NORTHWEST CROPS & SOILS PROGRAM

2020 Oat Variety Trial

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2020 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 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-five oat varieties.

MATERIALS AND METHODS

In 2020, 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, 2020.

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-19OT1	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, 8 to 15% slope (Table 2). The experimental design was a randomized complete block with three replications. The previous crop was hemp. 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 17-Apr with 6" row spacing at a rate of 125 lbs. ac^{-1}.

Table 2. Agronomic practices for the 2020 oat variety trial, Alburgh, VT.

Location	Borderview Research Farm, Alburgh VT
Soil type	Benson rocky silt loam, over shaly limestone, 8-15% slope
Previous crop	Hemp
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	17-Apr
Harvest date	31-Jul

On 23-Jul, plant measurements of heights and lodging were taken prior to harvest. Plots were harvested on 31-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), 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). Precipitation was below average from April through July; overall there was nearly 1 in. less rain during that four-month period. A cool April & May led to Growing Degree Days (GDDs) lagging behind the 30-year average, followed by a hotter than normal June and July. It was over 4 degrees warmer than normal in July. Plants exhibited drought stress as a result of the lack of rain and warm temperatures. A total of 3434 GDDs were accumulated April through July, 56 more than the 30-year normal.

Table 3. Temperature and precipitation summary for Alburgh, VT, 2020.

Alburgh, VT	April	May	June	July
Average temperature (°F)	41.6	56.1	66.9	74.8
Departure from normal	-3.19	-0.44	1.08	4.17
Precipitation (inches)	2.09	2.35	1.86	3.94
Departure from normal	-0.72	-1.04	-1.77	-0.28
Growing Degree Days (32-95°F)	315	746	1046	1326
Departure from normal	-99	-13	35	132

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.

Oat varieties were significantly different in terms of height and lodging (Table 4). The average height was 87 cm and ranged from 67 cm (*Reins*) to 108 cm (*Pringle's Progress*). The top performer, *Pringle's Progress* was statistically similar to three other varieties (*Richmond, Canmore, & Marin)* in terms of height. The average percent lodging was 2.4% and ranged from 0.0% to 11.7% (*Betagene*). There were nine varieties that had 0.0% lodging prior to harvest (*AAC Richmond, CDC Orrin, Esker2020, Kame, Leonard, MS-10OT1, Reins, Richmond, VNS lot # 18-6034).* Overall, lodging was low this season.

Table 4. Height and lodging by oat variety prior to harvest, Alburgh, VT, 2020.

Variety	Height	Lodging
	cm	%
AAC Richmond	93	0.0
AC Gehl	99	1.7
Antigo	83	3.3
Betagene	90	**11.7**
Canmore	103*	3.3
CDC Orrin	93	0.0
Corral	75	1.7
Deon	88	3.3
Esker2020	84	0.0
Hayden	92	3.3
Jerry	90	1.7
Jim	85	1.7
Kame	81	0.0
Keuka	91	5.0
Leonard	84	0.0
Marin	102*	3.3
MS-19OT1	92	0.0
Pringles Progress	**108**	8.3*
Reins	67	0.0
Richmond	105*	0.0
Saddle	82	1.7
Shelby 427	87	1.7
Streaker (hulless)	84	5.0
Sumo	84	3.3
VNS (lot# 18-6034)	99	0.0
LSD (0.10)	8.8	3.8
Trial mean	87	2.4

Treatments with an asterisk (*) are not statistically different from the top performer, shown in **bold**.

There were significant differences in harvest and quality measures between varieties (Table 5). The average yield this season was 3072 lbs. ac^{-1} and ranged from 1661 lbs. ac^{-1} (*Streaker*) to 3996 lbs. ac^{-1} (*MS-19OT1*). The highest yielding variety, *MS-19OT1,* was statistically similar to eleven other varieties. The average harvest moisture was 12.4%. The variety with the highest harvest moisture was *Deon* (13.4%), but it was statistically similar to thirteen other varieties. All of the varieties had a harvest moisture below 14%, which is the ideal storage moisture for oats. The average test weight was 33.0 lbs. bu^{-1}, and ranged from 29.1 lbs. bu^{-1} (*Kueka*) to 37.7 lbs. bu^{-1} (*Streaker*). *Streaker,* a hulless oat, had a test weight that was significantly

higher than all of the other varieties. Nineteen of the twenty-five varieties had a test weight that met or exceeded the industry standard of 32 lbs. bu^{-1} for oats. Falling number ranged from 62 seconds (*Deon*) to 317 seconds (*Streaker*). Streaker had a falling number that was almost 4 times greater than the variety with the next highest falling number (*Saddle*; 82 seconds). The average crude protein was 11.6% and *Streaker* had a significantly higher crude protein (13.0%) than the other varieties (Figure 1). It is important to note that *Streaker* is a hulless variety and hence, would have higher crude protein, falling number, and test weight because the hulls are not present.

Table 5. Harvest and quality measures, Alburgh, VT, 2020.

