

UVM ScholarWorks

Winter Barley Variety Trial

Item Type	report;article
Authors	Darby, Heather;Emick, Hillary
Download date	2026-06-16 21:25:23
Link to Item	https://hdl.handle.net/20.500.14849/6698



2021 Winter Barley Variety Trial



Dr. Heather Darby, UVM Extension Agronomist
Hillary Emick and John Bruce
UVM Extension Crop and Soil Technicians
(802) 524-6501

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

2021 WINTER BARLEY VARIETY TRIAL
Dr. Heather Darby, University of Vermont Extension
heather.darby[at]uvm.edu

With the development of a robust localvore movement and the revival of the small grains industry in the Northeast, craft breweries and distilleries have expressed an interest in sourcing local barley for malting. Malting barley must meet specific quality characteristics, such as moderate protein content and high germination rate. Winter barley has not been traditionally grown in the Northeast due to severe winterkill. However, newly developed varieties and a changing climate have encouraged our team to investigate this crop for the area. In 2020-2021, UVM Extension's Northwest Crops and Soils Program conducted a winter barley trial to evaluate the yield, quality and agronomic characteristics of malting barley varieties.

MATERIALS AND METHODS

A winter barley variety trial was initiated at Borderview Research Farm in Alburgh, VT. Winter barley was planted on 18-Sep 2020. Twenty-seven winter varieties (Table 1) were planted in a randomized complete block design with three replicates. The seedbed was prepared by conventional tillage methods. Plots were 5' x 20' and were seeded into a Benson rocky silt loam at 125 lbs ac⁻¹ with a Great Plains cone seeder. Rows were spaced at 6". All plots were managed with practices similar to those used by producers in the surrounding areas (Table 2).

Table 1. Winter malting barley varieties and seed sources.

Variety	Row Type	Seed Source
0214-007	2	Ohio State University
02WI-13	2	Ohio State University
13ARS537-13	2	USDA-ARS, Idaho
13ARS537-19	2	USDA-ARS, Idaho
13ARS537-25	2	USDA-ARS, Idaho
ARS15B12	2	USDA-ARS, North Carolina
Avalon (VA16M-81 2R)	2	Virginia Tech
Charles	2	Univ of Idaho Foundation Seed
Dementiel	6	Secobra
DH140963	2	Oregon State University
DH141132	2	Oregon State University
DH141222	2	Oregon State University
DH141225	2	Oregon State University
Endeavor	2	Univ of Idaho Foundation Seed
Flavia	2	Ackermann
Hirondella	6	Ackermann
KWS Faro	6	KWS
KWS Joyau	6	KWS
KWS Scala	2	KWS
KWS Somerset	2	KWS
NB15420	6	University of Nebraska-Lincoln

Pixel	6	Secobra
SC 31450 TH	2	Secobra
Thoroughbred	6	Virginia Tech
VA16M-84 2R	2	Virginia Tech
Visuel	6	Secobra
Wintmalt	2	Tri State Seeds

Table 2. Winter barley agronomic practices and trial information.

Trial information	Alburgh, VT Borderview Research Farm
Soil type	Benson rocky silt loam
Previous crop	corn
Seeding Rate (lbs ac⁻¹)	125
Row spacing (in)	6
Replicates	3
Planting date	18-Sep 2020
Harvest date	12-Jul 2021
Harvest area (ft)	5 x 20
Tillage operations	Fall plow, spring disk & spike tooth harrow

Winter survival was measured on 27-Apr 2021 by comparing the number of live tillers to winterkilled tillers in 2 one-foot sections of row. Heading date was recorded through the spring as the date when at least 50% of the plot had headed. Heights and lodging were recorded on 12-Jul 2021 prior to harvest. Heights were measured, excluding awns, in centimeters for three plants in each plot. Lodging was assessed by visual estimate on a scale of 0-9 where a rating of 1 meant that 1 to 10% of the plants were lodged and a rating of 9 meant that greater than 90% of the plants were lodged. Winter barley was harvested with an Almaco SPC50 small plot combine on 12-Jul 2021.

Following harvest, seed was cleaned with a small Clipper cleaner (A.T. Ferrell, Bluffton, IN). Quality measurements included standard testing parameters used by commercial malt houses. Plot yields were recorded. Harvest moisture was determined for each plot using a DICKEY-john Mini GAC moisture and test weight meter. Generally the heavier the barley is per bushel, the higher malting quality. A one-pound subsample was collected to determine quality. The samples were then ground into flour using the Perten LM3100 Laboratory Mill, and were evaluated for crude protein content using the Perten Inframatic 8600 Flour Analyzer. Falling number for all barley varieties were determined using the AACC Method 56-81B, AACC Intl., 2000 on a 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. Falling numbers greater than 350 indicate low enzymatic activity and sound quality barley. A falling number lower than 200 indicates high enzymatic activity and poor quality. Deoxynivalenol (DON) analysis was analyzed using Veratox DON 2/3 Quantitative test from the NEOGEN Corp. This test has a detection range of 0.5 to 5 ppm. DON values greater than 1 ppm are considered unsuitable for human consumption. Percent germination

(germination energy) was determined by incubating 100 seeds in 4.0 ml of water for 72 hours and counting the number of seeds that did not germinate. Each sample was run in duplicate. Grain assortment or plumpness was determined with the Pfeuffer Soritmat using 100g of clean seed, and was determined by the combining the amount of seed remaining on the 2.78mm and 2.38mm sieves.

