

PROJECT TITLE: Winter wheat variety evaluation in off-station and re-crop trials near Moccasin, Denton, Fort Benton, Moore, and Winifred.

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OBJECTIVES:

To evaluate the performance of winter wheat varieties in environments and cropping methods representative of the southern triangle and central Montana.

RESULTS:

Yield – Dry conditions resulted in lower than average yields at all sites with the exception of Moccasin where re-crop wheat followed barley. Growing season precipitation of 3.9 inches at the Fort Benton site contributed to low yields ranging from 8.8 to 12.6 bu/a. Yields were highest at the Moccasin site ranging from 35.8 to 46.2 bu/a. No yields were recorded at the Denton site due to a plugged opener during seeding that resulted in non-uniform plots. Quantum 542 averaged the highest yield over all sites followed by MT9513, Rocky, Judith, and Pronghorn. The current year's data are presented in Table 1. Multi-year summaries are presented in Tables 2, 3, 4, 5, and 6.

Test Weight – Test weights ranged from 58.1 to 64.1 lbs/bu in trials and the average across all sites and cultivars was 61.2 lbs/bu. The current year's data are presented in Table 7.

Protein – Grain protein was lowest at the Denton site and highest at the Fort Benton site. Relative ranking of cultivars for grain protein was similar for all sites with McGuire, Erhardt, Vanguard, Rampart, and MTW9441 having the highest percentages averaging from 17.2 to 16.2 percent across locations. Rocky had the lowest grain protein of any cultivar tested with an average of 14.6 percent over all site locations. The current year's data are presented in Table 8.

Heading Date – Heading occurred in mid-June with the average heading date being 168 days after January 1. Pronghorn and Halt headed one week ahead of the average at 161 days and Norstar headed latest at 174 days. The current year's data are presented in Table 9.

Plant Height – Plant height for a cultivar varied across sites depending on available moisture. Norstar was tallest averaging 33 inches across all sites while Halt and NuPlains were the shortest at 22 inches. The current year's data are presented in Table 9.

SUMMARY: Although moisture for the 2000 crop season was generally higher than that received the previous year, timing of rainfall contributed to a lower than average yield at most sites. Yields at the Moccasin site met the seven-year average for cultivars grown at that site. Yields at all other sites were well below their ten-year averages as noted in multi-year yield summaries for each site (Tables 2-6). The trials at Winifred and Denton were seeded into fallow ground while trials at Fort Benton and Moore were seeded into spring wheat stubble. The Moccasin trial was seeded into barley stubble. All cultivars had acceptable test weights averaging 61.2 lbs/bu across all sites and all cultivars. Test weights for the Moccasin site were lowest, but still averaged 59.7 lbs/bu for all cultivars grown at that site. Varieties averaging the highest yields across sites included Quantum 542, MT 9513, Rocky, Judith, and Pronghorn. Quantum 542 is a hybrid wheat variety from Hybritech Seed International released in 1988. Quantum 542 is a medium to early maturing variety that has consistently yielded well in research center variety trials. Equations predicting winter wheat yields based on past variety performance are presented in Table 10.

FUTURE PLANS:

Winter wheat variety evaluations will continue at Moccasin, Denton, Fort Benton, Moore, and Winifred.

Table 1. 2000 Winter Wheat Multi-Location Yield Performance.
Central Agricultural Research Center, Moccasin, Montana.

Variety	Loc #ID:	Moccasin	Denton	FtBenton	Winifred	Moore	Average
		3870	3871	3872	3873	3874	
		bu/a	bu/a	bu/a	bu/a	bu/a	bu/a
Quantum 542		38.9	*	11.6	35.5	34.6	30.1
MT 9513		44.3		11.2	33.5	30.5	29.9
Rocky		45.4		9.7	33.2	29.2	29.4
Judith		46.2		12.6	27.8	30.0	29.2
Pronghorn		42.9		10.0	32.9	28.3	28.5
MT9426		42.4		9.2	33.7	28.3	28.4
Promontory		46.2		9.2	28.7	28.3	28.1
Neeley		43.2		10.3	29.7	27.9	27.8
MTS9720		40.3		11.5	32.9	26.2	27.7
BigSky		40.1		11.0	30.8	29.1	27.7
Norstar		39.6		12.4	28.8	28.9	27.4
MTS9882		41.0		10.0	30.1	28.2	27.3
Bighorn		43.5		9.5	29.9	26.2	27.3
Tiber		41.3		9.7	28.8	28.8	27.1
NuWest		39.8		10.2	30.6	26.5	26.8
MTW9441		38.3		9.8	28.5	28.3	26.2
Rampart		37.2		10.4	28.8	28.1	26.1
Elkhorn		37.6		11.0	29.3	25.8	25.9
Halt		40.3		8.8	26.4	27.9	25.9
Vanguard		38.9		11.0	26.8	26.6	25.8
Morgan		38.4		10.0	28.6	25.7	25.7
Erhardt		36.8		9.3	26.5	23.7	24.1
McGuire		35.8		9.1	25.7	24.4	23.7
NuPlains		35.9		8.8	25.5	23.0	23.3
Mean		40.6		10.3	29.7	27.7	25.4
LSD (0.05)		5.4		2.2	4.0	3.3	

