2025 Rye Variety Trial

Dr. Heather Darby, UVM Extension Agronomist
John Bruce
UVM Extension Crops and Soils Technician
(802) 524-6501

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

© January 2026, University of Vermont Extension

University of Vermont | Extension
College of Agriculture and Life Sciences

Northwest Crops and Soils Program

2025 RYE VARIETY TRIAL
Dr. Heather Darby, University of Vermont Extension
heather.darby[at]uvm.edu

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 in recent years. As a result, farmers and end-users are requesting yield and quality information on cereal rye varieties. In 2024-2025, University of Vermont Extension Northwest Crops and Soils (NWCS) Program conducted a variety trial to evaluate yield and quality of cereal rye.

MATERIALS AND METHODS

The rye variety trial was initiated at Borderview Research Farm in Alburgh, VT in the fall of 2024. Plots were managed with practices similar to those used by producers in the surrounding area. Agronomic information is displayed in Table 1. The experimental design was a randomized complete block with four replicates. The field was prepared with Pottinger TerraDisc™ to prepare the seedbed for planting. Plots were seeded in 5' x 20' plots with a Great Plains Cone Seeder on 24-Sep 2024 at a seeding rate of 350 live seeds m^{-2}. Treatments were ten varieties of cereal rye (Table 2).

Table 1. Agronomic and trial information for the rye cover crop variety trial, 2024-2025.

	Borderview Research Farm, Alburgh, VT
Soil type	Benson rocky silt loam
Previous crop	Hemp Flower
Tillage operations	Pottinger TerraDisc™
Harvest area (ft.)	5 x 20
Seeding rate (live seeds m^{-2})	350
Replicates	4
Planting date	24-Sep 2024
Harvest date	22-Jul 2025

Table 2. Winter rye varietal information, Alburgh, VT, 2024-2025.

Variety	Source
Aroostook	Albert Lea Seed
Aviator	Albert Lea Seed
Danko	Albert Lea Seed
Hazlet	Albert Lea Seed
ND Dylan	Albert Lea Seed
ND Gardner	Albert Lea Seed
Receptor	Albert Lea Seed
Serafino	Albert Lea Seed
Spooner	Albert Lea Seed
Tayo	Albert Lea Seed

The trial was scouted for arthropod pests and plant diseases on 20-Jun 2025. Five plants from each plot were examined. The top two leaves were examined and evaluated for the presence of disease and insect damage. The Clive James, 'An Illustrated Series of Assessment Keys for Plant Diseases, Their Preparation and Usage' was used to identify and determine the severity of plant disease infection. Damage was recorded as a percentage of the leaf surface that was affected by each pest and disease.

On 18-Jul 2025, prior to harvest, three plant heights per plot were measured for each plot, excluding awns. Lodging was assessed visually as percent lodged, with 0% indicating no lodging and 100% indicating the entire plot was lodged. Grain plots were harvested at the Alburgh site with an Almaco SPC50 plot combine on 22-Jul. Seed was cleaned with a small Clipper M2B cleaner (A.T. Ferrell, Bluffton, IN) and a one-pound subsample was collected to analyze quality characteristics. Grain quality was determined at the E. E. Cummings Crop Testing Laboratory at the University of Vermont (Burlington, VT). Grains were analyzed for crude protein and starch content using the Perten Inframatic 9500 NIR Grain Analyzer (Perkin Elmer, Waltham, MA). The samples were then ground into flour using the Perten LM3100 Laboratory Mill (Perkin Elmer). Falling number for all rye varieties were determined using the AACC Method 56-81B, AACC Intl., 2000 on a Perten FN 1500 Falling Number Machine Mill (Perkin Elmer). The falling number indirectly measures enzymatic activity in the grain, which is typically used as an indicator of pre-harvest sprouting. It is determined by the time it takes, in seconds, for a stirrer to fall through a slurry of flour and water to the bottom of a test-tube. Deoxynivalenol (DON) analysis was done using Veratox DON 2/3 Quantitative test from the NEOGEN Corp (Lansing, MI). 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. Samples from one replicate were evaluated for DON and all samples tested below the FDA threshold for human consumption (1 ppm) (data not shown).

