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of the

WESTERN TRIANGLE AGRICULTURAL RESEARCH CENTER

Montana Agricultural Experiment Station

Conrad, Montana

2009 Crop Year

Submitted by

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INTRODUCTION

The information and data reported in this report are a compilation of ongoing or new research projects located at or near the Western Triangle Ag. Research Center, Conrad, Montana. Many projects are conducted in cooperation with faculty members and research associates from the Depts. of Plant Science and Plant Pathology and Land Resources and Environmental Science located on the campus of Montana State University, and Agricultural Research Centers: Central, Northern and Western of the Dept. of Research Centers.

These data should be used for comparative purposes rather than using absolute numbers. Statistics are used to indicate that treatment or variety differences are really different and are not different due to chance or error. The least significant difference (LSD) and coefficient of variability (CV) values are useful in comparing treatment or variety differences. The LSD value represents the smallest difference between two treatments at a given probably level. The LSD at $p=0.05$ or 5 % probability level is usually the statistic reported, and it means that the odds are 19 to 1 that treatment differences by the amount of the LSD are truly different. When no LSD is shown, then the treatments are not statistically different. The CV value measures the variability of the experiment or variety trial, and a CV greater than 15 % indicates a high degree of variability and less accuracy. Generally an experiment with a high CV has a large LSD value.

To simplify reading, trade or brand names of products, services, firms, or equipment are sometimes used. No endorsement of such names or firms is intended nor is criticism implied of those not mentioned.

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Summary of climatic data by month for the '08-'09 crop year (September thru August) at the Western Triangle Agricultural Research Center, Conrad, MT.

Month	Precipitation (inches)		Mean Temperature (°F)	
	Current Year	Average (24-yr)	Current Year	Average (24-yr)
September, 2008	2.45	1.22	53.9	56.8
October, 2008	0.00	0.58	45.5	45.2
November, 2008	0.20	0.29	38.7	32.5
December, 2008	0.55	0.18	14.9	24.8
January, 2009	0.11	0.18	24.3	23.3
February, 2009	0.24	0.23	25.1	24.9
March, 2009	0.24	0.43	26.7	33.1
April, 2009	1.16	0.95	39.5	43.2
May, 2009	0.94	1.80	49.1	52.3
June, 2009	1.88	2.87	57.0	59.7
July, 2009	4.31	1.43	64.3	67.1
August, 2009	0.59	1.23	63.2	66.1
Total	12.67	--	--	--
Average	--	11.35	41.9	44.2

Last killing frost in Spring (32°F)

2009----- June 07
 Average 1986-2009----- May 19

First killing frost in Fall (32°F)

2009----- September 28
 Average 1986-2008----- September 24

Frost free period (days)

2009----- 113
 Average----- 128

Maximum summer temperature----- 91.9°F (September 04, 2009)

Minimum winter temperature----- -26.3°F (December 15, 2009)

2009 Winter Wheat Variety Evaluations in the Western Triangle Area.

Location: Western Triangle Agricultural Research Center (WTARC), Conrad, MT.

Personnel: John H. Miller and Grant Jackson, WTARC, Conrad, MT; and Phil Bruckner and Jim Berg, MSU Plant Science Dept., Bozeman, MT.

The uniform, winter wheat intrastate and preliminary variety nurseries were the only winter wheat trials grown 2009.

Results: Winter wheat variety data are shown in Tables 1 thru 4.

The growing season in 2009 was cool with timely rains throughout the growing season. Grain yields were about 10 bu/acre higher than average, and grain protein levels were about 1.5 % below average. Low protein was due to inadequate nitrogen fertilization and higher than expected yields

Detailed descriptions of most of the varieties tested are included in Extension Bulletin 1098 "Performance Summary of Winter Wheat Varieties in Montana", available at County Agent Offices. Additional observations concerning the varieties are presented in the following pages.

Winter Wheat Variety Notes & Comments

Western Triangle Agricultural Research Center, Conrad, MT

Winterhardiness ratings: 5 = very good; 1 = poor.

Coleoptile length: Long = 3.4" or more; Short = 3" or less.

Stem solidness scores of 19 or higher are generally required for reliable sawfly resistance.

Accipiter (Sask. DH0018196): First tested in 2008. High yield in 2008. 4" taller than Falcon. Similar to Falcon for test weight, head date and protein. Parentage = Raptor x Falcon.

Bauermeister (WA7939, 2005): Winterhardiness = 2. Medium height, med-strong straw. Medium coleoptile. Very late maturity. Very low test weight.

Big Sky (MT9432, 2001): Nuwest/Tiber cross, hard red kernels, white chaff. Good winterhardiness (4). Strong, stiff straw, very good lodging resistance, height equal to Tiber. Medium coleoptile. Medium maturity, heading 1-2 days later than Rocky, but 2 days earlier than Tiber and Morgan. Yield about equal to Rocky, and 2-3 bu higher than Tiber. High test weight and protein. Post-harvest seed dormancy is high, like Tiber. Septoria and tan spot resistance is good. A good alternative to Tiber.

Bond (CO 2004): Winterhardiness = 2. Clearfield system IMI resistant. Stiff straw, medium height & coleoptile, early maturity. Above average yield. Average test weight. Resistant to biotype 1 Russian wheat aphid. Low protein and poor quality.

Buteo (CDC, WPB, Sask., 2006): Winterhardiness = 4. Standard height, medium coleoptile. Medium-late maturity. Below average yield. Above average test wt. Average protein.

Bynum (MSU & WPB, 2005): Clearfield system single-gene resistance to imazamox or 'Beyond' herbicide. Winterhardiness = 2. Medium strong straw, medium height, long coleoptile. Stem solidness = 20 (compared to 22 for Rampart), which typically provides a reliable level of sawfly tolerance. Similar in yield and other characteristics to Rampart. Sawfly resistant, low yield, high protein, and excellent baking quality.

Carter (WestBred, 2007): Winterhardiness = 3. Semidwarf height, stiff straw, short coleoptile. Stem solidness score = 15. Medium early heading. Average yield. Above average test weight. Average protein. Moderate resistance to stripe rust.

Darrell (S. Dak., 2006): Medium height and coleoptile. Medium-early heading. High yield. Average test weight and protein.

Falcon (CDC, WPB, Sask. 1999): Good winterhardiness (4). Semidwarf, stiff straw, 4" shorter than Rocky. Short coleoptile. The first true winterhardy semidwarf available for irrigated conditions in Montana. Heading 1 day later than Rocky, 2 days earlier than Neeley & Tiber. Above average yield and test weight on dryland, good performance for irrigated or high rainfall conditions. Protein similar to Rocky. Not for stripe rust areas.

Genou (MSU, 2004): Sawfly resistant. Stem solidness not quite as solid as Rampart; and may be more sensitive to environmental factors than that of Rampart. Solid stem comparison: (max rating = 25): Rampart = 22, Genou = 19. Winterhardiness higher than Vanguard and Rampart, equal to Rocky. Medium stiff straw. Height similar to Vanguard, and 2" shorter than Rocky. Medium coleoptile. Maturity 1-2 days later than Rocky. Yield 7% higher than Vanguard & Rampart, 5% less than Rocky. Average test weight and protein.

Hawken (AgriPro, 2007): Semidwarf height, short coleoptile. Early maturity. Yield is below average. Above average test weight and protein.

Hatcher (CO 2004): Winterhardiness = 2. Strong straw, semidwarf height, medium coleoptile. Early maturity. Low protein. Resistant to biotype 1 Russian wheat aphid and Great Plains biotype Hessian fly. Very low quality.

Jagalene (AgriPro, 2002): Winterhardiness = 2. Semidwarf, stiff straw, medium coleoptile. Early maturity, 1 day earlier than Rocky. Shatter resistant. Average yield. Very high test weight. Avg protein, but higher than Rocky. Good milling quality. Good disease resistance package (stem & stripe rust, tan spot and Septoria).

Jerry (ND, 2001): Winterhardiness high (5). Medium-stiff, med-tall straw, medium coleoptile. Medium-late maturity. Yield is below average, except in winterkill areas where it's above average. Below-average test weight. Average protein. Has one of the worst sawfly stem-cutting ratings. Shatter susceptible.

Ledger (WestBred, 2005): Winterhardiness = 2. Semidwarf height & stiff straw, 4" less than Rocky. Medium coleoptile. Stem solidness = 10, variable & sensitive to cloudy conditions; not a reliable level of sawfly tolerance. Early heading. Above avg yield & test wt. Avg protein and acceptable quality. Moderate stripe rust resistance.

Morgan (Sask & WPB, 1996): High winterhardiness (5). Standard height. Medium stiff straw. Very short coleoptile. Three days later to head and slightly later maturity than Rocky; heading similar to Neeley. Below average yield. Test wt 1-lb less than Rocky or Tiber. Protein slightly higher than Rocky, similar to Neeley. Milling and baking acceptable. Recommended for areas needing high levels of winterhardiness.

Neeley (Idaho, 1980): Winterhardiness medium (3). Medium short straw. Medium coleoptile. Medium-late maturity. Susceptible to stem rust. High yielder in good years, but does poor if stressed for moisture. Below average test weight. Good shatter resistance. Protein & quality are erratic, ranging from low to high. Not for stripe rust areas.

Norris (MSU & WPB, 2005): Clearfield system single-gene resistance to imazamox or 'Beyond' herbicide (which controls cheatgrass, goatgrass and wild oats). Winterhardiness = 3. Stiff straw, medium height, medium coleoptile. Early maturity. Above average yield and test weight. Average protein, good quality. Replaces MT1159CL.

Promontory (Utah, 1990): Red head. Winter hardiness poor (2 or less). Medium-short, medium-strong straw. Short coleoptile. Medium maturity. Excellent stripe rust & dwarf smut resistance; Stem rust susceptible. Average yield and above average test weight. Protein medium low. Has severe sawfly stem cutting ratings.

Pryor (WPB, 2002): Winterhardness 3 = Neeley. Short stiff straw, 4" shorter than Neeley. Short coleoptile. Medium late maturity similar to Neeley & Tiber, 2 days later than Rocky. Above average yield. Average test weight and protein, good quality. Intended mainly for Central Montana as a replacement for Neeley. Not for stripe rust areas.

Rampart (MSU, 1996): Sawfly resistant (sister line to Vanguard). Solid stem rating = 22. Red chaff, upright head. Winterhardness is marginal (2-). Should not be grown in areas where high levels of winterhardness are needed, unless protected by stubble. Height 1 inch shorter than Neeley, med-stiff straw. Very long coleoptile. Matures 1 day later than Rocky, 2 days earlier than Neeley. Some resistance to stem rust, and some tolerance to wheat streak mv. Medium shatter resistance. Yield is below average, but is above average under heavy sawfly conditions. Does not seem as prone to shatter as Vanguard. Good test weight, protein and quality. See Genou.

Ripper (Colorado, 2006): Semidwarf height, medium coleoptile. Early maturity. Above average yield and test weight. Average protein.

Rocky (Agripro, 1978): A selection from Centurk for soil borne mosaic resistance. Winterhardness = 2. Medium weak straw, medium height. Medium coleoptile. Early maturity. High yield. Very susceptible to yellow berry expression under low nitrogen conditions. Medium protein. See Jagalene and Ledger for shorter-straw alternatives.

Tiber (MSU, 1988): Dark Red head, (blackish-red in years of favorable moisture). Winterhardness = 3. Medium height with good lodging resistance. Stiff straw, which may cause it to thresh a little harder than weaker-strawed varieties. Med-long coleoptile. Very resistant to sprouting, causing some dormancy. Medium maturity. Susceptible to stem rust. Very resistant to shatter. Below average yield. Protein above average. Good milling and baking quality. Fdn seed being discontinued. See Big Sky for alternative.

Vanguard (MSU, 1995): Sawfly resistant. Good stem solidness. White chaff, nodding head. Winterhardness marginal (2-). Straw slightly stiffer and 1 inch shorter than Rocky, but moderately susceptible to lodging under high-yield conditions. Long coleoptile. Medium head date, 1 day later than Rocky, 3 days earlier than Neeley. Good wheat streak mv tolerance. Susceptible to stem & stripe rust. Below average yield; but under heavy sawfly infestation, yield is above average. Medium shatter resistance. Good test weight. Protein high; quality adequate. Not a satisfactory variety for non-sawfly areas, and should not be grown where high levels of winterhardness are needed unless protected by stubble. See Genou.

Wahoo (Nebr & Wyo, 2000): Winterhardness = 3. Semidwarf, 2" shorter than Rocky, stiff straw. Short coleoptile. Very early maturity. High yield. Average test weight & protein, marginally poor quality.

Willow Creek (MSU 2005): Beardless forage winter wheat for hay. HRW class. Winterhardness = 5. Very tall straw, lodging susceptible. Long coleoptile. Very late maturity. High forage yield. Tends to be safer than barley for nitrates, because earlier seasonal development escapes heat stress better. Low grain yield and test weight. High protein.

Yellowstone (MSU, 2005): Winterhardness = 4. Medium height similar to Neeley, and taller than Falcon, and Pryor. Straw strength is excellent. Medium-short coleoptile length. Medium maturity. Broadly adapted state-wide, but is stem-rust susceptible (thus, not for District 6, eastern Montana). Moderate resistance to stripe rust. Very high-yielding,

and 3% higher than Falcon. Below average test weight. Protein is medium. Excellent baking quality and good Asian noodle quality.

Hard White Winter Wheat

Protein of hard white wheat for bread baking needs to be higher than required for noodle markets. Some varieties are dual-purpose and can be used for both bread and noodles. Although not a concern for bread baking quality, varieties with low levels of polyphenol oxidase (PPO) are desirable for Chinese noodles, since high PPO levels are associated with noodle discoloration. Low PPO provides good noodle brightness and color stability. Some hard white varieties sprout more readily than hard reds, especially those developed from Australian germ-plasm. The pure white trait is difficult to maintain, as pollen from red wheats may pollinate a white variety, causing a mixture of red kernels. It is very important to clean the combine, storage bins and other grain handling equipment prior to harvest to avoid mixing hard white wheat with other wheat. Seeding equipment and seedbed must also be free of red wheat. It is important to have a market strategy in place before growing a hard white variety.

Alice (S. Dak., 2006): Hard white. Short straw, short coleoptile. Early heading. Above average yield, test weight and protein.

