PROJECT TITLE: Evaluation of winter wheat variety performance in off-station 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 – Yields ranged from 3 to 47.9 bu/a and were highest at the Denton site (Table 12). Low rainfall at Fort Benton contributed to unusually low yields. The Fort Benton nursery also sustained sawfly damage with up to 15 percent of the stems cut in some plots (Table 15). Yields were highest at the Denton site in spite of shattering due to hail damage (Table 15). Neeley and NuSky performed well in these off-station nurseries having the highest yields when averaged across the four locations. The nursery at Winifred was abandoned in 2001 due to kochia infestations and dry spring conditions not conducive to herbicide treatment. Multiple year summaries for each location are listed in Tables 16-20.

Test Weight – Test weights were generally below 60 lbs/bu this year due to dry conditions (Table13). This was most evident at the Fort Benton site where test weights ranged from 43.9 to 60.1 lbs/bu. Test weights were highest at Moore and ranged from 57.4 to 62.4 lbs/bu. Erhardt had the highest test weight of all varieties tested when averaged across the four locations.

Protein – Grain protein ranged from 13 to 18 percent with the highest protein levels reported in grains from the nursery planted at Fort Benton (Table 14). Protein levels at Moccasin, Denton, and Moore averaged around 15 percent. Erhardt and McGuire had the highest protein levels when averaged across all locations.

Heading Date – Heading dates were recorded for the Moccasin site only (Table 15). Halt headed at 160 days and Norstar headed at 171 days after January 1. The average heading date was June 16.

Plant Height – Plant heights ranged from 9 to 32 inches with the shortest heights being measured at the Fort Benton site where moisture was limiting. Norstar was consistently the tallest cultivar grown and averaged 26.4 inches across the four sites. Halt was the shortest cultivar averaging just 16.5 inches across the four locations.

SUMMARY: Moisture severely limited the plant growth and development of winter grains at the Fort Benton site. Low test weights from grain grown at the Fort Benton site were accompanied by high protein values. Grain shatter from hail damage at Denton reduced the yields collected from that site. Promontory, Erhardt, Rampart, and Norstar were among those most susceptible to grain shatter. Most resistant to shatter were Judith and Morgan. Sawfly damage was very evident in Fort Benton this year. Stems had been girdled at the soil level. Most susceptible to sawfly cutting were Elkhorn, Neeley, Judith, and Rampart. While all plots sustained some cutting, the cultivar with the least amount of sawfly damage was NuPlains. Since stem counts were conducted on only the first rep, results may be inconclusive. Equations predicting winter wheat yields based on past variety performance are presented in Table 21.

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

Table 12. 2001 Winter wheat off-station yield performance.