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

* There were blank rows in some plots due to drill opener problems, thus no yield data.

Planting Date:	9/23/99	9/24/99	9/24/99	9/25/99	10/14/99
Harvest Date:		7/25/00	7/24/00	8/8/00	
Previous Crop:	Barley	Fallow	Spr. Wht.	Fallow	Spr. Wht.
Fertilizer (lbs N/a):	60	60	60	60	60
Precipitation (in):	7.33	8.31	3.9	9.49	11.9
Cooperator:		Barber	Birkeland	Udelhoven	Tyler

Table 2. Moccasin Re-Crop Winter Wheat Multi-Year Yield Summary of Selected Varieties, 1993-2000.
Central Agricultural Research Center, Moccasin, MT.

Selected Varieties	1993	1995	1996	1997	1998	1999	2000	Avg.	Neeley	
									Same Yrs	
		----- bu/a -----								
Neeley	44	33	31	69	47	45	43	45	-	
Norstar	39	33 ^{1/}	26	54	45	41	40	40	45	
Rocky	40	39	34	73	50	43	45	46	45	
Tiber	45	36	29	56	46	45	41	43	45	
Judith	36	40	31	63	53	43	46	45	45	
Quantum 542	38	30	30	66	52	53	39	44	45	
Bighorn	35	40	28	65	48	42	44	43	45	
NuWest		38	30	51 ^{2/}	50	39	40	41	45	
Kestrel	40	44	29	51	49			43	45	
Erhardt		35	28	63	44	30	37	40	45	
Vanguard		27 ^{1/}	27	59	47	38	39	39	45	
Rampart		36	27	55 ^{2/}	48	38	37	40	45	
McGuire		31	28	53	36	32	36	36	45	
Promontory			29	61	50	48	46	47	47	
BigSky				65	47	39	40	48	51	
Morgan						42	38	40	44	
Mean	37	37	29	61	47	42	41			

^{1/} Suspected low germination resulted in low yields. ^{2/} Yields from one rep only. 1994 trial was abandoned due to variable germination, which resulted from extremely wet conditions experienced during seeding.

Table 3. Denton Off-Station Winter Wheat Multi-Year Yield Summary of Selected Varieties, 1990-2000.
Central Agricultural Research Center, Moccasin, MT.

Selected Varieties	1990	1991	1992	1993	1995	1996	1997	1998	1999	2000	Avg.	Neeley Same Yrs
	----- bu/a -----											
Neeley	55	64	24	66	82	44	62	61	45	*	56	-
Norstar	44	39	24	55	51 ^{1/}	35	54	51	35		43	56
Rocky	50	60	22	57	73	46	59	61	40		52	56
Tiber	52	55	28	65	73	42	65	61	46		54	56
Judith	59	61	26	55	87	45	59	66	45		56	56
Quantum 542	57		40	59	78	48	67	76	48		59	56
Bighorn	48	60 ^{2/}	23	56	73	46	64	67	39		53	56
NuWest	50	54			67	43	64	59	45		55	56
Kestrel				60	80	44	60	66			62	60
Erhardt					71	42	62	55	41		54	59
Vanguard					56	41	56	62	35		50	59
Rampart					76	40	51	55	37		52	59
McGuire					71	42	54	49	37		51	59
Promontory						53	56	65	47		55	53
BigSky							64	62	44		57	56
Morgan									46		46	45
Mean	49	53	22	56	73	43	60	60	42			

^{1/} Suspected low germination resulted in low yields. ^{2/} Bighorn was planted on one end of the trial and not randomized. 1994 trial was abandoned due to variable stands resulting from wind damage. 1999 only two reps were harvested due to an extremely hard field at planting resulting in poor germination of the 1st rep. 2000 no yields reported due to plugged drill opener in some rows.

