulting in 170 more Growing Degree Days (GDDs) than the 30-year average. Unfortunately, July was quite cool, averaging about 4.3 degrees below the 30-year average and resulting in 134 less growing days than normal. Despite July's cool weather, overall, a total of 3583 GDDs (base 32° F) were accumulated April through July, 36 more than the 30-year normal. Precipitation was well below average from April through July; overall there was about 4.99 inches less rain than normal.

Table 3. Temperature and precipitation summary for Alburgh, VT, 2021.

	2021			
Alburgh, VT	April	May	June	July
Average temperature (°F)	48.1	58.4	70.3	68.1
Departure from normal	2.52	-0.03	2.81	-4.31
Precipitation (inches)	3.52	0.66	3.06	2.92
Departure from normal	0.45	-3.1	-1.2	-1.14
Growing Degree Days (32-95°F)	497	818	1149	1119
Departure from normal	85	-1	86	-134

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.

Heading date, heights, and lodging were assessed prior to harvest (Table 4). Heading date was observed throughout the month of June and was recorded as the date when 50% of the plot had headed. Oat varieties were significantly different in terms of height and lodging. The average height was 100 cm and ranged from 79.4 cm (*Reins*) to 111 cm (*Richmond*). The top performer, *Richmond* was statistically similar to 7 other varieties (*Canmore, AC Gehl, CDC Orrin, AAC Richmond, VNS, Marin),* and last year's top performer

Pringle's Progress) in terms of height. The average percent lodging was 1.08% and ranged from 0.0% to 3.7% (*Streaker*). There were five varieties that had 0.0% lodging prior to harvest (*Jim, Shelby 427, Reins, Corral, & Saddle).* Additionally, 12 other varieties reported statistically similar lodging as to those that had 0%. Overall, lodging was very low this season.

Table 4. Heading date, height and lodging by oat variety prior to harvest, Alburgh, VT, 2021.

Variety	Heading Date	Height	Lodging
		cm	%
AAC Richmond	11-Jun	109*†	0.25*
AC Gehl	8-Jun	111*	1.00*
Antigo	7-Jun	92	1.00*
Betagene	10-Jun	102	2.00
Canmore	10-Jun	111*	2.75
CDC Orrin	11-Jun	109*	0.75*
Corral	8-Jun	89	**0.00**
Deon	9-Jun	100	0.75*
Esker2020	10-Jun	93	1.25*
Hayden	10-Jun	103	1.75
Jerry	8-Jun	100	1.75
Jim	7-Jun	94	**0.00**
Kame	8-Jun	90	0.75*
Keuka	10-Jun	103	1.25*
Leonard	9-Jun	98	1.75
Marin	8-Jun	107*	1.50
MS-19O71	10-Jun	95	0.50*
Pringles Progress	10-Jun	106*	2.00
Reins	10-Jun	79	**0.00**
Richmond	12-Jun	**111**	1.00*
Saddle	7-Jun	94	**0.00**
Shelby 427	7-Jun	98	**0.00**
Streaker (hulless)	8-Jun	102	3.75
Sumo	7-Jun	98	1.00*
VNS (lot# 18-6034)	13-Jun	107*	0.25*
LSD (0.10)‡	2.5	6.0	1.30
Trial mean	9-Jun	100	1.08

†Treatments with an asterisk (*) are not statistically different from the top performer, shown in **bold**.
‡LSD; least significant differences at p=0.10.

There were significant differences in harvest and quality measures between varieties (Table 5). The average yield this season was 2833 lbs. ac^{-1} and ranged from 1459 lbs. ac^{-1} (*Streaker*) to 3561 lbs. ac^{-1} (*CDC Orrin*) (Figure 1). However, Streaker's yield was 854 lbs. ac^{-1} less than the next lowest yielding variety (Pringles Progress – 2313 lbs. ac^{-1}) and not statistically similar to any other variety. The highest yielding variety, *CDC Orrin*, was statistically similar to nine other varieties. The ideal storage moisture for oats is 14% or below. None of the varieties met or were below 14% moisture, all varieties require drying before storage.

Moisture ranged from 14.7% (Kame) to 16.8% (Streaker) with an average harvest moisture of 15.4%. The average test weight was 33.0 lbs. bu^{-1}, and ranged from 28.7 lbs. bu^{-1} (*CDC Orrin*) to 42.6 lbs. bu^{-1} (*Streaker*). *Streaker*, a hulless oat, had a test weight that was significantly higher than all the other varieties. Fifteen of the twenty-five varieties had a test weight that met or exceeded the industry standard of 32 lbs. bu^{-1} for oats. The average crude protein was 11.6%. *Streaker* had the highest crude protein 12.8% and was statistically similar to 5 other varieties (Antigo, Sumo, Betagene, Jim and MS19071). It is important to note that *Streaker* is a hulless variety and hence, would have higher crude protein and test weight because the hulls are not present.

Table 5. Harvest and quality measures, Alburgh, VT, 2021.