Exp. 3800 Central Agricultural Research Center, Moccasin, MT

ID	Pedigree	Mocc Recrop 3870	Denton Recrop 3871	Ft Benton Recrop 3872	Moore Recrop 3874	Average Yield
		bu/a	bu/a	bu/a	bu/a	bu/a
CI 17860	Neeley	36.0	**47.9**	5.8	36.7	31.6
MTW9441	NuSky	37.3	44.8	5.3	38.4	31.4
MT9513	MT7811/MT8030	33.3	45.1	5.2	**39.2**	30.7
PI517194	Tiber	38.7	45.0	5.6	32.3	30.4
PI584526	Judith	35.7	41.7	6.1	37.5	30.2
MT9982	Promontory/Judith	**41.3**	35.6	5.0	38.8	30.2
MT 9426	MT8030/NLY	35.0	40.7	6.3	38.6	30.1
MT 9432	BigSky	36.7	39.2	3.4	38.0	29.3
PI586806	NuWest	37.3	38.9	4.7	35.8	29.2
PI607569	Ransom	35.0	40.8	6.2	33.5	28.9
CI 17735	Norstar	31.7	40.2	5.9	34.6	28.1
PI555458	Promontory	35.7	37.1	5.8	32.0	27.6
PI594920	Utah100	37.0	32.9	4.5	35.6	27.5
RH78W296	Bighorn	36.7	30.0	6.3	36.7	27.4
CI 17879	Rocky	38.7	30.6	6.0	34.2	27.4
PI599336	Morgan	35.0	33.7	5.2	34.5	27.1
PI593891	Vanguard	34.0	34.2	5.5	34.2	27.0
PI593889	Rampart	33.3	32.9	**7.3**	33.0	26.6
PI596352	Elkhorn	32.7	32.3	5.4	34.7	26.3
UT944158	Golden Spike	35.7	33.2	6.2	29.9	26.2
PI564761	Erhardt	32.0	33.1	3.7	29.9	24.7
PI593890	McGuire	**29.7**	32.0	5.8	30.1	24.4
PI605741	NuPlains	33.7	26.6	5.3	29.4	23.8
PI584505	Halt	32.3	**21.1**	**3.0**	**28.4**	21.2
Average		35.2	36.2	5.4	34.4	27.8
LSD (0.05)		3.5	8.1	ns	4.2	
CV (s/mean)*100		6.0	13.5	29.4	6.0	
Planting Date:		10/6/00	10/9/00	10/8/00		
Harvest Date:		8/9/01	8/7/01	7/25/01	8/15/01	
Previous Crop:		Barley	Lentil	Spring Wht	Canola	
Fertilizer (lbs N/a):		77.0	70	90		
Growing Season Precipitation (in):		7.3	5.75	4.65	7.00	
Producer/Cooperator:			Barber	Birkeland	Tyler	

Table 13. 2001 Winter wheat off-station test weight performance.
Exp. 3800 Central Agricultural Research Center, Moccasin, MT

ID	Pedigree	Mocc Recrop 3870	Denton Recrop 3871	Ft Benton Recrop 3872	Moore Recrop 3874	Average Test Weight
		lbs/bu	lbs/bu	lbs/bu	lbs/bu	lbs/bu
PI564761	Erhardt	60.0	60.0	59.3	60.6	60.0
PI605741	NuPlains	**60.5**	**61.9**	54.2	**62.4**	59.7
MTW9441	NuSky	58.3	60.9	59.4	60.2	59.7
CI 17879	Rocky	60.3	61.5	54.1	61.7	59.4
MT9982	Promontory/Judith	59.7	60.8	56.2	60.0	59.2
CI 17735	Norstar	58.9	60.3	54.3	61.1	58.6
UT944158	Golden Spike	57.5	58.2	**60.1**	**57.4**	58.3
PI593890	McGuire	59.1	60.0	54.5	59.3	58.2
PI555458	Promontory	59.3	60.3	51.3	61.8	58.2
RH78W296	Bighorn	57.6	59.3	55.5	60.2	58.1
PI584505	Halt	58.0	60.3	53.9	59.2	57.8
PI517194	Tiber	58.2	60.8	49.5	61.4	57.5
PI593891	Vanguard	58.8	59.8	48.8	60.9	57.1
PI586806	NuWest	59.3	61.4	45.8	61.3	56.9
PI607569	Ransom	54.5	59.1	54.0	60.0	56.9
PI584526	Judith	57.0	58.9	52.9	58.7	56.9
PI594920	Utah100	57.5	59.5	51.6	58.4	56.8
PI593889	Rampart	56.4	59.1	50.7	60.3	56.6
PI599336	Morgan	55.0	58.8	50.8	60.7	56.3
PI596352	Elkhorn	55.2	59.2	51.5	58.7	56.2
CI 17860	Neeley	55.6	59.9	49.4	59.5	56.1
MT 9432	BigSky	58.3	61.8	**43.9**	59.5	55.9
MT 9426	MT8030/NLY	54.3	**57.6**	51.9	59.2	55.7
MT9513	MT7811/MT8030	**50.8**	59.3	52.7	58.5	55.3
Average		57.5	59.9	52.8	60.0	57.6
LSD (0.05)		4.2	1.6		2.0	
CV (s/mean)*100		4.4	1.6		1.6	

