

PROJECT TITLE: Evaluation of spring barley variety performance in trials near Moccasin, Denton, and Fort Benton.

PROJECT LEADER: D. M. Wichman, Agronomist, Moccasin, MT

PROJECT PERSONNEL: T. K. Blake, Barley Breeder, Bozeman, MT
P. F. Hensleigh, Barley Research Assoc., Bozeman, MT
G. L. Sharp, Research Associate, Moccasin, MT
J. Vavrovsky, Research Specialist, Moccasin, MT
Dave Philips, Fergus County Extension Agent, Lewistown, MT
Judee Wargo, Chouteau County Ext. Agent, Fort Benton, MT

OBJECTIVES: To evaluate the performance of spring barley varieties in environments and cropping methods representative of the southern triangle and central Montana.

RESULTS:

Yield – Yields ranged from 47.3 to 59.7 bu/a at Moccasin and from 16.1 to 21.9 bu/a at Fort Benton (Table 1). Yields at Fort Benton were well below average due to low rainfall. Dry spring conditions contributed to uneven germination at the Denton site and the nursery was abandoned. The yield of Xena was high at both locations harvested although differences in yield between varieties were not significant at either site. Stressful growing conditions contributed to the increased variability. Multiple year yield summaries from each location are listed in Tables 3-5.

Test Weight – Test weights were near average this year with a nursery average of 49.6 lbs/bu at Moccasin and 48.1 lbs/bu at Fort Benton (Table 1).

Protein – Proteins were above average at both locations ranging from 15.5 to 18.3 percent at Moccasin and from 16.8 to 20.3 percent at Fort Benton (Table 1). High protein levels are not normally associated with average test weights.

Heading Date – Heading dates at Moccasin ranged from 183 to 188 days with all varieties heading within the first week of July (Table 2).

Plant Height – Plant heights ranged from 24 to 31 inches at Moccasin and from 16 to 22 inches at Fort Benton (Table 2). Lewis and Stark were among the tallest of the varieties grown at either location.

Plump Percent and Thin – Despite low moisture levels, the percentage of plump kernels for several varieties was satisfactory. Percent plump values for Moccasin ranged from 8.2 to 68 percent, with Xena, Harrington, Baronesse, and Stark all having values greater than 50 percent. Percent plump values at Fort Benton ranged from 24.3 to 80.1 percent.

SUMMARY: The trial at Moccasin was planted re-crop after canola and the trial at Fort Benton followed winter wheat. Barley yields ranged from average to well below average depending on the location and the amount of rainfall received. Equations predicting barley yields based on past variety performance are presented in Table 6. Post harvest seed dormancy evaluations were conducted on barley seed harvested from the trials as a means of predicting weed potential from volunteer barley in cropping systems. Cultivars having the longest germination times are hypothesized to be problematic as this seed would remain dormant through the winter and germinate in early spring to present a weed problem. In September, seed from seven varieties and three locations was placed on wet blotter paper and incubated at 50° F. At three, four, five, and seven days, the percentage of germinated seed was recorded. Harrington had a germination rate of 42 percent after three days, Lewis was 28 percent germinated, and Conlon's germination rate was lowest at 7 percent (Table 7). Differences in germination between the three sites were generally insignificant (Table 8).

FUTURE PLANS: Spring barley variety evaluations will continue at Moccasin, Denton, and Fort Benton.

Table 51. 2001 Spring barley yield, test weight, and protein performance in Central Montana.
Exp. 3600 Central Agricultural Research Center, Moccasin, MT.

