2015 Spring Barley Seeding Rate and Interseeding Trial

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With the revival of the small grains industry in the Northeast and the strength of the localvore 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. Many farmers are also interested in barley as a concentrated, high-energy feed source for livestock. Depending on the variety, barley can be planted in either the spring or fall, and both two- and six-row barley can be used for malting and livestock feed.

Producers have expressed interest in the best agronomic practices for cultivating spring barley. One factor that can contribute to overall yield and quality is seeding rate; it can help barley outcompete weeds and maximize nutrient uptake for a given tract of land. Another factor that can influence harvest yield, crop quality, and weed populations is an interseeded cover crop. The practice of interseeding, or planting a cover crop in the understory of the barley, can help minimize weed pressure. Quality of a barley crop can be decreased by the presence of weed seed during and after processing. However, it is unclear if the cover crop growing in the understory of the barley impacts nutrient availability and disease infection. The purpose of this trial was to evaluate the impact of seeding rate and interseeding of clover on the yield and quality of spring barley.

MATERIALS AND METHODS

A field experiment was established at the Borderview Research Farm located in Alburgh, VT on 29-Apr to investigate the effects of seeding rate and interseeded white clover (var 'Kopu') on barley (var 'Conlon') yield and quality parameters. The experimental design was a randomized complete block with split plots and four replicates. The seedbed at the Alburgh location was prepared by conventional tillage methods (Table 1). The previous crop planted at the site was sunflowers. Prior to planting, the trial area was plowed, disked, and spike tooth harrowed to prepare for planting. The plots were seeded with the Sunflower No-Till drill on 26-Apr at two seeding rates, 70 and 125 lbs ac^{-1}. Plot size was 10'x 20'. The white clover was broadcast planted by hand on 8-May after barley emergence.

Barley plots were harvested in Alburgh, VT on 30-Jul using an Almaco SPC50 small plot combine. Following harvest, grain moisture, test weight, and yield were calculated.

Table 1. Agronomic information for spring barley seeding rate and interseeding trial, Alburgh, VT, 2015

Trial Information	Alburgh, VT Borderview Research Farm
Soil type	Benson rocky silt loam
Previous crop	Sunflowers
Row spacing (inch)	7
Seeding rate (lbs ac^{-1})	70 and 125
Replicates	4
Varieties	Conlon
Planting date	26-Apr
Plot size (ft)	10’ x 20’
Tillage types	Fall plow, spring disk, & spike tooth harrow
Interseeded cover crop	White clover var. ‘Kopu’
Interseeding equipment	Hand seeded
Interseeding date	8-May
Barley harvest date	30-Jul

Following harvest, seed was cleaned with a small Clipper cleaner (A.T. Ferrell, Bluffton, IN). An approximate one pound subsample was collected to determine quality. Quality measurements included standard testing parameters used by commercial mills. Test weight was measured by the weighing of a known volume of grain. The acceptable test weight for barley is 48 lbs per bushel. Once test weight was determined, the samples were then ground into flour using the Perten LM3100 Laboratory Mill. At this time, flour was evaluated for mycotoxin levels. 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.

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 ($P< 0.10$). 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 following 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.

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

RESULTS

Weather data was collected with an onsite Davis Instruments Vantage Pro2 weather station equipped with a WeatherLink data logger at Borderview Research Farm in Alburgh, VT. Temperature, precipitation, and accumulation of Growing Degree Days (GDDs) are consolidated for the 2015 growing season (Table 2). Historical weather data are from 1981-2010 at cooperative observation stations in Burlington, VT, approximately 45 miles from Alburgh, VT.

The growing season this year was marked by lower than normal temperatures in April, June, and July, but fairly high temperatures in May. This was coupled with significantly lower than normal rainfall throughout the growing season, with the exception of June, which had much greater precipitation than in the average year. From April through July, there was an accumulation of 3429 Growing Degree Days (GDDs) in Alburgh which is 77 GDDs above the 30 year average.

Table 2. Temperature and precipitation summary for Alburgh, VT, 2015.