Table 14. 2001 Winter wheat off-station protein performance.
Exp. 3800 Central Agricultural Research Center, Moccasin, MT

ID	Pedigree	Mocc Recrop 3870	Denton Recrop 3871	Ft Benton Recrop 3872	Moore Recrop 3874	Average Grain Protein
		%	%	%	%	%
PI564761	Erhardt	**17.4**	16.3	**18.0**	15.6	16.8
PI593890	McGuire	16.7	**16.4**	17.9	**16.3**	16.8
MT9513	MT7811/MT8030	16.8	15.1	17.3	15.2	16.1
PI584505	Halt	16.0	16.2	16.8	15.2	16.1
PI593889	Rampart	15.7	15.9	17.1	14.9	15.9
MT 9432	BigSky	15.3	15.4	17.6	15.1	15.9
PI593891	Vanguard	14.2	16.1	17.7	15.3	15.8
PI605741	NuPlains	15.6	16.0	17.0	14.6	15.8
CI 17735	Norstar	16.1	15.0	16.6	15.1	15.7
PI517194	Tiber	15.2	14.9	17.2	15.1	15.6
PI599336	Morgan	14.9	15.7	17.1	14.5	15.6
MT 9426	MT8030/NLY	16.0	15.0	16.2	14.9	15.5
PI586806	NuWest	15.3	14.8	16.9	14.8	15.5
MTW9441	NuSky	14.8	14.8	17.3	14.5	15.4
PI596352	Elkhorn	15.1	15.1	16.9	14.3	15.4
RH78W296	Bighorn	14.7	15.6	16.6	14.4	15.3
PI584526	Judith	15.8	14.8	16.5	13.9	15.3
PI594920	Utah100	15.7	14.3	16.9	14.1	15.3
UT944158	Golden Spike	15.1	14.8	**16.4**	14.4	15.2
PI607569	Ransom	15.0	14.3	16.5	14.2	15.0
MT9982	Promontory/Judith	14.6	14.2	16.7	14.2	14.9
CI 17879	Rocky	15.0	14.7	16.1	13.9	14.9
PI555458	Promontory	14.9	13.9	16.6	**13.5**	14.7
CI 17860	Neeley	**13.3**	**13.0**	16.6	**13.5**	14.1
Average		15.4	15.1	16.9	14.6	15.5
LSD (0.05)						
CV (s/mean)*100						

Table 15. 2001 Winter wheat off-station heading date and plant height.

Exp. 3800 Central Agricultural Research Center, Moccasin, MT

ID	Pedigree	Mocc Heading	Mocc 3870	Denton 3871	Ft Benton 3872	Moore 3874	Average Height	Hail Denton	Sawfly Ft Benton
		days	in	in	in	in	in	0-5	%
CI 17860	Norstar	**171**	**32.5**	**28.0**	**16.0**	**29.0**	26.4	2.0	4.7
MTW9441	Elkhorn	168	29.8	**28.0**	12.0	24.5	23.6	1.0	14.8
MT9513	Neeley	169	27.7	27.0	14.0	24.5	23.3	1.0	13.6
PI517194	NuSky	168	25.7	27.0	13.0	24.5	22.6	1.0	6.5
PI584526	BigSky	167	25.7	27.0	12.0	25.0	22.4	1.0	8.9
MT9982	MT7811/MT8030	169	25.8	**28.0**	11.0	23.0	22.0	1.8	10.7
MT 9426	Utah100	167	26.2	24.0	13.0	24.5	21.9	1.3	5.9
MT 9432	Judith	165	25.3	24.0	14.0	24.0	21.8	0.5	12.5
PI586806	Morgan	169	26.8	24.0	12.0	24.5	21.8	0.3	7.7
PI607569	Tiber	166	24.7	25.0	14.0	23.0	21.7	0.8	5.9
CI 17735	Promontory/Judith	169	25.5	25.0	13.0	22.5	21.5	0.3	9.5
PI555458	Rampart	165	25.3	27.0	11.0	22.5	21.5	2.0	14.8
PI594920	NuWest	167	24.7	27.0	12.0	22.0	21.4	1.0	9.5
RH78W296	Golden Spike	170	26.2	23.0	13.0	23.0	21.3	1.3	8.3
CI 17879	Vanguard	165	25.8	25.0	10.0	23.5	21.1	1.0	3.0
PI599336	Ransom	166	24.3	26.0	10.0	22.5	20.7	1.2	3.0
PI593891	Rocky	164	22.8	25.0	12.0	22.0	20.5	0.8	3.6
PI593889	Promontory	165	24.2	23.0	11.0	21.0	19.8	2.7	3.0
PI596352	MT8030/NLY	167	21.5	22.0	12.0	21.5	19.3	2.7	2.4
UT944158	Erhardt	169	21.8	22.0	12.0	21.0	19.2	2.7	3.0
PI564761	McGuire	162	20.8	21.0	10.0	22.0	18.5	1.3	3.6
PI593890	Bighorn	167	22.2	21.0	10.0	20.0	18.3	1.3	4.7
PI605741	NuPlains	165	20.5	21.0	10.0	19.5	17.8	0.8	1.8
PI584505	Halt	**160**	**19.3**	**20.0**	**9.0**	**16.5**	16.2	1.7	10.7
Average		167	24.8	24.6	11.9	22.8	21.0	1.3	7.2

