2010 Maine and Vermont Organic Winter Wheat Variety Trial Results

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In 2010, the University of Maine and University of Vermont began a series of trials evaluating varieties of hard red winter wheat to identify those that perform well in northern New England under organic production. This publication presents results for winter wheat varieties. A separate publication is available for spring wheat varieties.

In Maine, trials were established at two locations: the University of Maine Rogers Farm Forage and Crop Research Facility in Old Town and Sites Farm, a private farm in Athens. In Vermont, these trials were established at the Borderview Research Farm in Alburgh and at Cornell University's Willsboro Research Farm in Willsboro, NY. This collaborative work was funded by a grant from the USDA Organic Agriculture Research and Extension Initiative to improve bread wheat production in our region.

TRIAL DESIGN AND VARIETIES

The experimental design was a randomized complete block with four replications, which means that each variety was planted in four separate plots at each location. The winter wheat varieties that were evaluated are listed in Table 1. All are hard red types except for two hard white and one soft white types. Only the hard red types were included in the statistical analyses. Hard types of wheat are preferred for bread flour.

Table 1. Winter wheat varieties planted in Maine, New York, and Vermont.

Winter Wheat Variety	Type†	Origin and Year of Release‡	Seed Source
AC Morley	HR	Canada	C&M Seed, Canada
Alliance	HR	NE, 1993	USDA-ARS, NE
Arapahoe	HR	NE, 1998	Albert Lea Seed House, MN
Bauermeister	HR	WA, 2005	Washington State Univ.
Borden	MHR	Canada, 1983	Semican, Canada
Camelot	HR	NE, 2008	USDA-ARS, NE
Expedition	HR	SD, 2002	Albert Lea Seed House, MN
Harvard	HR	Canada	Agri-Culver Seeds, NY
Jerry	HR	ND, 2001	North Dakota State Univ.
Mace	HR	NE, 2008	USDA-ARS, NE
Maxine	HR	Canada, 2001	C&M Seed, Canada
Millennium	HR	NE, 1999	USDA-ARS, NE
Overland	HR	NE, 2006	USDA-ARS, NE
Redeemer	HR	Canada	C&M Seed, Canada
Red Fife	HR	Heritage var., Canada, 1860	Butterworks Farm, VT
Roughrider	HR	**ND, 1975**	**North Dakota State Univ.**
Wahoo	HR	NE, 2000	USDA-ARS, NE
Warthog	HR	Canada	Semican, Canada
Wesley	HR	NE & SD &WY, 2000	USDA-ARS, NE
Zorro	HR	Canada	C&M Seed, Canada
Anton	HW	NE, 2008	USDA-ARS, NE
MDM	HW	WA, 2005	Washington State Univ.
Xerpha	SW	WA, 2008	Washington State Univ.

† HR = hard red, MHR = medium hard red, HW = hard white, SW = soft white.
‡ Year of release was not always available.

WEATHER DATA

Seasonal precipitation and temperature recorded at the Rogers Farm Forage and Crop Research Facility Old Town, ME and weather stations in close proximity to the Vermont and New York trials are shown in Table 2. Weather data for a site closer to Athens than Old Town were not available. Weather in 2010 was ideal for growing wheat. Mild conditions during the winter and an early spring caused the wheat to reach major developmental stages 1-2 weeks earlier than usual. From planting to harvest, there was an accumulation of 3427 Growing Degree Days (GDD) in Old Town, 5094 GDDS in South Hero, and 5189 GDDS in Willsboro.

CULTURAL PRACTICES

Plots were managed following practices similar to those used by farmers in New England (see Table 3).

Rogers Research Farm - Old Town, ME - The trial was conducted on two nearby fields both of which had been in annual crop production for more than 20 years. Sweet corn and mixed vegetables were grown on these fields the year prior to planting. In early September 2009, the fields were prepared using a moldboard plow and seedbed conditioner. Solid dairy manure was applied at a rate of 20 tons/ac on September 22 and immediately incorporated with a Perfecta harrow. The plots were seeded with an Almaco Cone Seeder on September 24, 2009 and harvested with an Almaco SPC20 plot combine on July 20, 2010.

Sites Farm - Athens, ME - The field used in the trial in Athens had been in a continual winter rye forage rotation for more than 5 years. In early September 2009, the fields were prepared using a moldboard plow and seedbed conditioner. On September 11, chicken manure (from an egg laying operation) was applied at a rate of 4 tons/ac and then incorporated with a spring-tine harrow on the same day. A spring-tine harrow was used for final seedbed preparation a day before planting. The plots were

Table 2. Temperature and precipitation summary for Old Town, ME, South Hero, VT, and Willsboro, NY, 2010.†