Golden Spike (UT, Gen Mills, 1998): Hard white, low PPO. Winterhardness 3. Height similar to Rocky, med-stiff straw. Medium coleoptile. Medium maturity. Below average yield. Low test weight & protein.

Hyalite (MSU & WPB, 2005): Hard White, low PPO with good noodle brightness and color stability. Clearfield system single-gene resistance to imazamox or 'Beyond' herbicide. Winterhardness = 3. Standard height, but stiff straw. Short coleoptile. Early maturity. Average yield and test weight. Red kernel occurrence is 0.7% (high, but still acceptable). Dual-purpose quality similar to NuWest & NuSky. Above average protein, good milling & baking quality. Stem rust resistant. Stripe rust susceptible.

MDM WA7936 (Wash., 2006): Hard white. Winterhardness = 2. Medium stiff straw. Medium coleoptile. Very late maturity. Yield similar to NuWest. Low test weight.

NuDakota (AgriPro, 2005): Hard white. Winterhardness = 2. Semidwarf height, stiff straw. Early heading. Average yield, test weight and protein. Medium PPO.

Nuwest (MSU, 1994): Hard white, low PPO. Dual purpose, noodle and bread. Winterhardness = 4. One inch shorter than Rocky. Stiff straw. Very short coleoptile. Two days later than Rocky. Resistant to stem rust but susceptible to stripe rust, dwarf bunt, and WSMV. Susceptible to sawfly, RWA, and Hessian fly. Average yield and well adapted to Montana. Medium test weight and protein. Good resistance to preharvest sprouting – (In 1993, everything sprouted - red or white). Contains 1 red kernel/1000. Protein medium to high. Good quality.

NuSky (MSU, 2001): Hard white, low PPO. (Sister line to the hard red var BigSky). Good dual purpose quality for noodles & bread. Winterhardness 4. Height and straw strength similar to Nuwest & Rocky, med-stiff. Short coleoptile. Heading similar to Nuwest, Tiber & Neeley; and 3 days later than Rocky. Shatter resistant. Average yield. Test weight similar to Nuwest. Medium to high protein. Quality similar to Nuwest. High level of post-harvest

dormancy (similar to Tiber), and thus does not have the sprouting problems common to some of the other hard white wheats. NuSky is a public release.

Wendy (SD, 2004): Hard white. Winterhardiness = 3. Semidwarf height, Short coleoptile. Early heading. Average yield. Above-average test weight and protein. Medium PPO.

Table 1. 2009 Intrastate Winter Wheat Variety Test, Conrad, MT.

Variety and Class	Source	Solid stem score*	Yield bu/ac	Test weight lb/bu	Heading date Julian	Plant height in	Protein %
NI04421			91.2	64.7	166	29	11.2
CDC Falcon	Sask/WestBred, 1999	6.6	84.5	63.5	168	29	11.1
Hawken	AgriPro, 2007		84.2	63.0	165	29	11.1
Peregrine	Sask, 2008		84.0	62.9	169	39	10.5
Pryor	WestBred, 2002		83.6	63.4	168	29	9.6
Curlew	Utah, 2009		83.5	63.5	169	35	10.6
MTS0705		23.7	83.1	63.9	169	34	11.7
Yellowstone	MSU 2005		83.0	62.2	169	32	10.3
Wahoo	NE, 2001		82.9	61.4	166	32	10.7
Ripper	CO, 2006		82.4	62.4	165	27	11.3
MTS0532 (HWW)		20.4	82.3	62.5	167	29	11.0
MT0495			81.9	62.1	168	30	11.8
MT06103			81.4	63.5	167	33	10.4
MTW0785			80.5	62.8	169	31	11.8
Settler CL	NE (SD, WY), 2008		80.4	63.3	168	30	11.3
Neeley	ID, 1980	5.3	80.4	62.5	170	32	10.6
MT0766			80.3	63.2	169	30	11.7
MT0742			80.2	62.4	168	38	10.2
MT0552			79.1	63.1	168	30	11.1
MTS0531 (HWW)		21.2	79.0	62.3	167	30	11.2
AP 503 CL2	Agripro, 2007		78.9	64.8	167	29	11.3
MT0861			78.5	64.3	168	32	11.0
BZ9W02-2051			78.4	63.1	169	29	9.7
Genou	MSU, 2004	20.7	78.2	63.3	168	33	11.0
Radiant	Alb, 2002 (Meridian Seeds)		78.1	62.6	170	35	10.5
Darrell	SD, 2006		78.1	62.9	166	31	12.0
Overland	NE, 2007		77.5	63.2	166	32	11.3
MTW0759			77.4	64.2	168	33	11.5
MTW0782			77.0	63.4	168	30	11.1
Promontory	UT, 1990		76.8	63.8	168	34	10.3
MT0738			76.6	62.1	170	33	11.3
Rocky	Agripro, 1978		76.6	63.4	169	34	10.5
Ledger	WestBred, 2004	7.8	75.1	63.5	168	29	10.7
Jagalene	AgriPro, 2002		74.9	64.8	167	27	11.8
Tiber	MSU, 1988		74.6	63.2	169	39	11.4
Jerry	ND, 2001		73.9	62.1	168	33	11.4
MTS0713		19.4	73.7	64.6	168	31	11.6
NuSky (HWW)	MSU, 2001		73.7	61.2	170	33	11.3

Variety and Class	Source	Solid stem score*	Yield bu/ac	Test weight lb/bu	Heading date Julian	Plant height in	Protein %
Rampart	MSU, 1996	23.6	72.8	62.3	168	32	10.5
Accipiter	Sask, 2008		72.4	62.6	171	30	10.7
MT0754			72.0	62.8	168	31	11.8
Wendy (HWW)	SD, 2004		71.7	63.1	166	29	12.6
Norris (CL)	MSU/WestBred, 2005		71.2	63.9	167	34	10.6
MTS0721		22.5	70.6	62.7	167	27	11.2
Carter	WestBred, 2006	12.8	70.3	62.5	167	25	11.6
Alice (HWW)	SD, 2006		70.0	63.0	166	29	11.2
Hyalite (CL, HWW)	MSU/WestBred, 2005		69.8	62.7	167	31	11.4
MT0771			69.8	62.7	168	31	12.5
Bynum (CL)	MSU/WestBred, 2005	21.8	65.9	62.7	166	32	13.2
Average			77.6	63.1	167.8	31.3	11.1
LSD (0.05)			8.98	0.63			
C. V. (%)			6.56	0.61			
P-value (Varieties)			<.0001	<.0001			

HWW = Hard White

CL = Clearfield System

Planted: 9/18/08 on fallow

Harvested: 8/11/09

Fertilized with actual pounds of N-P-K: 61-52-20

Sprayed with Huskie @ 11 oz/a and Axial @ 8.2 oz/a on 5/19/09

* Solid stem score of 19 or higher is generally required for reliable sawfly tolerance.

Location: MSU Western Triangle Ag. Research Center, Conrad, MT.

Table 2. 2009 Intrastate Winter Wheat Variety Test Condensed list, Conrad, MT.

Variety and Class	Source	Solid stem score*	Yield bu/ac	Test weight lb/bu	Heading date Julian	Plant height in	Protein %
CDC Falcon	Sask/WestBred, 1999	6.6	84.5	63.5	168	29	11.1
Hawken	AgriPro, 2007		84.2	63.0	165	29	11.1
Peregrine	Sask, 2008		84.0	62.9	169	39	10.5
Pryor	WestBred, 2002		83.6	63.4	168	29	9.6
Curlew	Utah, 2009		83.5	63.5	169	35	10.6
MTS0705		23.7	83.1	63.9	169	34	11.7
Yellowstone	MSU 2005		83.0	62.2	169	32	10.3
Wahoo	NE, 2001		82.9	61.4	166	32	10.7
Ripper	CO, 2006		82.4	62.4	165	27	11.3
MTS0532 (HWW)		20.4	82.3	62.5	167	29	11.0
Settler CL	NE (SD, WY), 2008		80.4	63.3	168	30	11.3
Neeley	ID, 1980	5.3	80.4	62.5	170	32	10.6
MTS0531 (HWW)		21.2	79.0	62.3	167	30	11.2
AP 503 CL2	Agripro, 2007		78.9	64.8	167	29	11.3
BZ9W02-2051			78.4	63.1	169	29	9.7
Genou	MSU, 2004	20.7	78.2	63.3	168	33	11.0
Radiant	Alb, 2002 (Meridian Seeds)		78.1	62.6	170	35	10.5
Darrell	SD, 2006		78.1	62.9	166	31	12.0
Overland	NE, 2007		77.5	63.2	166	32	11.3
Promontory	UT, 1990		76.8	63.8	168	34	10.3
Rocky	Agripro, 1978		76.6	63.4	169	34	10.5
Ledger	WestBred, 2004	7.8	75.1	63.5	168	29	10.7
Jagalene	AgriPro, 2002		74.9	64.8	167	27	11.8
Tiber	MSU, 1988		74.6	63.2	169	39	11.4
Jerry	ND, 2001		73.9	62.1	168	33	11.4
MTS0713		19.4	73.7	64.6	168	31	11.6
NuSky (HWW)	MSU, 2001		73.7	61.2	170	33	11.3
Rampart	MSU, 1996	23.6	72.8	62.3	168	32	10.5
Accipiter	Sask, 2008		72.4	62.6	171	30	10.7
Wendy (HWW)	SD, 2004		71.7	63.1	166	29	12.6
Norris (CL)	MSU/WestBred, 2005		71.2	63.9	167	34	10.6
MTS0721		22.5	70.6	62.7	167	27	11.2
Carter	WestBred, 2006	12.8	70.3	62.5	167	25	11.6
Alice (HWW)	SD, 2006		70.0	63.0	166	29	11.2
Hyalite (CL, HWW)	MSU/WestBred, 2005		69.8	62.7	167	31	11.4

Variety and Class	Source	Solid stem score*	Yield bu/ac	Test weight lb/bu	Heading date Julian	Plant height in	Protein %
Bynum (CL)	MSU/WestBred, 2005	21.8	65.9	62.7	166	32	13.2
Average			77.1	63.0	167.7	31.3	11.1
LSD (0.05)			8.98	0.63			
C. V. (%)			6.56	0.61			
P-value (Varieties)			<.0001	<.0001			

HWW = Hard White

CL = Clearfield System

Planted: 9/18/08 on fallow

Harvested: 8/11/09

Fertilized with actual pounds of N-P-K: 61-52-20

Sprayed with Huskie @ 11 oz/a and Axial @ 8.2 oz/a on 5/19/09

* Solid stem score of 19 or higher is generally required for reliable sawfly tolerance.

Location: MSU Western Triangle Ag. Research Center, Conrad, MT.

Table 3. Six-year averages, Winter Wheat varieties, WTARC, Conrad 2004 - 09.

Variety	Source	Class	Solid stem* score	6-Year Average					Winter survival class j
				Yield bu/a	Test wt	Height in.	Head date	Protein %	
Pryor	WestBred			76.9	63.1	31.7	165.7	11.1	3
MTS 0532		++ HW	20.2	74.3	61.9	32.2	164.0	12.5	
MT 0495				74.1	61.7	34.1	164.5	12.4	
Yellowstone	MSU			74.0	61.5	34.8	166.7	12.1	4
Ripper	Colorado			73.7	62.5	30.9	161.3	12.3	
MTS 0531		++ HW	21.1	73.6	62.1	32.4	164.4	12.7	
Wahoo	Nebraska			73.6	61.7	32.7	161.8	12.3	3
Norris	WestBred	CL		72.6	62.9	34.5	162.8	12.4	3
Darrell	S. Dakota			72.5	62.6	34.2	162.3	12.6	
Falcon	WestBred		6.9	72.2	63.0	30.8	165.0	12.1	4
Rocky	AgriPro			71.6	63.7	37.7	163.8	11.7	2
Ledger	WestBred		11.1	70.1	63.6	31.5	165.0	12.1	2
Genou	MSU	++	18.5	69.9	62.7	36.3	165.7	12.4	2
Neeley	Idaho			68.4	62.0	36.3	167.3	12.0	3
Promontory	Utah			68.3	63.4	34.5	165.5	11.8	2-
Carter	WestBred		14.1	68.0	63.0	29.5	164.4	12.7	3
Hyalite	WestBred	CL HW		68.0	62.1	34.5	162.7	12.6	3
Alice	S. Dakota	HW		67.9	62.9	30.6	161.9	12.9	
Jagalene	AgriPro			67.2	64.6	31.3	163.5	12.7	2
Hawken	AgriPro			67.0	63.1	30.9	160.6	12.6	
Wendy	S. Dakota	HW		65.9	62.8	29.3	160.8	13.4	3
Tiber	MSU			65.6	62.4	39.5	166.3	12.7	3
NuSky	MSU	HW		65.4	61.2	36.8	167.0	12.3	4
Jerry	N. Dakota			62.8	61.7	38.0	165.5	12.6	5
Rampart	MSU	++	21.4	62.1	62.4	34.7	165.7	13.1	2-
Bynum	WestBred	++ CL	20.2	60.2	62.3	34.0	164.0	13.8	2
average				67.4	62.4	34.4	163.8	12.5	

Class: ++ sawfly resistant. HW = hard white. CL = Clearfield herbicide system.

* Solid stem score of 19 or higher is generally required for reliable sawfly resistance.

Winterhardiness: 5 = high, 1 = low.

Location: MSU Western Triangle Ag. Research Center, Conrad, MT.

