



2023 Colored Wheat Variety Trial



Dr. Heather Darby, UVM Extension Agronomist
Hillary Emick and Gigi Walsh
UVM Extension Crops and Soil Technicians
802-524-6501

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

2023 COLORED WHEAT VARIETY TRIAL
 Dr. Heather Darby, University of Vermont Extension
 heather.darby[at]uvm.edu

There is an interest amongst bakers and the grain industry in the development of red and blue wheat crosses as a specialty grain that can be marketed in value-added products. Specialty grains can enhance local farm viability, and well as the viability of small-scale bakers and millers. Additionally, there is interest in evaluating the antioxidant capacity of colored wheats as they may have potential health benefits that could further increase their value as a specialty grain. In 2023, the University of Vermont Extension’s Northwest Crops and Soils Program evaluated the performance of twelve colored wheat crosses (Table 1) from the Washington State University wheat breeding program to examine their performance in organic production systems and to grow out seed for future variety trials and on-farm production.

MATERIALS AND METHODS

Table 1. Colored wheat varieties, 2023.

Variety	Breeding name	Mother	Father	Seed color
1000	5C14C0058	Espresso	CDC Primepurple	Red
1004	5C14C0024	Dayn	Purple La Prevision	Red
1006	5C14C0028	Purple Olympic	Edison	Red
1008	5C14C0037	Laval 19	Edison	Red
1012	5C14C0044	Edison	Sebesta Blue 3	Blue
1013	5C14C0062	6177049	UC66049	Blue
1014	5C14C0032	Gus	Sebesta Blue 3	Blue
1017	5C14C0047P	CDC Primepurple	Edison	Red
1018	6J130009	Seahawk	Sebesta Blue 3	Blue
1101	5C14C0019	Sebesta Blue 3	Dayn	Blue
1022-5	5C14C0056P	6177049	CDC Primepurple	Red
AHR-15	AHR-15	Nardo	1159.288.18b.1.2	Red

The colored wheat variety trial was carried out at Borderview Research Farm in Alburgh, VT. Plots were managed with practices similar to those used by producers in the surrounding area. The experimental plot design was a randomized complete block with four replications of twelve varieties of red or blue wheat. Varieties, parentage, and color are displayed in Table 1. Agronomic data is displayed in Table 2. The plots were seeded with a Great Plains Cone Seeder on 14-Apr at a seeding rate of 350 live seeds m⁻². Plots were 5’ x 20’. The previous crop was industrial hemp and the soil type was Benson rocky silt loam with 8 to 15 percent slopes.

Table 2. Trial agronomic information, 2022.

Trial information	Alburgh, VT Borderview Research Farm
Soil type	Benson rocky silt loam, 8-15% slopes
Previous crop	Industrial hemp
Seeding rate	350 live seeds m ⁻²
Row spacing (in)	6
Planting date	14-Apr
Harvest date	3-Aug
Harvest area (ft)	5 x 20
Tillage operations	Pottinger TerraDisc®

Plots were harvested with an Almaco SPC50 small plot combine on 3-Aug. Grain moisture, test weight, and yield were determined at harvest. A subsample was collected to determine quality characteristics. Grain quality was determined at the E. E. Cummings Crop Testing Laboratory at the University of Vermont (Burlington, Vermont). Samples were ground using the Perten LM3100 Laboratory Mill. Flour was analyzed for protein content using the Perten Inframatic 8600 Flour Analyzer. Most commercial mills target 12-15% protein content for bread wheat. Falling number was measured (AACC Method 56-81B, AACC Intl., 2000) on the Perten FN 1500 Falling Number Machine. The falling number indicates the level of enzymatic activity in the grain. 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. Falling numbers above 250 indicate low enzymatic activity and sound quality wheat. A falling number lower than 200 indicates high enzymatic activity and poor-quality wheat, typically as a result of pre-harvest sprouting damage in the grain. Falling number above 400 may retard fermentation when used for baking. Deoxynivalenol (DON), a vomitoxin, 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. Samples with DON values greater than 1 ppm are considered unsuitable for human consumption. One replicate of each variety was tested for DON and the results were all below the quantifiable level of the test (data not shown).

RESULTS

Seasonal precipitation and temperature recorded at a weather station at Borderview Research Farm are displayed below in Table 3. The growing season was cooler than normal overall, although the month of April was warmer than average. There were 3591 Growing Degree Days (GDDs) in the season, 44 growing degree days more than normal. There were 22.07 inches of precipitation, 6.92 inches more than normal.

Table 3. Temperature and precipitation summary for Alburgh, VT, 2023.

Alburgh, VT	April	May	June	July
Average temperature (°F)	48.3	57.1	65.7	72.2
Departure from normal	2.70	-1.28	-1.76	-0.24
Precipitation (inches)	4.94	1.98	4.40	10.8
Departure from normal	1.87	-1.78	0.14	6.69
Growing Degree Days (32-95°F)	524	766	1027	1274
Departure from normal	112	-53	-37	22

Based on weather data from a Davis Instruments Vantage Pro2 with WeatherLink data logger.

Historical averages are for 30 years of data provided by the NOAA (1981-2010) for Burlington, VT.

Table 4. Agronomic results for red and blue wheat varieties, Alburgh, VT, 2023.

