

# NORTHWEST CROPS & SOILS PROGRAM



## 2021 Spring Emmer Variety Trial



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**2021 SPRING EMMER VARIETY TRIAL**  
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Spring emmer (*Triticum dicoccon*) is an ancient two-rowed hulled wheat, also known as farro. Emmer was domesticated in the Fertile Crescent and was widely cultivated in the ancient world, but has since been replaced with higher yielding modern wheat varieties. Emmer is high in protein and as the ancestor of durum wheat, may be a suitable grain for producing pasta and flatbreads. There is an increasing consumer interest in locally grown grain for human consumption, and this has expanded the demand for end-products such as breads and pastries. Food grade grains will usually bring a premium price, but growers must also meet the higher quality standards, which can be difficult since there is very little information on emmer production in the Northeast. Varietal selection is one of the most important aspects of crop production and significantly influences yield potential. In 2021, the University of Vermont Extension Northwest Crops and Soils (NWCS) Program initiated a trial to evaluate yields and protein of eight spring emmer varieties.

## MATERIALS AND METHODS

In 2021, a spring emmer variety performance trial was conducted at Borderview Research Farm in Alburgh, VT. Eight spring emmer varieties were evaluated for yield and quality (Table 1).

**Table 1. Spring emmer varieties planted in Alburgh, VT, 2021.**

Variety	Seed source
CDC Tetra <sup>+</sup>	University of Maine
CDC Yon <sup>+</sup>	University of Maine
Debra <sup>+</sup>	Cornell University
Lucille	Cornell University
ND Common	Cornell University
NY15330-01-01-05-4	Cornell University
Red Vernal	Cornell University
Vernal	Cornell University

<sup>+</sup>Indicates a variety was only replicated 2 times

The trial was planted at Borderview Research Farm in Alburgh, VT on a Covington silty clay loam, 0 to 3% slope (Table 2). The experimental design was a randomized complete block with four replications. The previous crop was soybeans. The research plots were 5' x 20' and the seedbed was prepared with a Pottinger TerraDisc followed by a spike tooth harrow. The spring emmer varieties were planted on 9-Apr with 6" row spacing at a rate of 125 lbs. ac<sup>-1</sup>.

**Table 2. Agronomic practices for the 2021 spring emmer variety trial, Alburgh, VT.**

Location	Borderview Research Farm, Alburgh VT
Soil type	Covington silty clay loam, 0-3% slope
Previous crop	Soybeans
Tillage operations	TerraDisc, and spike tooth harrow
Row spacing (in)	6
Plot size (ft)	5 x 20
Seeding rate	125 lbs. ac <sup>-1</sup>
Replicates	4
Planting date	9-Apr
Harvest date	27-Jul

On 26-Jul, plant measurements of heights and lodging were taken prior to harvest. Lodging was assessed using a visual rating of 0 (no lodging) to 5 (complete lodging). Plots were harvested on 27-Jul with an Almaco SPC50 plot combine. After combining, the percentage of freely threshed seed for each variety was measured by taking a small subsample and recording the number of seeds with hulls compared to the total number of seeds in the sample. For example, a sample with 10 hulled seeds out of 100 would receive a score of 0.10 or 10%. Then the spring emmer varieties were cleaned with a small Clipper cleaner (A.T. Ferrell, Bluffton, IN) and an approximate one-pound grain sample per plot was collected for quality analysis. Quality measurements included standard testing parameters used by commercial mills. Plot samples were ground into flour, using the Perten LM3100 Laboratory Mill, and at this time, flour was evaluated for its crude protein content (CP), falling number and mycotoxin levels. Grains were analyzed for CP using the Perten Inframatic 8600 Flour Analyzer. CP is reported at 12% flour moisture. Falling number was determined using the AACC Method 56-81B, AACC Intl., 2000 on a Perten FN 1500 Falling Number Machine. The falling number is related to the level of sprout damage that has occurred in the grain. It is measured by the time it takes, in seconds, for a stirrer to fall through a slurry of flour and water to the bottom of the tube. Deoxynivalenol (DON) analysis was analyzed using Veratox DON 5/5 Quantitative test from the NEOGEN Corp. This test has a detection range of 0.5-5 ppm. Samples with DON values greater than 1 ppm are considered unsuitable for human consumption.

All data were analyzed using a mixed model analysis where replicates were considered random effects. The Least Significant Difference (LSD) procedure was used to separate cultivar means when the F-test was significant ( $P < 0.10$ ). 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. At the bottom of each table a LSD value is presented for each variable (e.g. yield). LSD 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 the 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 asterisk indicates that variety B was not significantly lower than the top yielding variety shown in bold.

Variety	Yield
A	3161
B	3886*
C	<b>4615*</b>
<b>LSD</b>	889

## RESULTS

Weather data was recorded with a Davis Instrument Vantage Pro2 weather station, equipped with a WeatherLink data logger at Borderview Research Farm in Alburgh, VT (Table 3). Temperatures in April, May and June were slightly warmer than normal, resulting in 170 more Growing Degree Days (GDDs) than the 30-year average. July was quite cool, averaging about 4.3 degrees below the 30-year average and resulting in 134 less growing days than normal. Despite July’s cool weather, overall, a total of 3583 GDDs (base 32° F) were accumulated April through July, 36 more than the 30-year normal. Precipitation was well below average from April through July; overall there was about 4.99 inches less rain than normal.