Table 4. 2009 Advanced Yield Nursery

Variety or ID	Yield bu/ac	Test weight lb/bu	Heading date Julian	Plant height in	Protein %
MT0875	81.6	62.2	168	30	9.9
Neeley	79.2	63.3	169	31	10.3
MT0866	78.8	63.9	168	28	10.9
Yellowstone	78.8	62.7	168	33	10.4
MT0859	77.5	64.9	168	28	10.2
MTS0826	77.2	63.1	170	32	10.4
MT0890	76.6	63.7	167	32	11.7
MT0855	75.9	63.2	168	25	11.6
MTS0832	74.1	62.5	170	31	10.7
MT0882	73.5	63.0	167	33	10.4
MT0871	73.0	62.2	168	29	10.3
MT0892	72.8	63.6	168	31	11.1
MT0863	72.5	65.0	168	31	10.3
MTS0802	72.5	62.9	168	28	10.2
MT0874	71.9	63.1	170	29	11.6
MT0834	70.2	62.6	168	28	10.8
MTS0819	70.1	63.8	168	31	11.3
MT0888	69.5	62.2	169	37	11.5
MT0887	68.5	64.2	167	29	11.4
MTW0881 W	68.3	63.4	168	28	10.9
MT0850	68.2	64.0	167	29	11.5
MTS0808	68.1	62.6	168	26	11.4
NuSky W	67.9	61.8	169	30	10.4
MT0865	67.8	62.3	168	30	10.7
MTS0818	67.8	64.8	167	27	10.4
MTS0817	67.6	64.1	168	27	10.7
MT0860	67.0	64.2	168	29	11.1
MT0862	66.8	64.5	167	28	11.2
CDC Falcon	66.4	63.6	168	25	11.0
MTS0827	65.8	62.9	172	27	11.0
MT0884	65.5	64.1	165	29	11.5
Rampart	65.2	62.9	168	32	11.6
MTS0803	65.2	63.7	167	28	11.9
MT0837	64.1	62.8	169	28	11.2
MT0889	62.9	62.2	167	26	12.1

Variety or ID	Yield bu/ac	Test weight lb/bu	Heading date Julian	Plant height in	Protein %
MTW0880 W	58.7	62.7	170	26	11.5
Average	70.5	63.3	168.1	29.2	11.0
LSD (0.05)	8.65	0.52			
C.V. (%)	6.76	0.46			
P-value (Varieties)	<.0001	<.0001			

Planted: 9/18/08 on fallow

Harvested: 8/12/09

Fertilized with actual pounds of N-P-K: 61-52-20

Sprayed with Huskie @ 11 oz/a and Axial @ 8.2 oz/a on 5/19/09

Location: MSU Western Triangle Ag. Research Center, Conrad, MT.

2009 Spring Wheat & Durum Variety Evaluations Grown In the Western Triangle Area.

Location: Western Triangle Agricultural Research Center (WTARC), Conrad, MT.

Personnel: John H. Miller and Grant Jackson, WTARC, Conrad, MT; Luther Talbert and Susan Lanning, MSU Plant Science Dept; and Joyce Eckhoff, EARC, Sidney, MT.

The uniform, advanced spring wheat and durum nurseries were planted on fallow and grown under dryland conditions in 2009. Off-station spring wheat variety nurseries were planted on chemical fallow and grown in Teton County near Choteau, Glacier County north of Cut Bank, and Choteau County near the Knees. In addition the off-station nursery was planted on fallow and grown under irrigated conditions at the research center. The Choteau trial was lost due to poor stands probably due to wire worm damage.

Results: The spring wheat data are presented in Tables 5 -14. The durum nursery data are shown in Tables 15 and 16.

The growing season in 2009 was cool with timely rains throughout the growing season, resulting in grain yields that were about 20 bushels/acre higher than average. Interestingly spring wheat grain protein contents were slightly higher than average while durum protein levels were slightly below the average.

Additional comments on spring wheat and durum varieties are presented in the following pages. Also refer to MSU Extension Bulletin 1093 for descriptions of many of the varieties tested.

Spring Wheat Variety Notes & Comments

Western Triangle Agricultural Research Center, Conrad MT

Sawfly Tolerant & Semi-tolerant Hard Red Spring Wheat Varieties:

Resistance (stem-solidness) among varieties ranges from low to high and varies with yearly climate differences; none have total resistance. Stem-solidness scores range from 5 (hollow) to 25 (completely solid). Solidness should be at least 19 to provide a reliable level of sawfly tolerance. However, some partially-solid stem varieties, such as Conan and Corbin, are less attractive to sawflies and show higher tolerance than expected for their level of stem solidness.

Agawam: See Hard White Spring Wheat. (Solid stem score = 23).

Choteau (MSU, 2004): Semidwarf with good straw strength. Height is 2" shorter than McNeal and 4" shorter than Fortuna. Stems very solid with good sawfly resistance (more solid than Fortuna). Sawfly resistance comparisons (max rating = 25): Choteau = 21, Fortuna = 19, Ernest = 16. Medium-early, 2 days later than Hank, 0.5 day later than Ernest & Fortuna, 2 days earlier than McNeal. High yield, similar to McNeal on both dryland and irrigated. Yields substantially higher than Ernest and Fortuna. Above average test wt (similar to Fortuna, and higher than McNeal). Moderate resistance to Septoria, and good resistance to most stem rust races. Protein above average. Normal gluten strength and good milling and baking quality. Fair Hessian fly tolerance. Some tolerance to root-lesion nematode.

Conan (WPB, 1998): Semidwarf. Solid stem score is low (10), but has low levels of sawfly-attractant cis-3-hexenylacetate, which increases sawfly resistance to medium. Medium maturity. Average yield and test weight. Some tolerance to Wheat Streak M V. Protein 0.5-0.9% higher than Rambo, and better protein quality than Rambo.

Corbin (WPB, 2006). Semidwarf height, 1" taller than Conan. Stem-solidness score = 10, medium sawfly resistance. Medium maturity, 1 day earlier than Conan. Average yield. Above-average test weight. Higher yield and test weight than Conan. Moderate resistance to stripe rust. Average protein.

Ernest (ND, 1995): Tall, weak straw. Medium sawfly resistance (solid stem score = 16). High level of sawfly-attractant cis-3-hexenylacetate. Moderately late maturing, slightly earlier than McNeal. Poor threshability. Tolerant to Fargo. Resistant to prevalent races of leaf & stem rust. Below average yield. High protein and test weight. Good quality.

Lillian (Sask.): Tall weak straw. Late heading. Partial stem solidness. Sawfly cutting for Lillian was 30% at Conrad 2008, compared to 65% for susceptible varieties. Below average test weight. Above average protein.

Fortuna (ND): Beardless, tall straw. Too tall for irrigated conditions, vulnerable to lodging. Good sawfly resistance (solid stem score = 19). Early maturity. Tolerant to Fargo. Very susceptible to Septoria. Medium to low yield except under severe sawfly conditions, where Fortuna often ranks high for yield. Susceptible to shattering, especially in conditions favoring development of large kernels. Average test weight and protein. Fair Hessian fly tolerance.

Triangle II (WestBred, bz9m1024, 2008): Clearfield version of Conan, 2-gene resistance. Stem solidness less than Conan. Yield 1 bu higher than Conan, otherwise similar to Conan.

Hollow-Stem, Sawfly Intolerant Hard Red Spring Wheat Varieties:

Alsen (ND, 2004). Moderate Fusarium scab resistance (MR). Semidwarf height. Medium maturity. Average yield. High test weight. High protein. Very poor Hessian fly tolerance.

AP604CL (AgriPro-8): Medium height, med-early maturity. Avg yield. Above avg test weight & protein.

AP603CL (AgriPro): Two-gene IMI resistance for Clearfield System. Med-tall, med-late maturity. Below average yield. Above average test weight & protein. Medium scab tolerance.

Freyr (AgriPro-3, 2004): Semidwarf height. Good lodging resistance, but less than Norpro. Medium maturity, 2 days earlier than McNeal. Average yield. Above average test weight. Average protein. Fusarium Scab resistance slightly lower than for Alsen (MR). Stripe rust MR. Acceptable quality.

Hank (WestBred): Semidwarf height. Medium lodging resistance. Early heading, 3 days earlier than McNeal. Above average yield. Better shatter resistance than 926. Below average test weight. Good tolerance to dryland root rot, tolerant to Far-go. Protein above average. Good quality. Hessian fly tolerant (similar to Choteau).

Hanna (AgriPro): Fusarium Scab tolerant.

Jedd (WestBred, 2007): Clearfield System hard red with 2-gene resistance. BC-derived from Hank. Short semidwarf height, 3" shorter than Hank or Choteau. Medium heading. Above average yield and test weight, dryland or irrigated. Higher dryland yield than Hank. Average protein. High quality. Moderately susceptible to stripe rust. Tolerance to Hessian fly biotypes of Washington, but unknown for biotypes in Montana.

Kelby (AgriPro, 2006, AP06): Good scab tolerance. Semidwarf height, stiff straw. Early heading. Below average yield. Above average test weight and protein. Good foliar disease resistance.

Kuntz (AgriPro-7, 2006): Medium height and maturity. Average yield. Above avg test weight. Average protein.

McNeal (MSU, 1994): Red chaffed. Semidwarf. Good lodging resistance, but straw is less resilient, and is prone to breaking over in strong wind. Medium-late maturity. Fair tolerance to wheat streak mv (2.5 on scale of 1-3). Some tolerance to dryland root rot. Above average yield, similar to Reeder and Choteau. Average test weight. Very good quality with high protein and loaf volume. Medium-low Hessian fly tolerance. Some tolerance to root lesion nematode.

Norpro (AgriPro-1): Semidwarf, very strong straw. Medium-late maturity. Below avg yield and test weight. Average protein. Low flour yield and high ash. Not well-adapted for dryland in District 5 (Triangle), but **suitable for irrigated**.

O'Neal (WestBred, bz999592, 2008): A McNeal/906R cross. Semidwarf height similar to McNeal. Head date similar to McNeal and one day later than Choteau. Above-average yield, 3-5 bu higher than McNeal and similar to Choteau. Average test weight, above-average protein. A high quality wheat for areas where McNeal is adapted. Hollow stemmed, but shows less sawfly damage than McNeal.

Outlook (MSU, 2002): Russian Wheat Aphid resistant, but susceptible to new biotype in 2004. Stiff straw, semidwarf, height equal to McNeal & Reeder. Med-late maturity = McNeal. Above average yield, similar to McNeal and Reeder. Below average test weight. Average protein. Quality acceptable, and superior to Reeder.

Reeder (ND, 1999): Semidwarf height. Medium head date, slightly earlier than McNeal, but maturity slightly later than McNeal. The "stay-green" trait provides a longer grain-fill period and higher yield, as long as moisture is available. Similar to McNeal for agronomics. Above average yield. Average test weight and protein. Quality is below average. Susceptible to Everest W.O. herbicide. Very poor Hessian fly tolerance.

Vida (MT 0245): Semidwarf height, medium straw strength. Med-late maturity, heading = McNeal, but stays green 3 to 4 days later than McNeal. High yield, 4 bu over McNeal. Average test weight and protein, acceptable quality. Possible replacement for Outlook and Reeder (except Outlook would remain in use for RWA resistance). MR stripe rust and Septoria. Partially-solid stem (stem score = 11), slightly less than Conan & Ernest for sawfly tolerance.

Volt (WestBred, 2007): Semidwarf height. Late heading. Average yield on dryland, above-average yield on irrigated. Above avg test wt. Average protein. Good tolerance to stripe rust and Fusarium head blight. Sawfly cutting similar to McNeal. A high yield, disease resistant variety **for irrigated conditions**.

WestBred - See also Agawam, Conan, Corbin, Hank, Jedd, O'Neal, Triangle II, Volt.

Hard White Spring Wheat

Protein of hard white wheat for bread baking needs to be higher than wheat required for noodle markets. Some varieties are dual-purpose and can be used for both bread and noodles. Although not a concern for bread baking quality, varieties with low levels of polyphenol oxidase (PPO) are desirable for noodles, since high PPO levels are associated with noodle discoloration. At present, all Montana hard white spring varieties are high PPO, and thus better suited for bread baking. Many hard white varieties sprout more readily than hard reds, especially those developed from Australian germ plasm. The pure white trait is difficult to maintain, as pollen from red wheats may pollinate a white variety, causing a mixture of red kernels. It is very important to clean the combine, storage bins and other grain handling equipment prior to harvest to avoid mixing white wheat with other wheats. Seeding equipment and seedbed must also be free of red wheats. Seeding rate should be 10% higher than for red wheat to reduce late tillers and thereby reduce green kernels.

Agawam (WestBred, 2005): Hard White. Semidwarf height. Sawfly resistant: solid stem score = 22, similar to that of Choteau, and has a low level of sawfly-attractant cis-3-hexenylacetate. Early heading, similar to Explorer. Very high yield and test weight. Protein 1.4% lower than Explorer. Fair Hessian fly tolerance.

Blanca Grande (Gen Mills): Hard white. Short stiff straw. Early maturity. Medium high yield. High test weight and low protein.

Clarine (WestBred): Hard white. Clearfield system, 2-gene resistance. Very high milling/baking quality. A Clearfield version of Pristine. Available in 2009.

Explorer (MSU, 2002): Hard white, bread-baking type. Semidwarf, 2 inches shorter than McNeal. Slightly solid-stem, but not sufficient for sawfly resistance. Early maturing. Average yield and test weight. Very susceptible to Septoria, thus not recommended for far eastern Montana. High protein, and probably too high for noodles. Excellent bread baking quality.

Golden 86 (GP Seed & Research Inc, 1986): Hard white. Used by a commercial milling and baking firm north of Three Forks, Montana. High quality.

MTHW 9420 (MSU, 1999): Experimental for exclusive release. Medium height and maturity. Below average yield. Average test weight. Very susceptible to wheat streak mosaic virus. Excellent bread quality, but too high in protein for noodles.

Plata (Gen Mills): Hard white. Short stiff straw. Medium maturity. Medium yield & test wt. Med-low protein.

Pristine (WPB): Hard white. Semidwarf. 3 days earlier than McNeal. Yield = McNeal. Protein 0.5% < McNeal. Very high quality, and used for bread baking by industry in Mid-west. See also Clarine.

Durum

Durum is generally much more susceptible to wheat streak mv and Fusarium crown rot than spring wheat.

Quality durum has strong gluten. Growers who plan to grow weak-gluten varieties need to have a marketing organization identified that will purchase those varieties. Kernel color is a very important quality trait. Rainfall or irrigation after heading causes color loss (bleaching), but some varieties are less prone to color loss. Canadian varieties are screened for bleaching resistance. Such varieties are the preferred choice in areas of late-season rainfall. Varieties that lose color more readily may be okay for drier areas of Montana. Seeding rate for durum should be 30% higher than for spring wheat due to the larger durum kernel (fewer kernels per bushel). An additional seed-rate increase may be desirable to suppress late tillers and thereby decrease green kernels. Color score is important, and green kernels contribute to poor color and dockage. 23 to 29 seeds per square foot (approx 1.0 to 1.26 million seeds per acre) has normally been a good seeding rate for durum.

