

NORTHWEST CROPS & SOILS PROGRAM



2022 Spelt Variety Trial



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2022 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 2022, the University of Vermont Extension Northwest Crops and Soils Program evaluated eleven varieties of heirloom winter spelt, planted in September 2021, in hopes of identifying varieties 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 eleven spelt varieties, which are listed in Table 1 with seed sources.

Table 1. Eleven spelt varieties trialed in Alburgh, VT, 2022.

Spring wheat varieties	Seed source
Altgold	USDA Small Grains Collection
Comet	French's Hybrids, Inc
Eluma River	
Guggisberg	USDA Small Grains Collection
Maverick	French's Hybrids, Inc.
Muri Rotkorn	USDA Small Grains Collection
Oberkulmer	King's AgriSeeds
Pfaelzer Dinkel	Gutenberg University in Mainz, Germany
Rothenburger Rotkorn	USDA Small Grains Collection
Sonic	French's Hybrids, Inc.
Sungold	French's Hybrids, Inc.

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 prepared for planting with a Pottinger TerraDisc. The plots were seeded with a Great Plains NT60 Cone seeder on 23-Sep 2021 at a seeding rate of 350 live seeds per m² in a plot size of 5' x 20'. The trial was scouted for arthropod pest damage and plant diseases on 14-Jun 2022. Five plants from each plot were evaluated. The top two leaves were examined and evaluated for the presence of disease and arthropod damage. The Clive James, 'An Illustrated Series of Assessment Keys for Plant Diseases, Their Preparation and Usage' was used to identify and determine the

severity of plant disease symptoms. Data was recorded as a percent of the leaf surface that was affected by each foliar symptom.

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	23-Sep 2021
Harvest date	20-Jul 2022
Harvest area (ft)	5 x 20
Tillage operations	Pottinger TerraDisc

Grain plots were harvested with an Almaco SPC50 plot combine on 20-Jul 2022. The harvest area was 5' x 20'. Prior to harvest, plant heights and lodging were recorded. The height of three plants per plot were measured in centimeters excluding the awns. Lodging was visually estimated as the percentage of each plot that was too lodged to be harvested. Grain yield and moisture were determined at harvest. The spelt grain was dehulled with a Trumpet Abrasion Dehuller. Following dehulling, test weight was taken on the dehulled spelt grain. 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. 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 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 sample of each variety was run and all tested below the quantifiable limit for the test (data not shown).

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

Variety	Yield
A	3161
B	3886*
C	4615*
LSD	889

from one another. The asterisk indicates that variety B was not significantly lower than the top yielding variety.

RESULTS

Seasonal precipitation and temperature recorded at Borderview Research Farm in Alburgh, VT are displayed in Table 3. The average fall temperature (Sep-21 to Nov-21) was 51.8° F, which was 3.03° F warmer than the 30-year normal. The average temperature from Mar 2022 to Jul 022 was 1.44° F cooler than the 30-year normal. This growing season was wetter than past years with a total precipitation of 22.6 inches from Mar 2022 to Jul 2022. From Sep 2021 to Jul 2022, there were 5546 Growing Degree Days (GDDs), which is consistent with historical means GDD trends over the last 30 years.

Table 3. Weather data for winter barley variety trial in Alburgh, VT.

Alburgh, VT	Sep-21	Oct-21	Nov-21	Mar-22	Apr-22	May-22	Jun-22	Jul-22
Average temperature (°F)	63.1	54.6	37.6	32.3	44.8	60.5	65.3	71.9
Departure from normal	0.40	4.31	-1.68	-0.03	-0.81	2.09	-2.18	-0.54
Precipitation (inches)	4.49	6.23	2.26	2.52	5.57	3.36	8.19	3.00
Departure from normal	0.82	2.40	-0.44	0.28	2.50	-0.40	3.93	-1.06
Growing Degree Days (base 32°F)	933	701	232	170	391	883	1000	1236
Departure from normal	11.0	133	-3.00	32.0	-20.0	65.0	-64.0	-17.0

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 2022 growing season, several observations and measurements were recorded before and during harvest of the eleven spelt varieties. Pre-harvest data (heights, lodging, and disease/arthropod scouting) are shown in Table 4. The tallest variety was Guggisberg at 136 cm, however all other varieties were statistically similar to this height. Sungold had the lowest lodging at 0%, which was statistically similar to all other varieties except for Guggisberg, Maverick, and Sonic. The most prevalent disease found in the trial was mosaic virus, with all varieties being affected by this virus. Every variety also had some arthropod damage, with Muri Rotkorn having the highest severity of arthropod damage. Sungold had the least damage to foliar surfaces (6.13%) which included assessment of foliar disease, arthropod damage, and physical damage.