Location	September 2009	October 2009	March	April	May	June	July	Total
Old Town, ME								
Total Precipitation (in.)	1	6‡	5	2	2	4‡	2	22
Departure from Normal	-3	2	1	-1	-2	0	-1	-2
Average Temperature (°F)	56	43	37	46	56	62‡	71	---
Departure from Normal	1	-2	6	4	2	-1	2	---
Growing Degree Days§	700	334	164	426	726	857‡	1182	4389
South Hero, VT								
Total Precipitation (in.)	4	5	3	3	1	5	4	25
Departure from Normal	1	1	1	0	-2	1	1	3
Average Temperature (°F)	58	44	38	49	60	66	74	---
Departure from Normal	-3	-5	7	6	3	0	3	---
Growing Degree Days	771	396	229	521	854	1019	1305	5095
Willsboro, NY								
Total Precipitation (in.)	1	2	3	2	1	5	2	16
Departure from Normal	-3	-2	2	1	-2	2	-1	-4
Average Temperature (°F)	60	47	39	50	60	66	74	---
Departure from Normal	1	-1	10	8	6	0	4	---
Growing Degree Days	816	427	239	533	876	1004	1294	5189

† Based on National Weather Service data from cooperative observer stations in close proximity to field trials available at http://www.ncdc.noaa.gov/crn/report. Historical averages are for 30 years (1971-2000) available at http://cdo.ncdc.gov/cgi-bin/climatenormals.pl

‡ Values are incomplete due to missing or suspect data.

§ Base 32°F

seeded with an Almaco Cone Seeder on September 25, 2009 and harvested with an Almaco SPC20 plot combine on July 23, 2010.

Borderview Research Farm - Alburgh, VT - The Alburgh site had been perennial forages (reed canary and alfalfa) for the previous 10 years. In the spring of 2009, the area was moldboard plowed. In August, the field was disked and spike tooth harrowed to prepare for planting the winter wheat. The plots were seeded with a Kincaid Cone Seeder on September 26, 2009 and harvested with an Almaco SP50 plot combine on July 21, 2010.

Willsboro Research Farm - Willsboro, NY - Planting of winter wheat at the Willsboro location followed three years of alfalfa/timothy sod. The sod was plowed in August 2008 and fallowed prior to planting. The field was dragged twice during the fallow period to knock down the alfalfa and perennial grasses. The plots were seeded on September 25, 2009 with a custom made eight-row cone planter and harvested on July 26, 2010 with a Hege plot combine.

MEASUREMENTS AND METHODS

Flowering date was recorded for each variety where possible. Once the wheat reached physiological maturity, plant height, number of tillers, and wheat and weed above-ground biomass were measured. Only tillers with filled grain heads (spikes) were counted. For biomass, plants were cut one inch above the soil surface. Prior to harvest, the incidence and severity of lodging was noted for each plot.

All varieties were harvested on the same day at each site once the latest maturing variety threshed free in hand tests and weather and logistics allowed. Following harvest, the grain from both locations was cleaned with a small Clipper cleaner. Measurements taken include grain yield, moisture, test weight, crude protein, falling number, and mycotoxin levels. Harvest moisture and test weights were determined using a Seedburro GMA 128 grain moisture meter. Subsamples were ground into flour using a Perten LM3100 Laboratory Mill. Flour was then analyzed for crude protein, falling number, and mycotoxin levels. Protein content was determined using a Leco Combustion Analyzer. Most commercial mills target 12-15% protein. Falling number was determined 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 due to enzymatic activity. It is measured by the time it takes, in seconds, for a plunger to fall through a slurry of flour and water to the bottom of the tube. Falling numbers greater than 250 seconds indicate low enzymatic activity and sound quality wheat. Falling numbers lower than 200 indicate high enzymatic activity and

Table 3. General plot management of the wheat trials.

Location	Rogers Research Farm Old Town, ME	Sites Farm Athens, ME	Borderview Farm Alburgh, VT	Willsboro Research Farm Willsboro, NY
Soil type	Melrose & Elmwood fine sandy loam	Adams loamy sand	Benson rocky silt loam	Kingsbury silt clay loam
Previous crop	Mixed vegetables/ sweet corn	Winter rye sod	Reed canary and alfalfa	Fallow
Fertility source	Solid dairy manure	Layer chicken manure	Plowed in sod	Plowed in sod
Target nitrogen rate (lbs/ac)	70	70	70	70
Row spacing (in)	6.5	6.5	6	6
Seeding rate (seeds/ft^2)†	30	30	30	30
Replicates	4	3‡	4	4
Planting date	9-24-09	9-25-09	9-26-09	9-25-09
Harvest date	7-20-10	7-23-10	7-21-10	7-26-10
Harvest area (ft^2)	4' x 34'	4' x 34'	5' x 20'	4' x 13.5'
Tillage operations	Moldboard plow, seedbed conditioner	Moldboard plow, seedbed conditioner	Fall plow, disc, & spike-toothed harrow	Fall plow, disc, & spike-toothed harrow

† The target seeding rate was calculated to achieve the same plant density for each variety. This translated to 70-140 lbs seed/acre (average 113), and depended on the seed weight of each variety. ‡ Four replicates were planted but the fourth block was compromised by soil erosion so results were not included in the analysis.