Data were analyzed using a general linear model procedure of SAS (SAS Institute, 1999). Replications were treated as random effects, and treatments were treated as fixed. Mean comparisons were made using the Least Significant Difference (LSD) procedure where the F-test was considered significant, at $p<0.10$. Variations in genetics, soil, weather, and other growing conditions can result in variations in yield and quality. Statistical analysis makes it possible to determine whether a difference between treatments is significant or whether it is due to natural variations in the plant or field. At the bottom of each table, an LSD value is presented for each variable (i.e. yield). Least Significant Differences (LSDs) at the 0.10 level of significance are shown. This means that when the difference between two varieties within a column is equal to or greater to the LSD value for the column, there is a real difference between the varieties 90% of the time. Varieties that were not significantly lower in performance than the highest value in a particular column are indicated with an asterisk.

In the example to the right, variety C was significantly different from variety A, but not from variety B. The difference between C and B is 1.5, which is less than the LSD value of 2.0 and so these varieties were not significantly different in yield. The difference between C and A is equal to 3.0, which is greater than the LSD value of 2.0. 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, indicated in bold.

Variety	Yield
A	6.0
B	7.5*
C	**9.0**
LSD	2.0

RESULTS

Seasonal precipitation and temperature recorded at Borderview Research Farm in Alburgh, VT are displayed in Table 3. Fall temperatures at establishment through November were 6.76° F warmer than average leading to strong winter survival for nearly all rye varieties. Unlike the previous two growing seasons, we saw significantly less precipitation leading up to harvest and for the bulk of the growing season. While May was above average for precipitation during the earlier parts of the month, this trend shifted during June with the month ending in 1.88 inches less precipitation than the 30-year average. The average temperature during the primary growing season was 6.53° F above average with cumulative Growing Degree Days (GDDs) reaching 5,384, 112 above average.

Table 3. Seasonal weather data collected in Alburgh, VT, 2024-2025.

Alburgh, VT	24-Sep	24-Oct	24-Nov	25-Apr	25-May	25-Jun	25-Jul
Average temperature (°F)	64.7	52.1	42.2	45.1	57.5	67.8	73.2
Departure from normal	2.02	1.81	2.93	-0.47	-0.93	0.35	0.82
Precipitation (inches)	2.61	2.00	1.75	3.71	5.78	2.38	3.76
Departure from normal	-1.06	-1.83	-0.95	0.64	2.02	-1.88	-0.3
Growing Degree Days (32-90°F)	981	628	328	297	790	1084	1276
Departure from normal	59	60	92	-115	-29	21	24

Historical averages are for 30 years of data provided by the NOAA (1991-2020) for Burlington, VT.

There were significant differences among varieties for winter survival, vigor, height, and lodging (Table 4). The majority of varieties had 100% winter survival, or were statistically similar to those with 100% survival, with the exception of Tayo, which averaged 45.0% survival within the trial and ND Dylan at 87.5%. To further distinguish between varieties and assess overall plant health at spring green-up, a vigor rating was given to each plot. Those varieties with higher values showed dark green, healthy plant growth with little to no leaf damage as a result of winter kill or disease. Plant vigor was highest with ND Gardner at a rating of 9.0 and was statistically similar to

Aroostook, Aviator, Danko, and Hazlet at 8.75 each (vigor scale 0-9 with 0=low vigor and 9=excellent vigor). Aroostook was the tallest variety in the trial at 162 cm alongside Aviator, Hazlet, ND Dylan, ND Gardner, and Spooner. Those varieties which were the tallest within the trial also exhibited higher instances of lodging whereas Receptor and Tayo showed zero lodging in the trial and were two or the shortest varieties.

Table 4. Cereal rye harvest measurements. Alburgh, VT, 2025.

