



2021 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 2019, the University of Vermont Extension’s Northwest Crops and Soils Program began evaluating the performance of twelve new 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 2021.

MATERIALS AND METHODS

Table 1. Colored wheat varieties, 2021.

| 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 with the harvest results in Table 1. Agronomic data is displayed in Table 2. The plots were seeded with a Great Plains Cone Seeder on 9-Apr at a seeding rate of 350 live seeds m². Plots were 5’ x 20’. The previous crop was soybeans and the soil type was Benson rocky silt loam with 8 to 15 percent slopes.

Table 2. Trial agronomic information, 2021.

| Trial information | Alburgh, VT Borderview Research Farm |
|---------------------------|---|
| Soil type | Benson rocky silt loam, 8-15% slopes |
| Previous crop | Soybeans |
| Seeding rate | 350 live seeds m ⁻² |
| Row spacing (in) | 6 |
| Planting date | 9-Apr |
| Harvest date | 27-Jul |
| Harvest area (ft) | 5 x 20 |
| Tillage operations | Spring disk & spike tooth harrow |

Heading date was collected through the month of June, recorded as the date when more than 50% of the plot was headed out. Plots were harvested with an Almaco SPC50 small plot combine on 27-Jul. 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 warmer than normal overall although the month of July was cooler than average. There were a surplus of growing degree days early in the season and a deficit in July, resulting in a season just 36 growing degree days (GDDs) above normal. There were 4.99 inches less precipitation than normal. Thunderstorms through late July resulted in less than ideal harvest timing, affecting both harvest moisture and falling number (Table 4).

Table 3. Seasonal weather data collected in Alburgh, VT, 2020-2021.

| | 2021 | | | |
|--------------------------------|------|-------|-------|-------|
| | Apr | May | Jun | Jul |
| Average temperature (°F) | 48.1 | 58.4 | 70.3 | 68.1 |
| Departure from normal | 2.52 | -0.03 | 2.81 | -4.37 |
| Precipitation (inches) | 3.52 | 0.66 | 3.06 | 2.92 |
| Departure from normal | 0.45 | -3.10 | -1.20 | -1.14 |
| Growing Degree Days (32°-95°F) | 497 | 818 | 1149 | 1301 |
| Departure from normal | 85 | -1 | 86 | 101 |

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) for Burlington, VT.

Table 4. Agronomic results for red and blue wheat varieties, Alburgh, VT, 2021.

| Variety | Heading date | Yield at 13.5% moisture | Harvest moisture | Test weight | Protein at 12% moisture | Falling number |
|------------|--------------|-------------------------|------------------|----------------------|-------------------------|----------------|
| | | lbs ac ⁻¹ | % | lbs bu ⁻¹ | % | seconds |
| 1000 | 9-Jun | 1207* | 24.9 | 44.7 | 13.1 | 234 |
| 1004 | 9-Jun | 956 | 22.1 | 48.5 | 14.9 | 243 |
| 1006 | 12-Jun | 641 | 20.3 | 46.1 | 13.4 | 288* |
| 1008 | 10-Jun | 1470* | 23.8 | 44.8 | 12.8 | 304* |
| 1012 | 11-Jun | 856 | 22.5 | 44.0 | 12.5 | 210 |
| 1013 | 11-Jun | 913 | 21.8 | 46.8 | 13.0 | 196 |
| 1014 | 14-Jun | 778 | 24.6 | 42.8 | 13.0 | 229 |
| 1017 | 15-Jun | 513 | 25.6 | 42.7 | 12.5 | 308* |
| 1018 | 10-Jun | 1499* | 21.8 | 46.2 | 11.6 | 176 |
| 1022-5 | 8-Jun | 734 | 23.1 | 43.9 | 12.4 | 258* |
| 1101 | 9-Jun | 1647* | 24.7 | 42.7 | 13.3 | 186 |
| AHR-15 | 15-Jun | 1178* | 26.7 | 41.9 | 12.8 | 320* |
| LSD (0.10) | NS | 615 | - | - | 0.76 | 54.5 |
| Trial Mean | 11-Jun | 1033 | 23.5 | 44.6 | 12.9 | 246 |

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.