WHAT IS A SIGNIFICANT DIFFERENCE?

Variations in yield and quality can occur not only due to genetics but also due to variability in soil, weather, and other growing conditions. Statistical analysis makes it possible to determine whether a difference between two varieties is real or whether it might have occurred due to other variability in the field. The Least Significant Difference (LSD) is the minimum difference needed between two averages to consider them statistically different. LSDs at the 5% level of probability are presented at the bottom of each table for each measure. Where the difference between two varieties within a column is equal to or greater than the LSD value, you can be sure in 19 out of 20 chances that there is a real difference between the two varieties.

In the example below, variety A is significantly different from variety C because the difference between their yields (1454) is greater than the LSD value (889). Variety A is not significantly different from variety B because the difference between their yields (725) is less than the LSD value (889).

Throughout this bulletin, the greatest value at each site for each measure is indicated with an underline and bold type. Varieties that are not significantly different from the greatest value are also in bold type. Using the example below, variety C had the highest measured yield (underlined and bolded) but it was not significantly different than the yield of variety B (bolded).

Example Table

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

poor quality wheat. Concentrations of deoxynivalenol (DON), a mycotoxin produced by the fungus that causes Fusarium head blight, was determined using Veratox DON 2/3 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. DON concentrations were not determined for the Athens site, but there were no signs of Fusarium infection on the grain heads.

All data were analyzed using mixed model Analysis of Variance (ANOVA) in which replicates were considered random effects. The LSD procedure was used to separate variety averages when the ANOVA F-test was significant ($P<0.05$). There were significant differences between the locations for most parameters, so results from each location are reported independently.

Harvesting the Old Town trial.

Harvesting the Alburgh trial.

RESULTS

Winter Wheat Growth and Development

In Maine, most varieties flowered during the last week of May and the first week of June, whereas most flowering at the Vermont and New York sites occurred during the first two weeks of June (Table 4). The Washington State University varieties, Bauermeister, MDM, and Xerpha, had the latest flowering dates at all sites. Lodging and wildlife damage was minimal at all locations.

Tillering is influenced strongly by variety, planting date, and weather. In our trial, we found tiller numbers to be correlated with wheat biomass (i.e., wheat with higher tiller numbers also tended to have greater biomass), and weakly related to grain yield. Wheat at the Vermont and New York sites had higher tiller numbers than those in Maine (Table 4). In Maine, Arapahoe and Jerry had the highest number of tillers at both locations, whereas Overland and Jerry had the highest tiller numbers in Vermont and New York. It is thought that taller varieties may be more competitive with weeds and therefore better suited for organic production than shorter varieties. However, a strong relationship between variety height and weed biomass was not observed in our trials. For instance, AC Morley, Borden, and Zorro were among the tallest varieties at all sites, in addition to Red Fife in Maine and Roughrider in Vermont

Table 4. Estimated wheat flowering date, number of tillers, and plant height, ME, NY, and VT.

Variety	Estimated Flowering Date				No. of Tillers (no./ft^2)				Plant Height (inches)			
	Week of June											
	Old Town ME	Athens ME	Alburgh VT	Willsboro NY	Old Town ME	Athens ME	Alburgh VT	Willsboro NY	Old Town ME	Athens ME	Alburgh VT	Willsboro NY
AC Morley	1-Jun	< 9-Jun	2nd wk	1st wk	30	31	56	35	36	31	**43**	**40**
Alliance	27-May	< 9-Jun	1st wk	2nd wk	35	**44**	**80**	**68**	27	23	34	32
Arapahoe	28-May	< 9-Jun	2nd wk	2nd wk	**45†**	**49**	**80**	**63**	29	27	36	32
Bauermeister	10-Jun	10-Jun	3rd wk	3rd wk	**39**	**39**	72	**53**	31	23	34	**38**
Borden	30-May	< 9-Jun	1st wk	1st wk	28	36	53	45	36	31	**45**	**39**
Camelot	29-May	< 9-Jun	1st wk	2nd wk	**39**	34	58	47	29	27	33	32
Expedition	26-May	< 9-Jun	1st wk	2nd wk	**38**	**43**	**82**	**68**	29	27	32	32
Harvard	28-May	< 9-Jun	1st wk	2nd wk	30	36	57	**63**	30	30	35	**34**
Jerry	1-Jun	< 9-Jun	2nd wk	2nd wk	**48**	**41**	**82**	**72**	33	26	**40**	**36**
Mace	1-Jun	< 9-Jun	2nd wk	2nd wk	35	33	**82**	**67**	25	20	32	34
Maxine	30-May	< 9-Jun	1st wk	2nd wk	22	30	49	34	28	24	32	31
Millennium	29-May	< 9-Jun	2nd wk	2nd wk	35	34	73	**55**	28	26	37	33
Overland	29-May	< 9-Jun	2nd wk	2nd wk	36	29	**88**	**74**	30	25	35	33
Redeemer	31-May	< 9-Jun	2nd wk	1st wk	28	34	52	40	30	29	36	33
Red Fife	3-Jun	< 9-Jun	---	---	26	21	---	---	**43**	**39**	---	---
Roughrider	---	---	2nd wk	2nd wk	---	---	**101**	**64**	---	---	**45**	**37**
Wahoo	29-May	< 9-Jun	2nd wk	2nd wk	35	**38**	**95**	**63**	28	25	36	34
Warthog	31-May	< 9-Jun	2nd wk	2nd wk	29	28	45	45	33	24	38	34
Wesley	27-May	< 9-Jun	1st wk	2nd wk	**38**	**43**	73	**53**	25	22	31	31
Zorro	2-June	< 9-Jun	2nd wk	2nd wk	27	24	45	35	37	32	38	**39**
Anton‡	29-May	< 9-Jun	2nd wk	2nd wk	29	33	51	49	28	23	33	29
MDM‡	10-Jun	11-Jun	3rd wk	3rd wk	35	34	58	44	30	22	32	34
Xerpha‡	6-Jun	10-Jun	3rd wk	3rd wk	29	31	56	50	27	24	30	32
Trial Average	---	---	---	---	*34*	*33*	*70*	*55*	*31*	*26*	*36*	*34*
LSD (0.05)	---	---	---	---	*10*	*11*	*23*	*21*	*1*	*4*	*5*	*5*