ID	Pedigree	----- Grain Yield -----			----- Test Weight -----			----- Grain Protein -----		
		Moccasin	Fort Benton	Average	Moccasin	Fort Benton	Average	Moccasin	Fort Benton	Average
		bu/a	bu/a	bu/a	lbs/bu	lbs/bu	lbs/bu	%	%	%
BZ594-19	Xena	59.7	20.9	40.3	50.1	47.4	48.8	15.7	17.5	16.6
SK76333	Harrington	57.2	16.1	36.7	48.1	46.6	47.3	16.6	18.6	17.6
MTLB5	MTLB5	55.0	17.7	36.4	50.5	47.0	48.8	15.5	20.3	17.9
MT950186	MT950186	50.5	21.9	36.2	50.0	49.8	49.9	16.9	17.1	17.0
MTLB13	MTLB13	53.5	18.7	36.1	47.9	46.7	47.3	16.9	19.2	18.1
CI15856	Lewis	53.1	18.9	36.0	50.7	48.4	49.6	16.7	19.4	18.0
PI568246	Baronesse	54.0	17.6	35.8	48.5	47.1	47.8	16.8	18.3	17.6
PI491534	Gallatin	52.1	19.0	35.5	51.4	49.4	50.4	15.7	17.3	16.5
MT970116	Klages/Baronesse	53.0	18.0	35.5	51.8	49.8	50.8	16.4	17.1	16.8
MT960099	Manley/Baronesse	49.5	21.3	35.4	47.3	48.5	47.9	18.0	17.7	17.9
H3860224	Lewis/Apex	53.6	16.9	35.3	50.0	48.6	49.3	16.8	19.6	18.2
PI610264	Valier	53.3	17.2	35.3	50.0	48.0	49.0	18.3	18.5	18.4
MT960228	Stark/Baronesse	49.8	19.5	34.7	48.1	46.9	47.5	17.9	17.2	17.6
MT960100	Manley/Baronesse	51.8	17.2	34.5	49.6	49.4	49.5	17.5	19.0	18.3
ND9866	Stark	48.8	17.8	33.3	51.6	49.7	50.7	15.8	16.8	16.3
ND13299	Conlon	47.3	18.8	33.1	47.8	46.6	47.2	17.1	18.0	17.5
Mean		52.6	18.6	35.6	49.6	48.1	48.9	16.8	18.2	17.5
CV (s/mean)*100		8.5	14.6		2.2	2.2		0.0		
LSD (0.05)		ns	ns		1.8	1.7		0.0		

High and low entries for each location are in bold and entries are listed by mean yield.

Planting Date: 4/19/01 4/23/01
Harvest Date: 8/13/01 8/16/01
Previous Crop: Canola Winter Wheat
Fertilizer (lbs N/a) 77.0 90.0
Growing Season Precipitation: 7.3 4.7
Producer/Cooperator: Birkeland

Table 52. 2001 Spring barley heading date, lodging, plant height, and grain plumpness in Central Montana.

Exp. 3600 Central Agricultural Research Center, Moccasin, MT.

ID	Pedigree	Heading	Lodging	Lodging	----- Plant Height -----			---- Plump ----		----- Thin -----	
		Date*	Prevalence**	Severity***	Moccasin	F Benton	Average	Moccasin	F Benton	Moccasin	F Benton
		day	%	degree	inches	inches	inches	%	%	%	%
BZ594-19	Xena	186	100	10	28.7	20.0	24.3	65.0	64.8	11.5	12.0
SK76333	Harrington	186	90	10	27.7	18.0	22.8	55.5	54.6	16.9	16.0
MTLB5	MTLB5	186	0	0	28.0	18.0	23.0	35.8	30.9	26.4	32.2
MT950186	MT950186	184	90	10	28.0	17.0	22.5	28.2	57.5	29.8	13.5
MTLB13	MTLB13	185	80	10	27.0	18.0	22.5	20.1	24.3	43.5	36.9
CI15856	Lewis	185	100	10	30.0	20.0	25.0	44.1	48.4	23.1	21.7
PI568246	Baronesse	187	90	10	25.3	19.0	22.2	59.3	58.3	15.2	14.6
PI491534	Gallatin	184	100	10	29.0	20.0	24.5	41.2	61.3	24.0	13.5
MT970116	Klages/Baronesse	183	100	10	30.7	18.0	24.3	67.6	80.1	10.2	5.7
MT960099	Manley/Baronesse	188	0	0	24.0	16.0	20.0	8.2	35.1	61.8	27.6
H3860224	Lewis/Apex	188	40	30	28.0	20.0	24.0	67.9	59.7	10.0	15.3
PI610264	Valier	186	80	10	29.0	18.0	23.5	35.7	38.9	28.0	23.6
MT960228	Stark/Baronesse	186	100	10	27.3	18.0	22.7	22.4	43.1	37.3	24.4
MT960100	Manley/Baronesse	188	0	0	24.3	16.0	20.2	27.6	56.4	30.0	13.8
ND9866	Stark	183	20	45	31.0	22.0	26.5	68.0	75.4	10.9	7.1
ND13299	Conlon	184	0	0	27.7	22.0	24.8	23.9	43.9	37.4	21.4
Mean		185.4	61.9	10.9	27.9	18.8	23.3	41.9	52.0	26.0	18.7
CV (s/mean)*100		0.6	0.0	0.0	4.6	2.2		29.6	17.7	31.6	31.2
LSD (0.05)		1.8	0.0	0.0	2.1	1.7		20.7	15.3	13.7	9.7

