

PROJECT TITLE: Spring barley variety evaluation in off-station and re-crop trials near Moccasin, Denton, and Fort Benton.

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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 to 60 bu/a at the Moccasin and Denton sites (Table 29). Yields at Fort Benton were well below average due to low rainfall and ranged from 13 to 37 bu/a. Xena, Stark, and two experimental lines averaged the highest yields across all locations with 48 to 47 bu/a. Baronesse, Bowman, and Lewis followed with 46 to 45 bu/a average over the three sites. Multi-year yield summaries are reported in Tables 30, 31, and 32.

Test Weight – Test weights for the Moccasin and Denton trials were above average with 51.8 and 50.4 lbs/bu, respectively (Table 33). Test weights at the Fort Benton site averaged 45.5 lbs/bu. Stark and Bowman averaged the highest test weights across all locations followed by two experimental lines. Harrington had the lowest test weight of all cultivars averaging just 47.5 lbs/bu across the three sites.

Protein – Proteins ranged from 14.5 to 19.7 percent and the average across all sites and all cultivars was 16.7 percent (Table 34).

Heading Date – The average heading date at the Moccasin site was 186.5 days after January 1 (Table 35). Stark and Bowman headed a week earlier than most other varieties while Valier, Baronesse, and some of the experimental lines headed 2 to 4 days later than the average. Heading dates were not taken at the Denton and Fort Benton sites.

Plant Height – Plant heights were shortest at the Fort Benton site and tallest at the Moccasin site (Table 35). The average height over all locations and all cultivars was 24.2 inches. Stark and Hector generally averaged the tallest across the three nursery locations.

Percent Plump and Thin – Tables 36 and 37 report barley percent plump and thins. Bowman had the highest percent plump with an average of 49.8 across the three locations. Bowman also had the lowest amount of thins. Grain plumpness at the Fort Benton site was severely affected by low moisture conditions. Bowman and Stark performed well at the Moccasin and Denton sites. Percent plump for all other cultivars was lower than 48.

SUMMARY: The trial at Denton was planted re-crop after lentils and the trial at Fort Benton followed barley. 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 38. 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. Quick germination of a cultivar would be beneficial in that volunteer seed would germinate early in the fall and be killed by the first frost. In September, seed from eight varieties and three locations was placed on wet blotter paper and incubated at 50° F. At three, four, and five days, the percentage of germinated seed was recorded and compared to a standard, Lewis. Seed was considered germinated when the coleoptile had extended the length of the seed and the radicle was present. Lewis barley had a germination rate of 41.6 percent after three days, Valier's germination was intermediate at 28.8 percent, and Xena's germination rate was lowest at 14.3 percent (Table 39). Grain harvested at the Fort Benton site had the lowest percentage of germination after three days of incubation (Table 40). However, after four days of incubation, the total number of germinated seed was equal to that of germinated seed from other sites tested. Slower germination of seed from the Fort Benton site probably relates to the poor quality of the seed as evidenced by the low test weight and percent plump due to limited precipitation at the site. After a four or five day incubation, differences among the cultivars were less distinct than differences evident at three days. Dormancy tests for the crop year 2001 will be conducted closer to actual harvest dates to better assess differences in dormancy among cultivars.

FUTURE PLANS:

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

Table 29. 2000 Barley Multi-Location Yield Performance.
Central Agricultural Research Center, Moccasin, Montana.

Variety	Loc #ID:	Moccasin Recrop 3670	Denton Recrop 3671	FtBenton Recrop 3672	Average
		bu/a	bu/a	bu/a	bu/a
Xena		56.8	55.7	32.1	48.2
MT950186		57.0	56.4	30.8	48.1
MT960228		60.3	50.6	31.0	47.3
Stark		51.3	53.0	37.3	47.2
Baronesse		57.1	52.1	29.1	46.1
Bowman		52.3	56.0	30.0	46.1
Lewis		53.5	55.0	26.5	45.0
Chinook		51.2	50.3	27.6	43.0
MTLB 5		52.0	48.3	28.2	42.8
MTLB 13		53.1	48.5	26.8	42.8
MT960099		51.5	52.1	24.3	42.6
Valier		50.3	47.9	27.4	41.9
Hector		52.8	51.7	21.0	41.8
MT960100		51.7	49.3	23.7	41.6
Gallatin		48.8	54.6	13.9	39.1
Harrington		51.3	47.3	18.6	39.0
MEANS		53.2	51.8	26.8	43.9
LSD (0.05)		6.1	5.3	8.7	