Alburgh, VT	April	May	June	July
Average temperature (°F)	43.4	61.9	63.1	70.0
Departure from normal	-1.4	5.5	-2.7	-0.6
Precipitation (inches)	0.09	1.94	6.42	1.45
Departure from normal	-2.73	-1.51	2.73	-2.70
Growing Degree Days (base 32°F)	373	930	938	1188
Departure from normal	-11	174	-76	-10

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) from Burlington, VT.

Impact of Seeding Rate:

Seeding rate did not significantly impact yield or quality of the barley. The barley had an average moisture level of 17.8%. The test weights for the 70 lbs ac^{-1} and 125 lbs ac^{-1} treatments were 43.9 and 44.0, respectively. The average harvest yield was 1338 lbs ac^{-1}. Crude protein had an average of 8.4% and the DON average was 4.9 ppm. Overall the wet conditions during June likely led to low yields and quality.

Table 3. Impact of seeding rate on barley harvest and quality, Alburgh, VT, 2015.

Seeding rate lbs ac^{-1}	Harvest moisture %	Test weight lbs bu^{-1}	Harvest yield lbs ac^{-1}	Crude protein @ 12% moisture %	DON ppm
70	**17.6**	43.9	**1466**	8.3	5.0
125	18.0*	**44.0**	1208	**8.5**	**4.8**
LSD (0.1)	NS	NS	NS	NS	NS
Trial mean	17.8	44.0	1338	8.4	4.9

*Treatments with an asterisk are not significantly different than the top performer in **bold**.
NS – No significant difference amongst treatments.

Impact of Interseeded Clover:

Clover interseeded into the spring barley crop did not reduce yield or quality compared to the no clover treatment (Table 4). The trial means for harvest moisture, test weight, and harvest yield were 17.8%, 44.0 lbs bu^{-1}, and 1336 lbs ac^{-1}, respectively. Crude protein for the clover treatment was 8.3% while the crude protein in the no clover control was 8.6%. The average DON level for the trial was 4.9 ppm. Overall the yield and quality were poor regardless of the interseed treatment.

Table 4. Impact of clover cover crop on barley harvest and quality, Alburgh, VT, 2015.

Seeding rate lbs ac^{-1}	Harvest moisture %	Test weight lbs bu^{-1}	Harvest yield lbs ac^{-1}	Crude protein @ 12% moisture %	DON ppm
Clover	**17.6**	**44.3**	1280	8.3	**4.8**
No Clover	18.0*	43.7	**1392***	**8.6**	5.1
LSD (0.1)	NS	NS	NS	NS	NS
Trial mean	17.8	44.0	1336	8.4	4.9

*Treatments with an asterisk are not significantly different than the top performer in **bold**.
NS – No significant difference amongst treatments.

DISCUSSION

Challenging weather during the 2015 growing season likely led to low yield and quality of spring barley in this trial. With a fairly warm and dry May, conditions for grain production were ideal; however, the amount of precipitation in June made it difficult for barley to thrive, and likely increased the risk of fusarium head blight infection. The test weights for all barley treatments fell below the industry standard of 48 lbs bu^{-1}. Crude protein levels were low this year compared to industry standards for six-row barley as well. Ideally, barley will have a crude protein of 9.0-12.0%. DON levels were too high to be approved for human consumption. The safe level for human consumption is 1 ppm, and with a trial average of 4.9 ppm, the barley trial was well outside the accepted range. However, this barley could still be used for animal consumption as some animals are tolerant up to a DON level of 10 ppm.

A low seeding rate of 75 lbs ac^{-1} did not differ significantly from the higher seeding rate of 125 lbs ac^{-1}. This first year of data suggests that seed costs can be lowered without impacting yields and weed control. The barley grown with clover did not impact yield or quality compared to the no clover control. Past research has shown that clover being grown in the understory of grains can help reduce weed pressure. Minimal weed pressure was observed in this trial regardless of treatment. Growing the clover crop in the understory of the barley could lead to plant competition for nutrients, water, and other nutrients. High rainfall during the project period led to ample moisture and it was clear that both treatments were lacking in nitrogen based on CP results. Lastly, it is unclear if the clover changes the microclimate within the understory. It is hypothesized that the clover might harbor more moisture and increase humidity, potentially creating an ideal climate for fusarium head blight infection. This first year of data suggests that clover planted in the understory of barley had no significant impact on disease compared to the no clover control. This study will be repeated in 2016 to build more research based information on this topic area.

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