2016 Organic Spring Barley Variety Trial

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UNIVERSITY OF VERMONT EXTENSION
CULTIVATING HEALTHY COMMUNITIES

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With the revival of the small grains industry in the Northeast and the strength of the locavore movement, craft breweries and distilleries have expressed an interest in sourcing local barley for malting. Malting barley must meet specific quality characteristics such as low protein content and high germination. Depending on the variety, barley can be planted in either the spring or fall, and both two- and six-row

Steffi	2-row	Ackerman, Germany
SY Sirish	2-row	Syngenta
Tradition	6-row	Busch Agricultural Resources, LLC

All plots were managed with practices similar to those used by producers in the surrounding areas (Table 2). The previous crop planted at the site were sunflowers. In April 2016, the trial area was plowed, disked and spike tooth harrowed to prepare for planting. The plots were seeded with a Great Plains NT60 Cone Seeder on 21-Apr at a seeding rate of 325 live seeds per m^2 into a Benson rocky silt loam. Plot size was

Table 2. 2016 agronomic and trial information for spring barley variety trial.

Trial Information	Borderview Research Farm Alburgh, VT
Soil type	Benson rocky silt loam
Previous crop	Sunflowers
Tillage operations	Spring plow, disc, and spike tooth harrow
Harvest area (ft)	5 x 20
Row spacing (in)	6
Seeding rate (live seed m^2)	325
Replicates	3
Planting date	21-Apr
Harvest date	27-Jul

Barley populations were measured by counting the number of plants in three 12-inch segments randomly throughout each plot on 19-May. A visual estimate of vigor was taken 31-May by rating the plots on a 1-5 scale, 1 for poor vigor and 5 for stong vigor. Flowering dates were recorded when at least 75% of a plot was in bloom. On 29-Jun plots were scouted for disease and insect pests. Five plants per plot were randomly selected throughout each plot. All leaves (between 1 and 3 leaves) on the five plants were scouted and every disease symptom and sign of insect damage was recorded. The W. Clive James, An Illustrated Series of Assessment Keys for Plant Diseases, Their Preparation and Usage (1971) was used to determine the severity of plant disease infection. Each plot was then given an overall health rating between 1 and 9 (1 being minimal damage and

weight was determined, the samples were then ground into flour using the Perten LM3100 Laboratory Mill, and were evaluated for crude protein content using the Perten Inframatic 8600 Flour Analyzer. In addition, falling number for all barley varieties were 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. Falling numbers greater than 350 indicate low enzymatic activity and sound quality sample. A falling number lower than 200 indicates high enzymatic activity and poor quality. 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 to 5 ppm. Samples with DON values greater than 1 ppm are considered unsuitable for human consumption. Percent germination (germination energy) was determined by incubating 100 seeds in 4.0 mL of water for 72 hours and counting the number of seeds that did not germinate. Each plot was done in duplicate. Grain assortment or Plumpness was determined using the Pfeuffer Soritmat using 100g of clean seed, and was determined by the combining the amount of seed remaining on the 2.78mm and 2.38mm sieves.

All data was analyzed using a mixed model analysis where replicates were considered random effects. The LSD procedure was used to separate cultivar means when the F-test was significant ($P< 0.10$). There were significant differences among the two locations for most parameters and therefore data from each location is reported independently.

LEAST SIGNIFICANT DIFFERENCE (LSD)

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). 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 the example below, 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.

Variety	Yield
A	3161
B	3886*

Table 4. 2016 spring barley agronomic characteristics in Alburgh, VT.

Variety	Population	Vigor	Flowering	Disease
	plants m^2	rating (1-5)	date	rating (1-9)
2ND28065	258	3.67	24-Jun	**1.00***
AAC Synergy	289	3.67	27-Jun	**1.00***
AC Metcalfe	318	4.33	24-Jun	**1.00***
Acorn	273			

had moistures above 14% at the time of harvest; therefore, those 18 required additional drying. The highest harvest moisture was Acorn (19.0%). Lacey had the highest test weight of 44.5 lbs bu^{-1}. Other varieties with high test weights included Innovation (44.3 lbs bu^{-1}), LCS Genie (43.7 lbs bu^{-1}), Tradition (44.3 lbs bu^{-1}), Innovation (44.2 lbs bu^{-1}), Acorn (43.5 lbs bu^{-1}), KWS Fantex (43.3 lbs bu^{-1}), Sy Sirish (42.7 lbs bu^{-1}), Robust (42.2 lbs bu^{-1}), Pioneer (42.0 lbs bu^{-1}), and 2ND28065 (41.0 lbs bu^{-1}) However, none of the varieties met the desired barley test weight of 48 lbs per bushel.

Table 5. Harvest results for the 25 spring barley varieties trialed in Alburgh, VT, 2016.

Variety	Harvest moisture	Test weight	Yield @ 13.5% moisture
	%	lbs bu^{-1}	lbs ac^{-1}
2ND28065	17.1	41.0*	3312
AAC Synergy	14.1	40.5	3700
AC Metcalfe	15.6	39.0	3452
Acorn	19.0	43.5*	3986
Bently	17.7	36.7	2899
CDC Copeland	17.3	39.2	2573
CDC Meredith	15.8	38.2	3084
Cerveza	12.7	38.0	**4243**
Conlon	15.8	39.0	3176
Explorer	16.4	38.0	3245
Innovation	8.87*	44.3*	3337
KWS Beckie	17.1	39.5	2517
KWS Fantex	17.0	43.3*	3462
Lacey	11.7*	**44.5***	2959

Figure 1. Yield and crude protein for the 25 spring barley varieties trialed in Alburgh, VT, 2016.
Varieties with the same letter did not differ significantly.

