NORTHWEST CROPS & SOILS PROGRAM

2020 Spelt Variety Trial

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THE UNIVERSITY OF VERMONT EXTENSION

2020 SPELT VARIETY TRIAL

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Spelt (*triticum spelta*) is an ancient grain that is closely related to common wheat (*triticum aestivum).* It was one of the earliest domesticated grains. It has become popular as a health food in Europe, where it is also known as dinkel in Germany and Austria or farro in Italy. It is used as a whole grain in many cooked dishes and spelt flour can be substituted for wheat flour in baking. Spelt has a distinctive nutty flavor and is higher in fiber than wheat. Spelt also has a more digestible form of gluten than wheat, giving it potential as a flour for gluten-sensitive individuals. Its popularity in Europe and potential dietary benefits are leading to increased interest in using and producing spelt in the U.S. Because it is a hulled grain, spelt must be dehulled prior to human consumption, which is an additional processing step requiring specialized equipment. In 2020, the University of Vermont Extension Northwest Crops and Soils Program evaluated five varieties of heirloom winter spelt, planted in September 2019, in hopes of identifying a variety well suited for the Northeast climate. The trial was established at the Borderview Research Farm in Alburgh, Vermont.

MATERIALS AND METHODS

The experimental plot design was a randomized complete block with four replications (Table 2). Treatments were six spelt varieties, which are listed in Table 1 with seed sources.

Table 1. Six spelt varieties trialed in Alburgh, VT, 2020.

Spring wheat varieties	Seed source
Altgold	USDA Small Grains Collection
Guggisberg	USDA Small Grains Collection
Muri Rotkorn	USDA Small Grains Collection
Pfaelzer Dinkel	Gutenberg University in Mainz, Germany
Rothenburger Rotkorn	USDA Small Grains Collection

The seedbed in Alburgh was prepared by conventional tillage methods. All plots were managed with practices similar to those used by producers in the surrounding areas (Table 2). The field site was previously sod. The area was disked and spike toothed harrowed to prepare for planting. The plots were seeded with a Great Plains NT60 Cone seeder on 20-Sep 2019 at a seeding rate of 350 live seeds per m^2 in a plot size of 5’ x 20’.

Table 2. General plot management of the winter spelt variety trial, 2020.

Location:	Borderview Research Farm Alburgh VT
Soil type	Benson rocky silt loam
Previous crop	Sod
Row spacing (in)	6
Seeding rate (lbs ac^{-1})	350 live seeds per m^2
Replicates	4
Planting date	20-Sep 2019
Harvest date	16-Jul 2020
Harvest area (ft)	5 x 20
Tillage operations	Fall plow, spring disk & spike tooth harrow

Grain plots were harvested with an Almaco SPC50 plot combine on 16-Jul 2020. The harvest area was 5' x 20'. Prior to harvest, plant heights and lodging were measured excluding the awns. The height of three plants per plot were measured in centimeters. Grain yield, test weight, and moisture were determined at harvest. Grain quality was determined at UVM Extension's Northwest Crop and Soils Quality Testing Laboratory (Burlington, Vermont). Samples were ground using the Perten LM3100 Laboratory Mill. Flour was analyzed for protein content using the Perten Inframatic 8600 Flour Analyzer. Falling number was measured (AACC Method 56-81B, AACC Intl., 2000) on the Perten FN 1500 Falling Number Machine. Deoxynivalenol (DON), a vomitoxin, was analyzed using Veratox DON 5/5 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 sample of each variety was run.

Variations in yield and quality can occur because of variations in genetics, soil, weather, and other growing conditions. Statistical analysis makes it possible to determine whether a difference among varieties is real or whether it might have occurred due to other variations in the field. Data were analyzed using a general linear model procedure of SAS (SAS Institute, 2008). Replications were treated as random effects, and treatments were treated as fixed. Mean comparisons were made using the Least Significant Difference (LSD) procedure where the F-test was considered significant, at $p<0.10$.

At the bottom of each table a LSD value is presented for each variable (e.g. yield). Least Significant Differences at the 10% level of probability are shown. Where the difference between two varieties 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 varieties. In this example, variety A is significantly different from variety C, but not from variety B. The difference between A and B is equal to 725, which is less than the LSD value of 889. This means that these varieties did not differ in yield. The difference between A and C is equal to 1454, which is greater than the LSD value of 889. This means that the yields of these varieties were significantly different from one another. The letters 'a' and 'b' indicate which varieties are statistically similar to each other in terms of yield; variety B is similar to both varieties A and C, but variety A and C are not statistically similar to each other.

Variety	**Yield**
A	3161^{b}
B	3886^{ab}
C	**4615^{a}**
LSD	**889**

RESULTS

Seasonal precipitation and temperature recorded at Borderview Research Farm in Alburgh, VT are displayed in Table 3. The winter temperatures were warmer than average, leading to strong winter survival. A cooler than average spring but warmer and drier summer led to 3433 Growing Degree Days (GDDs) accumulated April to July, which was 55 GDDs above the 30-year average. Precipitation from April to July was 3.81 inches below normal. Overall, precipitation across the entire growing season from September to July, was 1.61 inches below average.