Variety	Yield @ 13.5% moisture	Harvest moisture	Test weight	Crude protein @ 12% moisture
	lbs. ac^{-1}	%	lbs. bu^{-1}	%
AAC Richmond	3167*†	15.7	29.6	11.1
AC Gehl	2787	15.2*	31.9	11.5
Antigo	2461	15.3*	36.5	12.7*
Betagene	2530	15.6	32.4	12.2*
Canmore	3173*	15.2*	30.0	11
CDC Orrin	**3562**	15.8	28.7	10.6
Corral	3033*	15.3*	33.1	11.5
Deon	3065*	15.2*	33.7	11.1
Esker2020	3057*	15.0*	31.5	11.5
Hayden	3085*	16.1	35.0	11.3
Jerry	2748	15.2*	34.8	11.7
Jim	2686	15.3*	33.4	12*
Kame	2837	**14.7**	33.3	11.7
Keuka	2825	16.1	31.2	11.7
Leonard	2537	15.3*	31.7	11.5
Marin	2471	14.9*	32.1	11.8
MS-19OT1	3239	15.1*	31.3	12*
Pringles Progress	2314	15.7	32.1	11.5
Reins	3251*	14.8*	35.1	11.2
Richmond	2932	15.3	30.4	11.1
Saddle	3344*	15.5	35.1	11.9
Shelby 427	2646	15.3	35.3	11.9
Streaker (hulless)	1459	16.8	**42.6**	**12.8**
Sumo	2878	15.3	36.2	12.5*
VNS (lot# 18-6034)	2740	15.9	31	11
LSD (0.10) ‡	553.3	0.67	1.42	0.841
Trial mean	2833	15.4	33	11.6

†Treatments with an asterisk (*) are not statistically different from the top performer, shown in **bold**.
‡LSD; least significant differences at p=0.10.

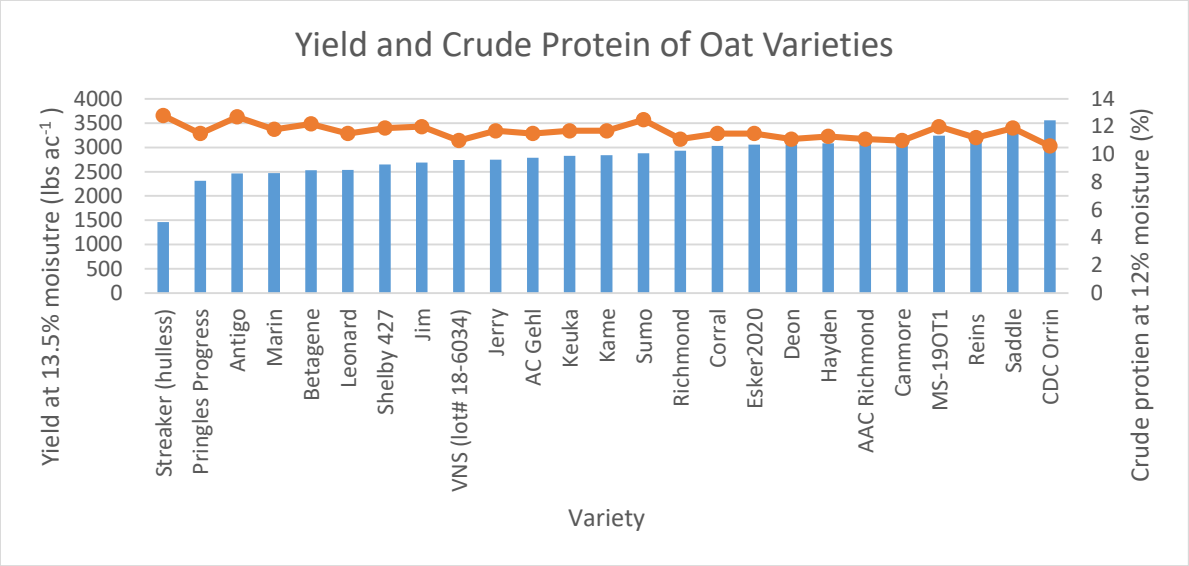

Figure 1. Yield and crude protein of 25 oat varieties evaluated in Alburgh, VT, 2021.

DISCUSSION

It is important to remember that the results only represent one year of data. The 2021 the oat varietal trial season started out with slightly warmer than normal temperatures but ended with a very cool July with temperatures about 4.3 degrees below the 30-year average. Despite a cool July, the warm spring balanced the overall temperature enough to produce 36 GGD's above the 30-day average. Average height for all varieties in 2021 was 100 cm, the tallest variety being 111 cm (Richmond) with 7 other statistically similar varieties. In contrast, the average height in 2020 was 87 with just 4 varieties growing over 100 cm. Lodging was also very low this year with an average of 1.08% and five varieties having 0% lodging. Harvest moisture was 15.4%, with none of the varieties being below the ideal storage moisture rate of 14%. The mean crude protein was 11.6% and average test weight was 33 lbs. bu^{-1}. In the 2021 oat variety trial, the mean yield was 2833 lbs. ac^{-1}, this is lower than the average yield in 2020 by about 240 lbs. ac^{-1}. 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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