

Title (4W4635): North Central Montana Off-Station Winter Wheat Variety Performance Evaluations

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Objectives:

Diverse cropping environments exist within the five-county area most closely served by Northern Agricultural Research Center. Winter wheat, spring wheat, barley, durum and oat production together in the five counties (Blaine, Chouteau, Hill, Liberty and Phillips) represents 31 percent of the 2008-2012 statewide totals (41 percent for winter wheat and 25 percent for spring wheat). Producers are keenly interested in variety performance data generated under local conditions. It is our objective, within budget and other resource limitations, to evaluate small grain variety performance, over time, under conditions representative of specific areas of northern Montana, yet differing from that of the Research Center. Growers in north central Montana are provided reliable, unbiased, up-to-date information to make comparisons among improved winter wheat varieties. This report provides producers in north central Montana the information necessary to select varieties best suited for their specific area and growing conditions.

In order to bring quality and quantity together, protein premium data are included to demonstrate the forces of market value on winter wheat varieties under varying cropping conditions.

Methods:

Standard off-station winter wheat variety performance trials were conducted in 2013 on chemical fallow at two locations in two northern Montana counties.

Dryland Winter Wheat Trials:

- | | | |
|------------------------------------|--------------|------------|
| 1. Cederberg Farm, Blaine County | (3NE Turner) | 13-36N-25E |
| 2. McKeever Farms, Chouteau County | (12N Loma) | 32-27N-10E |

Both trials consisted of 24 entries and were seeded in replicated, 3-row, 22-foot plots on a 12-inch row spacing utilizing a self-propelled cone seeder with Atom Jet paired row openers. All rows of each plot were trimmed to a harvest length of 16.5 feet with a three-point rototiller. Plant height was measured and percent sawfly cutting was estimated for each plot immediately prior to harvest. A 'Wintersteiger Classic' plot combine, funded in part by the Montana Wheat and Barley Committee, was used to harvest each 3-row plot. Seed was cleaned prior to measuring plot weight, test weight and moisture content. Protein content was determined using a Foss Infratec 1241 near infrared analyzer. Other variables specific to each individual trial are listed with the current year data tables.

Average annual Pacific Northwest (PNW) quotes for hard red winter wheat at 10 to 13 percent protein are graphed in Figure 1. Values along the top axis of the graph reflect the average annual amount per bushel (\$/bu) price spread between the minimum and maximum protein levels for which quotes are consistently available. Historical daily bids issued can be accessed via the Montana Wheat and Barley Committee website at:
<http://wbc.agr.mt.gov/wbc/Producers/Pricing.html>

Average price quotes at 0.25 percent increments of protein level were applied to the corresponding years' yield and protein production for each entry tested. Therefore, values included in individual off-station location figures are "actual" in terms of agronomic yield and associated gross return based on protein content and average annual market performance for each year.

Results:

Cropping environments in 2013 started out marginal, but with timely precipitation, ended up very good across north central Montana. Both the Turner and Loma locations went into the fall dryer than normal with poor seeding conditions. Turner then received higher than average precipitation during April, May and June resulting in above average yields. Although the amount was lower, the Loma location received timely precipitation also resulting in higher than average winter wheat yields.

At Havre, annual growing season precipitation (9/1/12 through 8/31/13) was 18.46 inches, 54 percent higher than the average for all years since 1916. April 1 through July 31 precipitation was 13.28 inches or 194 percent of the 98-year average. Heat units expressed as "Growing Degree Days" (GDD, base 50) from May through July totaled 1221, 95 percent of the average for the last 63 years (1951-2013). The last spring frost was earlier and first fall frost of 2013 was later than the 98-year average resulting in 150 frost-free days. The minimum winter temperature was -25 degrees F on December 25. Overall, the growing season was slightly cooler than normal. The April through July growing season saw an average daily temperature of 57.6 degrees F, only 1 degree below normal. July and August average temperatures were slightly higher than normal with the high for 2013 recorded on August 20 at 94 degrees F. There were 16 days with temperatures 90 degrees F or above, with no days over 100 degrees F.

Following a summer of substantial and timely rainfall, winter wheat yields at Turner averaged over 52 bu/ac (Table 1). 'Yellowstone', a Montana State University release, was the highest yielding entry at 63 bu/ac. 'SY Clearstone', 'Bearpaw', 'WB-Quake', 'CDC Falcon', 'Accipiter' and four experimental lines produced yields ranging from 55 to 60 bu/ac, statistically equal to that of Yellowstone. Test weight of all entries was greater than 60 lb/bu. Sawfly cutting was low in the winter wheat at Turner, averaging only three percent. Stand percent, plant height, yield, moisture, test weight, protein and sawfly cutting data for the 2013 Turner dryland winter wheat trial are summarized in Table 1.

Comparable averages are calculated using a standard long-term check variety when not all entries are present in a specific trial for all years. Variety means are adjusted by multiplying the actual check mean by the ratio of the individual variety mean compared to the check mean for the same years as tested. All varieties are then directly comparable to each other when in the same nursery. A minimum of 3 years of data is necessary to be included in comparable average calculation. Three-year comparable averages for seed yield and test weight at Turner are summarized in Table 2, while three-year comparable averages for sawfly cutting are summarized in Table 3. Three-year gross return information is summarized in Figure 2.

Loma winter wheat yields averaged 61 bu/ac with Montana State University experimental line 'MT0978' producing the highest yield at over 72 bu/ac (Table 4). 'Overland', CDC Falcon, Yellowstone, 'Judee', WB-Quake and SY Clearstone, along with four experimental lines all yielded statistically equal to MT0978. Sawfly cutting was high again this year in the Loma area with cutting in the winter wheat trial averaging 19.5 percent. 'Colter' and WB-Quake were most severely cut at 33.3 percent. In the small plot situation, 'Accipiter', 'Overland' and 'Warhorse' were all cut less than 10 percent. Plant height, yield, moisture, test weight, protein and sawfly cutting data for the 2013 Loma dryland winter wheat trial are summarized in Table 4. Ten-year comparable averages for seed yield and test weight at Loma are summarized in Table 5, while ten-year comparable averages for sawfly cutting are summarized in Table 6. Gross return information is summarized in Figures 3 through 6.