† For all measures, bolded values are not significantly different from the highest value, which is indicated with underline.
‡ Variety is not a hard red type and was not included in statistical analyses.

Table 5. Weed and wheat plant biomass, ME, NY, and VT.

Variety	Weed Biomass (lbs/acre)				Wheat Plant Biomass (lbs/acre)			
	Old Town ME	Athens ME	Alburgh VT	Willsboro NY	Old Town ME	Athens ME	Alburgh VT	Willsboro NY
AC Morley	130	530	0	197	6855	5141	9322	9736
Alliance	63	1019	0	213	5357	4282	8551	9468
Arapahoe	44	1352	0	140	6926	5856	11673	9107
Bauermeister	**36**	606	208	339	7663	5312	10914	9379
Borden	45	805	11	102	6736	6159	10648	11388
Camelot	**34**	1334	53	109	7785	5465	8990	8981
Expedition	126	550	20	29	6783	6246	10752	10849
Harvard	64	860	162	98	6853	7605	8894	10951
Jerry	86	817	155	78	8764	5850	12586	10097
Mace	80	1005	51	317	5393	3365	10653	8719
Maxine	229	808	20	**627**	5679	3104	11177	7982
Millennium	**33**	763	0	146	5944	5634	9051	9142
Overland	48	1103	75	211	6757	4337	10967	11345
Redeemer	42	748	113	160	5973	6238	9499	8516
Red Fife	127	1082	---	---	6741	4245	---	---
Roughrider	---	---	0	58	---	---	13203	10130
Wahoo	58	675	228	49	6423	5076	12898	9909
Warthog	121	1030	0	263	6851	4374	9928	8660
Wesley	48	706	168	257	6457	5909	8618	8923
Zorro	**26**	707	157	275	7215	5611	8817	8394
Anton‡	42	698	38	120	6265	5091	8979	9339
MDM‡	49	1099	0	753	6985	4325	8137	8301
Xerpha‡	45	1056	36	233	6833	5505	9505	10621
Trial Average	*76*	*873*	*75*	*232*	*6692*	*4755*	*10376*	*9562*
LSD (0.05)	*11*	*NS §*	*NS §*	*277*	*NS §*	*NS §*	*NS §*	*NS §*

† For all measures, bolded values are not significantly different from the highest value, which is indicated with underline. For weed biomass, the lowest values are indicated.
‡ Variety is not a hard red type and was not included in statistical analyses.
§ No significant difference among varieties.

and New York. Yet these varieties did not necessarily have the lowest weed biomass among the varieties (Table 5). Other factors, like variable plant stands and spotty weed pressure, also influenced weed biomass in our trials. In general, weed pressure at the Old Town site was lowest and consisted almost solely of the winter annual Shepherd's Purse (Capsella bursa-pastoris). The Athens site had the highest weed pressure where perennial weeds such as quackgrass (Elytrigia repens) were a major issue and contributed to the lower yields at this site. Generally, winter wheat is very competitive against summer annual weed problems but is very susceptible to perennial weeds. Therefore, it is important to choose a site with low perennial weed pressure for winter varieties.