Table 4. Fort Benton Off-Station Winter Wheat Multi-Year Yield Summary of Selected Varieties, 1990-2000.
Central Agricultural Research Center, Moccasin, MT.

Selected Varieties	1990	1991	1993	1994	1995	1996	1997	1998	1999	2000	Avg.	Neeley	Same Yrs
	----- bu/a -----												
Neeley	64	74	58	50	69	47	51	27	45	10	50	-	
Norstar	53	55	49	43	56 ^{1/}	32	45	25	40	12	41	50	
Rocky	56	68	51	44	63	42	56	25	54	10	47	50	
Tiber	59	66	56	47	74	46	54	28	52	10	49	50	
Judith	67	63	39	44	70	36	51	26	54	13	46	50	
Quantum 542	70		54	52	78	45	54	28	54	12	50	50	
Bighorn	59	66 ^{2/}	55	43	70	34	55	27	50	10	47	50	
NuWest	58	63		41	66	36	49	28	44	10	44	50	
Kestrel			58	44	70	43	49	27			49	50	
Erhardt				44	72	35	49	26	43	9	40	43	
Vanguard				40	68 ^{1/}	40	51	25	48	11	40	43	
Rampart				45	77	39	52	24	50	10	42	43	
McGuire					59	34	51	24	45	9	37	42	
Promontory						49	55	25	59	9	39	36	
BigSky							52	26	51	11	35	33	
Morgan									49	10	30	28	
Mean	58	62	51	45	69	40	52	25	49	10			

^{1/} Suspected low germination resulted in low yields. ^{2/} Bighorn was planted on one end of the trial and not randomized. 1992 trial was abandoned due to volunteer barley infestation. 1995 trial had a high incidence of volunteer spring wheat. The trial was located on the Ron Long farm, Shonkin, MT, 1988-1996 and on the Steve Birkeland farm, Fort Benton, MT, 1997-2000.

Table 5. Winifred Off-Station Winter Wheat Multi-Year Yield Summary of Selected Varieties, 1992-2000.
Central Agricultural Research Center, Moccasin, MT.

Selected Varieties	1992	1994	1996	1997	1998	1999	2000	Avg.	Neeley Same Yrs
	----- bu/a -----								
Neeley	40	52	43	51	65	49	30	47	-
Norstar	30	50	50	51	66	40	29	45	47
Rocky	32	50	55	45	62	50	33	47	47
Tiber	36	47	57	38	72	50	29	47	47
Judith	30	51	52	43	70	59	28	48	47
Quantum 542	47	59	55	45	75	59	36	54	47
Bighorn	31	53	50	54	63	55	30	48	47
NuWest		49	50	46	72	57	31	51	48
Kestrel		54	52	38	59			51	48
Erhardt		52	52	50	66	53	27	50	48
Vanguard		44	45	39	53	52	27	43	48
Rampart		49	43	33	52	53	29	43	48
McGuire			49	51	57	52	26	47	47
Promontory			54	41	58	61	29	49	47
BigSky				50	66	51	31	49	49
Morgan						55	29	42	39
Mean	32	51	50	45	64	54	30		

1993 and 1995 trials were not harvested due to hail damage.

Table 6. Moore Off-Station Winter Wheat Multi-Year Yield Summary of Selected Varieties, 1990-2000.
Central Agricultural Research Center, Moccasin, MT.

Selected Varieties	1990	1991 ^{1/}	1992	1994	1995	1996	1997	1998	2000	Avg.	Neeley
											Same Yrs
----- bu/a -----											
Neeley	34	64	42	37	45	36	56	72	28	46	-
Norstar	35	49	28	37	31 ^{2/}	34	48	67	29	40	46
Rocky	29	57	33	36	40	41	57	66	29	43	46
Tiber	33	56	41	35	43	39	57	69	29	45	46
Judith	36	56	32	34	47	35	54	65	30	43	46
Quantum 542	41		48	35	43	46	58	78	35	48	46
Bighorn	42	58 ^{3/}	34	35	41	34	60	66	26	44	46
NuWest	47	55		42	46	34	55	70	27	47	46
Kestrel				34	41	36	56	70		47	47
Erhardt				37	42	43	57	56	24	43	47
Vanguard				29	29 ^{2/}	35	52	57	27	38	47
Rampart				34	44	33	49	57	28	41	47
McGuire					41	37	48	54	24	41	47
Promontory						39	56	62	28	46	48
BigSky							56	67	29	51	52
Morgan									26	26	28
Mean	36	54	35	35	41	36	54	63	28		

^{1/} 1991 trial suffered aphid damage. ^{2/} Suspected low germination resulted in low yields. ^{3/} Bighorn was planted on one end of the trial and not randomized. 1993 trial suffered hail damage. 1999 trial not harvested due to cheat grass infestation.