Summary:

This work has been strongly supported by producers near each of the locations, and by the Northern Agricultural Research Center Advisory Council. With budget and other resources allowing, it is planned to continue off-station cereal variety investigations in the five-county area. The Blaine County location near Turner is entering its fourth year of winter wheat testing, while the Chouteau County location, between Big Sandy and Loma, has been used for various trials since 1998.

Funding Summary:

Expenditure information for grant index 4W4635 is to be provided by Montana State University, Office of Sponsored Programs. There is no other grant support for this project.

MWBC FY2015 Grant Submission Plans:

It is planned to submit this project for funding consideration in the next fiscal year.

TABLE 1. Dryland Fallow Winter Wheat Cultivar Evaluation Nursery Grown Off-Station at the Leon Cederberg Farm, Turner. Northern Agricultural Research Center. Havre, Montana. 2013. (Exp# 13-3851-WW)

ID	CULTIVAR or SELECTION	STAND %	PLNT HT Inches	1/	MOISTURE %	TEST WT Lbs/Bu	2/	3/
				YIELD Bu/Ac			PROTEIN %	SAWFLY %
Accipiter	Saskatchewan, 2008	99.3	25.1	55.1	12.6	62.2	11.5	2.3
Bearpaw	Montana, 2011	98.3	24.8	57.6	11.7	61.1	12.4	1.0
CDC Falcon	Sask/WestBred, 1999	97.6	22.4	55.3	12.9	61.0	11.8	3.7
Colter	Montana, 2013	99.0	25.8	50.1	12.2	62.0	12.1	6.7
Decade	Montana/North Dakota, 2010	97.0	25.2	52.1	12.3	61.0	13.2	2.0
Genou	Montana, 2004	100.0	27.9	49.8	12.4	62.0	11.4	1.0
Jagalene	AgriPro, 2002	98.7	24.6	46.9	12.1	62.7	12.6	3.7
Jerry	North Dakota, 2001	97.7	26.8	45.2	11.5	60.6	12.3	5.3
Judee	Montana, 2011	100.0	23.7	49.0	12.7	62.5	12.0	0.7
Ledger	WestBred, 2004	96.0	22.1	38.1	12.8	61.0	12.2	5.3
MT0978	MT9982//MTW0072/NW97S151	99.3	24.6	54.7	11.9	61.9	12.2	1.0
MT1078	MT02113*4/MTS0359	99.0	24.5	54.1	13.0	60.7	11.6	2.3
MT1090	Reeder/6*Yellowstone	99.3	25.4	60.2	12.1	61.8	10.7	6.7
MTCS1202	96X17E69/3/MTCL0309/CDC Teal 11A//MTW01	94.4	22.2	43.9	12.1	60.4	12.8	1.0
MTS0832	92X73E70/MTW9911	98.0	25.1	50.9	12.4	61.9	11.5	0.7
MTS1024	MT02113*4/MTS0359	98.7	24.1	55.7	12.4	61.3	11.3	5.0
MTW08168	MTW0047/2*MT9982	99.0	27.5	60.2	12.2	62.4	11.9	6.7
Norris (CL)	Montana/WestBred, 2005	100.0	27.0	54.2	12.6	62.0	11.9	5.0
Overland	Nebraska, 2007	99.3	23.7	52.6	12.3	61.1	12.4	2.3
Rampart	Montana, 1996	95.3	26.4	45.4	12.4	61.7	12.6	2.3
SY Clearstone	Yellowstone*4/3/MTCL01158/CDC Teal 11A//Jaç	99.7	24.1	59.9	12.2	61.5	11.1	1.0
Warhorse	Montana, 2013	96.0	22.8	52.1	12.4	62.2	12.2	0.7
WB-Quake	WestBred, 2011	99.3	24.4	56.9	12.7	62.0	11.5	0.7
Yellowstone	Montana 2005	100.0	25.1	63.0	11.9	61.5	11.5	6.7
EXPERIMENTAL MEANS		98.4	24.8	52.6	12.3	61.6	11.9	3.1
LSD (0.05)		5.2	2.8	8.7	1.1	0.8	-	3.5
C.V.%		3.2	6.8	10.0	5.6	0.8	-	68.8
P-VALUE (Varieties)		0.7714	0.0023	<.0001	0.6935	<.0001	-	0.0002

1/ Volumetric yields are based on plot weights adjusted to uniform 12 percent grain moisture and 60 lbs/bu as the standard test weight for wheat.

2/ Protein values are adjusted to 12 percent grain moisture.

3/ Sawfly rating is reported as the percentage of cut stems.

Bold indicates highest value within a column.

Bold indicates varieties with values equal to highest variety within a column based on Fisher's protected LSD (p=0.05).

Management Information (13-3851-WW)

Seeding Date: September 28, 2012

Harvest Date: September 5, 2013

Fertility: 100-20-10 side banded

System: no till

Herbicide: none

Insecticide: none

Previous Crop: Chemical Fallow - Durum

Precipitation: not available

TABLE 2. Three-Year Yield and Test Weight Summary of Selected Entries from Dryland Fallow Winter Wheat Variety Nurseries Grown Off-Station at the Cederberg Farm, Turner. Northern Agricultural Research Center. Havre, Montana. 2011-2013 (Exp# 3851-WW)