Variety	Winter survival	Vigor	Height	Lodging
	%	0-9†	cm	%
Aroostook	**100**	8.75*	**162**	38.8
Aviator	**100**	8.75*	160*	57.5
Danko	**100**	8.75*	151	25.0
Hazlet	**100**	8.75*	160*	60.0
ND Dylan	87.5	6.50	155*	41.3
ND Gardner	**100**	**9.00**	156*	78.8
Receptor	**100**	8.00	147	**0.00**
Serafino	**100**	8.00	146	6.25*
Spooner	95.0*	7.50	152*	57.5
Tayo	45.0	4.75	142	**0.00**
LSD (0.10) §	7.90	0.88	10.9	18.4
Trial mean	92.8	7.88	153	36.5

†Vigor 0=low vigor, 9=excellent vigor.
Within a column, varieties with an asterisk (*) were not different from the top performer (in **bold**).
§LSD; least significant difference at the p=0.10 level.

There were significant differences across varieties for disease, arthropod, and combined foliar damage (Table 5). Foliar diseases reduce photosynthetic leaf area, deplete plant nutrients, and increase respiration and transpiration within colonized host tissues. The diseased plant typically exhibits reduced vigor, growth, and seed fill, thus impacting grain quality and yields. Earlier occurrence, greater degree of host susceptibility, and longer duration of conditions favorable for disease development will increase the risk of yield loss. Each plot was evaluated for the presence of several individual diseases and disease symptoms. These individual disease ratings were combined into a single foliar disease rating for statistical analysis. Diseases noted in the winter rye variety trial were rust, brown spot, mosaic virus, yellow stripe, and powdery mildew (in order from most severe to least). Similar to previous years Serafino appeared to be impacted the least by both arthropods and diseases with minimal disease pressure observed throughout the trial. Aviator, Receptor, and Tayo have similarly low levels of combined foliar damage.

Table 5. Disease and arthropod damage in winter rye varieties. Alburgh, VT, 2025.

Variety	Disease damage % foliar surface affected	Arthropod damage % foliar surface affected	Combined foliar damage % foliar surface affected
Aroostook	3.13	50.5	64.1
Aviator	1.87*†	24.5*	27.5*
Danko	2.00*	39.5	49.3
Hazlet	1.53*	45.6	62.8
ND Dylan	3.00	47.7	69.7
ND Gardner	4.40	44.5	67.2
Receptor	**1.00***	27.7*	29.4*
Serafino	1.20*	**19.1**	**20.3**
Spooner	4.33	44.1	67.1
Tayo	2.93*	20.9*	24.2*
LSD (0.10)‡	1.94	10.3	10.9
Trial mean	2.54	36.4	48.2

†Within a column, varieties with an asterisk (*) were not different from the top performer (in **bold**).
‡LSD; least significant difference at the p=0.10 level.

Moisture measurements were recorded at harvest (Table 6). The ideal moisture content for grain storage is below 13.5%. Each variety at this stage of harvest was above the ideal moisture content for storage and required further drying. The ideal test weight for rye is 56 lbs bu^{-1}; none of the varieties met or exceeded this test weight. Danko had the highest overall test weight at 55.0 lbs bu^{-1} and was statistically similar to Aroostook (53.2 lbs bu^{-1}), Receptor (54.7 lbs bu^{-1}). Yields were once again lower when compared to peak years likely due to significant lodging within the trial. Trial average for the 2025 growing season was 2,630 lbs ac^{-1}, comparable to 2024 growing season at 2,945 lbs ac^{-1}, with top yielding variety Receptor reaching 4,978 lbs ac^{-1}. Serafino was the only other variety reaching similar yields at 4,533 lbs ac^{-1}. Falling number measures viscosity by recording the time in seconds it takes for a plunger to fall through a slurry to the bottom of a test tube. The viscosity is an indicator of enzymatic (alpha-amylase) activity in the kernel, which most often results from pre-harvest sprouting in the grain. Low falling number means high enzymatic activity, or more pre-harvest sprouting damage. This is most common if there are rain events as the grain is maturing prior to harvest. Values for falling number in each of the varieties was fairly high when compared to 2023, which had a number of varieties below 100 seconds. The highest observed falling number was seen in Serafino (354 seconds) with a trial average of 310 seconds. Danko, Receptor, and Tayo were statistically similar for falling number values at 329, 337, and 351 seconds respectively.