**Table 3. Temperature and precipitation summary for Alburgh, VT, 2021.**

Alburgh, VT	2021			
	April	May	June	July
Average temperature (°F)	48.1	58.4	70.3	68.1
Departure from normal	2.52	-0.03	2.81	-4.31
Precipitation (inches)	3.52	0.66	3.06	2.92
Departure from normal	0.45	-3.1	-1.2	-1.14
Growing Degree Days (32-95°F)	497	818	1149	1119
Departure from normal	85	-1.0	86	-134

Based on weather data from a Davis Instruments Vantage Pro2 with WeatherLink data logger. Historical averages are for 30 years of NOAA data (1991-2020) from Burlington, VT.

Just prior to harvest, heights and lodging were measured (Table 4). The average height was 90.9 cm and ranged from 70.8 to 98.4 cm. Vernal was the tallest variety, but that was not statistically different from four other varieties. The average lodging was 0.71 and four of the varieties had zero lodging. ND Common had the most lodging, 3.0, and that was statistically greater than all other varieties.

**Table 4. Pre-harvest measurements by spring emmer variety, Alburgh, VT, 2021.**

Variety	Height cm	Lodging 0-5 <sup>†</sup>
CDC Tetra	88.1	0.0
CDC Yon	95.6**	0.0
Debra	70.8	0.0
Lucille	96.6*	0.7
ND Common	93.2*	<b>3.0</b>
NY15330-01-01-05-4	89.3	0.0
Red Vernal	95.0*	1.0
Vernal	<b>98.4</b>	1.0
LSD (0.10) §	8.94	0.97
Trial mean	90.9	0.71

<sup>†</sup>Lodging rating of 0 = no lodging and 5 = 100% lodged.

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

<sup>§</sup>LSD; least significant differences at p=0.10.

Harvest and quality measures for each spring emmer variety are presented in Table 5. The average yield for this trial was 2236 lbs. ac<sup>-1</sup>. Lucille had the highest yield, 2979 lbs. ac<sup>-1</sup>, and that was not statistically different from three other varieties. Red Vernal had the highest falling number, 273 seconds, and that was statistically similar to three other varieties. The falling number ranged from 73 to 273 seconds. Crude protein is measured at 12% moisture. NY15330-01-01-05-4 had the greatest crude protein content, 14.8%, and was only statistically similar to one variety. DON levels were high this season in the spring emmer varieties. The trial average was 2.30 ppm, and that is above the acceptable level for human consumption of 1 ppm. CDC Yon had the highest level of DON, 3.97 ppm, and this was not statistically different from three other varieties. There was a lot of variability in the threshability score of the emmer varieties. Debra and NY15330-01-01-05-4 had very low scores, 1.0 and 4.0% respectively, indicating that there were very few seeds with hulls after combining. CDC Yon had the highest score, 94%, which was statistically similar to four other varieties.

**Table 5. Harvest and quality measures, Alburgh, VT, 2021.**

Variety	Yield @ 13.5% moisture	Falling number	Crude protein @ 12% moisture	DON	Free threshed seed
	lbs. ac <sup>-1</sup>	seconds	%	ppm	%
CDC Tetra	1153	93.0	13.5	3.77*	86.0*
CDC Yon	2046	171	14.0	<b>3.97</b>	<b>94.0</b>
Debra	2337	73.0	13.9	2.37*	1.00
Lucille	<b>2979</b>	273*	14.2*	2.57*	66.0
ND Common	2737*	236*	13.2	1.53	92.0*
NY15330-01-01-05-4	1728	229*	<b>14.8</b>	1.87	4.00
Red Vernal	2486*	<b>273</b>	13.7	1.13	91.0*
Vernal	2422*	202	13.7	1.23	93.0*
LSD (0.10) ‡	626	46.0	0.66	1.68	25.0
Trial mean	2236	194	13.9	2.30	66.0

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

‡LSD; least significant differences at p=0.10.

## DISCUSSION

The 2021 growing season was challenging due to a lack of precipitation. From May to July, precipitation was 5.44 inches below normal. While April and June were both a couple degrees warmer than average, July was unseasonably cool for the region, 4.31 degrees cooler than normal. It is important to remember that these results represent data from one year at one location. In 2021, overall, the lodging was low for most emmer varieties. The average yield was 2236 lbs ac<sup>-1</sup>, which is comparable to the average yield of the spring wheat varieties grown this year, 2777 lbs ac<sup>-1</sup>. The level of Deoxynivalenol (DON) was higher than the other spring grain trials from this season, and all of the emmer varieties had DON levels greater than 1 ppm, making them unsafe for human consumption. The availability of quality seed is very important, especially for these ancient grain varieties. With the growing interest in heirloom and ancient grains, it is important to

conduct more research on spring emmer varieties to determine which ones will do well in this region. The UVM Northwest Crops and Soils Program plans to repeat this trial again in 2022.

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