Table 7. 2000 Winter Wheat Multi-Location Grain Test Weight.
Central Agricultural Research Center, Moccasin, Montana.

Variety	Moccasin	Denton	FtBenton	Winifred	Moore	Average
	3870	3871	3872	3873	3874	
	lbs/bu	lbs/bu	lbs/bu	lbs/bu	lbs/bu	lbs/bu
Promontory	61.4	63.5	60.3	60.4	64.1	61.9
NuPlains	61.3	64.0	62.5	61.6	63.5	62.6
Rocky	61.0	63.5	62.9	61.2	63.4	62.4
BigSky	60.2	60.7	61.3	61.5	63.2	61.4
Tiber	59.6	62.3	60.7	61.1	63.1	61.4
Erhardt	60.8	62.6	61.7	60.6	62.9	61.7
Bighorn	60.2	62.4	61.2	59.7	62.8	61.3
NuWest	60.4	61.6	60.3	58.6	62.8	60.7
Vanguard	59.3	62.7	62.2	59.5	62.7	61.3
MTW9441	60.2	61.5	60.8	60.4	62.7	61.1
MTS9882	59.7	61.7	61.4	60.6	62.7	61.2
Quantum 542	59.5	61.9	63.1	60.5	62.5	61.5
Halt	58.9	62.6	63.0	60.6	62.5	61.5
Elkhorn	58.7	61.4	60.9	60.4	62.1	60.7
MT9513	59.4	61.4	60.8	60.5	62.0	60.8
Rampart	59.3	62.3	61.2	59.4	61.8	60.8
Norstar	59.7	63.0	62.6	61.2	61.7	61.6
MT9426	58.8	59.3	60.6	59.3	61.7	59.9
Pronghorn	60.6	62.9	62.9	60.3	61.7	61.7
Morgan	59.3	61.4	60.2	60.7	61.5	60.6
McGuire	58.1	61.8	61.9	58.6	61.5	60.4
Judith	59.1	61.4	59.6	59.5	61.4	60.2
MTS9720	58.8	60.2	60.8	60.5	61.4	60.3
Neeley	59.2	62.2	60.4	60.1	60.8	60.5
Mean	59.7	62.0	61.4	60.3	62.4	61.2
LSD (0.05)	1.0			1.5	1.0	

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

Table 8. 2000 Winter Wheat Multi-Location Grain Protein.
Central Agricultural Research Center, Moccasin, Montana.

Variety	Loc #ID:	Moccasin	Denton	FtBenton	Winifred	Moore	Average
		3870	3871	3872	3873	3874	
			%	%	%	%	%
McGuire	*		15.5	18.5	17.1	17.7	17.2
Erhardt			15.5	17.4	16.4	16.5	16.4
Vanguard			15.2	17.8	16.2	16.5	16.4
Rampart			15.3	17.7	15.8	16.3	16.3
MTW9441			15.5	17.1	15.8	16.4	16.2
NuWest			15.0	17.1	15.5	16.4	16.0
Bighorn			14.4	17.1	15.5	16.6	15.9
NuPlains			14.9	17.0	15.7	16.0	15.9
Morgan			14.7	16.9	15.9	16.0	15.9
Elkhorn			15.5	16.8	15.0	15.8	15.8
BigSky			14.5	16.9	15.5	16.2	15.8
MTS9720			14.6	17.2	14.6	15.9	15.6
MT9426			14.7	17.2	14.7	15.6	15.6
Tiber			14.4	16.7	15.0	15.8	15.5
Neeley			13.7	17.6	14.9	15.5	15.4
Judith			14.1	16.5	15.1	15.9	15.4
Pronghorn			13.7	17.0	14.0	16.4	15.3
MT9513			13.9	16.8	14.4	15.7	15.2
Halt			13.5	16.7	14.2	16.1	15.1
Quantum 542			13.9	16.8	13.9	15.7	15.1
Norstar			14.2	16.2	14.9	14.7	15.0
Promontory			14.1	17.1	14.3	14.5	15.0
MTS9882			13.7	16.3	14.9	15.0	15.0
Rocky			12.9	16.3	13.8	15.5	14.6

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

* Moccasin location had a high incidence of volunteer barley contamination, thus the seed had to be hand picked before running proteins.

