NORTHWEST CROPS & SOILS PROGRAM

# 2018 Rye Variety Trial

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THE UNIVERSITY OF VERMONT EXTENSION

**2018 RYE VARIETY TRIAL**

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The interest in growing cereal rye for grain to be sold as cover crop seed, or to other value-added markets (distillers and bakers), has increased considerably across the Northeast region. As a result, farmers and end-users are requesting yield and quality information on cereal rye varieties. In 2018, University of Vermont Extension Northwest Crops and Soils (NWCS) Program conducted a variety trial to evaluate yield and quality of cereal rye. The varieties were Aroostook, Brasetto, Danko, Guardian, Huron, Musketeer, ND Dylan, Spooner, Wheeler, and one unstated variety (VNS).

# MATERIALS AND METHODS

The experimental design of the study was a randomized complete block with treatment plots replicated four times. Treatments were ten varieties of cereal rye: Aroostook, Brasetto, Danko, Guardian, Huron, Musketeer, ND Dylan, Spooner, Wheeler, and one unstated variety (VNS) (Table 2). The field was plowed, disked, and prepared with a spike tooth harrow to prepare the seedbed for planting. The plots were planted with a Great Plains cone seeder on 21-Sep 2017; plots were 5' x 20' (Table 1). Prior to harvest, on 20-Jul 2018, three plant heights per plot were measured.

**Table 1: Agronomic and trial information for the rye cover crop variety trial, 2017-2018.**

| | **Borderview Research Farm, Alburgh, VT** |
|---|---|
| Soil Type | Benson rocky silt loam |
| Previous Crop | Winter Wheat |
| Tillage Operations | Fall plow, disc, and spike tooth harrow |
| Harvest Area (ft.) | 5 x 20 |
| Seeding Rate (live seeds $m^{-2}$) | 350 |
| Replicates | 4 |
| Planting Date | 21-Sep 2017 |
| Harvest Date | 20-Jul 2018 |

Grain plots were harvested at the Alburgh site with an Almaco SPC50 plot combine on 20-Jul. Following harvest, seed was cleaned with a small Clipper M2B cleaner (A.T. Ferrell, Bluffton, IN). Grain moisture, test weight, and yield were calculated. An approximate one pound subsample was collected to determine quality. Quality measurements included standard testing parameters used by commercial mills. Test weight was measured by the weighing of a known volume of grain. Once test weight was determined, the samples were then ground into flour using the Perten LM3100 Laboratory Mill. At this time, flour was evaluated for its protein content, falling number, and mycotoxin levels. Grains were analyzed for protein content using the Perten Inframatic 8600 Flour Analyzer. 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 done using Veratox DON 5/5 Quantitative test from the NEOGEN Corp. This test has a detection range of 0.5 to 5 ppm. Samples with DON values greater than 1 ppm are considered unsuitable for human consumption.

**Table 2. Winter rye varietal information, Alburgh, VT, 2018.**

| Variety | Source |
|---|---|
| Aroostook | Albert Lea |
| Brasetto | Seedway LLC |
| Danko | Knight Seeds |
| Guardian | LaCrosse Seed |
| Huron | Kings AgriSeeds |
| Musketeer | Saved Seed |
| ND Dylan | Seedway LLC |
| Spooner | Albert Lea |
| Wheeler | Moore Seed Farm |
| VNS | Seedway LLC |

Variations in project results can occur because of variations in genetics, soil, weather, and other growing conditions. Statistical analysis makes it possible to determine whether a difference among treatments 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 Differences (LSD's) at the 10% level of probability are shown. Where the difference between two treatments 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 values. Treatments that were not significantly lower in performance than the highest value in a particular column are indicated with an asterisk. In the following example, treatment A is significantly different from treatment C but not from treatment B. The difference between A and B is equal to 200, which is less than the LSD value of 300. This means that these treatments did not differ in yield. The difference between A and C is equal to 400, which is greater than the LSD value of 300. This means that the yields of these treatments were significantly different from one another.

| **Treatment** | **Yield** |
|---|---|
| **A** | **2100*** |
| B | 1900* |
| C | 1700 |
| LSD | 300 |

# 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. September, October, May, and July had above average temperatures whereas April and June were below average (Table 3). Growing months during the growing periods of 2017-2018 season saw well below average precipitation with the

exception of April which saw above average precipitation. There were 5159 growing degree days (GDDs) accumulated over the course of the growing season, 447 more growing degree days than the historical average.