Data was analyzed using mixed model analysis 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 when the F-test was considered significant ($p < 0.10$).

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

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

than the highest value in a particular column are indicated with an asterisk. In the accompanying 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.

RESULTS AND DISCUSSION

Seasonal precipitation and temperature recorded at a weather station in Alburgh, VT are shown in Table 3. Historical averages are for 30 years of data (1981-2010). The fall weather was overall cooler and drier than normal. The spring and summer growing season of 2021 was overall warmer and drier than normal. Over the 8 months of growing season for the winter barley, there were 5510 growing degree days, 98 more than the 30 year average, and 18.85 inches of precipitation, almost 9 inches less than normal.

Table 3. Weather data for winter barley variety trial in Alburgh, VT.

Alburgh, VT	Sep-20	Oct-20	Nov-20	Mar-21	Apr-21	May-21	Jun-21	Jul-21
Average temperature (°F)	59.2	48.3	42.0	33.2	48.1	58.4	70.3	68.1
Departure from normal	-3.53	-2.01	2.69	0.93	2.52	-0.03	2.81	-4.31
Precipitation (inches)	2.75	3.56	1.41	0.97	3.52	0.66	3.06	2.92
Departure from normal	-0.92	-0.27	-1.29	-1.27	0.45	-3.10	-1.20	-1.14
Growing Degree Days (base 32°F)	816	521	352	241	497	818	1146	1119
Departure from normal	-107	-48	117	103	85	-1	83	-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.

The variety with the best winter survival was Hirondella; 100% of the plants of this variety survived the winter without any winterkill. This was statistically similar to 18 other varieties with 85% or greater survival (Table 4). Heading dates for all varieties fell within a six day period between May 19 to May 25. The weather at heading date is often related to fusarium infection and presence of deoxynivalenol toxin, with colder, wetter weather associated with higher infection rates and higher toxin concentrations. The late May weather in 2021 was warm and dry and was not conducive to fungus growth. One rep of each variety tested for DON (data not shown). All samples tested below the detectable limit for the DON vomitoxin test (<0.5 ppm).

Table 4. Agronomic characteristics for winter barley variety trial in Alburgh, VT.

Variety	Winter survival %	Heading date	Height cm	Lodging %
0214-007	91.7*†	20-May	90.7	0.00
13AR5537-13	45.0	20-May	70.3	0.00
13AR5537-19	33.3	21-May	67.9	0.00
13AR5537-25	58.3	20-May	71.8	0.00
ARSS1SB12	51.7	21-May	87.1	0.00
Avalon	85.0*	20-May	104.0	0.00
Charles	71.7	22-May	76.8	1.33
DH140963	91.7*	23-May	85.4	0.00
DH141225	96.7*	21-May	88.9	2.67
DH141ZZZ	95.0*	23-May	87.8	2.00
DM141132	90.0*	24-May	85.2	2.00
Dementiel	93.3*	21-May	86.7	3.33
Endeavor	60.0	24-May	87.7	0.00
Flavia	91.7*	21-May	80.0	4.67
Hirondella	100.0*	24-May	90.9	8.00
KWS Faro	98.3*	19-May	87.9	6.00
KWS Joyau	91.7*	20-May	73.1	2.00
KWS Scala	90.0*	23-May	76.2	2.67
KWS Somerset	85.0*	25-May	84.6	0.00
NB15420	98.3*	19-May	109.8	8.67
OZWI-13	80.0	24-May	84.3	2.00
Pixel	96.7*	20-May	80.9	3.33
SC 31450T4	85.0*	21-May	77.1	0.67
Thoroughbred	95.0*	19-May	91.7	3.67
VA16M-84 ZR	73.3	22-May	104.3	0.00
Visual	93.3*	22-May	79.7	6.00
Wintmalt	90.0*	25-May	83.1	2.00
Trial Mean	82.7	21-May	85.0	2.26
LSD (0.10)	17.46	NS	6.17	2.59

†The top performer for each parameter/column is indicated in **bold**. Varieties with an asterisk* are statistically similar to the top performer. NS indicates that no significant difference was detected.