Robust had the highest falling number, 432 seconds. The variety with the lowest falling number, indicating sprouting damage, was AC Metcalfe at 204 seconds. DON concentration was not significantly different among varieties.The varieties 2ND28065 and CDC Copeland had the lowest DON concentrations at 0.03 ppm and the highest was Robust (0.8 ppm). All twenty-five spring barley varieties

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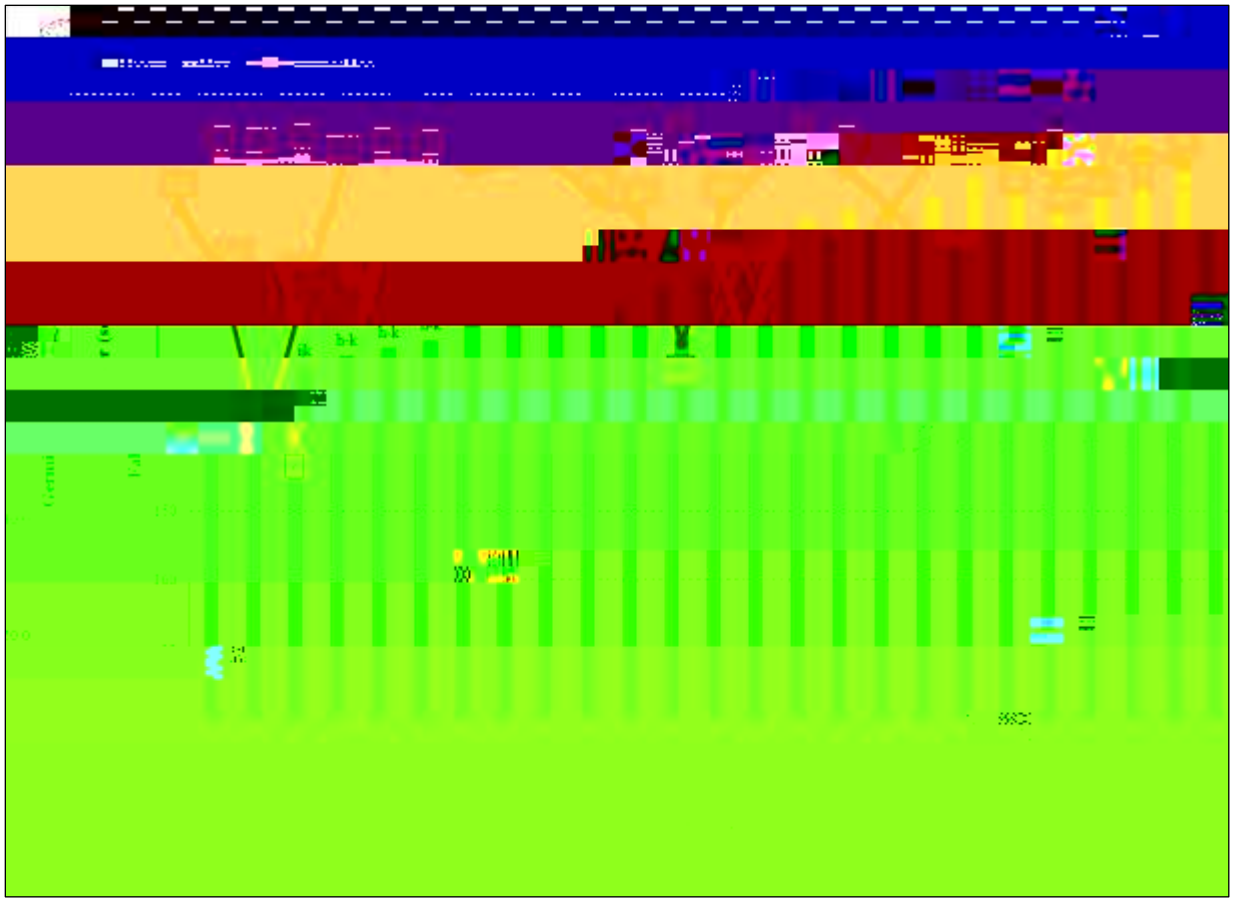

Figure 2. Falling number and germination comparison of the 25 spring barley varieties trialed in Alburgh, VT, 2016.
Varieties with the same letter did not differ significantly.

DISCUSSION

It is important to remember that the results only represent one year of data. Overall, the 2016 growing season was ideal for growing spring barley. The warmer than average temperatures along with below normal rainfall throughout much of the growing season resulted in higher yields and quality. Due to higher than normal bird pressure, possibly due to drought-like conditions, plots were covered with bird netting from soft dough until harvest. There was also an increase in thrip and mite damage recorded which could also be attributed to the dry conditions this season; however, the damage was not severe enough to cause economic loss. The average yield was 3213 lbs ac^{-1}, 1635lbs higher than the 2015 average yield. Test weight, a measure of grain plumpness, also an indicator used to determine malt quality, was the only quality parameter that was low, all varieties were below the ideal malting test weight of 48 lbs per bushel. However, kernel plumpness did not appear to be impacted, all varieties were above 90% for plumpness. The average percent protein this year was 10.4%, 2.88% higher than the trial mean in 2015. Twenty-three of the 25 spring barley varieties had protein levels that met industry standards, only Acorn (8.79%) and ND Genesis (8.84%) fell below these standards. For malting purposes, high quality barley typically has low to moderate protein levels ranging from 9.0 11.0%. In general, six-row barley

varieties usually have higher protein content ranging from 9.0-12.0%, compared to two-row barley varieties, which range from 9.0-11.0%. Lower crude protein is desirable from a malting/brewing perspective as high protein levels can make beer hazy. Higher protein levels are also often associated with