2013

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NORTHWEST CROPS & SOILS PROGRAM

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UNIVERSITY OF VERMONT EXTENSION
CULTIVATING HEALTHY COMMUNITIES

2013 ORGANIC SPRING WHEAT SEEDING RATE TRIAL REPORT

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Throughout Vermont and the Northeast, the demand for local organically grown wheat continues to rise. Due to this demand, there has been a renewed interest by producers to add wheat into their crop rotations. Several producers have asked questions about the best agronomic practices for cultivating organic spring wheat. As a result, University of Vermont Extension has been developing best agronomic practices for wheat production in the Northeast. Seeding rates can influence weed populations as well as overall yield and quality. The purpose of this trial was to determine optimum seeding rates for organic spring wheat in Vermont.

MATERIALS AND METHODS

In April 2013, an organic spring wheat seeding rate trial was established at the Borderview Research Farm in Alburgh, Vermont. The experimental plot design was a randomized complete block with four replications. The seedbed at the Alburgh location was prepared by conventional tillage methods. All plots were managed with practices similar to those used by producers in the surrounding areas (Table 1). The previous crop planted in the site was corn. In March 2013, the field was disked and spike tooth harrowed to prepare for planting. The plots were seeded with a Kincaid Cone Seeder on 23-Apr at seeding rates of 50, 75, 100, 125, 150, 175 or 200 lbs ac^{-1} with hard red spring wheat (var. 'Barlow'). Plot size was 7' x 20'.

Table 1. General plot management of the spring wheat seeding rate trial.

Trial information	Alburgh, VT Borderview Research Farm
Soil type	Benson rocky silt loam
Previous crop	Corn
Seeding Rates (lbs ac^{-1})	50, 75, 100, 125, 150, 175 & 200
Row spacing (in)	6
Replicates	4
Planting date	23-Apr
Harvest date	30-Jul
Harvest area (ft)	5 x 20
Tillage operations	Fall plow, spring disk & spike tooth harrow

Populations were measured on 22-May by taking two, 0.3 meter plant counts per plot. Grain plots were harvested at the Alburgh site with an Almaco SPC50 plot combine on 30-Jul, the harvest area was 5' x 20'. In addition, grain moisture, test weight and yield were calculated.

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. Generally the heavier the wheat is per bushel, the higher baking quality. The

acceptable test weight for bread wheat is 56-60 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 its protein content and falling number. Grains were analyzed for protein content using the Perten Inframatic 8600 Flour Analyzer. Grain protein affects gluten strength and loaf volume. Most commercial mills target 12-14% protein. Protein was calculated on a 12% moisture basis. 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. Falling numbers greater than 350 indicate low enzymatic activity and sound quality wheat. A falling number lower than 200 indicates high enzymatic activity and poor quality wheat.

All data was analyzed using a mixed model analysis where replicates were considered random effects. The LSD procedure was used to separate seeding rate 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 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*
C	**4615***
LSD	**889**

RESULTS AND DISCUSSION

Seasonal precipitation and temperatures were recorded with a Davis Instruments Vantage pro2 with Weatherlink data logger on site in Alburgh, VT (Table 2). The spring wheat growing season this year experienced normal temperatures and above average rainfall, especially in the month of June. From April to July there was an accumulation of 3398 Growing Degree Days (GDDs) in Alburgh, VT, which is 45 GDDs higher than the 30 year average.

Table 2. Temperature and precipitation summary for Alburgh, VT, 2013.

Alburgh, VT	April	May	June	July
Average temperature (°F)	43.6	59.1	64	71.7
Departure from normal	-1.2	2.7	-1.8	1.1
Precipitation (inches)	2.12	4.79	9.23 ł	1.89
Departure from normal	-0.7	1.34	5.54	-2.26
Growing Degree Days (base 32°F)	348	848	967	1235
Departure from normal	-36	91	-47	37

Based on weather data from Davis Instruments Vantage pro2 with Weatherlink data logger.
Historical averages for 30 years of NOAA data (1981-2010).
ł June 2013 precipitation data based on National Weather Service data from cooperative stations in South Hero, VT.

Plant populations per acre were not statistically different across all seeding rates (Table 3). The highest plant population was at the seeding rate of 175 lbs ac^{-1} (1,395,281 plants per acre), for the second consecutive year. Surprisingly, the seeding rate of 100 lbs ac^{-1} had the lowest plant population with 1,003,922 plants per acre. "Lower" plant population in high seeding rate treatments may be the result of high plant density causing smothering of plants.

Table 3. Impact of seeding rate on plant populations, Alburgh, VT.

Seeding rate lbs ac^{-1}	Plant population ac^{-1}
50	1,089,000
75	1,216,617
100	1,003,922
125	1,148,555
150	1,259,156
175	**1,395,281**
200	1,276,172
LSD (0.10)	NS
Trial mean	1,198,386

Values shown in **bold** are of the highest value or top performing.
NS - None of the varieties were significantly different from one another.