Table 3. Seasonal weather data collected in Alburgh, VT, 2019-2020.

	2019				2020						
	Sep	**Oct**	**Nov**	**Dec**	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**
Average temperature (°F)	60.0	50.4	31.2	26.0	23.5	21.8	35.0	41.6	56.1	66.9	74.8
Departure from normal	-0.51	2.32	-6.76	0.46	4.62	0.41	3.94	-3.19	-0.44	1.08	4.17
Precipitation (inches)	3.87	6.32	2.38	1.29	2.63	1.19	2.79	2.09	2.35	1.86	3.94
Departure from normal	0.21	2.76	-0.74	-1.06	0.63	-0.53	0.57	-0.72	-1.04	-1.77	-0.28
Growing Degree Days (32°-95°F)	840	571	128	67	37	48	193	315	746	1046	1326
Departure from normal	-15	58	-122	-13	-12	-8	27	-99	-13	35	132

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.

During the 2020 growing season, several observations and measurements were recorded during harvest of the five spelt varieties. Height and yield are shown in Table 4. The tallest variety was Guggisberg at 128 cm. The variety that yielded the highest was Pfaelzer Dinkel producing 4343 lbs ac^{-1}, with only Altgold being statistically similar. Altgold had the highest test weight, 29.5 lbs bu^{-1}, with Rothenburger Rotkorn statistically similar. Very little lodging was observed in the field (data not shown).

Table 4. Results of the six spelt varieties, Alburgh, VT, 2020.

Variety	Yield @ harvest moisture	Height	Grain moisture	Test weight
	lbs ac^{-1}	cm	%	lbs bu^{-1}
Altgold	4182 ^{ab†}	124 ^{bc}	12.7 ^{a}	29.5 ^{a}
Guggisberg	3722 ^{bc}	128 ^{a}	11.9 ^{b}	28.5 ^{b}
Muri Rotkorn	3247 ^{c}	126 ^{ab}	11.8 ^{b}	28.1 ^{b}
Pfaelzer Dinkel	4343 ^{a}	125 ^{ab}	12.2 ^{ab}	28.3 ^{b}
Rothenburger Rotkorn	3595 ^{bc}	122 ^{c}	11.9 ^{b}	28.7^{ab}
LSD (p= 0.10) ‡	609	3.03	0.59	0.96
Trial Mean	3817	125	12.1	28.6

†Within a column, treatments marked with the same letter were statistically similar (p=0.10).
‡LSD –Least significant difference at p=0.10.

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. All spelt varieties tested well below the 14% moisture threshold and did not require additional drying. Muri Rotkorn had the lowest harvest moisture at 11.75%. Test weight is the measure of grain density, which is determined by weighing a known volume of grain. Industry standard for hulled spelt is 40 lbs bu^{-1}. It is important to note that test weight, crude protein and falling number for spelt in this trial was measured on unhulled grain. Altgold had the highest test weight at 29.5 lbs bu^{-1}.

Grain quality was analyzed for protein and falling number, results are shown in Table 5. Rothenburger Rotkorn had the highest crude protein at 9.94%, adjusted for a 12% grain moisture basis. All varieties except for Pfaelzer Dinkel were statistically similar. The falling number measures viscosity which is an indicator 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 are best understood for wheat, in which case values between 300-350 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. This is most common if there are rain events as the grain is ripening prior to harvest. All varieties except for Ruthenburger Rotkorn had statistically similar falling numbers. It is important to note, as mentioned previously, that these analyses were conducted on unhulled grain. If the grain were hulled prior to analysis, the protein and falling number values would both likely be higher than these figures show. For this reason, a top performing variety was not identified in the Table 5.

Table 5: Results of the six spelt varieties, Alburgh, VT, 2020.

Variety	Crude protein at 12% moisture	Falling number
	%	seconds
Altgold	9.40 [ab]†	240 [a]
Guggisberg	9.60 [a]	256 [a]
Muri Rotkorn	9.61 [a]	243 [a]
Pfaelzer Dinkel	8.59 [b]	250 [a]
Rothenburger Rotkorn	9.94 [a]	188 [b]
LSD (0.10) ‡	0.93	40
Trial Mean	9.43	235

†Within a column, treatments marked with the same letter were statistically similar (p=0.10).
‡LSD –Least significant difference at p=0.10.

One replicate per variety was tested for deoxynivalenol (DON) vomitoxin, and all were below the FDA threshold of 1 ppm which is considered safe for human consumption (data not shown).

DISCUSSION

It is important to remember that the results only represent one year of data and more research is needed to know which varieties will thrive in the Northeastern climate and fluctuating weather. More information is needed to better understand quality standards for spelt, including test weight, protein and falling number in order to evaluate for potential end-use performance. When viewing data consider if the measurements for spelt are recorded using hulled or unhulled grain, as this can significantly affect the measurements. Spelt may have potential as a specialty grain crop for farmers in the Northeast. Because additional processing is required (dehulling) before it is suitable for human consumption, and existing markets may still be limited, it is important to communicate with potential buyers prior to planting spelt.

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