High and low entries for each location are in bold and entries are listed by mean yield.

* Heading date is the day from January 1, 2001 and was recorded for the Moccasin site only.

** Lodging prevalence is the percentage of plot that is lodged and ranges from 0-100; lodging notes were taken at the Moccasin site only.

*** Lodging severity is the angle of lodging from vertical measured in degrees; 0=vertical, 90= horizontal.

Table 53. 2001 Moccasin re-crop barley multi-year yield summary of selected varieties.

Exp. 3670 Central Agricultural Research Center, Moccasin, MT.

Selected Varieties	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	Average	Hector Same Years
	----- bu/a -----											
Hector	58	66	47	66	30	69	43	57	53	-	54.3	-
Harrington	45	62	44	65	31	71	36	50	51	57	51.2	54.3
Lewis	55	66	44	58	33	76	37	58	54	53	53.4	54.3
Bowman	56	62	35 ^{1/}	63	33	64	39	58	52	-	51.3	54.3
Gallatin	53	58	48	56	30	67	39	60	49	52	51.2	54.3
Chinook	48	68	40	68	28	73	43	52	51	-	52.3	54.3
Stark	58	60	38	58	32	70	42	51	51	49	50.9	54.3
Baronesse	59	76	44	63	33	73	44	54	57	54	55.7	54.3
Xena								53	57	60	56.6	55.0
Valier								56	50	53	53.1	55.0
Nursery Mean	52.6	64.3	42.1	63.5	30.6	71.7	41.8	54.9	53.2	52.6		

^{1/} Bowman experienced animal damage in the 1994 trial.

Table 54. 2001 Denton re-crop barley multi-year yield summary of selected varieties.

Exp. 3671 Central Agricultural Research Center, Moccasin, MT.

Selected Varieties	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001*	Average	Hector Same Years
	----- bu/a -----												
Hector	68	45	90	41	66	32	67	40	37	52	-	53.8	-
Harrington	59	37	102	33	70	25	68	40	33	47	-	51.4	53.8
Lewis	68	33	101	41	69	31	79	34	31	55	-	54.2	53.8
Bowman	51	37	99	42	67	29	65	37	29	56	-	51.2	53.8
Gallatin	65	39	100	40	68	31	78	38	31	55	-	54.5	53.8
Chinook	72	30	106	37	70	30	79	41	30	50	-	54.6	53.8
Stark	70	36	105	41	71	32	75	40	30	53	-	55.3	53.8
Baronesse	71	37	121	38	73	31	73	41	27	52	-	56.4	53.8
Xena									34	56	-	44.7	44.4
Valier									27	48	-	37.5	44.4
Nursery Mean	65.0	36.8	104.0	38.0	67.9	29.8	72.3	39.3	31.6	51.8			

* Trial was not harvested in 2001 because of extreme uneven germination throughout the trial.

1992 trial was planted re-crop on pea ground in 1992. 1996 trial was planted re-crop following buckwheat. 1997 trial was planted re-crop following millet. Only two reps were harvested in 1998 due to extremely uneven germination in one replication.

Table 55. 2001 Fort Benton re-crop barley multi-year yield summary of selected varieties.

Exp. 3672 Central Agricultural Research Center, Moccasin, MT.