**Table 3. Temperature and precipitation summary for Alburgh, VT, 2017 and 2018.**

| **Alburgh, VT** | September '17 | October '17 | April '18 | May '18 | June '18 | July '18 |
|---|---|---|---|---|---|---|
| Average temperature (°F) | 64.4 | 57.4 | 39.2 | 59.5 | 64.4 | 74.1 |
| Departure from normal | 3.76 | 9.16 | -5.58 | 3.10 | -1.38 | 3.51 |
| | | | | | | |
| Precipitation (inches) | 1.8 | 3.3 | 4.4 | 1.9 | 3.7 | 2.4 |
| Departure from normal | -1.80 | -0.31 | 1.61 | -1.51 | 0.05 | -1.72 |
| | | | | | | |
| Growing Degree Days 32°F | 971 | 786 | 272 | 853 | 973 | 1305 |
| Departure from normal | 113 | 284 | -112 | 97 | -42 | 107 |

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. (http://www.nrcc.cornell.edu/page_nowdata.html).

Heights, lodging, yield and test weight was measured prior to cereal rye harvest (Table 4). Wheeler was the tallest variety, whereas Brasetto was the shortest. Wheeler did not experience any lodging, yet Brasetto, Danko, Guardian, Huron, and VNS were not statistically different from Wheeler. It is also worth noting that lodging was very low across the board, with Musketeer and ND Dylan showing only 4% lodging for the growing season. The average lodging for the trial was 1.625%. Yields are presented at harvest moisture. Yields at harvest ranged between 2511 and 4210 lbs $ac^{-1}$ with Brasetto, Guardian, ND Dylan, and VNS as the top performing varieties. The ideal test weight for rye is 56 lbs $bu^{-1}$; top performing varieties reaching this mark in descending order were Danko, Musketeer, VNS, Spooner, Guardian, and Aroostook.

**Table 4: Pre-harvest measurements of winter rye varieties, Alburgh, VT 2018.**

| Variety | Height | Lodging | Yield | Test weight |
|---|---|---|---|---|
| | cm | % | lbs $ac^{-1}$ | lbs $bu^{-1}$ |
| Aroostook | 141 | 3.50 | 2925 | 56.0* |
| Brasetto | 114 | 0.50* | **4210** | 49.8 |
| Danko | 132 | 0.50* | 2837 | **57.2** |
| Guardian | 143 | 0.25* | 4061* | 56.1* |
| Huron | 143 | 1.50* | 3239 | 51.0 |
| Musketeer | 145 | 4.00 | 3320 | 56.7* |
| ND Dylan | 138 | 4.00 | 3627* | 54.5* |
| Spooner | 152 | 1.75 | 2980 | 56.3* |
| Wheeler | **167** | **0.00** | 2511 | 53.3* |
| VNS | 115 | 0.25* | 4015* | 56.4* |
| Trial mean | 139 | 1.625 | 3373 | 54.7 |
| LSD (0.10) | 10.4 | 1.64 | 883.24 | 4.34 |

*Treatments with an asterisk are not significantly different than the top performer in **bold**.
LSD – Least significant difference.
NS – No significant difference between treatments.

The ten cereal varieties were analyzed for crude protein concentration, falling number, and the vomitoxin DON (Table 5). Wheeler had the highest crude protein at 13.9%, and was significantly higher than the other varieties in the trial. Falling number ranged between 216 and 273; an ideal falling number falls around 260 seconds. The top performing variety was Brasetto at 272.25 seconds, but was not statistically significant from Danko, Guardian, ND Dylan, Spooner, Wheeler, and VNS, who were also top performers. Danko had very low DON levels, and was not significantly different from Aroostook, Huron, Spooner, and Wheeler.

**Table 5: Grain quality for ten cereal rye varieties, Alburgh, VT, 2018.**

| Variety | Crude protein @ 12% moisture | Falling number | DON |
|---|---|---|---|
| | % | Seconds | ppm |
| Aroostook | 11.7 | 227 | 0.200* |
| Brasetto | 10.4 | **272** | 0.350 |
| Danko | 10.8 | 266* | **0.025** |
| Guardian | 10.2 | 249* | 0.450 |
| Huron | 10.7 | 216 | 0.125* |
| Musketeer | 11.1 | 216 | 0.350 |
| ND Dylan | 11.1 | 254* | 0.350 |
| Spooner | 10.8 | 245* | 0.225* |
| Wheeler | **13.9** | 260* | 0.250* |
| VNS | 9.75 | 268* | 0.300 |
| Trial mean | 11.1 | 247 | 0.263 |
| LSD (0.10) | 0.716 | 30.8 | 0.242 |

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

LSD – Least significant difference.

## DISCUSSION

The hot, dry conditions in 2018 emulated the weather in the west, which led to high cereal rye yields and quality. Throughout the trial, and perhaps a result of this season's growing conditions, each variety appeared to perform quite well. Danko, Guardian, Wheeler, and VNS were top performing varieties across the board, with Brasetto, ND Dylan, and Spooner similarly performing quite highly in our trial. Overall, quality and yields were high this year, and each variety had DON levels suitable for human consumption.

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