Alkabo (ND, 2006): Medium-tall height, very stiff straw. Medium maturity. Above average yield and test wt. Good quality.

Alzada (WestBred, 2005): Semidwarf height, short stiff straw. Early maturing. High yield, average test weight. Medium protein. Very good quality and gluten strength, and very good semolina color.

Avonlea (Can, 1997): Medium tall. Medium straw strength and lodging resistance. Early maturity. High yield and average test weight. Good quality and protein.

Dilse (ND): Medium height, late maturity. Below average yield. Average weight. High protein, excellent quality.

Divide: (ND, 2006): Medium-tall height, stiff straw. Medium maturity. Average yield. Above average test wt. Excellent quality.

Grenora (ND, 2006): Medium-tall height, stiff straw. Medium maturity. Average yield and test wt. Good quality.

Kyle (Canada, 1984): Very tall weak straw, poor lodging resistance. Very late maturing. Average yield and test weight, large kernel size. Kyle has the highest tolerance to color-loss (rain-bleaching). Above average protein. Strong gluten; good quality.

Lebsock (ND, 1999): Medium height, stiff straw. Late maturity. Below average yield. High test weight and excellent quality.

Levante (AllStar Seeds, 2007): Short semidwarf height. Early heading. Above average yield & test weight on dryland in 2007; and average performance on irrigated.

Maier (ND, 1998): Medium height, stiff straw, good lodging resistance. Medium maturity. Above-average yield. Medium large kernels, very high test weight. Average protein. Good milling quality.

Mountrail (ND, 1998): Medium-tall, but stiff straw and fair lodging resistance. Medium-late maturity. Average yield and test weight. Medium large kernel and average protein. Medium quality, but kernel color more sensitive to late rain than some other varieties. (All durumms are sensitive to late rain/irrigation relative to color loss).

Navigator (Can): Med short, but weak straw. Med late maturity. Medium test weight & protein, good quality.

Normanno (AllStar Seeds, 2007): Semidwarf height. Medium maturity. Average yield and below average test weight in 2007.

Pathfinder (Can): Med tall, weak straw. Med late maturity. Med test weight. Med low protein, good quality.

Pierce (ND): Medium-tall height and lodging resistance. Below average yield. High test weight. Average protein, good quality.

Plaza (ND): Med-short straw, med lodging resistance. Late maturity. Below-average yield on dryland; above-average yield on irrigated. Below average test weight. Low protein, medium quality.

Strongfield (WestBred/Canada, 2005): Medium tall, med-late maturity. Above average yield. Average test weight. Above-average protein. Good color and quality. Low grain cadmium concentration.

Table 5. 2009 Advanced Spring Wheat variety nursery, Conrad Dryland.

Variety	Class	Yield bu/a	Test Wt lb/bu	Height in.	Head date	Protein %
MT 0801		86.8	62.8	32	179	14
BZ9M7106		86.6	60.2	28.0	184.0	14.6
Vida	+	85.5	62.5	33.0	180.0	13.7
Oneal		85.4	63.4	30.0	180.0	13.4
Outlook		82.0	62.1	30.0	181.0	13.5
MT 0744		81.6	64.0	29.0	179.0	14.1
AGRIPR12		80.6	64.9	25.0	180.0	13.5
MT 0750		79.9	63.2	31.0	179.0	14.1
MT 0873		79.5	63.3	28.0	180.0	14.1
MT 0664		78.7	63.8	31.0	179.0	13.3
Reeder		78.7	63.3	29.0	179.0	14.4
MT 0814		78.5	64.0	31.0	179.0	13.9
Mott		77.5	63.9	34.0	182.0	13.5
MT 0832		77.5	62.8	29.0	179.0	14.2
MT 0861		76.7	62.9	28.0	181.0	14.0
MT 0824		76.5	63.3	28.0	178.0	14.1
MT 0751		76.0	62.3	29.0	179.0	14.9
MT 0747		75.7	62.5	27.0	179.0	14.8
MT 0802		75.4	62.4	31.0	182.0	13.3
Hank		75.3	63.1	28.0	179.0	13.3
Choteau	++	75.0	63.2	27.0	179.0	14.6
MT 0414		74.8	63.8	29.0	180.0	14.4
MT 0755		74.8	63.4	29.0	178.0	14.5
Volt		74.7	62.7	31.0	180.0	13.8
McNeal		74.7	65.2	27.0	180.0	13.0
MT 0855		74.6	62.3	29.0	179.0	13.7
MT 0718		73.9	63.7	25.0	179.0	13.4
MT 0869		73.9	62.9	27.0	179.0	14.6
BZ92413W		73.8	63.6	29.0	179.0	13.7
Jenna		72.7	62.6	29.0	180.0	14.1
MT 0849		72.7	63.3	28.0	182.0	13.1
Corbin	+	72.5	64.5	27.0	178.0	13.8
Kuntz		72.4	63.6	26.0	179.0	13.6
MTHW0867		72.4	62.3	29.0	179.0	13.2
MT 0746		71.9	62.1	32.0	179.0	15.8
MT 0735		71.7	63.0	29.0	178.0	14.6
MT 0830		71.7	63.9	28.0	179.0	15.3

Variety	Class	Yield	Test Wt	Height	Head	Protein
MT 0847		71.6	64.2	26.0	179.0	15.1
MT 0826		70.9	62.5	30.0	179.0	15.1
MT 0745		70.8	62.8	27.0	178.0	14.7
MTHW0771		70.6	63.5	25.0	176.0	14.9
MT 0862		70.6	62.8	25.0	178.0	14.4
MT 0852		70.3	63.3	30.0	180.0	15.4
MT 0853		69.7	62.8	28.0	177.0	15.6
Lillian	+	69.7	62.0	31.0	181.0	14.8
AGRIPR11		69.5	64.0	27.0	180.0	14.7
MT 0868		69.4	63.9	29.0	180.0	14.6
MT 0829		69.4	62.6	30.0	179.0	14.7
Jedd		68.2	63.7	24.0	179.0	13.8
MT 0856		68.2	61.7	27.0	178.0	15.2
MT 0813		68.2	63.4	28.0	176.0	14.4
MT 0815		67.9	64.8	29.0	178.0	14.8
BZ92413R		67.7	63.4	29.0	179.0	13.7
MT 0827		67.1	63.2	29.0	178.0	15.3
MT 0816		66.9	63.2	27.0	177.0	15.1
Freyr		66.2	63.4	30.0	179.0	15.0
MT 0808		65.7	62.8	30.0	176.0	13.7
Thatcher		64.3	61.7	38.0	182.0	12.6
Fortuna	++	62.8	63.3	35.0	179.0	14.2
Conan	+	62.2	62.7	28.0	180.0	13.9
AP604 CL		60.7	64.2	28.0	179.0	16.1
Kelby		60.6	63.5	25.0	178.0	16.3
Brennan		60.2	63.9	24.0	178.0	15.9
MT 0807		55.9	64.1	31.0	176.0	15.6
Average		72.6	63.2	28.8	179.1	14.3
LSD (.05)		7.2	0.7			
C.V (%)		5.7	0.7			

++ = sawfly tolerance (solid stem score 19 or higher).

+ = partial sawfly tolerance.

HW = hard white. CL = Clearfield System.

Planted April 13, 2009. Harvested August 30, 2009.

Fertilizer, actual: 91-52-20

Sprayed with Huskie @ 11oz/a and Axial @ 8.2oz/a on 5/29/09.

Growing season ppt.: 8.88 inches

Location: MSU Western Triangle Ag Research Center, Conrad, MT

Table 6. 2009 Advanced Spring Wheat variety nursery, Conrad Dryland.
Condensed List

Variety	Class	Yield bu/a	Test Wt lb/bu	Height in.	Head date	Protein %
Vida	+	85.5	62.5	33	180	13.7
Oneal		85.4	63.4	30	180	13.4
Outlook		82.0	62.1	30	181	13.5
Reeder		78.7	63.3	29	179	14.4
Mott		77.5	63.9	34	182	13.5
Hank		75.3	63.1	28	179	13.3
Choteau	++	75.0	63.2	27	179	14.6
Volt		74.7	65.2	27	180	13.0
McNeal		74.7	62.7	31	180	13.8
Jenna		72.7	63.3	28	182	13.1
Corbin	+	72.5	64.5	27	178	13.8
Kuntz		72.4	63.6	26	179	13.6
Lillian		69.7	62.0	31	181	14.8
Jedd		68.2	63.7	24	179	13.8
Freyr		66.2	63.4	30	179	15.0
Thatcher		64.3	61.7	38	182	12.6
Fortuna	++	62.8	63.3	35	179	14.2
Conan	+	62.2	62.7	28	180	13.9
AP604 CL		60.7	64.2	28	179	16.1
Kelby		60.6	63.5	25	178	16.3
Brennan		60.2	63.9	24	178	15.9
Average		71.5	63.3	29	180	14.1
LSD (.05)		7.2	0.7			
C.V (%)		5.7	0.7			

++ = sawfly tolerance (solid stem score 19 or higher).

+ = partial sawfly tolerance.

HW = hard white. CL = Clearfield System.

Planted April 13, 2009. Harvested August 30, 2009.

Fertilizer, actual: 91-52-20

Location: MSU Western Triangle Ag Research Center, Conrad, MT

Table 7. Six-year averages, dryland Spring Wheat varieties,
Conrad area, Pondera Co. 2004 - 2009.

Variety	Source	Class	6-Year Average				
			Yield bu/a	Test weight	Height in.	Head date	Protein %
Vida	MSU	+	60.0	60.1	31	183	13.1
Oneal	WestBred		58.7	60.1	32	183	13.8
bz902413		++	59.8	60.8	31	180	13.5
Choteau	MSU	++	55.9	60.6	30	182	13.9
Outlook	MSU		55.5	58.2	32	184	13.7
Corbin	WestBred	+	54.8	60.2	32	181	13.5
Reeder	N. Dak.		54.4	60.3	32	182	13.9
McNeal	MSU		54.3	59.9	32	182	13.4
Hank	WestBred		52.3	58.8	30	181	13.6
Jedd	WestBred	CL	53.7	61.2	27	181	13.2
Freyr	AgriPro		52.1	61.1	33	181	13.9
Conan	WestBred	+	51.4	60.4	30	182	13.9
Kuntz	AgriPro		50.6	60.6	29	181	13.2
Volt	WestBred		50.9	62.1	30	184	13.3
Kelby	AgriPro		49.4	62.5	29	181	14.6
Fortuna		++	48.8	61.0	38	181	13.5
AP604 CL	AgriPro	CL	47.5	61.9	31	180	14.3
average			53.0	60.6	31.1	181.7	13.7

++ Sawfly resistant (solid stem score of 19 or higher).

+ Partial sawfly resistance

CL = Clearfield System (2-gene). HW = Hard White

Location: MSU Western Triangle Agr Research Center, Conrad, MT

Table 8. 2009 Irrigated Spring Wheat variety trial, Conrad, MT.

Variety	Class	Yield bu/a	Test Wt lb/bu	Height in.	Head date	Protein %
Hank		111.4	60.6	31	184	13.8
Volt		107.3	64.1	32	186	12.9
Choteau	++	106.3	62.9	31	188	13.2
Choteau+Vida		105.2	60.6	36	183	13.8
Choteau+Brennan		104.1	63.2	32	183	13.9
Choteau+Conan		102.1	60.8	33	183	13.4
Choteau+Reeder		99.6	63.0	38	185	13.5
Kuntz		97.7	62.3	30	183	14.0
Reeder		96.6	62.0	33	186	13.8
Oneal		96.1	61.0	35	183	13.3
Corbin		93.5	61.8	35	185	13.2
Outlook		92.9	60.6	34	187	13.5
Vida		91.2	60.6	31	184	13.9
Jedd		91.2	61.5	28	186	13.3
Ap604 CL		88.6	63.3	31	184	13.6
Conan	+	88.0	60.9	32	185	13.4
McNeal		87.8	61.7	34	185	13.4
Freyr		85.3	62.7	35	184	14.2
Kelby		82.6	63.4	29	181	15.0
Fortuna	++	80.7	62.2	40	185	14.0
mean		95.4	62.0	33.0	184.5	13.7
LSD (.05)		13.6	1.7			0.7
C.V. (s/mean)*100		8.6	1.6			3.1

++ = sawfly resistant (solid stem score 19 or higher).

+ = partial sawfly resistance.

HW = hard white.

Location: MSU Western Triangle Ag Research Center, Conrad, MT

Planted April 20, 2009 on fallow. Harvested September 14, 2009.

Fertilizer, actual: 177-12-26

Sprayed with: Huskie @ 11 oz/a and Axial @ 8.2 oz/a on 5/29/09.

Table 9. Five-year averages, irrigated Spring Wheat varieties,
Conrad area, Pondera Co. 2003 - 07 and 2009.

Variety	Source	Class	5-Year Average				
			Yield bu/a	Test wt.	Height in.	Head date	Protein %
Choteau	MSU	++	84.7	61.6	33	182.0	14.4
Hank	WestBred		84.4	59.8	32	180.0	14.6
Vida MT 0245	MSU		80.1	61.1	34	182.0	14.5
Reeder	ND		79.6	61.7	36	181.0	14.7
Outlook	MSU		76.0	59.7	35	183.0	14.0
McNeal	MSU		76.0	60.2	35	182.0	14.2
Conan	WestBred	+	73.4	60.8	33	181.0	14.2
Freyr	AgriPro		71.2	61.8	36	181.0	14.6
Fortuna	ND	++	66.3	61.7	40	181.0	14.5
nursery mean			76.9	60.9	34.9	181.4	14.4

++ Sawfly resistant (solid stem score of 19 or higher).

+ Partial sawfly resistance

HW = Hard White

Location: MSU Western Triangle Agr Research Center, Conrad, MT

Table 10. 2009 Spring Wheat variety trial, Cut Bank.