Selected Varieties	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	Average	Hector Same Years
	----- bu/a -----											
Hector	21	69	65	56	48	74	31	76	21	-	51.2	-
Harrington	21	68	54	64	51	68	23	67	19	16	45.1	51.2
Lewis	19	73	61	50	53	77	31	72	27	19	48.2	51.2
Bowman	20	75	59	59	44	84	35	73	30	-	53.2	51.2
Gallatin	28	66	63	52	46	67	29	77	14	19	46.1	51.2
Chinook	20	74	66	67	55	80	29	74	28	-	54.8	51.2
Stark	19	71	62	51	52	71	34	74	37	18	48.9	51.2
Baronesse	24	75	72	73	49	81	34	82	29	18	53.7	51.2
Xena								82	32	21	45.0	48.5
Valier								75	27	17	39.7	48.5
Nursery Mean	22.5	71.2	63.0	62.2	49.8	71.3	30.6	75.4	26.8	18.8		

All trials were planted on re-crop ground. The 1992-1996 trials were located on Ron Long's farm and the 1997-2001 trials were located at the Birkeland farm.

Table 56. Predicted yields of selected barley varieties grown in Central Montana based on previous seven years^{1/} of variety performance. Central Agricultural Research Center, Moccasin, MT.

Variety	Yield Level (X) in bu/a			LY ^{2/}	Predictive Equation	R ²
	30	45	60			
Baronesse	30.9	46.9	62.9	26	Y = 1.0669 - 1.069	0.9867
Bowman	31.3	45.1	58.9	20	Y = 0.9206 + 3.658	0.9540
Chinook	29.8	45.5	61.2	23	Y = 1.0443 - 1.486	0.9825
Gallatin	28.3	43.4	58.5	26	Y = 1.0066 - 1.939	0.9702
Harrington	27.1	42.4	57.7	26	Y = 1.0177 - 3.414	0.9804
Hector	30.4	44.8	59.2	23	Y = 0.9607 + 1.555	0.9835
Lewis	29.6	44.9	60.1	26	Y = 1.0187 - 0.9926	0.9710
Stark	31.4	46.0	60.5	26	Y = 0.9685 + 2.370	0.9691
Valier	28.6	43.3	58.0	10 ^{3/}	Y = 0.9824 - 0.9057	0.9904
Xena	33.5	48.0	62.5	10 ^{3/}	Y = 0.9650 + 4.590	0.9755

1/ Data used to calculate predictive equations is compiled from dryland environments, fallow and no-till, in Moccasin, Denton, Highwood and Fort Benton from 1995 - 2001. Valier and Xena were grown in three years.

2/ LY = Number of Location/Years used to create the predictive regression equation.

3/ Varieties with fewer than 12 location/years may not be accurate; use equation with caution.

Data file C:\Regression.xls

Table 57. 2001 Post harvest seed dormancy of selected barley varieties.
Central Agricultural Research Center, Moccasin, MT

ID	----- Percentage of seed germinated at 50 F -----						
	3 days	4 days	5 days	7 days	Total	Dead	Dormant
Baronesse	13	67	18	1	99.0	0.3	0.7
Conlon	7	64	27	0	98.7	0.4	0.9
H3860224	29	49	18	2	98.4	0.3	1.2
Harrington	42	41	14	1	97.4	0.4	1.3
Lewis	28	54	14	2	98.1	0.1	1.8
MT950186	25	54	17	2	98.4	0.2	2.0
Valier	22	61	13	2	97.8	0.2	2.1
Average	23.6	55.8	17.4	1.3	98.3	0.3	1.4
CV (s/mean)*100	85.3	23.5	78.4	71.8	1.0	227.5	24.1
LSD (0.05)	20.7	13.5	ns	1.0	1.0	ns	1.1

Table 58. 2001 Post harvest seed dormancy of spring barley at three locations.
Central Agricultural Research Center, Moccasin, MT

Location	----- Percentage of seed germinated at 50 F -----						
	3 days	4 days	5 days	7 days	Total	Dead	Dormant
Moccasin fallow	26.2	65.7	7.0	0.3	99.3	0.2	0.5
Moccasin no-till	22.1	50.0	21.5	2.9	96.9	0.1	3.0
Fort Benton no-till	22.5	51.8	23.5	0.8	98.7	0.5	0.8
Average	23.6	55.8	17.4	1.3	98.3	0.3	1.4
CV (s/mean)*100	187.3	81.3	162.0	120.3	1.4	296.9	84.4
LSD (0.05)	ns	ns	ns	1.4	1.2	ns	1.0