Heights and lodging were measured prior to harvest. Taller plants can be desirable for better competition against weeds; however, very tall plants can be prone to lodging. The tallest variety was NB15420 at 109.8 cm tall. This was statistically similar to VA16M-84 ZR and Avalon, both more than 100 cm tall. The tallest variety, NB15420 had the highest degree of lodging, with an average score of 8.67 on a scale from 0-9. This was statistically similar to Hirondezza, which although 20 cm shorter on average than NB15420, was lodged at a rate of 8 out of 9.

Table 5. Yield and quality data for winter barley variety trial in Alburgh, VT.

Variety	Yield @13.5% moisture content lbs ac ⁻¹	Moisture %	Test Weight lbs bu ⁻¹	Crude Protein @ 12% moisture content %	Falling Number seconds	Germination %	Plumpness %
0214-007	4617	12.0*†	45.4	13.7	397*	99.3*	99.3*
13AR5537-13	2505	13.0	41.6	12.5	65	85.3	97.4*
13AR5537-19	2284	15.1	46.2*	12.1	100	96.3*	96.9*
13AR5537-25	2707	13.2	43.7	12.8	82	82.0	98.1*
ARSS1SB12	3777	13.3	44.7	12.7	317	99.7*	98.8*
Avalon	2852	13.1	43.9	14.3	294	99.7*	99.3*
Charles	2749	11.7*	40.0	12.1	172	98.7*	93.0
DH140963	5089*	12.6*	43.8	11.2*	309	98.3*	99.5*
DH141225	4687	12.6*	43.8	12.0	286	100.0*	96.8*
DH141ZZZ	4522	12.2*	45.7	12.3	333	100.0*	98.1*
DM141132	4066	12.4*	42.8	11.6	341*	99.7*	98.0*
Dementiel	4575	11.8*	40.5	10.8*	345*	100.0*	89.1
Endeavor	3144	14.4	45.1	12.1	123	99.3*	94.6*
Flavia	4820	12.1*	45.7	12.6	258	99.0*	98.3*
Hirondezza	6022*	11.9*	42.6	11.9	314	99.0*	91.9
KWS Faro	5757*	12.2*	46.1*	11.1*	315	99.7*	96.9*
KWS Joyau	4427	11.9*	42.4	11.7	262	98.7*	98.3*
KWS Scala	4224	11.5*	43.5	12.3	326	98.7*	99.4*
KWS Somerset	4436	12.2*	43.0	12.4	343*	98.7*	99.6*
NB15420	3419	11.6*	38.9	12.8	381*	100.0*	63.4
OZWI-13	4058	11.6*	41.5	13.7	294	100.0*	99.2*
Pixel	5349*	12.0*	41.4	11.3*	359*	100.0*	92.0
SC 31450T4	4007	12.4*	45.4	12.7	314	99.3*	98.1*
Thoroughbred	4603	12.0*	45.5	11.3*	349*	100.0*	90.6
VA16M-84 ZR	2682	14.8	48.0*	13.4	374*	99.7*	97.2*
Visual	4218	12.0*	42.0	11.9	309	98.7*	92.1
Wintmalt	3947	12.7*	44.0	12.5	293	99.7*	99.5*
Trial Mean	4057	12.5	43.6	12.3	283	98.1	95.4
LSD (0.10)	1196	1.21	2.22	0.76	57.2	5.34	5.15

†The top performer for each parameter/column is indicated in **bold**. Varieties with an asterisk* are statistically similar to the top performer.

Winter barley yields were good, averaging over two tons per acre (Table 5). The highest yielding variety was Hirondeella, with a yield of 6022 lbs ac⁻¹. This was statistically similar to three other varieties that all averaged over 5000 lbs ac⁻¹ (KWS Faro, Pixel, and DH140963). Harvest moisture overall was low and few plots required drying down for storage. Falling number was extremely variable, ranging from 65 to 397 seconds, indicating great variability in grain maturity at harvest. Only five varieties had falling number below the desired value of 250 seconds. Most varieties were within the acceptable range for protein concentrations for malting barley, but 8 varieties had protein concentrations higher than 12.5% and higher than ideal for malting barley. Test weights were somewhat low overall, with no varieties meeting the industry standard of 50 lbs bu⁻¹. Germination was good for most varieties in the trial, with several varieties exhibiting 100% germination. Only two varieties (13AR5537-13 and 13AR5537-25) had germination rates less than 95%. Plumpness, a proxy for starch content and overall malting quality, was very good in this year's winter barley (Figure 1). All varieties except one were above the 80% industry minimum.