2/ VARIETY or SELECTION	No. of YEARS TESTED	1/ YIELD (Bushels Per Acre)							TEST WEIGHT (Pounds Per Bushel)								
		2011	2012	2013	2014	2015	AVE. for YEARS TESTED	% of CHECK YIELD 3/	3-YR COMP. AVE. YIELD 4/	2011	2012	2013	2014	2015	AVE. for YEARS TESTED	% of CHECK TEST WT 3/	3-YR COMP. AVE. TEST WT 4/
MT00159 YELLOWSTONE (++)	3	49.7	24.0	63.0			45.5	100.0	45.5	61.3	58.8	61.5			60.5	100.0	60.5
WB-Quake WB-QUAKE	3	54.0	24.4	56.9			45.1	99.0	45.1	60.7	59.2	62.0			60.6	100.2	60.6
Bearpaw BEARPAW (P+)	3	51.7	24.4	57.6			44.6	97.8	44.6	61.2	59.5	61.1			60.6	100.1	60.6
S94-4 CDC FALCON (P+)	3	54.9	21.1	55.3			43.8	96.1	43.8	59.9	58.7	61.0			59.9	98.9	59.9
Accipiter ACCIPITER	3	47.4	23.9	55.1			42.1	92.4	42.1	60.4	59.0	62.2			60.5	100.0	60.5
MTS 0031 GENOU (saw fly res)(++)	3	51.7	24.5	49.8			42.0	92.2	42.0	60.9	59.6	62.0			60.8	100.5	60.8
Judee JUDEE (P+)	3	52.6	23.7	49.0			41.8	91.7	41.8	61.4	60.4	62.5			61.4	101.5	61.4
Decade DECADE (++)	3	50.0	20.9	52.1			41.0	90.0	41.0	61.9	60.0	61.0			61.0	100.7	61.0
ND9257 JERRY	3	52.2	22.7	45.2			40.0	87.9	40.0	60.9	58.5	60.6			60.0	99.2	60.0
MTCL0316 NORRIS (P, CL++)	3	44.2	20.0	54.2			39.5	86.7	39.5	62.6	60.1	62.0			61.6	101.7	61.6
MTS0808 WARHORSE (P+)	3	38.1	25.1	52.1			38.5	84.4	38.5	62.5	59.5	62.2			61.4	101.5	61.4
JAGALENE JAGALENE (P+)	3	46.1	18.8	46.9			37.2	81.7	37.2	63.2	61.0	62.7			62.3	102.9	62.3
PI593889 RAMPART (saw fly res)	3	43.6	22.5	45.4			37.2	81.6	37.2	62.1	59.4	61.7			61.1	100.9	61.1
Ledger LEDGER (P+)	3	41.2	23.4	38.1			34.2	75.1	34.2	60.8	59.6	61.0			60.5	99.9	60.5
MEANS (For Entries Listed)		48.4	22.8	51.5					40.9	61.4	59.5	61.7					60.9
5/ Growing Season Precipitation (in.)		3.7	7.5	n/a			5.6										
Soil PAW (in.) to SD @ Planting		8.6	8.9	7.8			8.4										
Total Plant Available Water (in.)		12.3	8.9	n/a			10.6										
Soil NO3 (lbs.) to SD at Planting		80	15	11			35										
Fertilizer Applied	(# N)	70	70	100			80										
	(# P ₂ O ₅)	40	40	20			33										
	(# K ₂ O)	25	25	10			20										

Check Variety is Yellow stone.

1/ See MCES Bulletin 1098 or the Plant Sciences & Plant Pathology website at <http://plantsciences.montana.edu/> for evaluation of other important variety performance characteristics to include protein, quality, winter hardiness, disease resistance, etc. before making cultivar selection decisions.

2/ P = Private Variety, + = Protected Variety, ++ = PVP Title 5 or Title 5 Pending, HW = Hard White Wheat, CL = Clearfield Tolerant.

3/ Percent of Neeley yield or test weight for the same data years as those in which a given entry was tested.

4/ 3-Yr Comparable Average = (x/y) * z where x = average yield or test weight of a given entry for years tested, y = average yield or test weight for Neeley for the same years, and z = 3-Yr average yield or test weight for the check variety Neeley

5/ May 3 to 14 days prior to harvest maturity.

TABLE 3. Three-Year Sawfly Summary of Selected Entries from Dryland Fallow Winter Wheat Variety Nurseries Grown Off-Station at the Cederberg Farm, Turner. Northern Agricultural Research Center. Havre, Montana. 2011-2013. (Exp# 3851-WW)

2/ VARIETY or SELECTION	No. of YEARS TESTED	1/ SAWFLY RATING (% of cut and lodged stems)					AVE. for YEARS TESTED	% of CHECK SWFLY 3/	3-YR COMP. AVE. SWFLY 4/
		2011	2012	2013	2014	2015			
MTS0808 WARHORSE (P+)	3	1.0	2.3	0.7			1.3	26.7	1.3
PI593889 RAMPART (saw fly res)	3	1.0	11.7	2.3			5.0	100.0	5.0
Judee JUDEE (P+)	3	7.0	8.3	0.7			5.3	106.7	5.3
MTS 0031 GENOU (saw fly res)(++)	3	1.0	18.3	1.0			6.8	135.6	6.8
S94-4 CDC FALCON (P+)	3	2.3	18.3	3.7			8.1	162.2	8.1
Bearpaw BEARPAW (P+)	3	3.7	20.0	1.0			8.2	164.4	8.2
WB-Quake WB-QUAKE	3	20.0	10.0	0.7			10.2	204.4	10.2
Decade DECADE (++)	3	11.7	23.3	2.0			12.3	246.7	12.3
MT00159 YELLOWSTONE (++)	3	20.0	18.3	6.7			15.0	300.0	15.0
Ledger LEDGER (P+)	3	25.0	15.0	5.3			15.1	302.2	15.1
ND9257 JERRY	3	13.7	26.7	5.3			15.2	304.4	15.2
MTCL0316 NORRIS (P, CL++)	3	11.7	30.0	5.0			15.6	311.1	15.6
Accipiter ACCIPITER	3	26.7	18.3	2.3			15.8	315.6	15.8
JAGALENE JAGALENE (P+)	3	21.7	25.0	3.7			16.8	335.6	16.8
MEANS (For Entries Listed)		11.9	17.5	2.9					10.8
5/ Growing Season Precipitation (in.)		3.7	7.5	n/a			5.6		
Soil PAW (in.) to SD @ Planting		8.6	8.9	7.8			8.4		
Total Plant Available Water (in.)		12.3	8.9	n/a			10.6		
Soil NO3 (lbs.) to SD at Planting		80	15	11			35		
Fertilizer Applied (# N)		70	70	100			80		
(# P ₂ O ₅)		40	40	20			33		
(# K ₂ O)		25	25	10			20		

Check Variety is Rampart.

