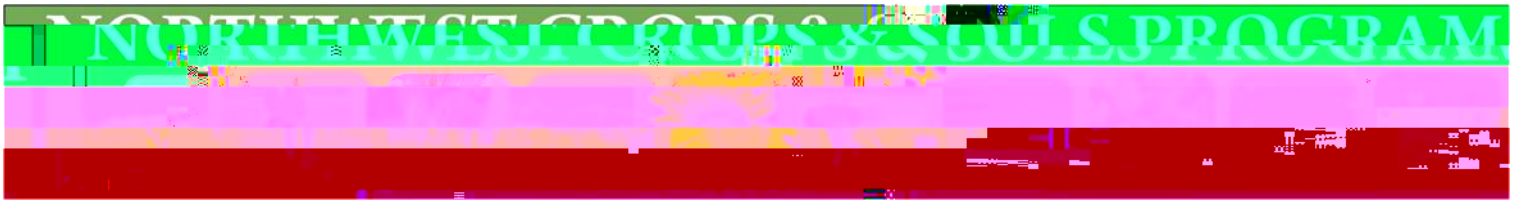

2013 Organic

2013 ORGANIC WINTER WHEAT PLANTING DATE TRIAL

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In 2013, the University of Vermont Extension Northwest Crops and Soils Program conducted a winter wheat planting date trial. As the demand for local organic wheat has risen over the last few years, UVM Extension has been trying to determine the best agronomic practices for wheat production in the problematic Northeastern climate.

Table 3. Winter wheat planting date trial specifics in Alburgh, VT, 2013.

Trial information	Borderview Research Farm Alburgh, VT
Soil type	Benson rocky silt loam
Previous crop	Spring wheat
Row spacing (in)	6
Seeding rate (lbs ac^{-1})	125
Replicates	4
Harvest area (ft)	5 x 20
Tillage operations	Fall plow, disk, and spike tooth harrow

Winter survival and vigor were measured on 19-Apr 2013. Winter survival was based on a visual estimate of percent survival and vigor was rated using a 0 – 5 scale, where 5 represents excellent stand density, and 0 represents no stand. Populations were measured on 1-May 2013 by taking two, 0.3 meter counts per plot.

Grain plots were harvested on 22-Jul 2013 with an Almaco SPC50 plot combine, the harvest area was 5' x 20'. At the time of harvest plant heights were measured, excluding awns, and the severity of lodging was recorded based on a visual rating with a 0 – 5 scale, where 0 indicates no lodging and 5 indicates severe lodging and a complete crop loss. 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, falling number, and mycotoxin levels. 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 12-15% protein. 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. 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.

Data was analyzed using mixed model analysis using the mixed procedure of SAS (SAS Institute, 1999). Replications were treated as random effects and treatments were treated as fixed. Mean comparisons were made using the Least Significant Difference (LSD) procedure when the F-test was considered 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

RESULTS

Seasonal precipitation and temperature recorded at weather stations in close proximity to the 2012 and 2013 sites are shown in Table 4. The growing season this year was marked by lower than normal temperatures in April and June and higher than normal rainfall in the months of May and June. In Alburgh, there was an accumulation of 5035 Growing Degree Days (GDDs), which is 5 GDDs below the 30 year average.

Table 4. Temperature, precipitation, and growing degree days (GDDs) data by month for Alburgh, VT, 2013.

Alburgh, VT	Sep-12	Oct-12	Mar-13	Apr-13	May-13

Figure 1. Planting date by variety interaction of plant heights.