Winter Wheat Yield

Yields are presented in Table 6 and also in graphical form in Figure 1 to easily compare varieties. Overall, wheat yields were higher in Vermont and New York than in Maine, which was likely related to their greater number of growing degree days. Differences in weed pressure and background fertility were also likely involved. Average yields were 3647 lbs/ac in Alburgh, 3707 lbs/ac in Willsboro, 2785 lbs/ac in Old Town, and 1610 lbs/ac in Athens; Table 6, Fig. 1. The highest yielding varieties were, in Old Town, Jerry at 3469 lbs/ac; in Athens, Harvard at 2409 lbs/ac; and in Vermont and New York, Borden at 4615 and 4657 lbs/ac. Varieties that yielded well at all sites were Borden, Camelot, Harvard, and Jerry. Additional varieties that yielded well at two or three sites included Alliance, Arapahoe, Millennium, Overland, Wahoo, and Zorro. Red Fife is considered a spring type wheat but sowing it in the fall as a winter wheat has gained interest in our region. In this winter wheat trial Red Fife was the lowest yielding variety in Old Town and the third lowest in Athens. It was not included at the other sites. In general, most varieties reach the optimal 55 to 60 lb/bu test weight for wheat. The later maturing varieties from

Table 6. Grain moisture at harvest, test weight, and yield of winter wiheat in ME, NY, and VT.

Variety	Grain Moisture at Harvest† (%)				Test Weight (lbs/bu)				Yield at 13.5% Moisture (lbs/acre)			
	Old Town ME	Athens ME	Alburgh VT	Willsboro NY	Old Town ME	Athens ME	Alburgh VT	Willsboro NY	Old Town ME	Athens ME	Alburgh VT	Willsboro NY
AC Morley	21	14	**17**	11	58	**56‡**	**57**	**59**	2746	1635	3985	3798
Alliance	22	14	13	11	57	**56**	56	59	2667	1769	4011	**4390**
Arapahoe	21	14	14	11	56	**55**	55	**59**	2515	1853	4041	**4439**
Bauermeister	**25**	15	**17**	11	54	50	51	56	2656	1158	3176	3146
Borden	20	14	15	9	55	53	54	58	**3344**	**2127**	4615	**4657**
Camelot	22	14	**16**	11	57	**55**	**56**	**59**	**2887**	**1962**	3631	**4121**
Expedition	22	14	**16**	12	58	**56**	**56**	**60**	2656	**2371**	3466	**4173**
Harvard	19	15	**16**	14	58	**56**	56	**60**	**3247**	**2409**	3237	**4303**
Jerry	21	14	15	10	57	**55**	56	59	**3469**	**1897**	4408	**4432**
Mace	20	14	12	10	57	53	54	57	2384	762	3653	3337
Maxine	19	14	15	11	59	**55**	**57**	58	2388	1788	3692	2822
Millennium	22	14	**16**	11	58	**56**	**56**	**59**	2511	1521	4319	**4397**
Overland	22	15	**16**	11	57	**55**	56	**59**	**3001**	1645	4208	**4372**
Redeemer	19	13	15	12	59	**56**	**57**	58	2652	**1905**	3886	3043
Red Fife	20	13	---	---	58	**56**	---	---	1923	1313	---	---
Roughrider	---	---	15	10	---	---	**57**	**60**	---	---	3423	3798
Wahoo	21	14	14	10	56	**55**	55	**59**	**2797**	1724	3881	**4451**
Warthog	20	13	**17**	11	58	**55**	**57**	58	**3387**	1444	3580	3178
Wesley	21	14	12	9	57	**54**	55	57	2679	1676	3661	4054
Zorro	19	14	15	13	59	**55**	**56**	**59**	**3145**	**2091**	2836	3746
Anton§	21	14	14	11	58	55	56	59	2637	1574	3521	3413
MDM§	27	15	15	10	56	47	51	56	2830	843	2606	3315
Xerpha§	22	14	12	7	54	53	51	50	3496	1530	3135	2095
Trial Average	*21*	*14*	*15*	*11*	*57*	*55*	*55*	*58*	*2785*	*1610*	*3647*	*3707*
LSD (0.05)	---	---	*1*	*NS ¶*	---	*2*	*1*	*2*	*695*	*539*	*NS*	*564*

† All varieties at each site were harvested on the same day.
‡ For all measures, bolded values are not significantly different from the highest value, which is indicated with an underline.
§ Variety is not a hard red type and was not included in the statistical analyses.
¶ No significant difference among varieties.

Washington state (Bauermeister, MDM, and Xerpha) tended to have lower test weights and higher moisture.