- 1/ See MCES Bulletin 1098 or the Plant Sciences & Plant Pathology website at <http://plantsciences.montana.edu/> for evaluation of other important variety performance characteristics to include protein, quality, winter hardiness, disease resistance, etc. before making cultivar selection decisions.
- 2/ P = Private Variety, + = Protected Variety, ++ = PVP Title 5 or Title 5 Pending, HW = Hard White Wheat, CL = Clearfield Tolerant.
- 3/ Percent of Rampart saw fly rating for the same data years as those in which a given entry was tested.
- 4/ 3-Yr Comparable Average = (x/y) * z where x = average saw fly rating of a given entry for years tested, y = average saw fly rating for Rampart for the same years, and z = 3-Yr average saw fly rating for the check variety Rampart.
- 5/ May 3 to 14 days prior to harvest maturity.

TABLE 4. Dryland Fallow Winter Wheat Cultivar Evaluation Nursery Grown Off-Station at McKeever Farm & Seed, Inc., Loma. Northern Agricultural Research Center. Havre, Montana. 2013. (Exp# 13-3853-WW)

ID	CULTIVAR or SELECTION	STAND %	PLNT HT Inches	1/		2/		3/
				YIELD Bu/Ac	MOISTURE %	TEST WT Lbs/Bu	PROTEIN %	SAWFLY %
Accipiter	Saskatchewan, 2008		28.6	58.3	11.2	58.8	13.7	6.7
Bearpaw	Montana, 2011		26.5	57.3	12.0	58.8	14.0	20.0
CDC Falcon	Sask/WestBred, 1999		26.9	68.4	12.0	58.0	13.9	10.0
Colter	Montana, 2013		28.4	58.8	11.0	57.5	13.9	33.3
Decade	Montana/North Dakota, 2010		28.3	58.7	12.1	58.5	14.7	23.3
Genou	Montana, 2004		27.7	57.8	12.0	58.4	14.0	23.3
Jagalene	AgriPro, 2002		28.3	56.6	11.8	59.7	14.0	21.7
Jerry	North Dakota, 2001		29.4	55.0	11.5	58.3	13.9	20.0
Judee	Montana, 2011		27.6	65.6	11.5	59.8	13.6	30.0
Ledger	WestBred, 2004		26.4	57.2	11.9	59.5	12.8	25.0
MT0978	MT9982//MTW0072/NW97S151		27.4	72.5	11.1	58.8	13.6	16.7
MT1078	MT02113*4/MTS0359		28.8	63.3	11.4	57.7	13.0	25.0
MT1090	Reeder/6*Yellowstone		29.5	67.3	11.1	57.8	13.5	10.0
MTCS1202	96X17E69/3/MTCL0309/CDC Teal 11A//MTW01143/4/MTC		26.5	62.0	11.6	58.4	13.4	11.7
MTS0832	92X73E70/MTW9911		28.1	48.7	11.7	60.3	13.2	16.7
MTS1024	MT02113*4/MTS0359		26.7	66.2	11.0	56.8	13.1	18.3
MTW08168	MTW0047/2*MT9982		30.3	60.9	11.1	58.0	14.0	28.3
Norris (CL)	Montana/WestBred, 2005		29.0	54.3	11.3	59.2	13.6	28.3
Overland	Nebraska, 2007		29.7	71.6	12.1	58.6	13.2	6.7
Rampart	Montana, 1996		28.2	56.7	11.4	58.3	14.2	16.7
SY Clearstone	Yellowstone*4/3/MTCL01158/CDC Teal 11A//Jagalene		28.1	62.6	11.0	57.2	13.6	20.0
Warhorse	Montana, 2013		28.6	61.3	11.1	59.8	13.7	8.3
WB-Quake	WestBred, 2011		28.5	64.7	12.5	57.1	13.5	33.3
Yellowstone	Montana 2005		28.6	66.9	11.1	57.8	13.4	15.0
EXPERIMENTAL MEANS			28.2	61.4	11.5	58.5	13.6	19.5
LSD (0.05)			2.1	10.7	0.3	1.2	-	12.4
C.V.%			4.6	10.6	1.8	1.2	-	38.5
P-VALUE (Varieties)			0.0198	0.0066	<.0001	<.0001	-	0.0002

1/ Volumetric yields are based on plot weights adjusted to uniform 12 percent grain moisture and 60 lbs/bu as the standard test weight for wheat.

2/ Protein values are adjusted to 12 percent grain moisture.

3/ Sawfly rating is reported as the percentage of cut stems.

Bold indicates highest value within a column.

Bold indicates varieties with values equal to highest variety within a column based on Fisher's protected LSD (p=0.05).

Management Information (13-3853-WW)

Seeding Date: September 28, 2012

Harvest Date: August 26, 2013

Fertility: 100-20-10 side banded

System: no till

Herbicide: pending

Insecticide: none

Previous Crop: Chemical Fallow - Spring Wheat

Precipitation: 9.03"

TABLE 5. Ten-Year Yield and Test Weight Summary of Selected Entries from Dryland Fallow Winter Wheat Variety Nurseries Grown Off-Station at McKeever Farms, Loma. Northern Agricultural Research Center. Havre, Montana. 2004-2013. (Exp# 3853-WW)

