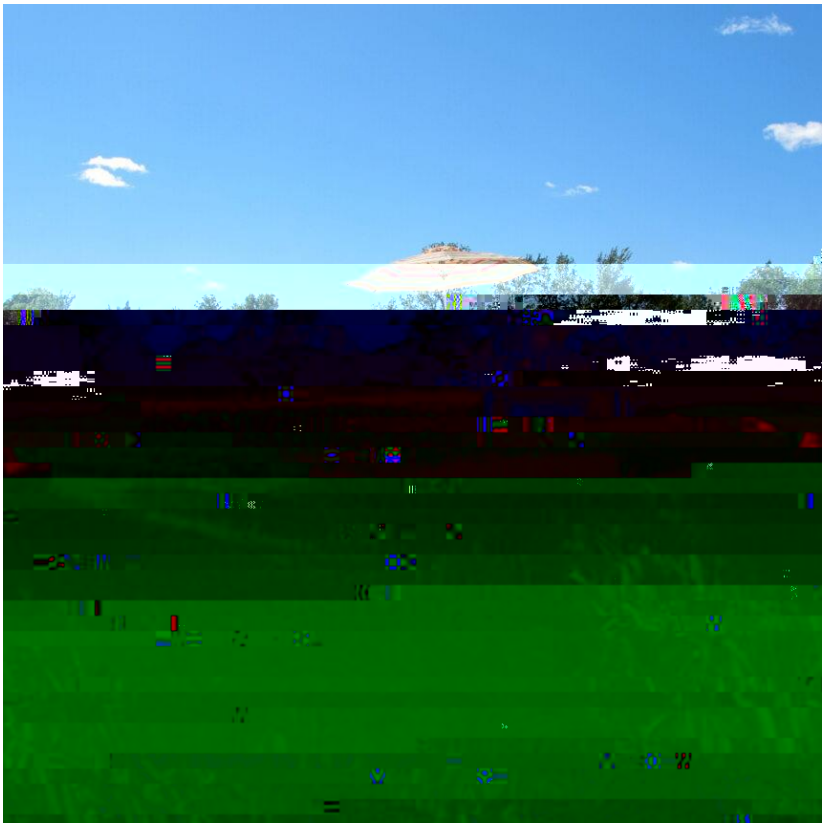
2023 Organic Spring Wheat Variety Trial



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in centimeters, including the head but excluding the awns. Lodging was assessed visually and recorded as the percentage of each plot that was too lodged to be harvested.

Plots were harvested with an Almaco SPC50 small plot combine on 6-Aug. Grain moisture, test weight, and yield were determined at harvest. Seed was cleaned with a small Clipper M2B cleaner (A.T. Ferrell, Bluffton, IN) and 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). Grains were analyzed for protein and starch content using the Perten Inframatic 9500 Grain Analyzer. Samples were ground using the Perten LM3100 Laboratory Mill. 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. An ideal falling number range is between 250-350, which indicates 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 indicates very low enzymatic activity, which can inhibit fermentation but can be suitable for baking with the addition of malt extract. 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.

Varietal characteristics were analyzed using mixed model analysis using the mixed procedure of SAS (SAS Institute, 1999). Replications within the trial were treated as random effects, and treatments were treated as fixed. Treatment 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 than the highest value in a particular column are indicated with an asterisk. In this 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.

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

RESULTS

Seasonal precipitation and temperature recorded at a weather station at Borderview Research Farm are displayed below in Table 3. Weather data were recorded with a Davis Instrument Vantage Pro2 weather station, equipped with a WeatherLink data logger. The growing season was cooler and much wetter than normal. Between April and August, over 28 inches of rain fell at the farm, 9.65 inches more than the 30 year average. There were 4441 Growing Degree Days (GDDs) accumulated, 304 days less than normal. These cool, wet conditions were challenging for grain growth and harvest timing.

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

Alburgh, VT	April	May	June	July	August
Average temperature (°F)	48.3	57.1	65.7	72.2	67.0
Departure from normal	2.70	-1.28	-1.76	-0.24	-3.73
Precipitation (inches)	4.94	1.98	4.40	10.8	6.27
Departure from normal	1.87	-1.78	0.14	6.69	2.73

Moisture content in grain must be under 14% for storage to prevent spoilage. Although the average moisture content of a few varieties were less than 14%, the overwhelming majority of varieties tested over 14% moisture content and all were dried

MS Barracuda	15.1	58.8	221	1.60*
ND Vitpro	14.8	59.2	263	1.33*
Oland	14.7	58.6	168	4.77
Pokona	14.1	59.3	313	1.33*
Prevail	14.5	59.6	295	1.93*
Prosper	14.2	60.8*	257	3.33
Raven	13.5*	59.5	**410***	1.15*
Red Fife	15.1	58.2	189	4.57
Rocket	**13.2***	60.0*	282	3.07
Rouge de Bordeaux	14.9	58.5	257	3.10
Sabin	15.1	58.0	337	1.40*
Shelly	14.2	59.8	284	2.27
Tom	14.2	**60.8***	304	2.20*
Torgy	15.3	58.6	273	1.37*
Wilkin	14.2	60.3*	339	**0.70***
Adirondack Kelse/AC Walton	14.0	58.7	253	2.53
Adirondack Kelse/Helios	14.1	59.6	239	2.10*
Butterworks Kelse/AC Walton	14.9	58.1	280	3.17
Grange Corner Faller/Tigre	14.2	59.0	278	3.53
LSD (p=0.10)	0.75	0.88	44.2	1.52
Trial mean	15.8	52.8	278	2.33

†Within a column, values labeled with an asterisk (*) were not statistically different from the top performer in **bold** (p=0.10).