Variety	Class	Yield bu/a	Test Wt lb/bu	Lodging %	Protein %
Oneal		99.9	60.3	1.7	12.7
Choteau	++	92.8	62.3	0.1	13.7
Choteau + Vida		90.5	62.4	1.7	12.5
Outlook		86.8	60.6	3.4	12.8
Corbin	+	86.4	63.6	0.1	12.8
Vida	+	86.2	61.7	0.1	13.4
Hank		84.5	61.4	5	12.8
Choteau + Brennan		82.2	63.8	0.1	13.1
Jedd	CL	81.5	63.2	0.1	12.0
Choteau + Conan		81.1	61.7	0.1	13.4
McNeal		81.0	62.1	6.7	12.3
Kuntz		80.8	62.9	5	12.4
Reeder		79.1	61.1	8.3	13.1
Freyr		78.4	62.7	5	12.9
Volt		77.9	64.0	10	12.4
Conan	+	76.8	58.9	0.1	13.4
Choteau + Reeder		75.2	61.4	5	13.8
AP 604 CL	CL	74.9	64.8	6.7	13.9
Kelby		74.1	63.7	1.7	14.1
Fortuna	++	63.7	63.9	0.1	12.9
Average		81.7	62.4	3.0	13.0
LSD .05		7.3	1.1	3	0.8
C.V. %		5.40	1.1	56.1	3.8

++ = sawfly tolerant (solid stem score 19 or higher).

+ = partial sawfly tolerance.

Cooperator & location: Kevin Bradley, north of Cut Bank, MT

Planted April 22, 2009.

Fertilizer, actual: 91-52-20

Harvested September 18, 2009.

Sprayed with Huskie @ 11 oz/a and Axial @ 8.2 oz/a on 6/15/09

Choteau plus other varieties are 20% Choteau and 80% other variety.

Conducted by MSU Western Triangle Ag Research Center.

Table 11. Five-year averages, Spring Wheat varieties,
Cut Bank area, Glacier Co. 2005 - 09.

Variety	Source	Class	5-Year Average			
			Yield bu/a	Test weight	Height in.	Protein %
Vida	MSU	+	57.6	57.1		13.4
Choteau	MSU	++	58.5	59.3		13.7
Corbin	WestBred	+	56.2	59.8		13.3
Freyr	AgriPro		56.2	58.2		13.4
Hank	WestBred		55.1	57.3		13.3
Outlook	MSU		52.8	56.7		13.1
Fortuna		++	52.5	60.5		13.5
Reeder	N. Dak		52.2	57.8		13.5
Conan	WestBred	+	49.3	60.5		14.0
McNeal	MSU		49.1	57.8		13.3
average			54.0	58.5		13.5

++ Sawfly tolerant (solid stem score of 19 or higher).

+ Partial sawfly tolerance

Cooperator & Location: Kevin Bradley, north of Cut Bank, MT
Conducted by MSU Western Triangle Agr Research Center.

Table 12. 2009 Spring Wheat variety trial, Choteau, MT.

Variety	Class	Yield bu/a	Test Wt lb/bu	Height in.	Protein %
Volt		72.6	64.3		13.5
Kuntz		67.7	63.1		13.6
Choteau + Vida		67.3	60.9		14.8
Outlook		66.1	61.0		14.6
Reeder		65.7	62.6		14.7
Hank		65.2	62.0		14.6
Vida	+	64.7	60.9		14.7
Choteau + Reeder		63.1	61.9		15.2
Conan	+	60.6	61.8		14.3
AP 604 CL	CL	59.8	64.4		15.6
Oneal		59.0	60.7		14.7
Corbin	+	55.8	62.8		14.3
Freyr		54.2	60.8		15.0
Choteau + Conan		53.4	61.4		14.5
Choteau	++	52.1	60.6		15.7
Jedd	CL	47.2	62.0		14.4
Fortuna	++	41.9	62.4		15.9
McNeal		39.7	57.3		15.6
Choteau + Brennan		38.1	60.6		16.3
Kelby		37.6	61.1		16.3
Average		56.6	61.6		14.9
C.V. 1(%): (S/mean)*100		23.50	2.8		3.6
LSD .05		22.00	2.9		0.9

++ = sawfly tolerant (solid stem score 19 or higher).

+ = partial sawfly tolerance.

Cooperator & location: Scott & Roy Inbody, east of Choteau, MT

Planted May 18, 2009.

Fertilizer, actual: 91-52-20

Harvested September 16, 2009.

Choteau plus other varieties are 20% Choteau and 80% other variety.

Conducted by MSU Western Triangle Ag Research Center.

Table 13. Five-year averages, Spring Wheat varieties,
Choteau area, Teton Co. 2005 - 09.

Variety	Source	Class	5-Year Average			
			Yield bu/a	Test weight	Height in.	Protein %
Vida	MSU	+	49.2	56.6		15.5
Corbin	WestBred	+	47.5	58.9		15.7
Outlook	MSU		46.3	56.0		15.3
Choteau	MSU	++	44.5	57.5		16.1
Conan	WestBred	+	43.7	57.4		15.6
Reeder	N. Dak.		43.2	57.8		15.8
Hank	WestBred		42.9	55.7		16.1
McNeal	MSU		39.5	55.5		16.0
Fortuna		++	39.3	59.6		16.0
Freyr	AgriPro		38.3	57.1		15.4
average			44.0	57.2		15.8

++ Sawfly tolerant (solid stem score of 19 or higher).

+ Partial sawfly tolerance

Cooperator & Location: Scott & Roy Inbody, Choteau, MT. Teton Co.
Conducted by MSU Western Triangle Agr Research Center.

Table 14. 2009 Spring Wheat variety trial, Knees area, MT

Variety	Class	Yield bu/a	Test Wt lb/bu	Height in.	Protein %	Lodging %
Choteau + Vida		54.1	61.8	27	12.6	2.0
Vida	+	47.3	61.5	26	13.0	2.0
Corbin	+	47.2	61.9	26	12.7	2.0
Oneal		47.0	63.3	26	13.6	2.5
Choteau	++	44.1	61.6	25	13.5	0.0
Choteau + Brennan		43.4	62.1	25	13.5	12.5
McNeal		42.1	60.3	28	12.9	10.0
Volt		41.0	63.5	25	12.6	20.0
Reeder		39.6	61.8	26	14.0	25.0
Hank		39.5	60.6	25	13.9	12.5
Jedd	CL	39.2	62.9	21	12.6	7.5
Conan	+	39.0	62.2	24	14.3	0.0
Choteau + Reeder		38.7	62.2	25	13.6	7.5
Choteau + Conan		38.6	62.1	24	14.0	0.0
Fortuna	++	35.6	61.7	31	13.8	0.0
Outlook		35.5	60.5	25	14.2	4.5
Freyr		35.2	61.3	28	13.8	45.0
Kelby		34.6	62.0	22	14.6	25.0
AP 604 CL	CL	33.9	62.8	25	13.1	45.0
Kuntz		32.7	61.1	24	13.2	35.0
mean		40.4	61.9	25.0	13.4	12.9
LSD (.05)		7.06	1.3	2.7	0.9	13.2
C.V. 1 (%) (S/mean)*100		8.4	1.0	5.2	3.1	49.1

++ = sawfly tolerant (solid stem score 19 or higher).

+ = partial sawfly tolerance.

Cooperator & location: Aaron Killion, western Chouteau Co.

Planted April 22, 2009 on chem-fallow.

Fertilizer, actual: 91-52-20

Harvested August 31, 2009.

Choteau plus other varieties are 20% Choteau and 80% other variety.

Conducted by MSU Western Triangle Ag Research Center.

Table 15. Multi-Year x Location Averages - Spring Wheat Varieties.
Western Triangle Area

Variety	Source	Class	15 Year x Location Average*				
			Yield bu/a	Test weight	Height in.**	Protein %	Head date**
Vida	MSU	+	55.6	57.9	31	14.0	183
Corbin	WestBred	+	52.8	59.6	32	14.2	181
Choteau	MSU	++	53.0	59.1	30	14.6	182
Outlook	MSU		51.5	57.0	32	14.0	184
Reeder	N. Dak		49.9	58.6	32	14.4	182
Fortuna		++	46.9	60.4	38	14.3	181
Hank	WestBred		50.1	57.3	30	14.3	181
Conan	WestBred	+	48.1	59.4	30	14.5	182
McNeal	MSU		47.6	57.7	32	14.2	182
Freyr	AgriPro		48.9	58.8	33	14.2	181

++ Sawfly resistant (solid stem score of 19 or higher).

+ Partial sawfly resistance

** Head date and plant height, Conrad only.

* Conrad 6-yr + Choteau 4-yr + Cut Bank 5-yr.

Years included are 2004 to 2009. Comparable average calculations.

Cooperators: Kevin Bradley, Cut Bank; Roy and Scott Inbody,
Choteau;
Conducted by MSU Western Triangle Agr Research Center.

Table 16. 2009 dryland Durum variety trial, Conrad, MT.

Variety	Yield bu/a	Test Wt lb/bu	Height in.	Heading,	Heading,	Protein %	HAVC	100- seed wt, gm
				days from Jan 1	days from planting			
Cimmyt11	97.3	64	30	181	78	10.1	57.2	5.32
Strongfield	94.0	63.4	32	182	79	12.6	97.6	4.83
Cimmyt8	87.1	64.7	27	182	79	10.3	46.0	4.37
Levante	78.3	63.5	23	179	76	12.6	90.1	5.01
Cimmyt5	75.1	63.3	24	181	78	10.7	74.5	4.02
Mountrail	74.9	63.1	32	182	79	12.8	91.9	4.73
MT04293	74.9	61.7	25	182	79	13.5	89.1	5.46
MT04317	74.5	61.5	25	182	79	13.4	86.4	5.48
MT01649	74.2	61.8	22	179	76	12.8	95.6	4.63
Svevo	74.0	63.1	24	179	76	12.9	90.9	5.04
MT04174	73.8	64.3	29	179	76	12.7	96.8	4.52
Grenora	72.9	63.9	30	181	78	12.6	93.4	4.90
Maestrale	71.7	62.7	25	179	76	11.2	75.2	4.69
MT04340	71.6	64.2	27	182	79	13.0	89.9	5.04
Normanno	71.4	62.4	23	180	77	12.4	81.8	4.84
Pierce	70.5	64.1	31	181	78	14.0	92.9	4.72
Dilse	70.0	63.9	30	181	78	13.0	92.4	4.99
MT03012	69.9	63.9	26	179	76	12.4	87.3	4.47
Saragolla	69.7	62.9	23	179	76	11.6	76.0	4.63
Divide	68.3	63.5	31	181	78	13.5	96.7	5.12
Alzada	67.7	63.7	26	179	76	12.9	89.5	5.27
Alkabo	67.5	63.8	31	181	78	13.0	88.0	5.11
MT04252	65.8	61.6	24	182	79	13.3	87.0	4.91
MT04268	63.4	60.5	26	182	79	12.8	84.7	4.62
Average	74.1	63.2	26.9	180.6	77.6	12.50	85.5	4.86
LSD (.05) =	16.2	1.5						
CV, S/mean	13.3	1.5						
P value (0.05)	0.020	0.000						

Planted April 13, 2009.

Fertilizer, actual: 91-52-20

Harvested Aug 25, 2008.

Growing season ppt.: 8.88 inches

Location: MSU Western Triangle Ag Research Ctr, Conrad, MT

Table 17. Six-year averages, dryland Durum varieties.
 Conrad area, Pondera Co. 2004 - 09.

Variety	Source	6-Year Average				
		Yield bu/a	Test weight	Height in.	Head date	Protein %
Strongfield	WestBred	60.2	63.4	34	184	13.6
Levante	AllStar	57.4	63.5	26	181	12.8
Alzada	WestBred	56.7	63.7	28	181	12.6
Normanno	AllStar	56.3	62.4	27	181	12.9
Pierce	N. Dak.	55.5	64.1	35	183	13.6
Mountrail	N. Dak.	54.5	63.1	34	184	13.6
Dilse	N. Dak.	54.3	63.9	35	180	14.4
Grenora	N. Dak.	54.2	63.9	32	182	13.2
Alkabo	N. Dak.	53.2	63.8	33	182	13.1
Divide	N. Dak.	52.1	63.5	34	183	13.1
average		55.4	63.5	31.8	182.1	13.3

Location: MSU Western Triangle Agr Research Center, Conrad, MT.

2009 Barley Variety Evaluations In The Western Triangle Area.

Location: Western Triangle Agricultural Research Center (WTARC), Conrad, MT.

Personnel: John H. Miller and Grant Jackson, WTARC, Conrad; and
Tom Blake and Stan Bates, MSU Plant Science Dept.

The uniform, intrastate barley nursery was grown on dryland and irrigated fallow conditions at the Research Center. The dryland off-station barley variety nursery was planted, no-till on chemical fallow in Teton County near Choteau, Glacier County near Cut Bank, Choteau County near the Knees, and under irrigated, conventional fallow conditions at the Research Center.

Results: Data for the various locations are presented in Tables 18 - 30, and include 2009 results and multi-year averages. The dryland intrastate nursery data are shown in Tables 18, 19 and 20, while Tables 21, 22, and 23 contain the data from the irrigated nursery. The information from the off-station barley trials are shown in Tables 24 thru 30.

The growing season in 2009 was cool with timely rains throughout the growing season, especially after heading, resulting in higher than average yields, kernel plumpness, and test weights and lower than expected grain protein content. All malt varieties in the dryland trials met or exceeded dryland contract requirements for protein and kernel plumpness in 2009.

The 2-row variety, Hockett, was approved by the American Malt Barley Association (MABA) for malt production.

A 2-row winter-barley, variety 'Charles', was fall-planted at Conrad, but failed to survive the winter.

Additional comments on barley varieties are presented in the following pages. Also refer to MSU Extension Bulletin 1094.

Barley Variety Notes & Comments

Western Triangle Agricultural Research Center, Conrad, MT

Baroness (WestBred): 2-row feed. Short straw and good lodging resistance; 2.5" shorter than Harrington. Equal or slightly later maturity than Harrington. High yield when tested in favorable moisture conditions. Average test weight. Stripe rust resistant.

Boulder (WestBred, 2005): 2-row feed. Composite-cross, non-Baroness derived. Height similar to Haxby. Heading 1 day later than Haxby, and 1 day earlier than Baroness. High yield, similar to Haxby. High test weight, 0.5 lb less than Haxby. Replacement for Baroness and Xena.

Challenger (WestBred, 2008): 2-row feed. Above average yield and test weight. Average height and maturity.