2/ VARIETY or SELECTION	No. of YEARS TESTED 3/	1/ YIELD (Bushels Per Acre)								TEST WEIGHT (Pounds Per Bushel)							
		2009	2010	2011	2012	2013	AVE. for YEARS TESTED 3/	% of CHECK YIELD 4/	10-YR COMP. AVE. YIELD 5/	2009	2010	2011	2012	2013	AVE. for YEARS TESTED 3/	% of CHECK TEST WT 4/	10-YR COMP. AVE. TEST WT 5/
PI619098 WAHOO (++)	8	54.9	68.6	50.3			66.9	100.7	66.2	57.8	51.2	55.6			57.4	98.7	57.0
MT00159 YELLOWSTONE (++)	10	44.6	66.6	62.2	59.0	66.9	65.8	100.0	65.8	59.1	52.7	60.3	56.7	57.8	57.9	100.0	57.8
S94-4 CDC FALCON (P+)	10	45.8	56.0	57.1	52.0	68.4	63.1	95.9	63.1	57.8	52.3	60.3	55.6	58.0	58.0	100.2	57.9
PI55458 PROMONTORY	7	48.2	58.6				64.1	95.6	62.9	60.1	54.2				60.0	103.9	60.0
MTW 9441 NUSKY (HW)	6	44.2					64.0	95.3	62.7	59.9					59.5	101.5	58.7
CI 17860 NEELEY	7	42.3	56.1				63.9	95.3	62.7	58.2	52.4				57.6	99.7	57.6
MT0552 DECADE (++)	6	48.6	61.5	55.2	53.8	58.7	59.1	94.4	62.1	59.5	53.7	59.6	57.3	58.5	57.6	101.1	58.4
MTS0808 WARHORSE (++)	3			60.8	53.8	61.3	58.6	93.6	61.5			59.3	56.0	59.8	58.4	100.2	57.9
JAGALENE JAGALENE (P+)	10	49.4	57.0	52.5	49.4	56.6	61.3	93.2	61.3	59.9	55.0	61.3	59.5	59.7	60.4	104.2	60.2
BZ96-919 PRYOR (P+)	9	45.1	51.8	55.3	52.3		61.0	92.9	61.1	58.9	53.2	58.8	56.6		57.8	99.8	57.7
MTS0713 JUDEE (saw fly res)(++)	5	45.2	55.1	62.6	49.5	65.6	55.6	92.9	61.1	60.6	53.0	61.5	56.5	59.8	58.3	101.7	58.8
CI 17879 ROCKY (P)	6	41.7					62.2	92.6	60.9	60.2					60.7	103.5	59.8
WB-Quake WB-QUAKE (P+)	3			64.9	43.2	64.7	57.6	91.9	60.4			61.0	53.9	57.1	57.3	98.4	56.9
BZ022060 CARTER (P++)	3	45.7	59.3				56.3	90.0	59.2	58.3	54.7				56.6	101.8	58.8
BZ96-788 LEDGER (P+)	8	46.9	62.2	49.2	55.4	57.2	56.2	88.9	58.4	58.6	54.5	60.4	59.4	59.5	59.0	102.3	59.1
MTCL0316 NORRIS (P, CL++)	9	41.2	52.8	45.2	44.3	54.3	55.7	88.2	58.0	60.5	52.4	60.1	55.6	59.2	59.0	101.8	58.8
MTCL0318 BYNUM (sf res)(P, CL++)	7	37.3	60.4	51.2			54.6	86.9	57.1	58.4	55.2	61.1			59.5	102.2	59.1
MTS 0031 GENOU (saw fly res)(++)	10	42.8	51.6	49.1	49.4	57.8	56.8	86.3	56.8	57.4	51.9	59.7	55.0	58.4	57.8	99.8	57.6
ND9257 JERRY	10	41.0	41.9	53.6	43.7	55.0	56.6	86.1	56.6	57.5	49.7	59.2	55.4	58.3	57.5	99.2	57.3
MTS0721 BEARPAW (++)	4	54.7	51.2	52.9	57.3		54.0	84.9	55.8	54.1	59.8	56.8	58.8		57.4	100.9	58.3
DH001819 ACCIPITER	5	46.3	46.8	53.2	45.4	58.3	50.0	83.5	54.9	59.3	51.1	59.1	55.7	58.8	56.8	99.1	57.3
PI593889 RAMPART (saw fly res)	10	41.1	52.7	55.0	40.8	56.7	54.3	82.6	54.3	58.9	52.8	60.7	55.3	58.3	58.2	100.5	58.1
MEANS (For Entries Listed)		44.9	56.3	54.6	49.7	59.9			60.1	59.0	53.0	59.9	56.4	58.7			58.3
6/ Growing Season Precipitation (in.)		n/a	n/a	9.4	9.4	8.8	8.1										
Soil PAW (in.) to SD @ Planting		7.5	10.1	9.6	7.9	9.1	8.0										
Total Plant Available Water (in.)		7.5	10.1	19.4	7.9	n/a	12.2										
Soil NO3 (lbs.) to SD at Planting		36	82	26	68	51	173										
Fertilizer Applied	(# N)	70	70	70	70	100	73										
	(# P ₂ O ₅)	40	40	40	40	20	38										
	(# K ₂ O)	25	25	25	25	10	24										

Long-term check variety is Yellow stone.

1/ See MCES Bulletin 1098 or the Plant Sciences & Plant Pathology website at <http://plantsciences.montana.edu/> for evaluation of other important variety performance characteristics to include protein, quality, winter hardiness, disease resistance, etc. before making cultivar selection decisions.

2/ P = Private Variety, + = Protected Variety, ++ = PVP Title 5 or Title 5 Pending, HW = Hard White Wheat, CL = Clearfield Line.

3/ Only the most recent 5 years show n, but summary calculations include all years noted.

4/ Percent of Yellow stone yield or test weight for the same data years as those in which a given entry was tested.

5/ 10-Yr Comparable Average = (x/y) * z where x = average yield or test weight of a given entry for years tested, y = average yield or test weight for Yellow stone for the same years, and z = 10-Yr average yield or test weight for the check variety Yellow stone.

6/ May 7 to 14 days prior to harvest maturity.

TABLE 6. Ten-Year Sawfly Summary of Selected Entries from Dryland Fallow Winter Wheat Variety Nurseries Grown Off-Station at McKeever Farms, Loma. Northern Agricultural Research Center. Havre, Montana. 2004-2013. (Exp# 3853-WW)