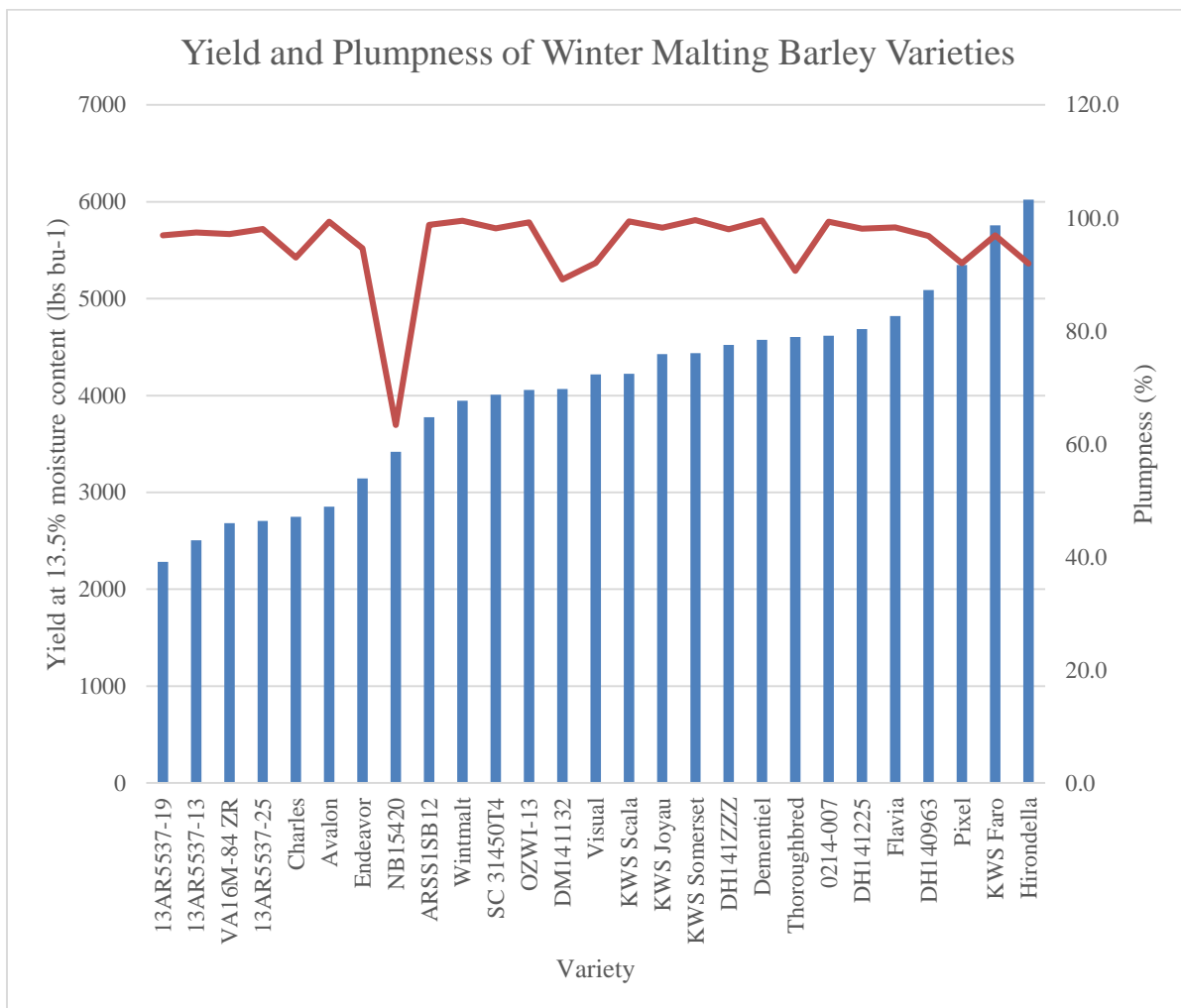


Figure 1. Yield and plumpness of winter malting barley varieties, Alburgh, Vermont

ACKNOWLEDGEMENTS

The UVM Extension Crops and Soils Team would like to thank Roger Rainville and the staff at Borderview Research Farm for their generous help with this research. We would also like to acknowledge Henry Blair, Catherine Davidson, Ivy Krezinski, Rory Malone, Lindsey Ruhl, Laura Sullivan, Sophia Wilcox Warren, and Sara Zeigler for their assistance with data collection and entry. This information is presented with the understanding that no product discrimination is intended and neither endorsement of any product mentioned, nor criticism of unnamed products, is implied.

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



Issued in furtherance of Cooperative Extension work, Acts of May 8 and June 30, 1914, in cooperation with the United States Department of Agriculture. University of Vermont Extension, Burlington, Vermont. University of Vermont Extension, and U.S. Department of Agriculture, cooperating, offer education and employment to everyone without regard to race, color, national origin, gender, religion, age, disability, political beliefs, sexual orientation, and marital or familial status.