Winter Wheat Quality

Commercial mills use a variety of measurements to determine if a particular lot of wheat grain is suitable for bread flour, including grain protein, falling number, test weight, and mycotoxin (DON) concentration. Overall, crude protein was higher in Athens and Willsboro (12.0 and 13.0%, respectively) than in Old Town and Alburgh (10.7 and 10.8%, respectively;Table 7, Fig. 2). Maxine and Redeemer had were among the top protein varieties at all sites. Other varieties with relatively high protein levels at two or more sites AC Morley, Red Fife, Roughrider, and Zorro. There were no statistically significant differences among the crude protein levels at the Athens site. Almost every variety had acceptable falling number levels based on mill standards (>250 seconds). Xerpha and MDM, which are not hard red varieties, were exceptions.

There were few signs of Fusarium head blight at either of the Maine sites, and DON levels measured for the varieties grown at Old Town were all under the 1 ppm limit for human consumption. DON levels were not measured for the Athen site. The fun-

gus that causes Fusarium head blight and produces DON infects the plants through the flower. Conditions were dry just before and during flowering in Maine which would have prevented innoculum from building up and infecting plants. In contrast, in Vermont and New York, a few varieties exceeded the 1 ppm standard. In particular, the three Washington state varieties (Bauermeister, MDM, and Xerpha) had the highest levels, which could be related to their later flowering time or to the fact that these varieties were developed in a region with low Fusarium disease pressure.

Table 7. Quality of winter wheat, ME, NY, and VT.

Variety	Crude Protein at 12% Moisture (%)				Falling Number at 14% Moisture (seconds)			DON (ppm)		
	Old Town ME	Athens ME	Alburgh VT	Willsboro NY	Old Town ME	Alburgh VT	Willsboro NY	Old Town ME	Alburgh VT	Willsboro NY
AC Morley	10.8	12.1	**12.1**	13.1	383	368	349	< 0.5	0.6	0.7
Alliance	10.4	11.5	9.9	12.4	283	346	333	< 0.5	< 0.5	< 0.5
Arapahoe	11.0	12.0	11.2	13.0	397	396	**400**	< 0.5	0.6	0.6
Bauermeister	10.1	11.8	11.4	**13.5**	**443**	380	375	< 0.5	**5.6**	**4.2**
Borden	10.1	11.6	9.7	12.1	393	364	361	< 0.5	< 0.5	0.5
Camelot	10.7	11.9	11.1	13.1	**415**	395	386	< 0.5	0.6	0.4
Expedition	10.2	12.1	10.1	13.1	404	388	363	< 0.5	0.6	0.8
Harvard	9.6	11.3	9.7	12.2	300	374	363	< 0.5	1.9	0.6
Jerry	10.9	12.1	10.7	12.7	371	381	376	< 0.5	2.1	< 0.5
Mace	10.8	12.0	**11.5**	12.9	**429**	388	387	< 0.5	0.9	0.9
Maxine	**11.7†**	12.3	10.8	**13.6**	292	385	375	< 0.5	< 0.5	0.8
Millennium	10.8	12.1	10.0	12.8	388	376	378	< 0.5	< 0.5	1.0
Overland	10.5	12.1	9.6	12.8	**416**	382	**399**	< 0.5	0.8	< 0.5
Redeemer	**11.5**	12.0	**12.9**	**14.3**	**426**	**421**	**420**	< 0.5	< 0.5	< 0.5
Red Fife	**11.7**	12.3	---	---	386	---	---	< 0.5	---	---
Roughrider	---	---	11.4	**13.6**	---	**399**	365	---	0.6	0.8
Wahoo	10.1	11.9	9.5	13.1	381	377	379	< 0.5	2.0	0.9
Warthog	10.7	12.1	11.1	13.1	**426**	**412**	**422**	< 0.5	1.0	0.9
Wesley	10.6	12.5	10.8	12.8	406	382	377	< 0.5	0.7	1.4
Zorro	10.6	11.8	**12.1**	13.1	297	370	342	< 0.5	0.9	0.9
Anton‡	10.9	11.9	11.5	13.7	342	355	236	0.5	1.8	2.4
MDM‡	10.5	12.7	11.5	13.7	306	272	224	< 0.5	9.2	10.1
Xerpha‡	10.0	11.9	11.1	13.3	248	211	209	0.8	7.5	8.9
Trial Average	*10.7*	*12.0*	*10.8*	*13.0*	*389*	*383*	*376*	---	*1.7*	*1.7*
LSD (0.05)	*0.7*	*NS §*	*1.5*	*1.1*	*33*	*24*	*27*	---	*1.9*	*0.9*

† For all measures, bolded values are not significantly different from the highest value, which is indicated with an underline.
‡ Variety is not a hard red type and was not included in the statistical analyses.
§ No significant difference among varieties.