Champion (WestBred, 2007): 2-row feed. Medium stiff straw. Heading one day later than Haxby and Boulder. Very high yield, greater than for Boulder & Baroness. High test weight, 1 lb less than Haxby.

Charles: 2-row malt. Grown as a winter barley in Idaho, but has very low winter hardiness. Winter survival on tillage-fallow at Conrad was 40% in 2007, and 10% in 2008.

Conlon (ND, 1996): 2-row malt. Medium height, weak straw. Early maturity, 1-2 days earlier and higher test weight than Bowman. Developed for areas of heat & drought stress. High resistance to net blotch; susceptible to spot blotch & Fusarium head blight.

Conrad (Busch Ag): 2-row malt, Busch Agr Resources. About 2 inches shorter than Harrington. Medium maturity, similar maturity as Harrington. Higher yield than Harrington. Slightly higher test weight and plump than Harrington.

Copeland (Sask. Canada, 1999): 2-row malt. Better straw strength and earlier maturity than Harrington. Similar yield, test weight, and plump than Harrington. Net blotch resistant. Scald & Septoria susceptible.

Craft (MT970116; MSU, 2006): 2-row malt. Taller than Harrington & Merit. 2 days earlier heading than Harrington, but later heading than Hockett. High yield, test weight, & plump. Moderate stripe rust resistance. Susceptible to net blotch. European style of malt enzyme activity for microbrew market. AMBA approved for organic malt production.

Drummond (ND 15477): 6-row malt. Stronger straw than other 6-row malt types. Improved yield over Morex, Robust and Foster. Plump higher than Morex.

Eslick (MSU, 2005): 2-row feed. Height 1" taller than Baroness, 1" shorter than Haxby. Heading date similar to Harrington, and 1-2 days later than Haxby. Yield similar to Baroness and Haxby. Test wt = Baroness, greater than Harrington, and 2# less than Haxby. Eslick has superior performance in areas of ample moisture, while Haxby is preferred where lower moisture conditions are expected.

Geraldine (MT960101; MSU, Miller Brewing): 2-row malt for Miller Brewing Co. One day later heading than Harrington. Good performance on irrigated conditions; below average performance on dryland. Moderate stripe rust resistance.

Goldeneye (Utah, 2005): 6-row feed. Height similar to Haxby, Test Wt. and Protein, slightly lower than Haxby in 2009. Yields not significantly different from Haxby on dryland or irrigated. Susceptible to barley stripe rust, and resistant to barley loose smut and covered smut.

Harrington (Sask. Can): 2-row malt. Medium height; medium weak straw. Medium-late maturity. Sensitive to hot dry areas; yields good in moist areas. Can sprout or germinate (internal falling number) at a lower moisture content than other varieties.

Haxby (MSU, 2002): 2-row feed. 3 inches taller and two days earlier than Baroness. Among highest yielders in Triangle Area. Highest test weight of all varieties. High feed quality. Non-Baroness derived, providing good diversity. Haxby has superior yield performance in lower moisture conditions, while Eslick has a yield advantage in high moisture conditions.

Hays (MSU, 2004): Hooded 2-row forage. Shorter than Haybet and more resistant to lodging. Higher grain yield than Haybet. Low test weight. Higher forage yield than Haybet and Westford (8%). Harvest between heading stage and 5 days post-heading for highest protein. Caution: any cereal grain grown for hay should be tested for nitrate level prior to cutting. Nitrates decrease during grain filling, but in drought conditions, nitrates may be high all season, unless irrigation is available.

Hockett (MSU, MT910189): 2-row malt for dryland. 4 days earlier than Harrington, and retains plump on dryland much better than Harrington. 5 bu/a higher yield than Harrington. Very susceptible to stripe rust.

Kendall (Can): 2-row malt. High irrigated yield.

Lacey (M98, MN 1999): 6-row malt. Intended to replace Robust. Height intermediate between Robust & Stander. Lodging resistance greater than Robust, but less than Stander.

Legacy (Busch Ag): 6-row malt. 2 to 4 inches taller than Harrington. Higher yield than Morex and Robust, but lower than Harrington. Has 30% resistance to vomatoxin. Very susceptible to stripe rust.

Merit (Busch Ag): 2-row malt. Late maturing, too late for dryland. Lodges easier than Harrington, but yields higher. Very high diastatic power for excellent malting ability. Net blotch resistance, and moderate Scald resistance.

Metcalfe (Manitoba Canada, 1994): 2-row malt. Replacement for Harrington in Canada. Medium straw strength. Latitude sensitive - higher yield, test weight and plump than Harrington in Canada, but similar to Harrington in Montana. Similar protein as Harrington. Medium-late, slightly earlier to head than Harrington. Moderate resistance to spot-form net blotch. Susceptible to scald and Septoria.

Stellar (ND16301, 2005): 6-row malt. Medium-short. Good straw strength and widely adapted across North Dakota. Medium maturity. High plump and low protein. Excellent malt quality. Moderate spot-blotch resistance. Net-blotch susceptible.

Stockford (WestBred, 2005). 2-row hooded hay barley. Height is 2" taller than Hays. Heading is 2 days earlier than Hays. Forage yield is similar to Hays and Haybet. Harvest between heading stage and 5 days post-heading for highest protein. Caution: any cereal grain grown for hay should be tested for nitrate level prior to cutting (see note for Hays).

Tradition (Busch Ag.): 6-row malt. Stiffer straw than Legacy, good lodging resistance. Higher yield, test weight and plump than Legacy and other 6-row varieties. Very susceptible to stripe rust.

Xena (WPB bz594-19): baroness/stark cross. 2-row feed. Two inches taller and better boot emergence than Baroness. Lodging resistance equal to Baroness. Late maturity, similar to Baroness. Better adapted to dryland than Baroness, (higher test wt and plump than Baroness on dryland). Equal or better yield than Baroness on dryland.

"BG Barley": A food barley classification, and includes waxy hulless and waxy covered varieties. Beta glucan levels of BG varieties are 50% higher than for oats or pearled barley. Grain yields are generally lower than other barley varieties. End-use includes various foods, including rice-extender, 'Heart Balance Cereal' etc.

Table 18. Dryland Intrastate Barley variety trial, Conrad 2009.

Variety	Yield bu/a	Test Wt lb/bu	Plump %	Thin %	Protein %	Head date	Height in.
Champion	107.8	53.6	97.7	0.9	12.1	179	26
MT070086	106.5	52.1	96.6	1.1	10.5	186	18
MT061032	103.8	52.0	98.4	0.6	11.3	183	21
MT061036	103.3	52.2	97.2	0.8	11.1	184	23
Baronesse	103.1	52.6	98.4	0.5	11.8	186	26
MT061045	102.0	51.7	97.6	0.8	11.0	185	23
MT061048	101.9	52.2	97.3	0.8	11.2	186	22
Goldeneye	100.9	50.7	95.9	1.3	10.6	179	24
Conrad	100.2	51.7	97.9	0.6	11.9	186	24
MT070125	99.2	52.7	96.8	1.1	11.3	183	26
MT061035	98.5	51.9	98.0	0.6	11.4	184	25
MT070136	97.4	52.4	98.1	0.7	12.2	181	24
MT070111	97.3	53.1	96.7	1.1	10.7	183	27
MT040209	96.8	53.1	97.7	0.6	10.4	186	26
MT070063	96.4	53.6	97.4	0.9	11.3	180	29
Craft	96.0	53.2	97.9	0.7	12.0	181	27
Bentley	95.9	52.3	98.2	0.5	11.7	182	27
MT050030	95.0	52.0	97.9	0.8	10.9	181	25
MT050062	94.1	53.5	97.8	0.8	10.9	183	28
MT070062	93.8	52.0	97.6	0.7	11.5	184	25
Geraldine	92.6	52.6	94.1	1.8	11.7	183	22
MT070148	92.5	52.7	98.7	0.6	11.8	186	24
MT061169	92.5	53.9	97.0	0.9	12.0	185	23
Haxby	92.5	54.1	96.9	1.1	11.5	182	25
MT070157	92.3	52.3	96.0	1.2	10.7	183	22
Harrington	92.3	52.5	97.0	0.8	11.0	183	23
MT061047	91.7	51.6	97.2	0.8	11.2	183	23
MT070219	90.9	50.2	94.7	1.8	10.1	185	26
Metcalfe	90.7	52.8	97.9	0.7	12.0	182	25
Hockett	90.7	53.3	97.7	0.7	11.7	183	26
MT070158	90.5	52.5	97.6	0.8	11.2	186	24
MT050049	90.1	53.9	97.4	1.0	11.5	180	27
MT070175	89.4	52.1	97.7	0.8	10.0	183	28
MT061104	89.4	52.5	99.1	0.3	11.8	183	28
MT030042	88.0	53.9	95.5	1.4	9.9	182	23
MT020162	87.1	52.9	96.7	1.2	11.2	183	26

Variety	Yield bu/a	Test Wt lb/bu	Plump %	Thin %	Protein %	Head date	Height in.
MT020204	87.1	52.8	96.7	1.1	11.8	180	25
MT061248	86.5	52.3	98.9	0.4	12.2	181	22
MT040073	86.4	53.3	96.6	1.1	11.9	185	23
MT070161	86.4	52.1	97.0	0.9	10.8	183	23
MT020155	86.1	51.7	95.6	1.5	11.8	180	22
MT070159	85.9	50.8	95.2	1.6	10.4	183	22
MT061225	85.9	52.7	97.4	0.8	11.5	186	22
MT050048	85.9	53.4	97.5	1.1	11.8	183	26
Tradition	85.7	51.4	97.5	0.8	12.3	179	28
MT030063	85.2	53.1	96.5	1.5	11.2	184	26
MT040226	85.2	54.4	96.2	1.3	11.8	185	24
MT061134	85.1	50.9	97.7	0.8	12.2	183	27
MT070156	84.7	51.4	97.0	1.0	10.5	183	21
MT030079	83.3	53.5	97.7	0.9	12.0	183	26
MT061011	83.1	48.1	94.2	1.8	10.2	179	23
MT010158	82.5	52.4	97.1	0.9	11.5	182	24
MT010160	82.3	53.0	97.3	0.9	10.9	185	26
MT061201	81.8	52.5	96.6	1.2	12.2	180	28
MT020205	81.8	52.6	97.3	1.0	11.3	184	24
MT050201	81.6	52.8	97.2	0.9	11.8	180	29
MT070087	81.5	52.5	95.8	1.2	10.9	183	22
MT020167	81.5	52.8	96.8	1.1	10.3	182	24
MT061207	77.6	51.7	98.2	0.6	11.6	183	23
MT070192	77.6	48.5	93.2	2.6	9.6	180	21
MT061026	76.5	47.2	95.5	1.7	10.3	186	21
MT070193	75.9	48.8	94.8	1.6	9.3	179	22
MT070174	74.0	51.8	97.6	0.8	10.6	180	25
MT061025	67.3	47.0	93.7	2.2	9.5	178	21
Means	89.8	52.2	97.0	1.0	11.2	183	24
LSD (.05)	13.2	0.9	1.4	0.6	1.0		
C.V. (%)	7.6	0.7	0.9	3.4	1.7		

Planted April 13, 2009 on fallow. Harvested August 23, 2009.

Fertilizer, actual: 11-52-0

Sprayed with Huskie @ 11 oz/a and Axial @ 8.2 oz/a on 5/29/09.

Growing season ppt.: 8.88 inches

Location: MSU Western Triangle Ag Research Center, Conrad, MT.

Table 19. Dryland Intrastate Barley variety trial, Conrad 2009.

Condensed List

Variety	Yield bu/a	Test Wt lb/bu	Plump %	Thin %	Protein %	Head date	Height in.
Champion	107.8	53.6	97.7	0.9	12.1	179	26
Goldeneye	100.9	50.7	95.9	1.3	10.6	179	24
Conrad	100.2	51.7	97.9	0.6	11.9	186	24
Craft	96.0	53.2	97.9	0.7	12.0	181	27
Bentley	95.9	52.3	98.2	0.5	11.7	182	27
Geraldine	92.6	52.6	94.1	1.8	11.7	183	22
Haxby	92.5	54.1	96.9	1.1	11.5	182	25
Harrington	92.3	52.5	97.0	0.8	11.0	183	23
Metcalfe	90.7	52.8	97.9	0.7	12.0	182	25
Hockett	90.7	53.3	97.7	0.7	11.7	183	26
Tradition	85.7	51.4	97.5	0.8	12.3	179	28
Mean	95.0	52.6	97.1	0.9	11.7	181.7	25.1

Planted April 13, 2009 on fallow. Harvested August 23, 2009.

Fertilizer, actual: 11-52-0

Sprayed with Huskie @ 11 oz/a and Axial @ 8.2 oz/a on 5/29/09.

Growing season ppt.: 8.88 inches

Location: MSU Western Triangle Ag Research Center, Conrad, MT.

Table 20. 5-year averages, dryland Barley varieties, Conrad, MT, 2005- 2009.

Variety ①	5-Year Average						
	Yield bu/a	Test Wt lb/bu	Plump %	Thin %	Protein %	Head date	Height in.
Champion	91.9	53.6	81	4.6	11.4	181	28
Conrad	87.6	51.7	86	4.6	12.0	183	27
Craft	84.4	53.2	91	2.6	11.8	180	30
MT020155	83.4	51.7	85	3.3	12.1	178	29
Tradition	79.4	51.4	73	6.0	12.1	179	31
MT010158	77.6	52.4	89	2.5	12.6	181	27
Mean	84.1	52.3	84.0	3.9	12.0	180.4	28.6

① Tradition is 6-row; all others are 2-row.

Location: MSU Western Triangle Agr Research Center, Conrad, MT.

Table 21. Irrigated Intrastate Barley variety trial, Conrad 2009.