2/ VARIETY or SELECTION	No. of YEARS TESTED	1/ SAWFLY RATING (% of cut and lodged stems)										AVE. for YEARS TESTED	% of CHECK SWFLY 3/	10-YR COMP. AVE. SWFLY 4/	
		2004	2005	2006	2007	2008	2009	2010	2011	2012	2013				
MTS0808 WARHORSE (++)	3								5.0	5.0	8.3	6.1	42.2	3.1	
MTS0721 BEARPAW (++)	4							8.3	10.0	13.3	20.0	12.9	96.8	7.1	
PI593889 RAMPART (saw fly res)	10	0.0	0.0	0.0	0.0	3.7	16.7	10.0	10.0	16.7	16.7	7.4	100.0	7.4	
WB-Quake WB-QUAKE (P+)	3							15.0	12.5	33.3	20.3	140.2	10.3		
MTS0713 JUDEE (saw fly res)(++)	5						31.7	53.3	10.0	31.7	30.0	31.3	223.7	16.5	
MTS0031 GENOU (saw fly res)(++)	10	0.0	0.0	0.0	2.0	3.7	50.0	51.7	21.7	26.7	23.3	17.9	242.8	17.9	
BZ96-919 PRYOR (P+)	9	0.0	1.7	0.3	0.3	1.0	28.3	70.0	6.7	76.7		20.6	324.5	23.9	
MT0552 DECADE (++)	6						2.3	40.0	96.3	13.3	71.7	23.3	41.2	335.1	24.7
BZ96-788 LEDGER (P+)	8			0.0	3.7	4.0	38.3	100.0	26.7	68.3	25.0	33.2	360.9	26.6	
MTCL0318 BYNUM (sf res)(P, CL++)	7		0.0	2.3	2.3	8.3	56.3	63.3	13.3			20.9	361.9	26.7	
CI 17879 ROCKY (P)	6	0.0	1.7	0.7	2.3	5.3	66.3					12.7	375.3	27.7	
S94-4 CDC FALCON (P+)	10	0.0	0.0	0.3	0.7	1.0	63.3	99.7	15.0	86.7	10.0	27.7	375.3	27.7	
MTW9441 NUSKY (HW)	6	1.7	0.0	0.3	1.0	3.7	71.7					13.1	385.2	28.4	
DH001819 ACCIPITER	5						60.0	97.7	28.3	90.0	6.7	56.5	403.7	29.8	
JAGALENE JAGALENE (P+)	10	1.7	5.0	2.3	5.3	2.3	71.3	99.7	28.3	86.7	21.7	32.4	440.0	32.4	
ND9257 JERRY	10	1.7	1.7	0.7	6.7	8.3	76.3	96.7	30.0	88.3	20.0	33.0	448.2	33.0	
MT00159 YELLOWSTONE (++)	10	0.0	0.0	0.7	2.3	10.0	85.0	99.3	21.7	97.7	15.0	33.2	450.0	33.2	
BZ022060 CARTER	3						3.7	38.3	96.0			46.0	454.9	33.5	
MTCL0316 NORRIS (P, CL++)	9		1.7	0.3	11.7	18.3	91.7	93.0	45.0	86.7	28.3	41.8	511.0	37.7	
PI619098 WAHOO (++)	8	0.0	3.3	0.7	5.3	10.0	76.7	98.3	38.3			29.1	576.7	42.5	
CI 17860 NEELEY	7	0.0	1.7	2.3	7.0	10.3	86.3	96.3				29.1	672.4	49.6	
PI555458 PROMONTORY	7	3.3	3.3	3.7	11.7	15.0	94.7	100.0				33.1	763.6	56.3	
MEANS (For Entries Listed)		0.7	1.4	1.0	4.2	6.5	60.2	79.4	19.9	57.2	20.1			27.1	
5/ Growing Season Precipitation (in.)		7.4	n/a	8.6	6.9	8.9	n/a	n/a	9.4	9.4	8.8	8.5			
Soil PAW (in.) to SD @ Planting		5.7	4.0	7.6	n/a	10.5	7.5	10.1	9.6	7.9	9.1	8.0			
Total Plant Available Water (in.)		13.1	4.0	16.2	n/a	19.4	7.5	10.1	19.4	7.9	n/a	12.2			
Soil NO3 (lbs.) to SD at Planting		286	514	192	n/a	300	36	82	26	68	51	173			
Fertilizer Applied	(# N)	70	70	70	70	70	70	70	70	70	100	73			
	(# P ₂ O ₅)	40	40	40	40	40	40	40	40	40	20	38			
	(# K ₂ O)	25	25	25	25	25	25	25	25	25	10	24			

Long-term check variety is Rampart.

1/ See MCES Bulletin 1098 or the Plant Sciences & Plant Pathology website at <http://plantsciences.montana.edu/> for evaluation of other important variety performance characteristics to include protein, quality, disease resistance, etc. before making cultivar selection decisions.

2/ P = Private Variety, + = Protected Variety, ++ = PVP Title 5 or Title 5 Pending, HW = Hard White Wheat, CL = Clearfield Line.

3/ Percent of Rampart cut for the same data years as those in which a given entry was tested.

4/ 10-Yr Comparable Average = (x/y) * z where x = average saw fly rating of a given entry for years tested, y = average saw fly rating for Rampart for the same years, and z = 10-Yr average saw fly rating for the check variety Rampart.

5/ May 7 to 14 days prior to harvest maturity.

Average Annual Market Quotes

* (\$/Bu - Hard Red Winter Wheat)