Variety	Yield @ 13.5% moisture lbs. ac^{-1}	Harvest moisture %	Test weight lbs. bu^{-1}	Falling number Sec	Crude protein @ 12% moisture %
AAC Richmond	3060	13.4*	31.8	71	11.8
AC Gehl	2929	12.0	32.1	71	11.5
Antigo	2590	13.1*	35.1	69	11.9
Betagene	2456	12.3*	32.3	65	11.4
Canmore	3199*	13.2*	33.1	64	11.7
CDC Orrin	3268*	12.3	31.1	67	11.7
Corral	2695	12.4*	32.7	64	11.8
Deon	2761	**13.4**	33.0	62	11.5
Esker2020	3202*	12.3	32.0	72	11.3
Hayden	3174*	12.6*	34.7	73	11.1
Jerry	3096	12.6*	33.9	62	11.7
Jim	3452*	12.5*	33.5	64	11.6
Kame	3903*	12.0	32.3	63	11.6
Keuka	2612	12.8*	29.1	67	11.5
Leonard	3153*	11.9	31.1	64	11.6
Marin	2980	12.4*	32.3	64	11.3
MS-19OT1	**3996**	11.8	30.5	67	11.6
Pringles Progress	2739	11.8	31.9	64	11.7
Reins	3440*	12.3*	34.7	73	11.4
Richmond	3498*	12.1	32.5	67	11.9
Saddle	3366*	12.2	33.1	82	11.5
Shelby 427	2955	12.6*	35.0	70	11.3
Streaker (hulless)	1661	10.2	**37.7**	**317**	**13.0**
Sumo	2655	13.1*	34.6	75	12.1
VNS (lot# 18-6034)	3967*	12.1	34.0	64	11.7
LSD (0.10)	881	1.14	2.26	10.8	0.362
Trial mean	3072	12.4	33.0	78	11.6

Treatments with an asterisk (*) are not statistically different from the top performer, shown in **bold**.
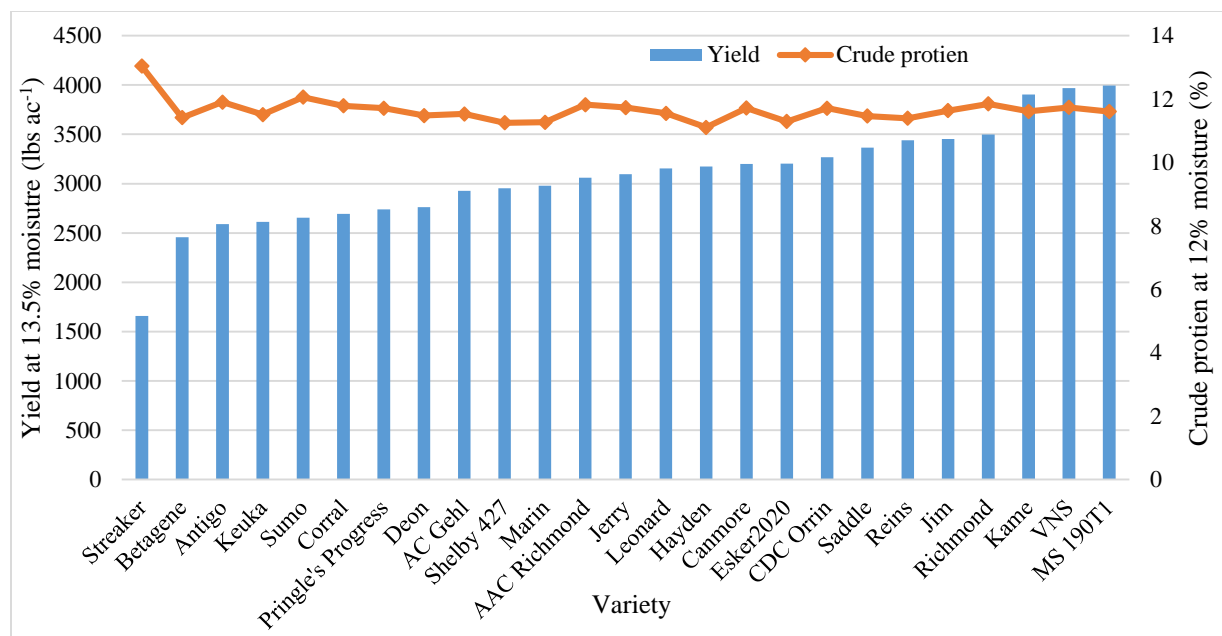
Figure 1. Yield and crude protein of 25 oat varieties evaluated in Alburgh, VT, 2020.

DISCUSSION

It is important to remember that the results only represent one year of data. In the 2020 oat variety trial, the mean yield was 3072 lbs. ac^{-1}, this is lower than the average yield in 2019 by about 1000 lbs. ac^{-1}. The season started out cooler than average; it was about 3 degrees cooler in April than normal. But by July, temperatures increased and the monthly average for July was more than 4 degrees above normal. In addition to the warm weather, precipitation was below the average from April through July. This is likely why harvest moisture was low for most varieties; nearly all varieties had a harvest moisture less than 14%. I 2019, the average harvest moisture was 16.6%, with some varieties having harvest moistures of 20-30%. 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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