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

Planting Date:	4/11/00	4/11/00	4/11/00
Harvest Date:	8/9/00	8/9/00	8/9/00
Previous Crop:		Lentils	Barley
Fertilizer (lbs N/a):	60	60	60
Precipitation (inches):	7.33	8.31	3.9
Producer/Cooperator:		Barber	Birkeland

Table 30. Moccasin Re-Crop Barley Multi-Year Yield Summary.

Central Agricultural Research Center, Moccasin, MT.

Selected Varieties	1990	1992	1993	1994	1995	1996	1997	1998	1999	2000	Average	Hector Same Years
	----- bu/a -----											
Hector	31	58	66	47	66	30	69	43	57	53	52.0	-
Harrington	25	45	62	44	65	31	71	36	50	51	48.0	52.0
Lewis	34	55	66	44	58	33	76	37	58	54	51.5	52.0
Bowman	29	56	62	35 ^{1/}	63	33	64	39	58	52	50.7	52.0
Gallatin	34	53	58	48	56	30	67	39	60		49.5	52.0
Chinook	38	48	68	40	68	28	73	43	52	51	50.9	52.0
Stark	35	58	60	38	58	32	70	42	51	51	49.5	52.0
Baronesse		59	76	44	63	33	73	44	54	57	55.9	54.3
WPB Xena									53	57	54.8	54.8
Valier									56	50	53.2	55.0
Nursery Mean	31.9	52.6	64.3	42.1	63.5	30.6	71.7	41.8	54.9	53.2		

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

Table 31. Denton Re-Crop Barley Multi-Year Yield Summary.
Central Agricultural Research Center, Moccasin, MT.

Selected Varieties	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	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
WPB Xena									34	56	44.7	44.4
Valier									27	48	37.5	44.4
Nursery Mean	65.2	36.8	104.0	38.0	67.9	29.8	72.3	39.3	31.6	51.8		

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 32. Fort Benton Re-Crop Barley Multi-Year Yield Summary.
Central Agricultural Research Center, Moccasin, MT.

Selected Varieties	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	Average	Hector Same Years
	----- bu/a -----											
Hector	42	21	69	65	56	48	74	31	76	21	50.3	-
Harrington	36	21	68	54	64	51	68	23	67	19	47.1	50.3
Lewis	43	19	73	61	50	53	77	31	72	27	50.6	50.3
Bowman	41	20	75	59	59	44	84	35	73	30	52.0	50.3
Gallatin	39	28	66	63	52	46	67	29	77	14	48.1	50.3
Chinook	38	20	74	66	67	55	80	29	74	28	53.1	50.3
Stark	38	19	71	62	51	52	71	34	74	37	50.9	50.3
Baronesse	41	24	75	72	73	49	81	34	82	29	56.0	50.3
WPB Xena									82	32	57.1	48.7
Valier									75	27	51.1	48.7
Nursery Mean	39.9	22.5	71.2	63.0	62.2	49.8	71.3	30.6	75.4			

All trials were planted on re-crop ground. The 1992-1996 trials were located on Ron Long's farm and the 1997-2000 trials were located at the Birkeland farm.

Table 33. 2000 Barley Multi-Location Grain Test Weight.
Central Agricultural Research Center, Moccasin, Montana.

Variety	Loc #ID:	Moccasin Recrop	Denton Recrop	FtBenton Recrop	Average
		3670	3671	3672	
		lbs/bu	lbs/bu	lbs/bu	lbs/bu
Stark		53.8	52.9	49.3	52.0
MT950186		53.8	50.9	49.7	51.5
Bowman		52.2	52.9	47.9	51.0
MTLB 5		53.1	49.6	46.2	49.6
MT960228		51.3	50.2	46.8	49.4
Gallatin		52.0	50.8	45.0	49.3
Chinook		52.6	50.9	44.1	49.2
Lewis		52.3	50.7	44.4	49.1
MT960099		50.5	51.3	45.1	49.0
Valier		50.6	49.1	46.8	48.8
Xena		50.5	49.6	45.8	48.6
Hector		52.0	50.6	43.1	48.6
MT960100		50.7	49.8	44.3	48.3
Baronesse		51.2	48.8	44.5	48.2
MTLB 13		50.8	49.2	44.1	48.0
Harrington		52.2	48.6	41.6	47.5
MEANS		51.8	50.4	45.5	49.2
LSD (0.05)		2.3	2.7	2.3	

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

Table 34. 2000 Barley Multi-Location Grain Protein.
Central Agricultural Research Center, Moccasin, Montana.

