



2022 Colored Wheat Variety Trial



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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 2022, the University of Vermont Extension's Northwest Crops and Soils Program began evaluating the performance of twelve colored wheat crosses (Table 1) from the Washington State University wheat breeding program in order to examine their performance in organic production systems and to grow out seed for future variety trials and on-farm production. This research was continued in 2023.

MATERIALS AND METHODS

Table 1. Colored wheat varieties, 2022.

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 25-Apr at a seeding rate of 350 live seeds m⁻². Plots were 5' x 20'. The previous crop was milkweed 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	Milkweed
Seeding rate	350 live seeds m ⁻²
Row spacing (in)	6
Planting date	25-Apr
Harvest date	10-Aug
Harvest area (ft)	5 x 20
Tillage operations	Pottinger TerraDisc®

Plots were harvested with an Almaco SPC50 small plot combine on 10-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). Seed was cleaned by hand in the laboratory prior to analysis. 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 May was warmer than average. There were 3510 Growing Degree Days (GDDs) in the season, 36 growing degree days less than normal. There were 20.1 inches of precipitation, 4.97 inches more than normal.

Table 3. Temperature and precipitation summary for Alburgh, VT, 2022.

Alburgh, VT	April	May	June	July
Average temperature (°F)	44.8	60.5	65.3	71.9
Departure from normal	-0.81	2.09	-2.18	-0.54
Precipitation (inches)	5.57	3.36	8.19	3.00
Departure from normal	2.50	-0.40	3.93	-1.06
Growing Degree Days (32-95°F)	391	883	1000	1236
Departure from normal	-20	65	-64	-17

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, 2022.

Variety	Yield at 13.5% moisture	Harvest moisture	Test weight	Crude protein at 12% moisture	Falling number
	lbs ac ⁻¹	%	lbs bu ⁻¹	%	seconds
1000	1673	22.5*	42.2	11.7*	271*
1004	1365	22.2*	50.6*	12.8*	335*
1006	1230	20.7*	45.5*	11.3	325*
1008	2499	22.4*	43.1*	12.0*	276*
1012	2096	19.7*	42.3	11.9*	156
1013	2452	21.3*	45.0*	11.3*	278*
1014	1279	24.8	40.0	11.5*	313*
1017	1745	21.3*	44.1*	12.5*	296*
1018	2254	20.3*	43.4*	10.9	207
1022-5	1696	15.7*	37.1	11.6*	225
1101	2273	18.8*	45.0*	11.1	197
AHR-15	1765	31.2	35.1	13.3*	320*
p-value	0.110	0.013	0.0008	0.013	0.0001
Trial Mean	1793	21.7	43.6	11.8	274

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

NS indicates that there was no statistical difference between varieties.

1008, a red wheat, had the highest yield at 2499 lbs bu⁻¹ (Table 4, Figure 1). However, it was not statistically different from the other varieties. 1004, a red wheat, had the highest test weight at 50.6 lbs bu⁻¹ and was statistically similar to six other varieties. 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%, with 1022-5 having the lowest moisture of 15.7%. Only one variety, AHR-15, was not statistically similar to 1022-5, and had a high moisture level of 31.2%.

The highest protein concentration (13.3%) was AHR-15, a red wheat, and was statistically similar to all other varieties except for 1006, 1018, and 1101. All varieties had acceptable protein for baking. The highest falling number was AHR-15, at 335 seconds. This was similar to seven other varieties with a falling number

over 250 seconds. Two varieties had both yields above the trial average of 1793 lbs ac⁻¹ and falling numbers above 250 seconds: 1008 and 1013 (Figure 1). One replicate of each variety was tested for DON and the results were all below the quantifiable level of the test (data not shown). We plan to continue this research and to grow out seed for these varieties in 2023.

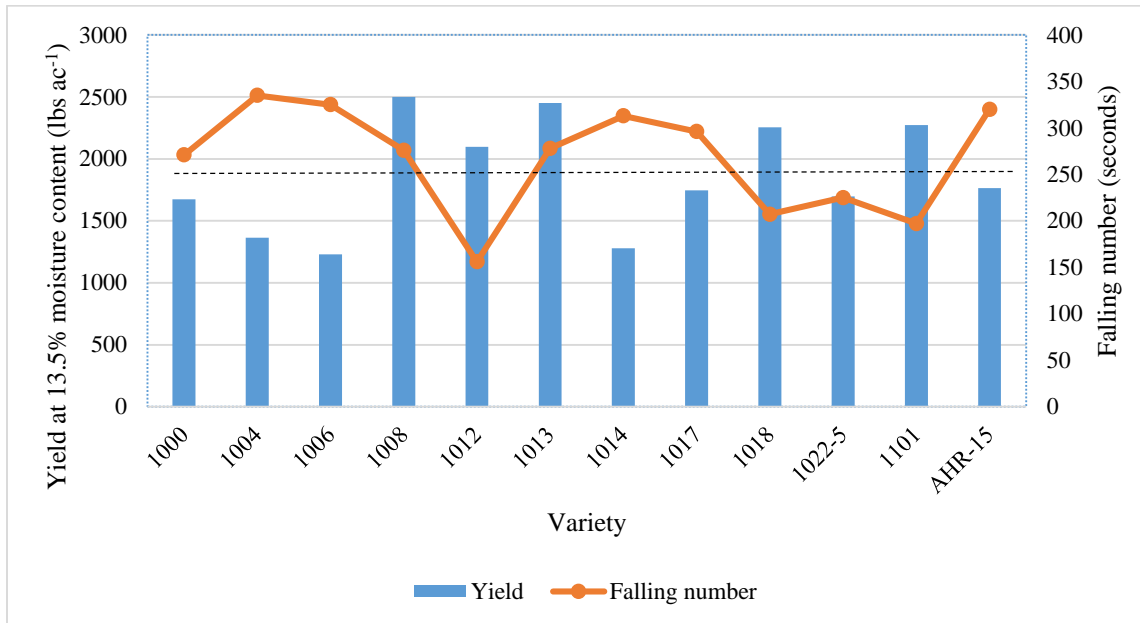


Figure 1. Yield and falling number for red and blue wheat varieties, 2022. Dashed line indicates acceptable falling number of 250 seconds.

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