Table 16. Moccasin recrop winter wheat multi-year yield summary of selected varieties, 1993-2001.

Exp. 3800 Central Agricultural Research Center, Moccasin, MT

Selected Varieties	1993	1995	1996	1997	1998	1999	2000	2001	Avg.	Neeley Same Yrs
					bu/a					
Neeley	44	33	31	69	47	45	43	36	43.5	-
Norstar	39	33[1/]	26	54	45	41	40	32	38.8	43.5
Rocky	40	39	34	73	50	43	45	39	45.3	43.5
Tiber	45	36	29	56	46	45	41	39	42.1	43.5
Judith	36	40	31	63	53	43	46	36	43.5	43.5
Quantum 542	38	30	30	66	52	53	39	-	44.0	44.6
Bighorn	35	40	28	65	48	42	44	37	42.3	43.5
NuWest		38	30	51[2/]	50	39	40	37	40.7	43.4
Kestrel	40	44	29	51	49	-	-	-	42.6	44.8
Erhardt		35	28	63	44	30	37	32	38.4	43.4
Vanguard		27[1/]	27	59	47	38	39	34	38.7	43.4
Rampart		36	27	55[2/]	48	38	37	33	39.1	43.4
McGuire		31	28	53	36	32	36	30	35.1	43.4
Promontory			29	61	50	48	46	36	45.0	48.0
BigSky				65	47	39	40	37	45.5	48.0
Morgan						42	38	35	38.3	41.3
Mean	37.0	37.0	29.0	61.0	47.0	42.0	41.0	35.2		

[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 17. Denton recrop winter wheat multi-year yield summary of selected varieties, 1993-2001.

Exp. 3800 Central Agricultural Research Center, Moccasin, MT

Selected Varieties	1990	1991	1992	1993	1995	1996	1997	1998	1999	2001	Avg.	Neeley Same Yrs
	---------- bu/a ----------											
Neeley	55	64	24	66	82	44	62	61	45	48	55.1	-
Norstar	44	39	24	55	51[1/]	35	54	51	35	40	42.8	55.1
Rocky	50	60	22	57	73	46	59	61	40	31	49.9	55.1
Tiber	52	55	28	65	73	42	65	61	46	45	53.2	55.1
Judith	59	61	26	55	87	45	59	66	45	42	54.5	55.1
Quantum 542	57		40	59	78	48	67	76	48	-	59.1	55.1
Bighorn	48	60[2/]	23	56	73	46	64	67	39	30	50.6	55.1
NuWest	50	54	-	-	67	43	64	59	45	39	52.6	55.1
Kestrel				60	80	44	60	66	-	-	62.0	63.0
Erhardt					71	42	62	55	41	33	50.7	57.0
Vanguard					56	41	56	62	35	34	47.4	57.0
Rampart					76	40	51	55	37	33	48.7	57.0
McGuire					71	42	54	49	37	32	47.5	57.0
Promontory						53	56	65	47	37	51.6	52.0
BigSky							64	62	44	39	52.3	54.0
Morgan									46	34	39.9	46.5
Mean	49	53	22	56	73	43	60	60	42	36		

[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 yields not reported due to plugged drill opener in some rows.