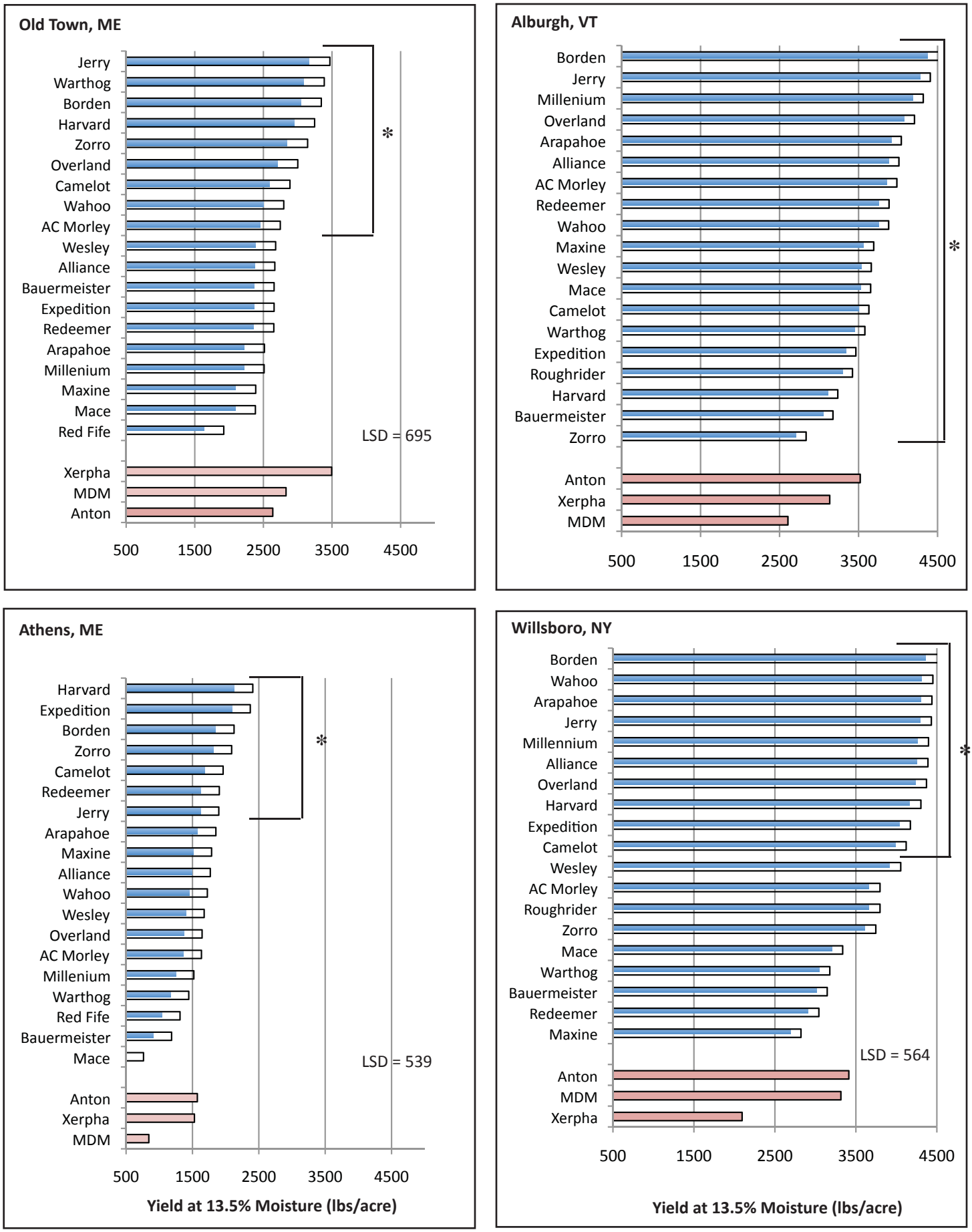

Figure 1. Yield of winter wheat varieties.

* Varieties under this bar did not perform significantly lower than the top performing variety.