Table 6. Cereal rye grain quality. Alburgh, VT, 2025.

Variety	Moisture	Test weight	Yield @ 13.5% moisture	Starch @12% moisture	Crude protein @ 12% moisture	Falling number
	%	lbs bu^{-1}	lbs ac^{-1}	%	%	seconds
Aroostook	16.0	53.2*†	1753	61.2*	8.29	277
Aviator	16.8	51.1	2095	60.9	8.34	303
Danko	**13.6**	**55.0**	2801	61.5*	7.91	329*
Hazlet	16.5	51.7	1624	60.7	8.90	307
ND Dylan	16.7	50.5	1517	60.0	9.66	286
ND Gardner	16.6	48.5	1210	58.7	**10.5**	281
Receptor	18.2	54.7*	**4978**	**61.8**	7.43	337*
Serafino	20.1	52.3	4533*	61.5*	7.70	**354**
Spooner	15.9	51.2	1652	60.2	9.39	280
Tayo	22.1	49.3	4134	61.2*	8.04	351*
LSD (0.10)‡	1.78	1.92	735.2	0.638	0.559	33.4
Trial mean	17.3	51.8	2630	60.8	8.61	310

† Within a column, varieties with an asterisk (*) were not different from the top performer (in **bold**).

‡LSD; least significant difference at the p=0.10 level.

Wheat with 12% crude protein is generally considered ideal for baking bread; however, it is unclear how protein concentrations in rye impact the baking characteristics. This year's varieties resulted in a trial mean of 8.61% (Table 6) compared to a trial average of 7.00% in 2024 and 8.50% in 2023. Lower protein levels are characteristic of rye. The highest observed value for crude protein was seen in ND Gardner at 10.5% which has historically had higher protein levels in our trials. Starch measurements were also obtained from grain samples with the highest average starch content observed in Receptor at 61.8% and was statistically similar to Aroostook, Danko, Serafino, and Tayo.

DISCUSSION

With a number of the varieties impacted greatly by lodging, the few that were relatively unimpacted (Receptor, Serafino, Tayo in particular) were amongst hybrid rye varieties that stood out in terms of harvestability. However, overall yields for the trial were low compared to past years, with some open pollenated varieties exhibiting particularly low yields in both 2025 and 2024. One replicate per variety were tested for deoxynivalenol (DON) vomitoxin, and all were below the FDA threshold of 1 ppm, which is considered safe for human consumption.

There are well established ranges for falling number as an indicator of baking and malting quality in wheat and barley, but the ideal range for rye is not yet clearly documented. The ideal falling

number range for wheat is 250-350, however lower falling numbers around 150 seconds are acceptable and may be preferable to bakers using rye flours. Because rye bread relies on different grain components to create high-quality bread, and ferments more readily than wheat, it is expected that lower falling numbers are preferred for rye than for wheat, possibly closer to 100-200 seconds. The falling number results in this trial are consistent with our prior studies, but more research is needed to characterize potential end uses for rye with different falling numbers. See the 2020 and 2022 Rye Harvest Date Trial Report for more details about the impact of harvest date and variety on falling number in rye. Furthermore, other compounds such as pentosans, polysaccharides that impact the water holding capacity of the flour, could prove to be more impactful in rye flour and baking quality, highlighting the importance of additional studies with rye. These data highlight the importance of varietal selection, but also only represent one year of data in ongoing trials. More data and other factors should be considered when making management decisions.

ACKNOWLEDGEMENTS

UVM Extension helps individuals and communities put research-based knowledge to work.