Table 18. Fort Benton recrop winter wheat multi-year yield summary of selected varieties, 1993-2001.

Exp. 3800 Central Agricultural Research Center, Moccasin, MT

Selected Varieties	1991	1993	1994	1995	1996	1997	1998	1999	2000	2001	Avg.	Neeley Same Yrs
						bu/a						
Neeley	74	58	50	69	47	51	27	45	10	6	43.7	-
Norstar	55	49	43	56[1/]	32	45	25	40	12	6	36.3	43.7
Rocky	68	51	44	63	42	56	25	54	10	6	41.9	43.7
Tiber	66	56	47	74	46	54	28	52	10	6	43.9	43.7
Judith	63	39	44	70	36	51	26	54	13	6	40.2	43.7
Quantum 542		54	52	78	45	54	28	54	12	-	47.1	44.6
Bighorn	66[2/]	55	43	70	34	55	27	50	10	6	41.6	43.7
NuWest	63	-	41	66	36	49	28	44	10	5	38.0	43.7
Kestrel		58	44	70	43	49	27	-	-	-	48.5	50.3
Erhardt			44	72	35	49	26	43	9	4	35.2	38.1
Vanguard			40	68[1/]	40	51	25	48	11	6	36.1	38.1
Rampart			45	77	39	52	24	50	10	7	38.0	38.1
McGuire				59	34	51	24	45	9	6	32.5	31.0
Promontory					49	55	25	59	9	6	33.8	31.0
BigSky						52	26	51	11	3	28.7	27.8
Morgan								49	10	5	21.4	20.3
Mean	62	51	45	69	40	52	25	49	10	5		

[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, 1997-2001.

Table 19. Winifred winter wheat multi-year yield summary of selected varieties, 1993-2001.

Exp. 3800 Central Agricultural Research Center, Moccasin, MT

Selected Varieties	1992	1994	1996	1997	1998	1999	2000	2001	Avg.	Neeley Same Yrs
		---------- bu/a ----------								
Neeley	40	52	43	51	65	49	30	*	47.1	-
Norstar	30	50	50	51	66	40	29		45.1	47.1
Rocky	32	50	55	45	62	50	33		46.7	47.1
Tiber	36	47	57	38	72	50	29		47.0	47.1
Judith	30	51	52	43	70	59	28		47.6	47.1
Quantum 542	47	59	55	45	75	59	36		53.7	47.1
Bighorn	31	53	50	54	63	55	30		48.0	47.1
NuWest		49	50	46	72	57	31		50.8	48.3
Kestrel		54	52	38	59	-	-		50.8	48.3
Erhardt		52	52	50	66	53	27		50.0	48.3
Vanguard		44	45	39	53	52	27		43.3	48.3
Rampart		49	43	33	52	53	29		43.2	48.3
McGuire			49	51	57	52	26		47.0	47.6
Promontory			54	41	58	61	29		48.6	47.6
BigSky				50	66	51	31		49.5	48.8
Morgan						55	29		42.0	39.5
Mean	32	51	50	45	64	54	30			

* 2001 trial was not harvested due to severe drought and kochia infestation; 1993 and 1995 trials were not harvested due to hail.

Table 20. Moore recrop winter wheat multi-year yield summary of selected varieties, 1993-2001.