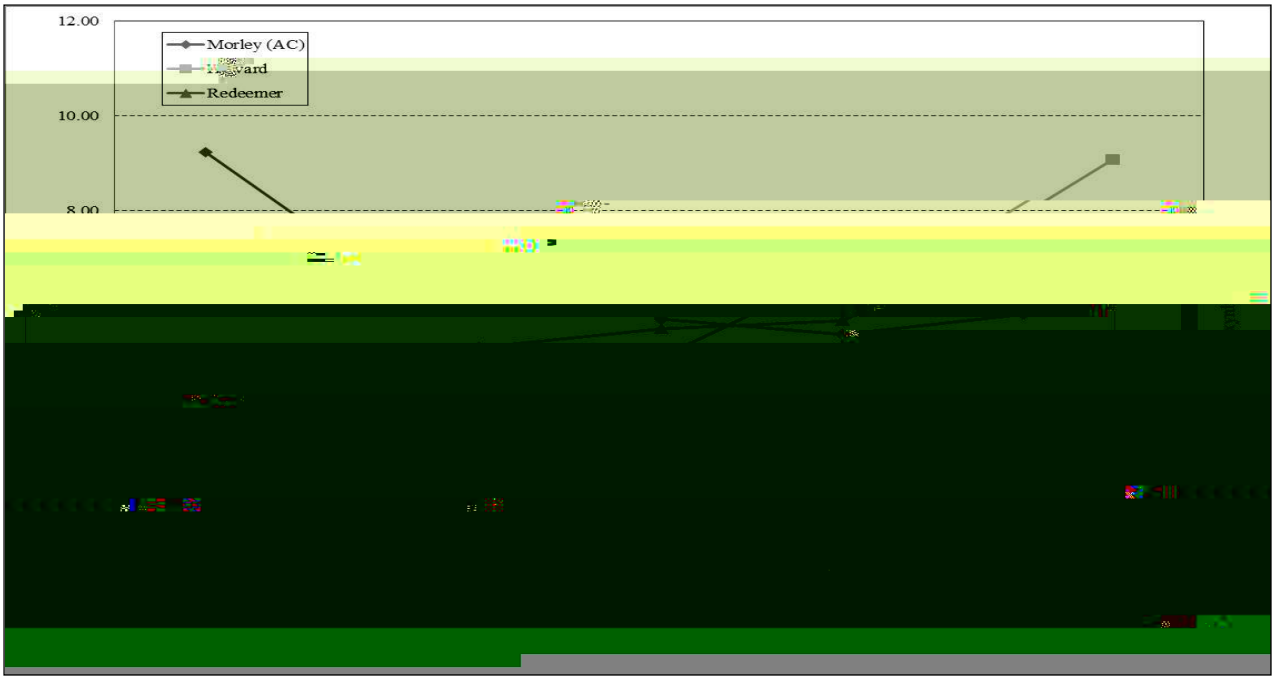

Figure 2. Planting date by variety interaction of deoxynivalenol (DON) concentrations.

Impact of Planting Date

There was significant difference in spring plant population, winter survival, vigor, and plant height by planting date (Table 5). The first planting date (12-Sep) had the highest plant population (25.0 plants per 0.33 meter), winter survival (93.3%), vigor (4.92), and plant height (41.2 inches). The last planting date of 25-Oct had the lowest spring plant population (3.63 plants per 0.33 meter), winter survival (14.6%), vigor (1.25), and plant height (29.3 inches).

Table 5. Winter wheat plant measurements by planting date, 2013.

Planting Date	Plant population	Winter survival	Vigor	Plant heights
	0.33 meter	%	(1-5)	inches
12-Sep 2012	**25.0***	**93.3***	**4.92***	**41.2***
20-Sep 2012	20.5	88.3*	4.58*	39.2*
26-Sep 2012	18.0	83.8	3.92	38.4
5-Oct 2012	12.6	85.0	3.42	34.5
11-Oct 2012	11.8	63.8	2.17	32.2
18-Oct 2012	8.63	52.5	2.00	33.5
25-Oct 2012	3.63	14.6	1.25	29.3
LSD (0.10)	2.32	7.63	0.35	2.37
Trial Mean	14.3	68.8	3.18	35.5

* Treatments that did not perform significantly lower than the top-performing treatment (in **bold**).

The sixth planting date had the highest protein level (13.9 %) and was likely related to severely depressed yields at this date. The protein levels from all of the planting dates met industry standards of 12-15% protein. All of the falling numbers for each of the planting dates were higher than 350 seconds indicating little or no sprout damage.

In the Northeast, *Fusarium* head blight (FHB) is predominantly caused by the species *Fusarium graminearum*. This disease is very destructive and causes yield loss, low test weights, low seed germination and contamination of grain with mycotoxins. A vomitoxin called deoxynivalenol (DON) is considered the primary mycotoxin associated with FHB. The spores are usually transported by air currents and can infect plants at flowering through grain fill. Eating contaminated grain greater than 1ppm poses a health risk to both humans and livestock. The DON levels were extremely high this year. All of the planting dates were above the FDA's 1ppm limit. The lowest DON level was the 20-Sep planting date (4.65 ppm).