The ideal range for wheat falling numbers is 250-350. Falling number below 250 has a negative impact on bread quality and might lead to lower prices paid for the wheat or possible rejection at the mill. High falling numbers, over 400 seconds, can potentially lead to slower fermentation, poorer loaf volume, and drier bread texture, depending on the end product. A majority of the varieties had falling number within the ideal range of 250-350 seconds. Eleven varieties below 250 seconds including, Adirondack Kelse/Helios, LCS Rebel, LNR-13-0627, LCS Albany, Camero, MS Barracuda, Glenn, LCS Breakaway, LCS Anchor, Red Fife and Oland. Two varieties were above 350 seconds – Raven and Magog.

There was considerable variation in DON concentrations, ranging from 0.70 – 4.77 ppm. The FDA threshold for human consumption is 1 ppm. The DON vomitoxin is caused by infection with the *Fusarium graminearum* fungus, also known as *Fusarium* head blight (FHB). Fungicides are only somewhat effective in preventing infection and toxin development, so choosing a resistant variety is very important in producing high-quality grain that is fit for human consumption. Two varieties were below the 1 ppm threshold established by the FDA: Wilkin with 0.70 ppm and LNR-13-0627 with 0.97 ppm. These were statistically similar to 20 other varieties with DON concentrations at 2.20 ppm or lower.

DISCUSSION

There is often inverse relationship between yield and crude protein concentration, with higher yields tending to correlate with lower protein concentrations. This year's variety trial had much lower average yields than

the last five years of spring wheat variety trials but higher average protein concentrations (Tables 4 & 5, Figure 1). Unfortunately, almost all varieties had DON concentrations above the 1 ppm threshold for human consumption.

The 2023 growing season was slightly cooler and significantly wetter than the 30-year average. Heavy rainfall through the flowering period when wheat is susceptible to FHB infection and through the harvest season resulted in issues with FHB and harvest timing, leading to unacceptable DON concentrations in most varieties and unacceptable falling number in several varieties.

It is important to note that this only represents one year of data. It is important as farmers make variety selections to evaluate data from multiple years and from test sites that are as similar to their region as possible. Wheat is generally considered a specialty crop in the Northeast and it is recommended growers consider quality standards and post-harvest handling requirements, and communicate with potential buyers during variety selection and prior to planting large acreage of grain.

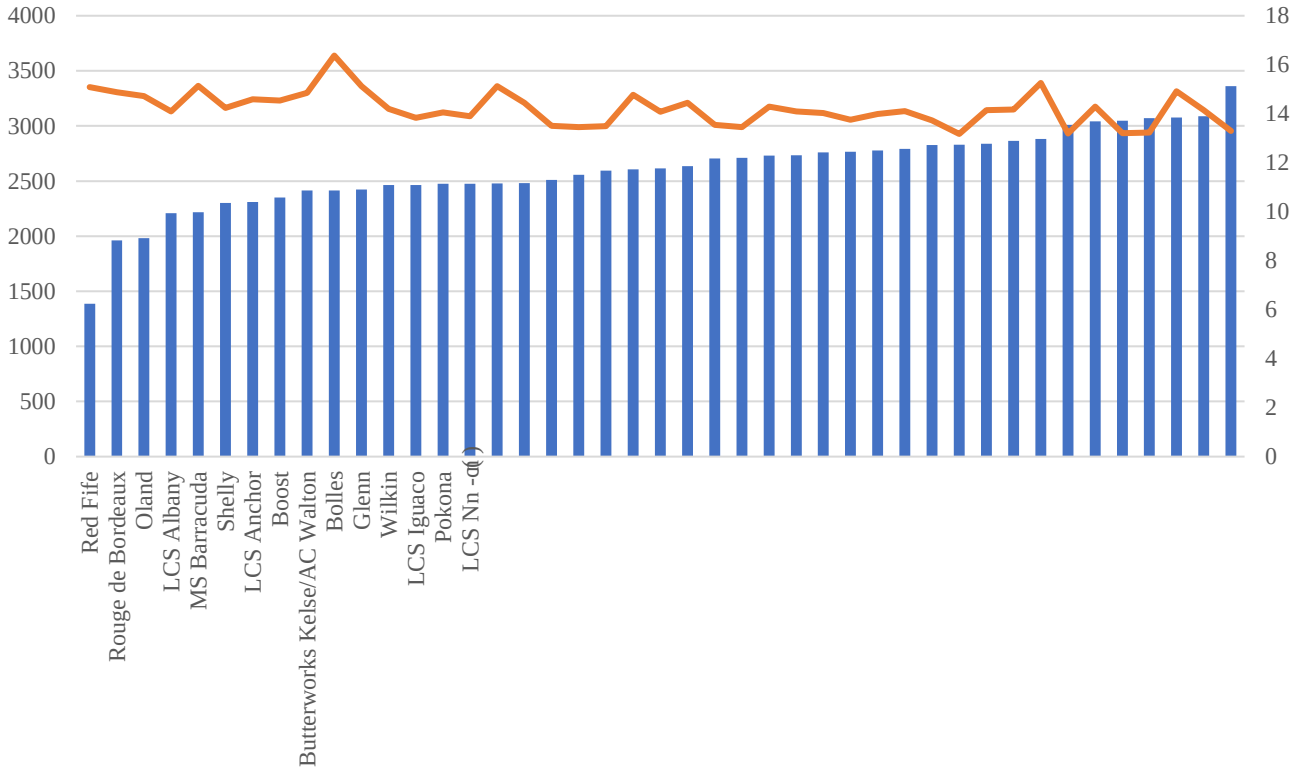

Figure 1. Yield and crude protein content of 43 spring wheat varieties, Alburgh, VT, 2023.