1101, a blue wheat, had the highest yield at 1647 lbs bu⁻¹ (Table 4, Figure 1). This was statistically similar to four other varieties that yielded over 1100 lbs bu⁻¹. All varieties had very high moisture at harvest. Many replicates had moisture content too high for the meter to record moisture or test weight. There were too few replicates within the calibration to run statistical analysis on this data. All varieties had at least one replicate with test weight and moisture data available, and averages of available data are displayed for each variety.

The highest protein concentration (14.9%) was 1004, a red wheat. No other varieties were statistically similar. All varieties had acceptable protein for baking. The highest falling number was AHR-15, a red wheat, at 320 seconds. This was similar to four other varieties with a falling number over 250 seconds. Two varieties had both yields above the trial average of 1033 lbs bu⁻¹ and falling numbers above 250 seconds: AHR-15 and 1008 (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 2022.

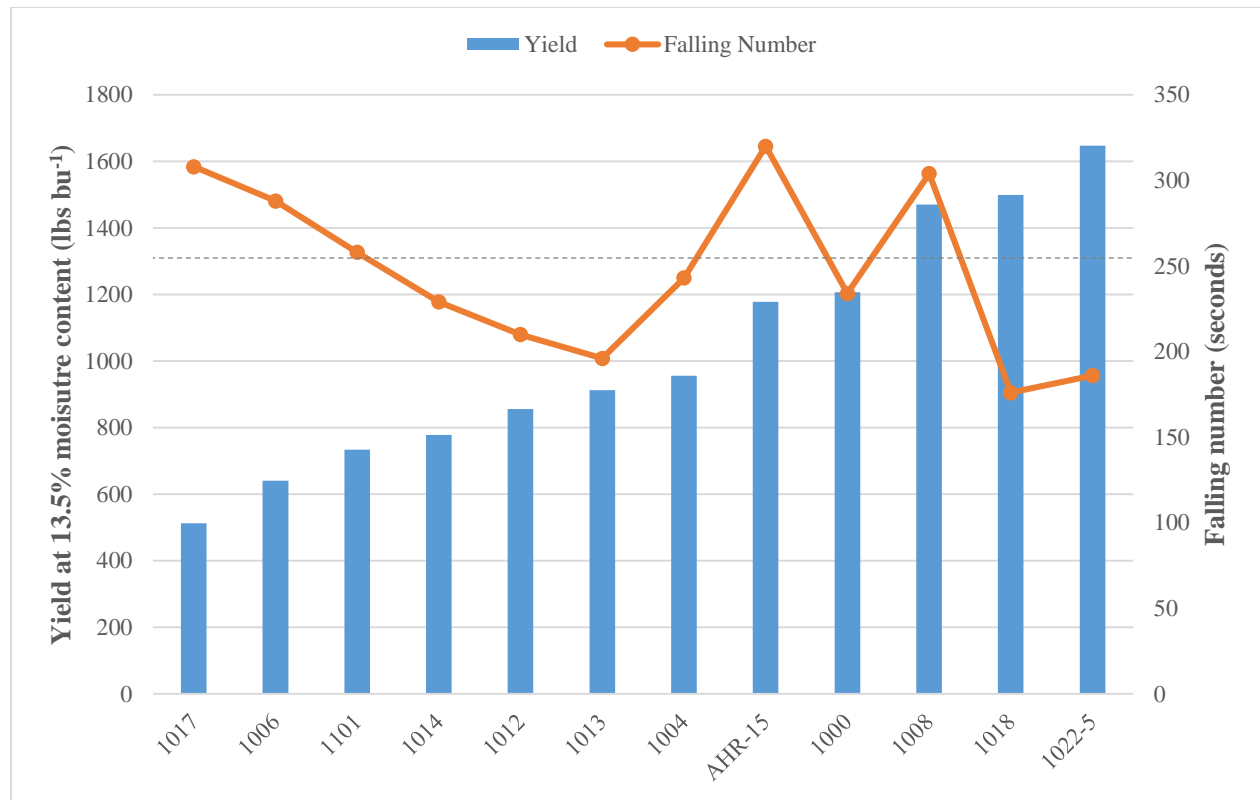


Figure 1. Yield and falling number for red and blue wheat varieties, 2021. Dashed line indicates acceptable falling number of 250 seconds.

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