Pacific Northwest Delivery

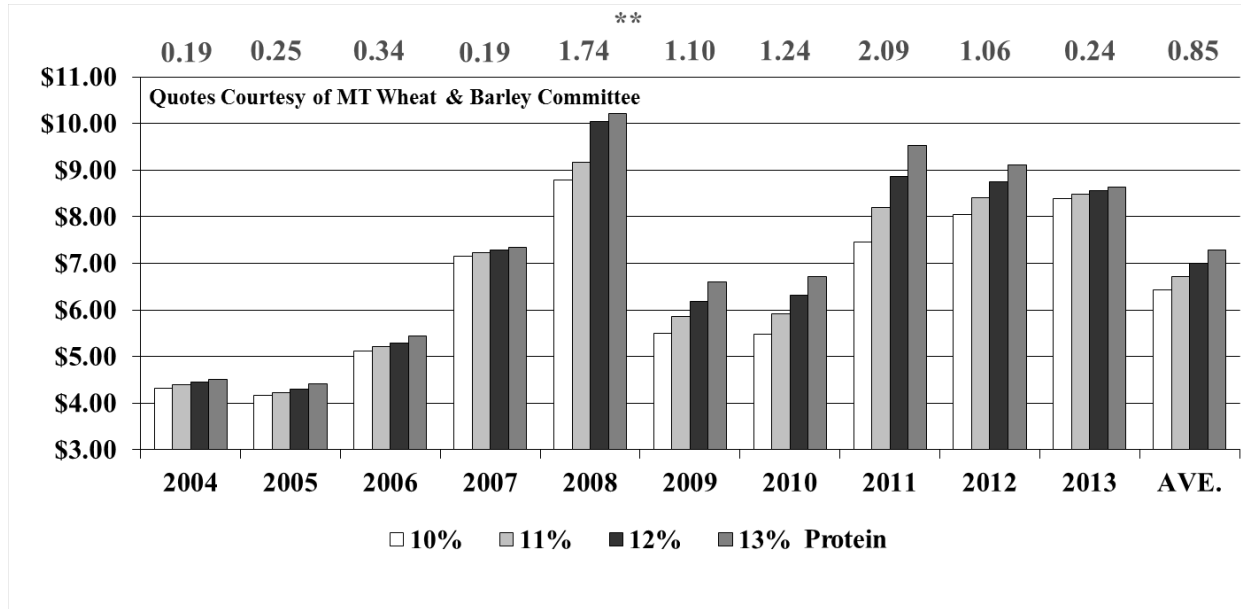


Figure 1.

MSU/MAES/NARC

* Average of All Market Days/Market Year

** \$/Bu Difference Between 10 & 13% Protein

Gross Return - Fallow Winter Wheat

Cederberg Farm – Turner, Montana

3-Yr Means (2011-2013)

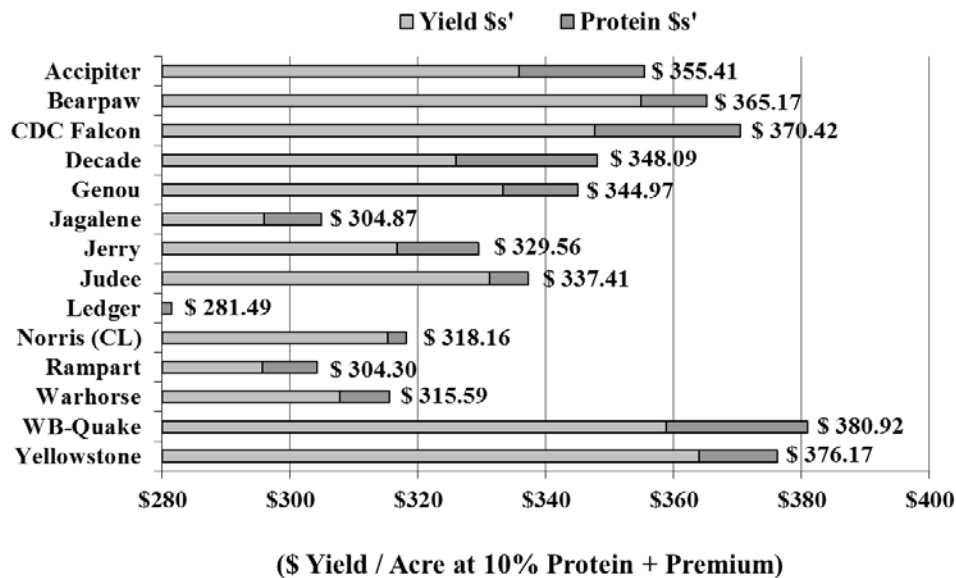


Figure 2.

MSU/AES/NARC-Havre

Ref=13-38513 P=.0811 CV=11.29%

LSD (P<=.05), Gross Return = \$ 60.07 / ac
Prices = PNW Average Annual Market/Year

Gross Return - Fallow Winter Wheat McKeever Farm & Seed, Inc. – Loma, Montana 10-Yr Means (2004-2013)

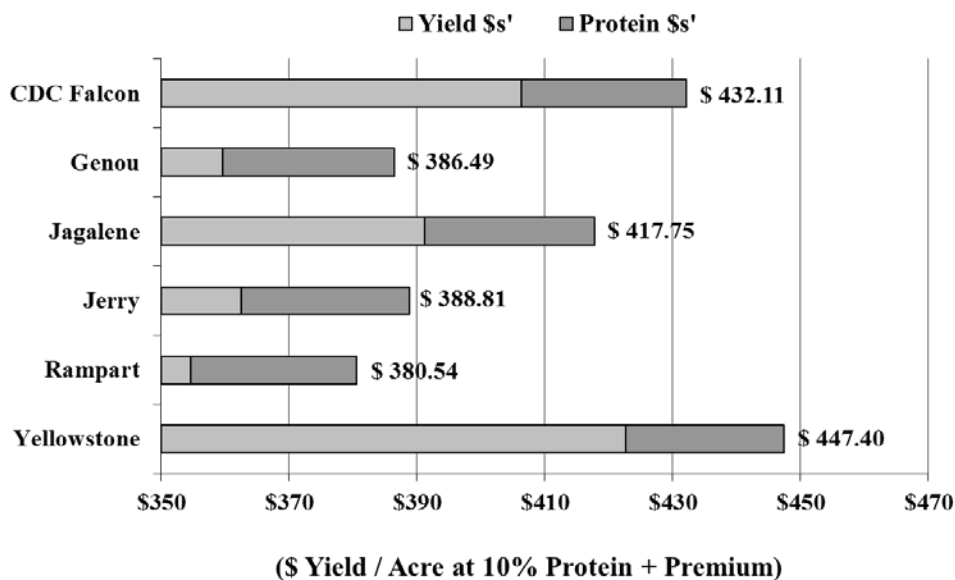


Figure 3.