Variety	Loc #ID:	Moccasin Recrop 3670	Denton Recrop 3671	FtBenton Recrop 3672	Average
		%	%	%	%
MTLB 5		16.2	18.6	18.9	17.9
Valier		16.6	17.4	19.5	17.8
Chinook		17.4	16.0	18.8	17.4
MTLB 13		15.4	18.0	18.6	17.3
Harrington		16.4	16.0	19.2	17.2
Lewis		16.0	15.2	19.7	17.0
Hector		15.7	15.4	19.7	16.9
MT960100		16.3	14.7	19.0	16.6
Bowman		16.4	14.9	18.3	16.5
Gallatin		15.9	14.8	18.9	16.5
Baronesse		16.1	15.7	17.4	16.4
MT960099		16.3	14.7	17.9	16.3
Xena		15.1	15.5	16.9	15.8
Stark		15.9	14.7	16.9	15.8
MT950186		14.6	14.9	17.5	15.7
MT960228		14.7	14.5	16.9	15.4
Mean		15.9	15.7	18.4	16.7

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

Table 35. 2000 Barley Multi-Location Heading Date and Plant Height.
Central Agricultural Research Center, Moccasin, Montana.

Variety	Loc #ID:	Moccasin Recrop	Moccasin Recrop	Denton Recrop	FtBenton Recrop	Average
		3670	3670	3671	3672	
		Head Date	in	in	in	in
Stark		181	32.0	30.0	23.0	28.3
Hector		186	31.0	25.0	23.0	26.3
Lewis		187	30.7	26.0	21.0	25.9
Bowman		178	28.3	26.0	22.0	25.4
Chinook		187	28.7	27.0	20.0	25.2
Gallatin		185	28.7	26.0	20.0	24.9
Xena		187	26.7	25.0	23.0	24.9
MTLB 5		189	27.7	24.0	21.0	24.2
MT950186		185	26.7	25.0	19.0	23.6
MT960228		187	28.0	24.0	18.0	23.3
Harrington		187	26.0	24.0	19.0	23.0
MT960099		191	27.0	24.0	18.0	23.0
Valier		189	29.0	22.0	18.0	23.0
Baronesse		188	25.7	21.0	21.0	22.6
MTLB 13		187	27.0	21.0	19.0	22.3
MT960100		191	26.7	22.0	17.0	21.9
MEANS		186.52	28.1	24.5	20.1	24.2
LSD (0.05)		1.28	3.4			

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

Heading Date = Number of days from January 1.

Table 36. 2000 Barley Multi-Location Percent Plump.
Central Agricultural Research Center, Moccasin, Montana.

Variety	Loc #ID:	Moccasin Recrop	Denton Recrop	FtBenton Recrop	Average
		3670	3671	3672	
		%	%	%	%
Bowman		64.8	61.6	23.0	49.8
Stark		57.1	57.7	6.2	40.3
Harrington		47.8	34.7	12.7	31.7
Lewis		42.2	41.2	6.7	30.0
Hector		46.9	29.8	1.6	26.1
MT950186		47.9	26.9	2.2	25.7
Gallatin		37.2	28.9	4.8	23.6
MT960228		26.7	28.0	2.4	19.0
Chinook		32.5	21.8	0.8	18.4
Xena		30.7	20.3	1.3	17.4
Baronesse		22.2	15.2	1.6	13.0
MTLB 13		27.0	10.0	0.6	12.5
MT960100		18.3	15.0	3.5	12.3
Valier		22.4	10.2	2.0	11.5
MTLB 5		25.2	1.3	0.3	8.9
MT960099		12.2	10.0	0.4	7.5
Mean		35.1	25.8	4.4	21.7

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

Plump > 6/64

Table 37. 2000 Barley Multi-Location Percent Thin.
Central Agricultural Research Center, Moccasin, Montana.