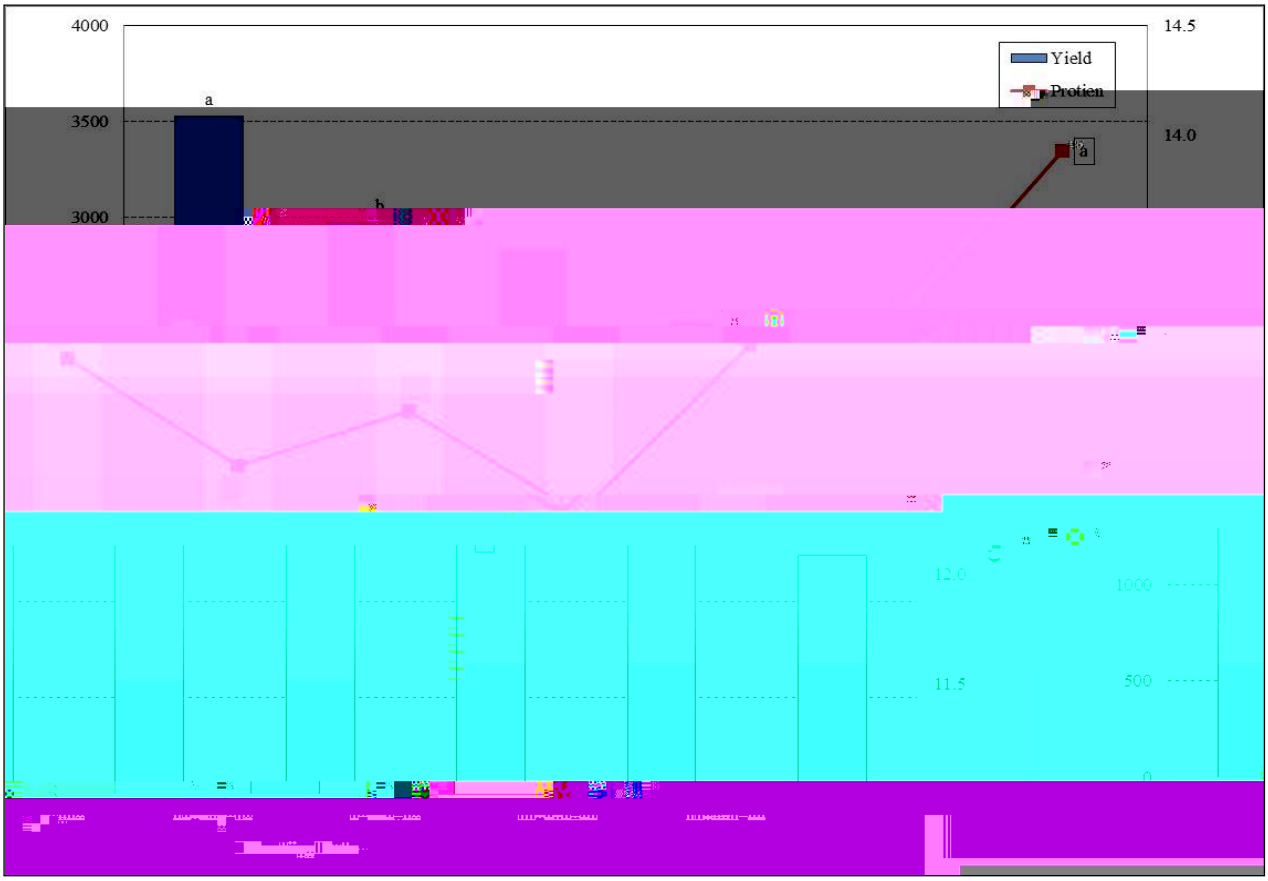

Figure 3. Yield and protein comparison between planting dates across hard red winter wheat varieties in Alburgh, VT, 2013. Treatments that share a letter did not differ significantly by planting date.

Impact of Variety

Plant population, winter survival, and vigor were not significantly different between the three winter wheat varieties Morley (AC), Harvard, and Redeemer (Table 7). Morley (AC) was the tallest variety (37.2 inches) and Harvard was the shortest (34.1 inches).

Figure 4. Yield and protein comparison between hard red winter wheat varieties across all planting dates in Alburgh, VT, 2013. Treatments that share a letter did not differ significantly by variety.

DISCUSSION

It is important to remember that the results only represent one year of data. The 2013 growing season was by far one of the most challenging in recent history due to the excessive rains during key periods of wheat development. The wet weather in May and June brought an excess of 7 inches of rain to the area. The rains started soon after spring green up which saturated the plots impacting wheat development. This could explain the increase in weed pressure observed especially in the later planting dates. The seventh planting date could not be harvested due to excessively high weed pressure. The increased weed pressure could also help explain the overall decrease in yields. The mean

This study indicates that winter wheat planted during mid-September will result in higher yields and quality. In general, as yields increase the protein concentrations decrease. Earlier planting dates produced taller wheat across all varieties and may play a role in suppressing weeds during the growing season. The last harvested planting date (18-Oct) had the lowest yield, the highest harvest moisture, the lowest test weight, the lowest falling number and the highest amounts of DON. This indicates that planting wheat in mid-October will produce a crop, but could result in reduced yields and quality. Overall, planting winter wheat early, allowing for six to eight weeks of growth before the soil freezes, will provide the best chances of high yield and quality winter wheat

ACKNOWLEDGEMENTS

The UVM Extension Crops and Soils Team would like to thank the Borderview Research Farm for their generous help with the trials, as well as acknowledge the USDA OREI grants program for their financial support. We would like to also thank Katie Blair, Ben Leduc and Laura Madden for their assistance with data collection and entry. This information is presented with the understanding that no product discrimination is intended and neither endorsement of any product mentioned, nor criticism of unnamed products, is implied.

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