Variety	Yield at 13.5% moisture	Harvest moisture	Test weight	Crude protein at 12% moisture	Falling number	DON
	lbs ac ⁻¹	%	lbs bu ⁻¹	%	seconds	
1000	2042*†	17.3*	52.9*	12.0	227	3.83*
1004	2006*	16.4*	54.1*	11.8	266*	3.60*
1006	1828	16.6*	49.3	11.8	224	3.97*
1008	2200*	16.8*	48.7	11.4	214	4.10*
1012	1162	20.0	42.4	11.3	139	6.10
1013	1516	18.2	46.4	11.6	264	5.63
1014	1112	19.6	43.0	11.8	234	5.07
1017	1417	17.8	49.2	12.6*	275*	2.90*
1018	1272	18.9	43.9	10.5	160	7.57
1022-5	1925*	18.0	46.9	11.8	207	6.70
1101	1691	17.5*	46.6	11.7	194	5.00
AHR-15	1518	18.6	47.6	12.3*	293*	4.63*
LSD (p=0.10)	301	1.12	1.71	0.54	27.8	1.76
Trial Mean	1641	18.0	47.6	11.7	225	4.93

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

The variety 1008, a red wheat, had the highest yield at 2200 lbs ac⁻¹ (Table 4, Figure 1). This was statistically similar to 1000, 1004, and 1022-5. The variety 1004, a red wheat, had the highest test weight at 54.1 lbs bu⁻¹ and was statistically similar to 1000, the only two varieties over 50 lbs bu⁻¹. Harvest moisture below 14% is desirable for grain storage. Grain above this moisture content has to be dried down after harvest, adding time and cost to farmers. None of the varieties had a grain moisture lower than 14%.

The highest protein concentration (12.6%) was 1017, a red wheat. All varieties had acceptable protein with most in the ideal range. All varieties tested well above the threshold for human consumption for DON of 1 ppm. The highest falling number was AHR-15, at 293 seconds. This was similar to 1004 and 1017. One variety had both yield above the trial average of 1793 lbs ac⁻¹ and falling number above 250 seconds: 1004 (Figure 1).

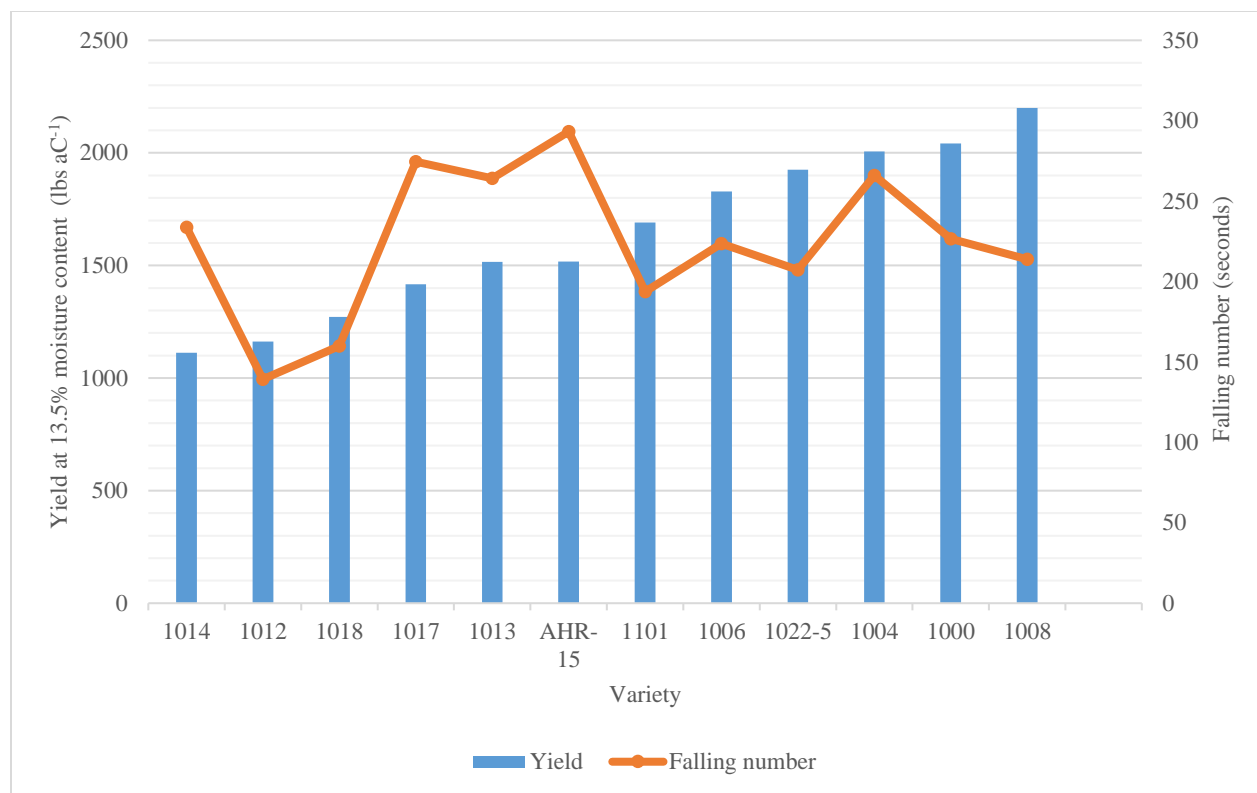


Figure 1. Yield and falling number for red and blue wheat varieties, 2023.

The 2023 growing season was challenging for both wheat growth and harvest timing, leading to lower yields, higher harvest moisture, higher DON, and lower falling number than ideal in most of these varieties. We will continue this research in 2024.

ACKNOWLEDGEMENTS

The UVM Extension Northwest Crops and Soils Team would like to thank Roger Rainville and the staff at Borderview Research Farm. Would also like to thank Dr. Stephen Jones and the Washington State University Bread Lab for providing seed. Thanks to John Bruce, Hillary Emick, Ivy Krezinski, Andrea Rainville, Lindsey Ruhl, Laura Sullivan, and Sara Ziegler 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.