Variety	Yield bu/a	Test Wt lb/bu	Plump %	Thin %	Protein %	Head date	Height in.
MT050030	153.4	52.2	97.0	1.1	11.2	183	27
MT061047	144.2	52.2	96.8	1.5	10.7	185	28
Baronesse	142.5	52.4	97.2	1.1	11.4	185	25
MT061036	142.1	51.7	96.5	1.3	9.9	186	28
MT061045	142.0	52.4	96.8	1.3	10.4	185	29
Champion	140.0	52.0	97.1	1.0	11.2	182	28
MT061032	139.5	52.1	97.5	1.0	10.1	185	27
MT050062	139.0	52.3	95.9	1.9	10.3	183	30
MT070158	137.7	51.0	94.3	2.6	11.3	185	25
MT070157	137.4	51.8	95.6	2.1	10.6	182	24
MT070175	137.1	51.7	95.3	1.9	10.2	181	28
MT070161	136.6	52.0	96.6	1.3	11.2	181	26
Haxby	136.2	53.1	94.5	2.6	12.6	181	25
MT061035	135.4	52.1	97.4	1.1	10.2	186	29
MT050201	134.7	52.9	96.5	1.6	11.9	183	29
MT040209	134.5	52.1	93.9	2.3	11.0	185	26
Goldeneye	133.7	50.0	97.6	0.8	10.3	180	26
MT061048	133.5	52.3	97.6	1.1	9.5	186	27
MT030042	133.5	52.5	93.4	2.6	10.7	182	25
MT070111	131.6	52.6	97.2	1.0	10.4	185	28
Conrad	130.6	52.0	97.0	1.0	11.8	185	26
MT020162	130.4	52.3	95.7	2.0	11.5	186	28
Geraldine	129.8	52.2	97.6	1.0	10.9	185	26
MT070159	129.1	51.0	96.5	1.2	10.5	182	26
MT030079	128.9	53.9	97.8	0.8	10.5	183	25
MT050048	127.9	53.6	97.4	0.7	11.7	183	29
MT020155	127.4	50.8	94.1	2.3	11.1	181	27
MT010160	127.3	52.1	95.6	1.9	11.3	185	28
MT061104	127.2	52.6	97.1	1.2	12.2	182	28
MT050049	127.0	53.2	97.4	1.1	10.8	181	27
MT070087	126.9	52.3	96.3	1.5	10.7	186	27
MT061225	126.4	52.3	96.9	1.2	10.9	182	26
MT070086	125.5	51.1	96.9	1.3	9.6	186	20
MT030063	125.0	53.0	97.0	1.4	11.1	184	28
MT070156	124.8	50.3	94.1	2.8	10.9	185	25
MT070063	124.2	52.3	95.4	1.7	11.7	183	29

Variety	Yield bu/a	Test Wt lb/bu	Plump %	Thin %	Protein %	Head date	Height in.
MT070125	124.2	52.2	97.2	1.6	11.3	185	27
MT020204	123.7	51.8	94.0	2.6	11.6	181	29
MT020167	123.3	52.7	97.0	1.2	11.4	183	25
Craft	121.3	53.3	96.7	1.4	11.5	181	30
MT070062	121.3	51.8	92.9	3.9	12.3	183	26
MT061169	120.7	52.2	93.8	3.6	11.6	185	26
MT040226	120.6	54.8	97.2	1.1	11.3	183	28
MT070136	120.5	51.9	97.6	0.8	11.8	185	27
Bentley	120.4	51.2	97.6	0.8	11.3	185	30
MT040073	119.2	53.1	95.3	2.7	11.6	183	26
MT010158	118.0	52.6	97.0	1.4	11.0	186	27
MT020205	118.0	51.3	95.1	2.1	11.4	182	28
MT070148	118.0	51.7	95.9	2.0	12.0	182	27
MT061134	117.8	51.3	98.1	0.7	11.3	184	30
Hockett	116.0	51.9	95.3	2.4	11.8	185	26
MT070174	115.4	51.2	97.0	1.2	10.9	179	26
Harrington	114.3	50.8	96.4	1.5	10.4	184	27
MT061248	113.3	52.6	97.0	1.3	12.6	182	27
MT070219	111.3	47.8	94.1	1.6	10.1	179	24
Metcalf	110.3	51.5	96.1	1.5	10.9	184	29
MT061201	107.1	51.6	96.5	1.5	12.2	181	28
MT061025	106.1	46.2	92.9	2.4	10.3	179	23
MT070193	105.0	47.2	93.5	2.0	9.3	181	20
Tradition	103.8	49.6	99.1	0.2	11.1	180	28
MT061026	102.8	44.5	93.5	1.8	10.5	179	24
MT061207	102.5	51.4	97.3	1.0	11.3	181	25
MT061011	99.5	45.2	92.9	2.2	10.1	179	23
MT070192	97.4	47.8	93.7	2.3	9.5	179	24
Mean	124.9	51.5	96.1	1.6	11.0	183	27
LSD (.05)	15.2	1.1	2.4	1.4	1.1		
C.V.	7.8	0.9	1.4	6.4	1.9		

LSD (0.05) = 2 means in the same block.

Planted April 20, 2009 on fallow. Harvested September 1, 2009.

Fertilizer, actual: 91-52-20

Irrigation = 5.05 inches Growing season ppt: 8.78 inches

Sprayed with Huskie @ 11 oz/a and Axial @ 8.2 oz/a on 5/29/09.

Location: MSU Western Triangle Ag Research Center, Conrad, MT.

Table 22. Irrigated Intrastate Barley variety trial, Conrad 2006.

Condensed List

Variety	Yield bu/a	Test Wt lb/bu	Plump %	Thin %	Protein %	Head date	Height in.
Baronesse	142.5	52.4	97.2	1.1	11.4	185	25
Champion	140.0	52.0	97.1	1.0	11.2	182	28
Haxby	136.2	53.1	94.5	2.6	12.6	181	25
MT030042	133.5	52.5	93.4	2.6	10.7	182	25
Conrad	130.6	52.0	97.0	1.0	11.8	185	26
Geraldine	129.8	52.2	97.6	1.0	10.9	185	26
MT020155	127.4	50.8	94.1	2.3	11.1	181	27
Craft	121.3	53.3	96.7	1.4	11.5	181	30
Bentley	120.4	51.2	97.6	0.8	11.3	185	30
MT010158	118.0	52.6	97.0	1.4	11.0	186	27
Hockett	116.0	51.9	95.3	2.4	11.8	185	26
Harrington	114.3	50.8	96.4	1.5	10.4	184	27
Metcalfe	110.3	51.5	96.1	1.5	10.9	184	29
Tradition	103.8	49.6	99.1	0.2	11.1	180	28
MT061207	102.5	51.4	97.3	1.0	11.3	181	25
Mean	123.1	51.8	96.4	1.5	11.3	183.1	26.9

Planted April 20, 2009 on fallow. Harvested September 1, 2009.

Fertilizer, actual: 91-52-20

Irrigation = 5.05 inches Growing season ppt: 8.78 inches

Sprayed with Huskie @ 11 oz/a and Axial @ 8.2 oz/a on 5/29/09.

Location: MSU Western Triangle Ag Research Center, Conrad, MT.

Table 23. 7-year averages, irrigated Barley varieties, Conrad, MT, 2002 - 2007, 2009.

Variety	7-Year Average						
	Yield bu/a	Test Wt lb/bu	Plump %	Thin %	Protein %	Head date	Height in.
Champion	124.2	52.7	97.0	1.4	11.7	180	32
Baronesse	120.3	52.7	92.0	2.7	12.0	182	31
Geraldine 960101	119.4	52.7	89.0	4.1	12.0	183	31
Haxby MSU	118.2	54.8	95.0	2.0	12.6	181	31
Conrad BuschAg	116.9	52.7	94.0	2.0	12.9	182	30
Craft 970116	111.1	53.9	93.0	3.0	12.7	180	34
Tradition BuschAg	108.2	51.3	93.0	1.3	12.4	179	34
Metcalfe	104.8	52.1	94.0	2.5	12.5	182	32
Hockett 910189	102.6	52.6	92.0	3.8	12.5	180	31
Harrington	100.4	51.4	90.0	3.2	12.2	182	31
mean	112.6	52.7	92.9	2.6	12.4	181.1	31.7

Tradition is 6-row; all others are 2-row.

Location: MSU Western Triangle Agr Research Center, Conrad, MT.

Table 24. Irrigated Malt Barley variety trial, Conrad 2009.

Variety	Spike	Yield bu/a	Test Wt lb/bu	Plump %	Thin %	Protein %	Head date	Height in.
Goldeneye	6	129.2	48.9	96.5	1.3	10.6	180	31
Champion	2	119.5	51.3	96.8	1.0	10.4	182	31
MT020155	2	119.4	50.8	95.8	1.7	10.8	180	31
Geraldine	2	119.0	51.7	97.2	0.9	10.1	185	29
Conrad	2	119.0	49.9	94.7	2.4	11.0	184	27
Baronesse	2	118.7	52.4	98.4	0.6	9.7	185	28
Pinnacle	2	118.1	50.1	98.7	0.4	10.7	181	31
Haxby	2	117.3	53.2	97.0	1.3	11.1	181	32
MT030042	2	116.1	51.5	91.1	4.0	10.7	183	28
MT010158	2	115.9	51.2	96.9	1.2	11.1	182	29
Craft	2	111.8	52.0	95.9	1.7	11.0	181	32
MT061207	2	111.6	51.3	98.0	0.8	12.4	181	30
Harrington	2	111.3	48.2	93.5	3.4	10.4	184	31
Metcalfe	2	109.0	50.4	95.4	1.9	11.4	185	33
Hockett	2	108.7	50.8	95.4	2.0	11.3	181	31
Gallatin	2	99.4	52.0	95.3	1.8	10.4	181	32
Mean		115.3	51.0	96.0	1.7	10.8	182	30
LSD (.05)		19.7	1.3	4.0	2.1	1.8		
C.V.		10.3	1.6	2.5	76.7	10.0		

Planted April 20, 2009 on fallow. Harvested September 1, 2009.

Fertilizer, actual: 91-52-20

Sprayed with Huskie @ 11 oz/a and Axial @ 8.2 oz/a on 5/29/09.

Irrigated with 5.05 inches of water. Growing season ppt: 8.78 inches

Location: MSU Western Triangle Ag Research Center, Conrad, MT.

Table 25. Six-year averages, irrigated Malt Barley varieties, Conrad 2003 - 07 and 2009.

Variety	Spike	6-Year Average						Head date	Height in.
		Yield bu/a	Test Wt lb/bu	Plump %	Thin %	Protein %			
Geraldine 960101	2	112.3	52.7	88.7	3.7	12.2	183	30	
Haxby MSU	2	109.5	54.5	92.3	2.7	12.3	179	32	
Craft 970116	2	107.8	53.6	91.0	3.8	12.5	179	35	
Conrad BuschAg	2	106.8	50.1	90.7	3.9	12.4	181	31	
Hockett 910189	2	100.3	52.9	90.6	4.5	12.7	178	32	
Metcalfe	2	99.3	51.8	89.2	4.3	12.9	181	33	
Harrington	2	94.1	49.5	81.1	7.2	12.4	182	32	
Mean		104.3	52.2	89.1	4.3	12.5	180.4	32.0	

Location: MSU Western Triangle Agr Research Center, Conrad, MT.

Table 26. 2009 Barley variety trial, Cut Bank.

Variety	Spike	Yield bu/a	Test Wt lb/bu	Plump %	Thin %	Protein %
Champion <small>WestBred</small>	2	133.2	53.1	98.1	0.6	11.3
Geraldine <small>MSU</small>	2	122.7	54.0	98.1	0.6	11.1
MT030042		122.4	53.7	96.8	1.3	11.2
Pinnacle		115.1	52.2	98.2	0.6	10.5
Baronesse	2	113.4	53.9	97.4	0.9	11.6
MT061207		112.8	53.2	98.0	0.6	11.8
Craft <small>MSU</small>	2	111.5	54.0	98.1	0.6	11.4
Goldeneye	6	110.0	51.0	97.3	0.8	10.6
Haxby <small>MSU</small>	2	109.3	54.9	97.6	1.1	11.3
MT020155	2	108.9	52.9	96.9	1.3	11.9
MT010158	2	108.1	52.6	97.5	0.9	11.7
Gallatin		106.5	53.5	95.5	2.0	11.2
Conrad <small>Busch AG</small>	2	106.0	52.2	98.3	0.6	11.1
Hockett <small>MSU</small>	2	103.6	52.9	98.5	0.5	11.2
Harrington	2	103.3	52.3	97.9	0.7	11.3
Metcalfe	2	101.4	52.0	97.5	1.2	11.8
Average		111.8	53.0	97.6	0.9	11.3
LSD (.05) =		18.3	1.3	1.6	0.8	1.0
P-Value (0.05)		NS	0.000	0.040	0.040	NS
C.V. =		9.80	1.47	0.99	52.30	4.28

Cooperator & Location: Kevin Bradley, north of Cut Bank, MT.

Planted April 22, 2009. Harvested September 18, 2009.

Fertilizer, actual: 6-20-20

Sprayed with Huskie @ 11 oz/a and Axial @ 8.2 oz/a on 6/15/09.

Conducted by MSU Western Triangle Ag Research Center.

Table 27. Five-year averages, Barley varieties, Cut Bank area, 2005 - 09.

Variety	Rows/ spike	5-Year Average				
		Yield bu/a	Test Wt lb/bu	Plump %	Thin %	Protein %
Haxby MSU	2	71.1	52.7	76.0	13.7	11.8
Craft MSU	2	70.9	51.3	82.9	6.8	12.0
Geraldine MSU	2	70.8	50.4	75.7	15.9	11.5
Harrington	2	69.1	49.0	79.4	11.4	11.4
Hockett MSU	2	67.6	50.5	81.0	10.1	11.6
Conrad Busch Ag	2	66.8	49.2	81.4	9.3	11.9
Metcalfe	2	65.8	49.5	80.3	10.6	12.1
average		68.9	50.4	79.5	11.1	11.8

Cooperator & Location: Kevin Bradley, north of Cut Bank, MT.

Conducted by MSU Western Triangle Agr Research Center.

Table 28. 2009 Barley variety trial, Choteau.