Proteins were run on one rep for each location except for 3 reps at Winifred.

Table 9. 2000 Winter Wheat Multi-Location Heading Date and Plant Height.
Central Agricultural Research Center, Moccasin, Montana.

Variety	Moccasin	Moccasin	Denton	FtBenton	Winifred	Moore	Average
	3870	3870	3871	3872	3873	3874	
	HeadDate	in	in	in	in	in	in
Norstar	174	36	40	20	36	32	33
BigSky	169	30	37	19	30	25	28
Judith	167	31	34	20	27	26	28
Quantum 542	164	30	36	18	27	27	28
Morgan	173	30	34	18	27	28	27
Tiber	171	33	36	15	27	26	27
Rampart	170	32	33	16	25	30	27
Elkhorn	171	32	36	16	25	26	27
NuWest	170	32	32	16	26	27	27
MT9513	170	32	33	19	24	24	26
MTW9441	170	29	34	16	25	27	26
Pronghorn	161	27	35	16	27	24	26
Promontory	168	30	28	20	26	25	26
McGuire	163	25	33	19	29	22	26
Neeley	170	27	33	15	27	25	25
Vanguard	168	29	32	17	26	23	25
MT9426	170	28	33	15	26	24	25
MTS9720	169	27	33	15	25	24	25
Erhardt	169	27	31	15	24	25	24
Rocky	166	27	33	14	24	23	24
MTS9882	170	26	29	16	26	24	24
Bighorn	170	25	31	15	25	24	24
Halt	161	23	26	16	25	21	22
NuPlains	168	24	25	16	23	23	22
Mean	168	29	33	17	26	25	26
LSD (0.05)	2.3	3.0				4.5	

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

Height was recorded for one or three reps.

Table 10. Predicted yields of selected winter wheat varieties grown in Central Montana based on previous seven years^{1/} of variety performance. Central Agricultural Research Center, 2000.

Variety	Class	Yield Level (X) - bu/a			LY ^{2/}	Predictive Equation	R ²
		30	45	60			
		Projected Yields (Y) - bu/a					
Big Sky	HRW	30.9	46.7	62.4	23	$Y = 1.049X - 0.52$	0.986
Bighorn	HRW	30.3	46.2	62.2	35	$Y = 1.061X - 1.53$	0.980
Erhardt	HRW	28.9	43.7	58.4	35	$Y = 0.985X - 0.68$	0.958
Judith	HRW	30.9	47.6	64.3	35	$Y = 1.113X - 2.49$	0.976
Kestrel	HRW	30.6	45.8	61.0	27	$Y = 1.016X + 0.08$	0.953
McGuire	HRW	28.06	40.9	53.7	32	$Y = 0.854X + 2.44$	0.956
Morgan	HRW	29.4	45.7	62.1	12 ^{3/}	$Y = 1.091X - 3.34$	0.995
Neeley	HRW	31.2	47.4	63.7	35	$Y = 1.083X - 1.35$	0.962
Norstar	HRW	29.0	41.0	52.9	35	$Y = 0.799X + 4.98$	0.909
NuWest	HWW	30.9	45.5	60.1	35	$Y = 0.973X + 1.67$	0.959
Promontory	HRW	32.8	47.4	62.0	28	$Y = 0.973X + 3.63$	0.950
QT 542	HRW	33.5	49.9	66.4	35	$Y = 1.099X + 0.50$	0.962
Rampart	HRW	28.0	42.3	56.7	35	$Y = 0.952X - 0.74$	0.955
Redwin	HRW	32.3	44.0	55.7	32	$Y = 0.778X + 8.95$	0.956
Rocky	HRW	32.1	46.8	61.5	35	$Y = 0.980X + 2.69$	0.971
Tiber	HRW	30.7	46.1	61.4	35	$Y = 1.021X + 0.085$	0.973
Vanguard	HRW	27.3	40.7	54.2	35	$Y = 0.900X + 0.26$	0.945

1/ Data used to calculate predictive equations is compiled from dryland environments, fallow and no-till, in Moccasin, Denton, Highwood, Fort Benton and Winifred from 1994 - 2000. Big Sky, Bighorn, Kestrel, McGuire, Promontory, and Redwin were grown six years. Morgan was grown five 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