Table 4. Pre-Harvest results of the eleven spelt varieties, Alburgh, VT, 2022.

Variety	Height	Lodging	Disease severity	Arthropod Damage	Total Foliar Damage
	cm	%	% foliar surface affected	% foliar surface affected	% foliar surface affected
Altgold	133	0.00*	4.07	2.67	7.33
Comet	126	0.00*	4.53	3.47	10.1
Eluma River	125	10.0*	4.47	2.93	8.07
Guggisberg	136	32.5	3.07	3.32	7.67
Maverick	133	40.0	2.60	2.80	6.93
Muri Rotkorn	125	0.00*	2.33	4.00	7.87
Oberkulmer	124	17.5*	3.00	2.87	7.87
Pfaelzer Dinkel	120	5.00*	4.53	2.90	12.7
Rothenburger Rotkorn	135	2.50*	3.40	2.87	9.80
Sonic	129	27.5	4.20	2.53	7.80
Sungold	133	0.00*	2.47	3.07	6.13
LSD (p= 0.10)	NS	21.5	NS	NS	NS
Trial Mean	129	12.3	3.52	3.04	8.39

*Varieties with an asterisk are not significantly different than the top performer in **bold**.

NS – no significance.

Table 5. Harvest results of the eleven spelt varieties, Alburgh, VT, 2022.

Variety	Yield @ harvest moisture	Grain moisture	Test weight
	lbs ac ⁻¹	%	lbs bu ⁻¹
Altgold	4967	17.8	53.0*
Comet	4826	16.8*	56.0*
Eluma River	5408*	19.6	49.3
Guggisberg	3158	17.3	54.5*
Maverick	4723	18.1	57.0*
Muri Rotkorn	4876	15.9*	52.5*
Oberkulmer	4426	19.2	53.0*
Pfaelzer Dinkel	5802*	14.6*	55.8*
Rothenburger Rotkorn	4616	15.3*	48.3
Sonic	5108	18.2	56.8*
Sungold	6100*	16.4*	48.5
LSD (p= 0.10)	779	2.22	5.66
Trial Mean	4910	17.2	53.1

*Varieties with an asterisk are not significantly different than the top performer in **bold**.

Harvest data is displayed in Table 5. The variety that yielded the highest was Sungold at 6100 lbs ac⁻¹, with both Pfaelzer Dinkel and Eluma River being statistically similar. The lowest yielding variety was Guggisberg at 3158 lbs ac⁻¹. While Guggisberg was the tallest variety, it also had a higher lodging percentage than most other varieties, which most likely influenced its low yield.

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 Pfaelzer Dinkel having the lowest moisture of 14.6%. Four other varieties (Rothenburger Rotkorn, Muri Rotkorn, Sungold, and Comet) were statistically similar to this grain moisture. The industry standard for hulled spelt test weight is 40 lbs bu⁻¹. All varieties were above the industry standard for hulled spelt, with Marverick having the highest test weight of 57.0 lbs bu⁻¹.

Table 6: Grain quality results of the eleven spelt varieties, Alburgh, VT, 2022.

Variety	Crude protein at 12% moisture	Falling number
	%	seconds
Altgold	13.4	220
Comet	11.8	351*
Eluma River	11.1	254
Guggisberg	14.7*	316*
Maverick	11.8	313*
Muri Rotkorn	14.2*	340*
Oberkulmer	13.3	259
Pfaelzer Dinkel	12.3	307
Rothenburger Rotkorn	14.2*	279
Sonic	11.8	303
Sungold	10.7	289
LSD (0.10)	9.43	38.2
Trial Mean	12.7	294

*Varieties with an asterisk are not significantly different than the top performer in **bold**.

Grain quality was analyzed for protein and falling number, which results are shown in Table 6. The industry standard for crude protein content for spelt is between 12 and 15%. The variety with the highest crude protein was Guggisberg at 14.7%, and was statistically similar Muri Rotkorn and Rothenburger Rotkorn. All varieties, except for Comet, Eluma River, Maverick, Sonic, and Sungold were within the industry standard of crude protein.

The falling number measures viscosity, which is an indicator of enzymatic activity in the grain. Falling numbers are best understood for wheat, in which case values between 250-350 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 falling numbers were above 200, with Comet having the highest falling number of 351. Guggisberg, Maverick, and Muri Rotkorn were all statistically similar to Comet.

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

The 2022 spelt variety trial had the highest trial mean yield of 4910 lbs ac⁻¹, compared to the previous 2020 and 2018 spelt trials conducted at Borderview Research Farm. The 2022 trial also had higher mean test weight, crude protein content, and falling number.

It is important to remember that the results only represent one year of data and that 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 the data, consider that the quality measurements for spelt are recorded using hulled grain. Spelt that has not been dehulled will be significantly different than the hulled grain results. 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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