Exp. 3800 Central Agricultural Research Center, Moccasin, MT

Selected Varieties	1990	1991[1/]	1992	1994	1995	1996	1997	1998	2000	2001	Avg.	Neeley Same Yrs
	---------- bu/a ----------											
Neeley	34	64	42	37	45	36	56	72	28	37	45.1	-
Norstar	35	49	28	37	31[2/]	34	48	67	29	35	36.3	45.1
Rocky	29	57	33	36	40	41	57	66	29	34	42.2	45.1
Tiber	33	56	41	35	43	39	57	69	29	32	43.4	45.1
Judith	36	56	32	34	47	35	54	65	30	38	42.7	45.1
Quantum 542	41		48	35	43	46	58	78	35	-	48.0	44.1
Bighorn	42	58[3/]	34	35	41	34	60	66	26	37	43.3	45.1
NuWest	47	55		42	46	34	55	70	27	36	45.8	45.1
Kestrel				34	41	36	56	70	-	-	47.4	44.4
Erhardt				37	42	43	57	56	24	30	41.3	44.4
Vanguard				29	29[2/]	35	52	57	27	34	37.6	44.4
Rampart				34	44	33	49	57	28	33	39.7	44.4
McGuire					41	37	48	54	24	30	39.0	45.6
Promontory						39	56	62	28	32	43.4	45.7
BigSky							56	67	29	38	47.5	48.2
Morgan									26	35	30.3	32.4
Mean	36.0	54.0	35.0	35.0	41.0	36.0	54.0	63.0	28.0	34.4		

[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 21. Predicted yields of selected winter wheat varieties grown in Central Montana based on previous seven years[1/] of variety performance. Central Agricultural Research Center, Moccasin, MT.

		Yield Level (X) in bu/a					
		30	**45**	**60**			
Variety	Class	Projected Yields (Y) - bu/a			LY[2/]	Predictive Equation	R^2
Big Sky	HRW	**31.0**	**46.7**	**62.5**	28	Y = 1.0497 - 0.5313	0.9893
Bighorn	HRW	**30.6**	**46.3**	**62.1**	37	Y = 1.0500 - 0.9465	0.9814
Erhardt	HRW	**28.3**	**43.3**	**58.2**	37	Y = 0.99582 - 1.567	0.9675
Judith	HRW	**31.7**	**48.0**	**64.4**	37	Y = 1.0898 - 1.024	0.9802
Kestrel	HRW	**30.8**	**45.9**	**61.0**	24	Y = 1.0065 + 0.628	0.9502
McGuire	HRW	**27.7**	**40.6**	**53.6**	37	Y = 0.8634 + 1.745	0.9658
Morgan	HRW	**30.8**	**46.6**	**63.1**	17	Y = 1.0641 - 2.279	0.9950
Neeley	HRW	**31.6**	**47.5**	**63.5**	37	Y = 1.0628 - 0.310	0.9619
Norstar	HRW	**31.0**	**42.4**	**55.2**	37	Y = 0.8066 + 4.383	0.9263
NuWest	HWW	**32.8**	**47.0**	**62.2**	37	Y = 0.9832 + 1.437	0.9701
Promontory	HRW	**34.3**	**48.7**	**64.3**	32	Y = 0.9972 + 2.219	0.9625
QT 542	HRW	**36.3**	**51.6**	**68.4**	32	Y = 1.0856 + 1.108	0.9612
Rampart	HRW	**28.1**	**42.2**	**56.4**	37	Y = 0.9447 - 0.271	0.9636
Redwin	HRW	**32.1**	**43.7**	**55.3**	28	Y = 0.7747 +8.809	0.9650
Rocky	HRW	**31.8**	**46.8**	**61.7**	37	Y = 0.994 + 1.921	0.9762
Tiber	HRW	**31.2**	**46.4**	**61.5**	37	Y = 1.0086 + 0.96	0.9748
Vanguard	HRW	**30.0**	**42.7**	**56.5**	37	Y = 0.8831 + 1.501	0.9542

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 1995 - 2001.
2/ LY = Number of Location/Years used to create the predictive regression equation. Varieties with fewer than 12 location years may not be accurate: use equation with caution.
Data file - C:\Regression.xls