MSU/AES/NARC-Havre
Ref=13-385310 P=.0038 CV=10.58%

LSD (P<=.05), Gross Return = \$ 38.89 / ac
Prices = PNW Average Annual Market/Year

Gross Return - Fallow Winter Wheat McKeever Farm & Seed, Inc. – Loma, Montana 8-Yr Means (2006-2013)

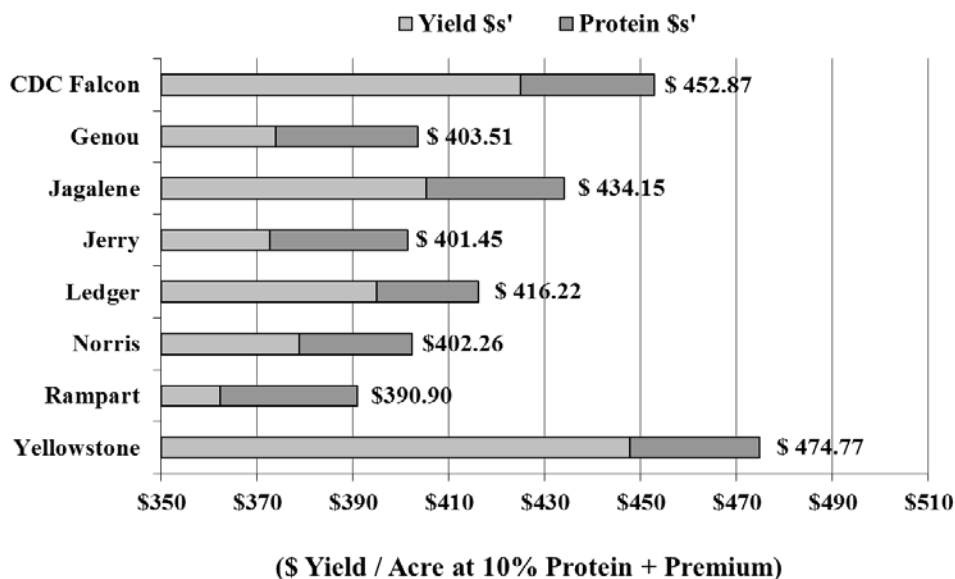


Figure 4.

MSU/AES/NARC-Havre
Ref=13-38538 P=.0017 CV=9.90%

LSD (P<=.05), Gross Return = \$ 41.98 / ac
Prices = PNW Average Annual Market/Year

Gross Return - Fallow Winter Wheat McKeever Farm & Seed, Inc. – Loma, Montana 4-Yr Means (2010-2013)

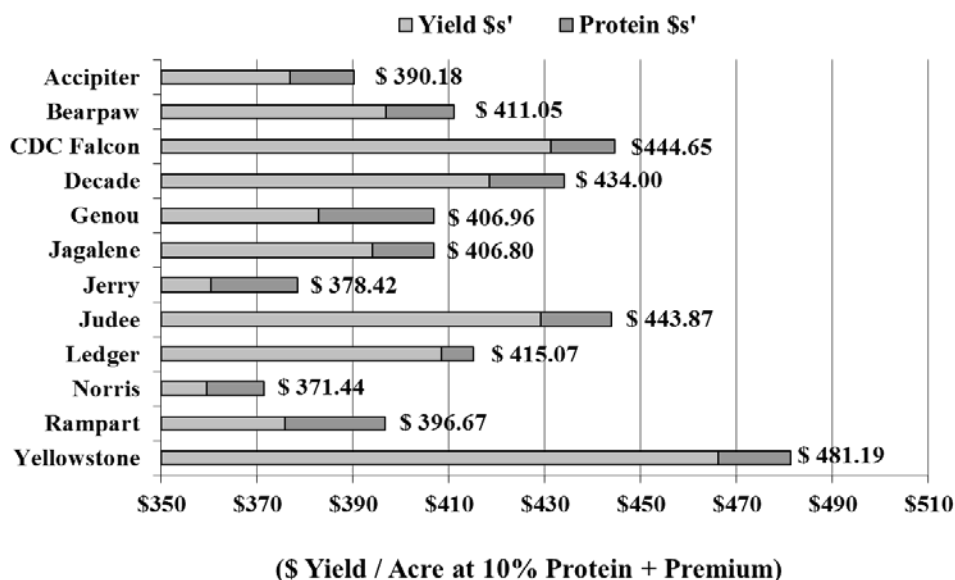


Figure 5.

MSU/AES/NARC-Havre
Ref=13-38534 P=.0002 CV=6.82%

LSD (P<=.05), Gross Return = \$ 40.71 / ac
Prices = PNW Average Annual Market/Year

Gross Return - Fallow Winter Wheat McKeever Farm & Seed, Inc. – Loma, Montana 3-Yr Means (2011-2013)

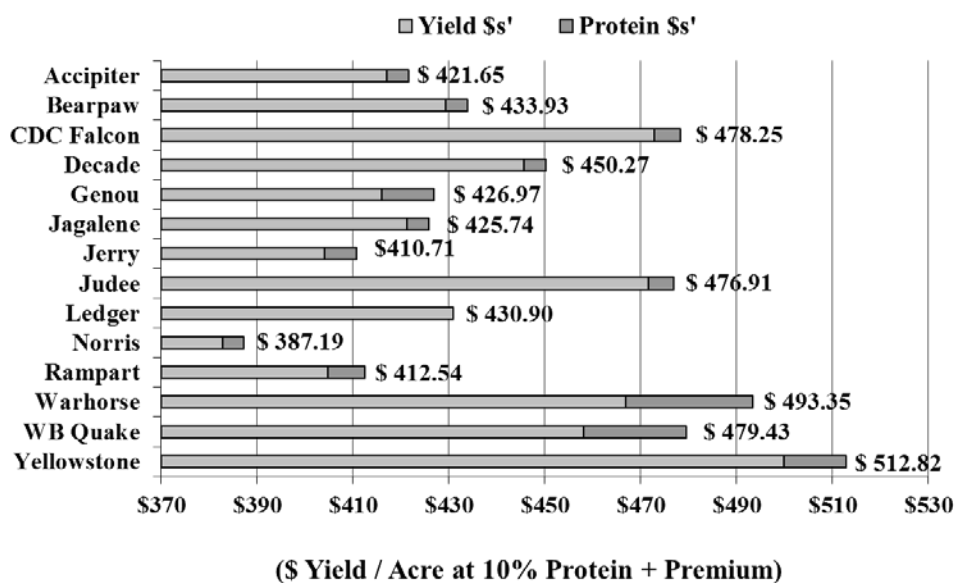


Figure 6.

MSU/AES/NARC-Havre
Ref=13-38533 P=.0104 CV=8.37%

LSD (P<=.05), Gross Return = \$ 62.65 / ac
Prices = PNW Average Annual Market/Year