Variety	Loc #ID:	Moccasin Recrop 3670	Denton Recrop 3671	FtBenton Recrop 3672	Average
		%	%	%	%
MT960099		43	57	83	61.1
MTLB 13		27	63	80	56.7
MTLB 5		24	57	82	54.4
MT960100		37	55	64	52.0
Valier		27	54	70	50.3
Chinook		30	34	81	48.3
Baronesse		28	37	68	44.3
MT960228		28	32	67	42.2
Hector		19	28	74	40.0
Xena		20	31	66	39.2
MT950186		15	34	65	38.0
Gallatin		24	25	57	35.2
Lewis		21	20	60	33.5
Harrington		18	23	53	31.4
Stark		14	10	52	25.4
Bowman		11	10	26	15.5
Mean		24	36	66	41.7

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

Thin < 5.5/64

Table 38. Predicted yields of selected barley varieties grown in Central Montana based on previous seven years^{1/} of variety performance. Central Agricultural Research Center, 2000.

Variety	Yield Level (X) – bu/a			LY ^{2/}	Predictive Equation	R ²
	30	45	60			
Baronesse	31.1	47.2	63.4	27	$Y = 1.077X - 1.24$	0.983
Bowman	31.2	45.0	58.8	24	$Y = 0.918X + 3.69$	0.949
Chinook	29.6	45.4	61.2	27	$Y = 1.053X - 1.94$	0.983
Gallatin	28.8	43.7	58.6	27	$Y = 0.994X - 1.01$	0.961
Harrington	26.9	42.2	57.5	27	$Y = 1.020X - 3.72$	0.978
Hector	30.9	45.2	59.5	27	$Y = 0.952X + 2.37$	0.981
Lewis	29.7	45.1	60.5	27	$Y = 1.026X - 1.12$	0.969
Stark	31.9	46.2	60.4	27	$Y = 0.948X + 3.49$	0.964
Valier	28.4	42.8	57.3	7 ^{3/}	$Y = 0.963X - 0.51$	0.987
WPB Xena	33.9	47.5	61.1	7 ^{3/}	$Y = 0.907X + 6.69$	0.967

1/ Data used to calculate predictive equations is compiled from dryland environments, fallow and no-till, in Moccasin, Denton, Highwood and Fort Benton from 1994 - 2000. Valier and WPB Xena were grown in two 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:\Regress\Regression.xls

Table 39. Post Harvest Seed Dormancy of Selected Barley Varieties.
Central Agricultural Research Center, Moccasin, Montana.

----- Number of Seed Germinated at 50 F -----						
Variety	72 hr		96 hr		120 hr	
Lewis	41.6	C*	50.5	A*	6.6	AB*
Xena	14.3	A	71.4	B	11.8	ABC
MTLB 5	35.0	BC	61.7	AB	2.7	A
MTLB 13	36.9	BC	57.6	AB	3.6	A
Valier	28.8	ABC	61.2	AB	5.3	A
MT950186	28.9	ABC	59.3	AB	10.6	ABC
MT960228	17.8	AB	59.5	AB	20.8	C
MT960099	17.6	AB	60.9	AB	19.8	BC
MEAN	29.09		58.91		9.89	
SE FOR MEAN	6.87		5.98		4.80	
SE FOR DIF	9.72		8.46		6.79	
LSD (0.05)	19.65		17.10		13.72	
DIF 0.9 POWER	32.35		28.16		22.59	

* Varieties with the same letter are not statistically different from one another.

Table 40. Post Harvest Seed Dormancy of Spring Barley at Off-Station Locations.
Central Agricultural Research Center, Moccasin, Montana.

----- Number of Seed Germinated at 50 F -----						
Location	72 hr		96 hr		120 hr	
Moccasin No-till	32.5	B*	53.8	A*	11.7	A*
Denton Till Plow	34.7	B	56.0	A	6.5	A
Fort Benton No-till	15.6	A	71.1	B	12.2	A
MEAN	29.09		58.91		9.89	
SE FOR MEAN	4.21		3.66		2.94	
SE FOR DIF	5.95		5.18		4.16	
LSD (0.05)	12.03		10.47		8.40	
DIF 0.9 POWER	19.81		17.24		13.83	

* Locations with the same letter are not statistically different from one another.