Seeding rate did not significantly impact grain yields, grain moisture, and test weights (Table 4). The highest yielding seeding rate was 150 lbs ac^{-1} (1777 lbs ac^{-1}). Not surprisingly, the lowest yielding seeding rate was 50 lbs ac^{-1} (1244 lbs ac^{-1}); however, the second lowest yeilding seeding rate was 175 lbs ac^{-1} (1341 lbs^{-1}) (Figure 1). The seeding rates did not significantly impact CP or falling number. All of the seeding rates had protein levels slightly higher then industry standards of 12-14% . All of the falling numbers were above 250 seconds. All seeding rates had DON numbers higher then the cut off for human consumption of 1 part per million (ppm), but lower then the cut off for feed of 10 ppm.

Early planting of wheat allowed all seeding rates to establish prior to significant weed growth. This may have led to all seeding rates having similar yields and quality.

Table 4. The impact of seeding rate on wheat harvest and quality, Alburgh, VT.

Seeding rate	Yield @13.5% moisture	Moisture	Test weight	Crude protein @12% moisture	Falling number	DON
lbs ac^{-1}	lbs ac^{-1}	%	lbs bu^{-1}	%	seconds	ppm
50	1244	16.3	55.5	14.5	**347**	5.0
75	1614	**17.7**	54.8	15.4	308	4.2*
100	1371	16.2	53.3	14.8	340	4.2*
125	1542	15.9	57.3	15.0	325	4.8
150	**1777**	17.4	**57.5**	15.4	327	**3.6***
175	1341	17.6	56.5	**15.8**	293	**3.6***
200	1564	15.5	56.9	14.9	319	4.7
LSD (0.10)	NS	NS	NS	NS	NS	0.74
Trial mean	1493	16.6	55.9	15.1	323	4.3

Values shown in **bold** are of the highest value or top performing.
*Treatments that did not perform significantly lower than the top-performing treatment in a particular column are indicated with an asterisk.
NS - None of the varieties were significantly different from one another.

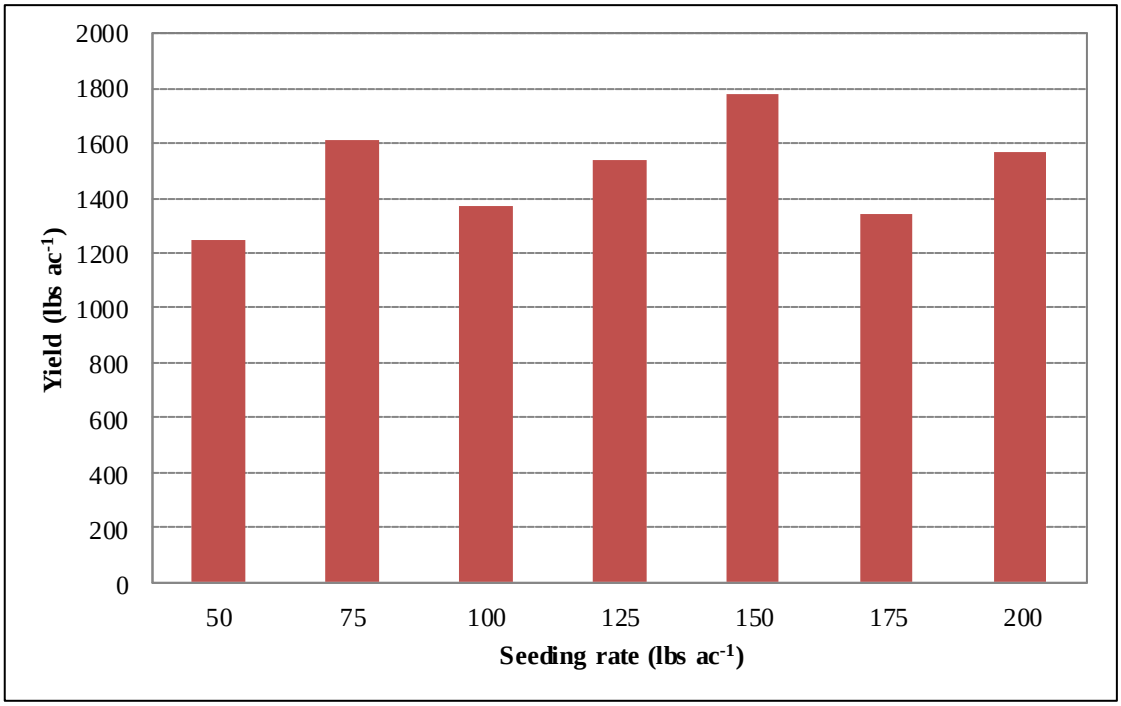

Figure 1. Impact of seeding rate on wheat yields Alburgh, VT, 2013.

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