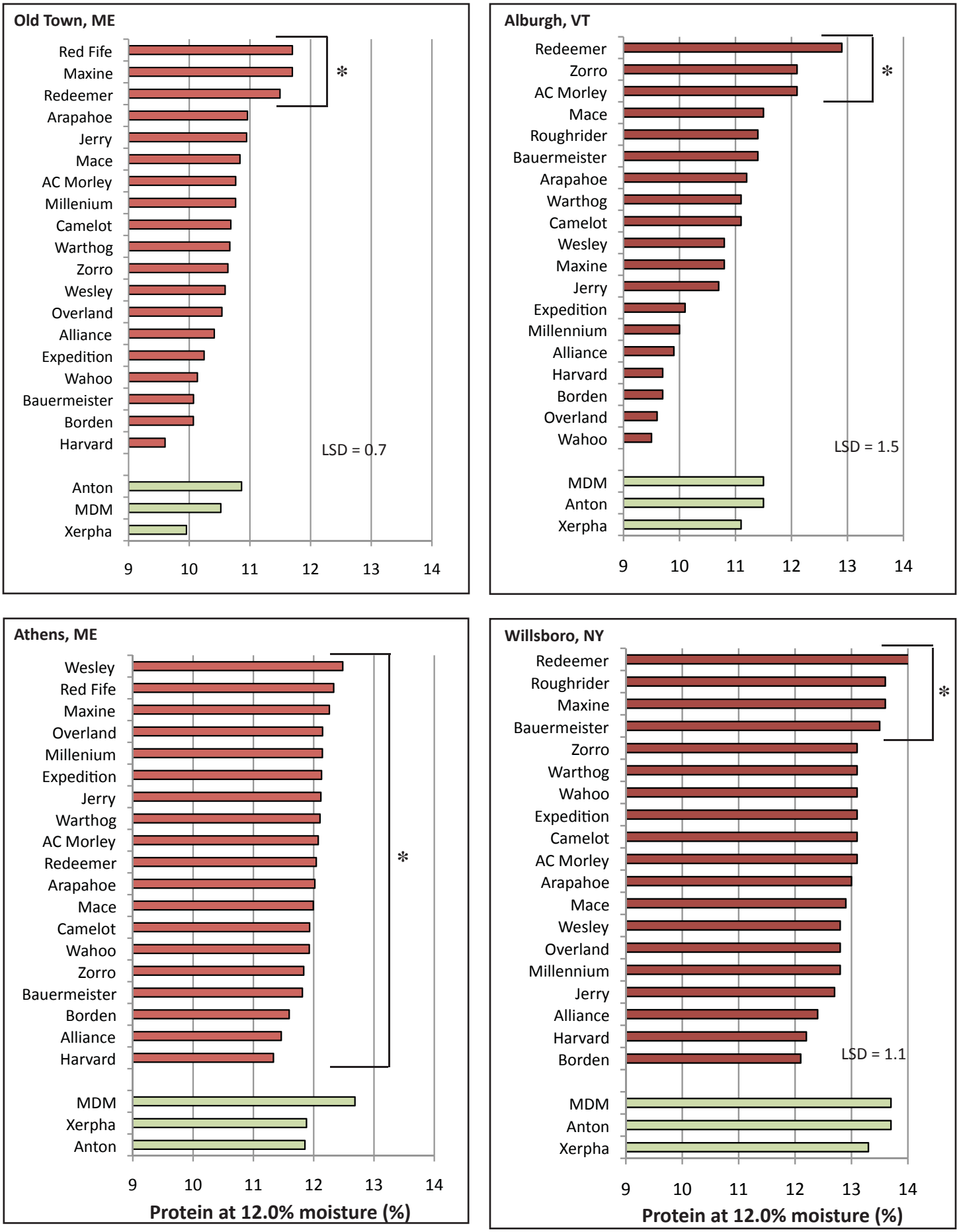

Figure 2. Protein concentration in winter wheat varieties.

* Varieties under this bar did not perform significantly lower than the top performing variety.

DISCUSSION

It is important to note that the results presented in this report are from just one year of data, and do not necessarily reflect how the varieties would perform in different years. We will repeat these trials in 2011. However, some observations are worth noting at this point. Historical yields for organic hard red winter wheat grown in this region over the last 10 years are estimated to be 2500 lbs/ac (personal communication, Matt Williams, 2011). Average yields in these trials exceeded this average at three of the four sites. The average yield in Willsboro (3707 lbs/ac) and Alburgh (3647 lbs/ac) was higher than in Old Town (2785 lbs/ac) and much higher than in Athens (1610 lbs/ac). High weed pressure and low background fertility contributed to poor growing conditions at the Athens site. The relative performance of each variety was not always consistent across locations, due likely to such differences in growing conditions and soil type. For instance, a few varieties that were in the top-yielding group in Old Town, yielded relatively poorly in Athens (ex. Warthog); and others that were top yielders in Athens were not in the top group in Old Town (ex. Expedition). Yet some varieties yielded consistently well at all sites, including Borden, Camelot, Harvard, and Jerry. In addition, Zorro performed well in Maine, and Alliance, Arapahoe, and Millennium performed well in New York and Vermont.

Crude protein levels were highest at the Athens and Willsboro sites, with nearly all varieties at or above 12%, the standard cutoff for good baking characteristics. High yields are often associated with lower protein as seen at the Old Town site. This was not the case at the Willsboro site, however, where yields were high and accompanied high protein levels. Redeemer stands out for being a variety that consistently yielded close to or above the historical level and also had relatively high grain protein values at all sites.

One variety new to the Northeast that showed promise in our trials is Jerry. While not always the top performer for each measurement, Jerry was among the top yielders at all sites and had relatively good grain protein levels. We're looking forward to seeing how it performs next year.

Before selecting varieties, it may be helpful to compare these results to variety trials from other regions. Ultimately, though, it is important to evaluate data from test sites that are similar to your farm and region in terms of soil type and climate when deciding which varieties to grow.

Visitors tour the winter wheat variety trial at the 2010 University of Maine Sustainable Agriculture Field Day at Rogers Research Farm.

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