NORTHWEST CROPS & SOILS PROGRAM

2018 Rye Harvest Date

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THE UNIVERSITY OF VERMONT EXTENSION

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The interest in growing cereal rye for grain to be sold as cover crop seed, or to other value-added markets (distillers and bakers), has increased considerably across the Northeast region. As a result, farmers and end-users are requesting yield and quality information on cereal rye varieties. In 2018, University of Vermont Extension Northwest Crops and Soils (NWCS) Program conducted a harvest date trial to evaluate harvest date yield and quality of cereal rye. The overall goal of this project is to help in determining ideal harvest dates for winter rye in hopes of maximizing yields and quality. For the harvest date study, a newer variety known as Bono was used. This year, a preliminary experiment was conducted to establish baseline information on the impact of harvest date on yields and quality parameters.

MATERIALS AND METHODS

The field was plowed, disked, and prepared with a spike tooth harrow to prepare the seedbed for planting. The plots were planted with a Great Plains cone seeder on 21-Sep 2017; plots were 5' x 20' (Table 1). Prior to harvest, on 20-Jul 2018, three plant heights per plot were measured.

Table 1: Agronomic and trial information for the rye cover crop variety trial, 2017-2018.

	Borderview Research Farm, Alburgh, VT
Soil Type	Benson rocky silt loam
Previous Crop	Winter Wheat
Tillage Operations	Fall plow, disc, and spike tooth harrow
Harvest Area (ft.)	5 x 20
Seeding Rate (live seeds m^{-2})	350
Replicates	1
Planting Date	21-Sep 2017
Harvest Dates	HD 1: 20-Jul 2018 HD 2: 27-Jul 2018 HD 3: 3-Aug 2018 HD 4: 10-Aug 2018

Grain plots were harvested at the Alburgh site with an Almaco SPC50 plot combine on 20-Jul. Following harvest, seed was cleaned with a small Clipper M2B cleaner (A.T. Ferrell, Bluffton, IN). Grain moisture, test weight, and yield were calculated. 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. 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 its protein content, falling number, and mycotoxin levels. Grains were analyzed for protein content using the Perten Inframatic 8600 Flour Analyzer. The determination of falling number (AACC

Method 56-81B, AACC Intl., 2000) was measured on the 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 done 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.

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 (i.e. yield). Least Significant Differences (LSD's) at the 10% level of probability are shown. Where the difference between two treatments 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. Treatments that were not significantly lower in performance than the highest value in a particular column are indicated with an asterisk. In this example, A is significantly different from C but not from B. The difference between A and B is equal to 1.5, which is less than the LSD value of 2.0. This means that these varieties did not differ in yield. The difference between A and C is equal to 3.0, which is greater than the LSD value of 2.0. This means that the yields of these varieties were significantly different from one another. The asterisk indicates that B was not significantly lower than the top yielding variety.

Treatment	**Yield**
A	**2100***
B	1900*
C	1700
LSD	300

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. September, October, May, and July had above average temperatures whereas April and June were below average (Table 2). Growing months during the growing periods of 2017-2018 season saw well below average precipitation with the exception of April which saw above average precipitation. There were 5159 growing degree days (GDDs) accumulated over the course of the growing season, 447 more growing degree days than the historical average.

Table 2. Temperature and precipitation summary for Alburgh, VT, 2017 and 2018.

Alburgh, VT	September '17	October '17	April '18	May '18	June '18	July '18
Average temperature (°F)	64.4	57.4	39.2	59.5	64.4	74.1
Departure from normal	3.76	9.16	-5.58	3.10	-1.38	3.51
Precipitation (inches)	1.8	3.3	4.4	1.9	3.7	2.4
Departure from normal	-1.80	-0.31	1.61	-1.51	0.05	-1.72
Growing Degree Days 32°F	971	786	272	853	973	1305
Departure from normal	113	284	-112	97	-42	107

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. (http://www.nrcc.cornell.edu/page_nowdata.html).

Heights, yield, and test weight were measured prior to cereal rye harvest (Table 3). From the four different harvest dates, heights increased slightly over the four week period but were not statistically different. Yields were highest during the third harvest date on 3-Aug at 5011 lbs ac^{-1} but the second and fourth dates were similarly high. Test weight was also the highest at the third harvest date, with the second harvest date as a similar top performer.

Table 3: Pre-harvest measurements of Bono variety winter rye harvest dates, Alburgh, VT, 2018.

Harvest Date	Height	Yield	Test weight
	cm	lbs ac^{-1}	lbs bu^{-1}
20-Jul	92.8	2861	46.7
27-Jul	93.7	4086*	55.8*
3-Aug	97.2	**5011**	**56.2**
10-Aug	99.0	4400*	53.7
Trial mean	95.7	4089	53.8
LSD (0.10)	NS	1883	1.27

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

The four harvest dates were also analyzed for crude protein concentration, falling number, and the vomitoxin DON (Table 4). All four harvest dates showed similar values for crude protein, falling number and DON levels suggesting that there was no significant difference in quality amongst treatments.

Table 4: Grain quality for the four cereal rye variety harvest dates, Alburgh, VT, 2018.

Variety	Crude protein @ 12% moisture	Falling number	DON
	%	Seconds	ppm
20-Jul	9.0	298	0.05
27-Jul	8.8	276	0.05
3-Aug	9.0	274	0.05
10-Aug	8.8	264	0.05
Trial mean	8.9	278	0.05
LSD (0.10)	NS	NS	NS

LSD – Least significant difference.
NS – No significant difference between treatments.

DISCUSSION

The hot, dry conditions in 2018 emulated the weather in the west, which led to high cereal rye yields and quality across all harvest dates. During a harvest period with greater amounts of rainfall from week to week, there is greater potential for reduced quality crops as a result of increased disease pressure. This can be an important consideration when attempting to determine ideal harvest windows as you may be forced to harvest at an earlier date to salvage a crop and maintain grain quality. As this preliminary experiment occurred during a season conducive to high quality rye, we were able to see impacts of harvest date without the interference of detrimental weather conditions and disease on harvest and quality. Yields and test weights were highest in the weeks after our "normal" determined harvest date with highest yields occurring during the third date after harvest. Based on yields and test weights, we could potentially push harvest dates further back with little to no impact on grain quality.

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