Variety	Spike	Yield bu/a	Test Wt lb/bu	Plump %	Thin %	Protein %
Goldeneye	6	106.8	51.9	95.4	0.9	13.6
MT030042		105.7	55.1	97.8	0.6	12.4
Baronesse	2	104.3	53.7	98.2	0.6	14.7
Geraldine	2	102.7	54.3	95.5	1.1	14.0
Haxby	2	102.1	54.9	98.6	0.4	13.2
Craft	2	101.4	54.7	98.6	0.4	13.3
Champion	2	100.6	54.5	97.8	0.5	13.1
MT020155	2	96.2	53.1	96.5	0.9	13.7
Hockett	2	94.3	53.3	97.7	0.9	13.2
Harrington	2	89.5	53.0	96.7	1.0	13.8
Conrad	2	87.8	52.3	97.3	0.7	15.0
MT010158	2	87.3	53.4	97.1	0.9	14.5
Metcalfe	2	85.4	53.5	98.4	0.5	14.1
MT061207		84.8	52.7	98.1	0.7	13.5
Gallatin		83.0	53.7	96.6	1.2	13.9
Pinnacle		77.3	54.4	98.6	0.6	11.7
Average		94.3	53.7	97.4	0.7	13.6
LSD (.05) =		19.7	0.8	1.7	0.5	0.6
C.V. =		12.50	0.87	1.06	44.30	2.62
P-Value (0.05)		NS	0.000	0.004	NS	0.000

Cooperator & Location: Scott & Roy Inbody, east of Choteau, MT.

Planted May 18, 2009. Harvested September 16, 2009.

Fertilizer, actual: 6-20-20

Conducted by MSU Western Triangle Ag Research Center.

Table 29. Five-year averages, Barley varieties, Choteau area, 2005 - 09.

Variety	Rows/ spike	5-Year Average				
		Yield bu/a	Test Wt lb/bu	Plump %	Thin %	Protein %
Haxby MSU	2	84.3	53.6	69.1	9.6	14.9
Craft MSU	2	83.2	51.2	78.2	6.2	15.0
Hockett MSU	2	78.3	50.6	75.1	9.8	14.9
Geraldine MSU	2	75.6	49.2	52.9	22.8	16.1
Conrad Busch Ag	2	74.2	48.3	66.7	14.3	16.3
Metcalfe	2	74.0	49.1	69.8	11.5	15.9
Harrington	2	73.5	48.0	62.6	14.9	15.6
average		77.6	50.0	67.8	12.7	15.5

Cooperator & Location: Scott & Roy Inbody, east of Choteau, MT.
 Conducted by MSU Western Triangle Agr Research Center.

Table 30. 2009 Barley variety trial, Knees.

Variety	Spike	Yield bu/a	Test Wt lb/bu	Plump %	Thin %	Protein %
Champion	2	94.4	52.0	95.6	1.8	12.3
Goldeneye	6	86.5	48.3	91.3	2.7	11.1
Pinnacle		85.5	50.5	98.1	0.9	11.0
Craft	2	84.2	52.2	95.5	1.6	12.4
Baronesse	2	84.0	50.7	90.7	3.8	11.8
Haxby	2	82.6	52.6	94.1	2.1	12.4
MT030042		81.7	52.1	88.6	4.8	11.1
MT020155	2	81.0	49.3	92.0	3.1	12.3
Harrington	2	78.3	49.7	89.3	4.4	12.1
Geraldine	2	77.2	50.3	79.6	9.4	13.1
Conrad	2	76.8	49.9	88.5	4.5	13.0
Gallatin		75.9	50.5	88.7	4.6	12.4
Hockett	2	71.1	51.1	91.1	4.0	12.3
MT010158	2	70.6	50.8	91.2	3.4	12.3
Metcalfe	2	69.3	50.1	90.3	4.3	13.1
MT061207		66.5	50.7	95.1	1.9	11.6
Average		79.1	50.7	91.2	3.6	12.1
LSD (.05) =		13.4	1.0	6.1	3.4	1.1
C.V. =		8.10	0.93	3.10	44.20	4.39
P-Value (0.05)		0.033	0.000	0.003	0.016	0.019

Cooperator & Location: Arron Killion, east of Brady, MT.

Planted April 22, 2009. Harvested August 24, 2009.

Fertilizer, actual: 6-20-20

Sprayed with Huskie @ 11 oz/a and Axial @ 8.2 oz/a on 6/16/09.

Growing season ppt from 6/1/09 until harvest: 3.05
inches

Conducted by MSU Western Triangle Ag Research Center.

Title: Spring lentil and pea variety evaluation.

Year: 2009

Location: Western Triangle Agriculture Research Center, Conrad, MT.

Personnel: Grant Jackson and John Miller, Western Triangle Ag. Research Center, Conrad, MT;

Objectives: To evaluate the performance of pea and lentil varieties under dryland, fallow conditions.

Procedures: Thirteen lentil and 14 pea varieties were seeded into fallow with a 5-row, 12 inch spaced, plot planter equipped with Conserv-a-Pac openers. Phosphorus and potash fertilizers were placed with the seed while planting. Plot size was five by 25 feet with four replicates. Plots were direct cut with a Hege plot combine.

Results: The data are summarized in Tables 31 and 32. Lentil and pea yields were very high, averaging 2451 and 3585 lbs/acre, respectively. Richlea lentil and pea varieties: Mozart, Delta, and Stirling were the high yielding entries.

Table 31. Lentil variety performance trial. Western Triangle Ag. Research Center. Conrad, MT 59425. 2009.

Entry	Cotyledon Color	Seed Yield lbs/acre	Flower Date	Plant Ht., in
LC01602307E	Green	3248 a	June 25	21
LC01602300R	Green	3113 ab	June 23	22
Richlea	Green	2831 abc	June 25	19
LC01602245P	Red	2627 bcd	June 23	17
Pennell	Green	2578 bcd	June 23	17
Meteor	Green	2450 cde	June 24	18
LC01602062T	Red	2385 cdef	June 23	18
Brewer	Green	2272 def	June 23	19
Redberry	Red	2234 def	June 24	16
Merrit	Green	2183 def	June 22	16
Riveland	Green	2127 def	June 24	19
Crimson	Red	1921 ef	June 24	14
Vantage	Green	1887 f	June 24	20
Statistical Summary				
Mean		2451		
LSD (0.05)		559		
CV (%)		13.5		

Data with the same letter are not significantly different according to the LSD at p=0.05.

Notes:

Seeding Date: April 13

Harvest Date: August 31

Growing Season ppt: 8.88 inches

Planting Rate: 12 seeds/ft²

Previous Crop: Fallow

Herbicide: Sonalan at 1 qt/acre applied October 2, 2008

Fertilizer: 3-20-10, seed placed

Inoculant: granular at 5 lbs/acre

Table 32. Pea variety performance trial. Western Triangle Ag. Research Center.
Conrad, MT 59425. 2009.

Entry	Cotyledon Color	Seed Yield lbs/acre	Flower Date	Plant Ht., in	1000 Seed Wt., gms	Test Wt. lbs/bu
Mozart	Yellow	4223 a	June 24	32	258 a	64.5 bcdef
Delta	Yellow	3996 ab	June 24	26	266 a	64.6 abcdef
Stirling	Green	3932 ab	June 23	28	222 cd	64.7 abcdef
PS9910140	Yellow	3932 ab	June 26	29	252 ab	63.9 efg
PS01102958	Yellow	3931 ab	June 26	29	265 a	65.0 abcd
Midas	Yellow	3620 bc	June 27	32	218 d	64.8 abcde
Admiral	Yellow	3607 bc	June 26	35	249 ab	65.1 abc
PS0010836	Yellow	3606 bc	June 26	26	266 a	64.1 defg
Golden	Yellow	3400 c	June 26	34	235 bcd	65.1 ab
Majoret	Green	3345 cd	June 27	32	227 cd	64.6 bcdef
Aragorn	Green	3340 cd	June 24	29	225 cd	63.8 fg
Striker	Green	3189 cd	June 26	36	250 ab	65.6 a
Cruiser	Green	3154 cd	June 24	30	239 bc	64.1 cdefg
Medora	Green	2917 d	June 28	33	223 cd	63.5 g
Summary Statistics						
Mean		3585			242	64.5
LSD (0.05)		479			17	1
CV (%)		8.0			4.3	0.9

Data with the same letter are not significantly different according to the LSD at $p=0.05$.

Notes:

Seeding Date: April 13

Harvest Date: August 17

Growing Season ppt: 8.88 inches

Planting Rate: Six seeds/ft²

Previous Crop: Fallow

Herbicide: Sonalan at 1 qt/acre applied October 2, 2008 and Basagran at 1.5 pts/acre on June 11, 2009.

Fertilizer: 3-20-10, seed placed

Inoculant: granular at 5 lbs/acre

Title: Oilseed variety evaluation.

Year: 2009

Location: Western Triangle Agriculture Research Center, Conrad, MT.

Personnel: Grant Jackson and John Miller, Western Triangle Ag. Research Center, Conrad, MT;

Objectives: To evaluate the performance of camelina, canola, and yellow mustard varieties or hybrids under dryland, fallow conditions.

Procedures: Fifteen camelina varieties, 16 canola varieties or hybrids, and six mustard varieties were planted into fallow with a five-row, 12 inch spaced, plot planter equipped with Conserv-a-Pac openers. Nitrogen, potash, and sulfur fertilizers were broadcast, and phosphorus was placed with the seed while planting. Plot size was five by 25 feet with four replicates. Plots were swathed with a Swift plot swather and threshed with a Hege plot combine.

Results: Excellent yields were measured this year. The camelina nursery (Table 34) averaged 1824 lbs/acre while the canola nursery (Table 35) averaged 1781 lbs/acre and the mustard nursery (Table 36) averaged 1551 lbs/acre.

Table 34. Camelina variety performance trial. Western Triangle Ag. Research Center. Conrad, MT 59425. 2009.

Entry	Seed Yield, lbs/acre	Lodge Rating	Plant Ht, in	Seed Oil Content, %	Protein Content, %
Calena	2062 a	2.00 g	34	39.2 ab	25.2 d
Suneson	2009 ab	3.00 ef	33	38.7 abc	26.5 bc
SO-3	1948 ab	2.50 fg	38	38.8 abc	25.5 cd
SO-1	1932 abc	2.75 ef	35	38.3 abcd	26.8 b
SO-4	1929 abc	5.00 a	36	38.1 bcd	26.9 b
SO-5	1919 abc	3.25 de	35	38.3 abcd	26.7 b
Ligena	1860 abcd	3.25 de	37	38.2 abcd	26.3 bcd
Blaine Creek	1860 abcd	2.50 fg	36	39.4 a	25.5 cd
SO-2	1812 bcd	3.25 de	37	38.7 abc	26.3 bcd
GO-42	1804 bcd	4.25 bc	36	38.3 abcd	26.4 bc
GP-10	1802 bcd	3.75 cd	35	38.8 abc	26.3 bcd
GP-11	1726 cde	4.75 ab	31	37.3 d	27.2 b
SO-6	1658 de	3.00 ef	33	37.7 cd	
GP-68	1590 e	3.25 de	34	37.5 d	26.7 b
GP-07	1333 f	3.75 cd	34	37.3 d	29.5 a
Summary Statistics					
Mean	1824	3.35		38.3	26.5
LSD (0.05)	241	0.6		1.2	1.1
CV (%)	8.0	12.4		2.1	3.0

Data with the same letter are not significantly different according to the LSD at p=0.05.

Notes:

Seeding Date: April 9

Swathed: August 10

Threshed: August 17

Growing Season ppt: 8.29 inches

Planting Rate: 5 lbs/acre

Previous Crop: Conventional Fallow

Herbicide: Sonalan at 1 qt/acre applied October 2, 2008

Fertilizer: 20-20-10-24

Table 35. Canola hybrid and variety performance trial. Western Triangle Ag. Research Center. Conrad, MT 59425. 2009.

Entry	Seed Yield, lbs/acre	Flowering Date	Plant Ht, in	Seed Oil Content, %	Protein Content, %
DKL 30-42	2049 a	177 fgh	40	46.9 bc	12.2 bcd
InVigor 5550	2040 ab	177 fgh	52	46.0 cde	13.3 b
HyClass 940 RR	1960 abc	178 efg	41	46.6 bcd	10.6 ef
InVigor 5440	1944 abc	180 bc	45	45.2 def	13.1 bc
IS 7145 RR	1929 abcd	181 ab	47	46.8 bcd	12.2 bcd
IS 3057 RR	1886 abcde	176 h	41	47.9 ab	9.7 f
InVigor 8440	1874 abcde	178 fg	43	46.1 cde	11.0 def
InVigor 5630	1848 abcde	179 cde	45	47.9 ab	
DKL 72-55	1809 abcde	178 efg	45	47.5 bc	11.0 def
HyClass 921 RR	1749 abcde	178 cdefg	48	49.4 a	9.8 f
DKL 52-41	1742 bcde	178 defg	40	46.8 bcd	12.2 bcd
Hyola 357 Magnum	1670 cdef	177 gh	37	43.8 f	13.0 bc
UISC 0135	1630 def	179 cdef	44	44.7 ef	12.6 bc
HyClass 924 RR	1609 ef	178 efg	45	46.4 bcd	12.8 bc
Oscar	1394 f	181 a	41	41.8 g	14.9 a
UISC 3117	1367 f	179 cd	44	46.9 bcd	10.8 def
Summary Statistics					
Overall Mean	1781	178		46.3	11.8
LSD (0.05)	303	1		1.6	1.6
CV (%)	11.9	0.5		2.5	9.2

Data with the same letter are not significantly different according to the LSD at p=0.05.

Notes:

Seeding Date: May 6

Swathed: August 18

Threshed: August 23

Growing Season ppt: 7.13 inches

Planting Rate: 5 lbs/acre

Previous Crop: Conventional Fallow

Herbicide: Sonalan at 1 qt/acre applied October 2, 2008

Fertilizer: 20-20-10-24

Table 36. Yellow mustard variety performance trial. Western Triangle Ag. Research Center. Conrad, MT 59425. 2009.

Entry	Seed Yield, lbs/acre	Flowering Date	Plant Ht, in
Andante	1848 a	161 a	42
Pacific Gold	1790 ab	168 b	50
Pennant	1703 ab	161 a	39
Tilney	1603 ab	161 a	39
Ida Gold	1538 b	160 a	41
Forge	827 c	174 c	57
Statistical Summary			
Overall Mean	1551	164	
LSD (0.05)	277	3	
CV (%)	11.9	1.2	

Data with the same letter are not significantly different according to the LSD at p=0.05.

Notes:

Seeding Date: April 9

Swathed: August 10

Threshed: August 17

Growing Season ppt: 8.29 inches

Planting Rate: 5 lbs/acre

Previous Crop: Conventional Fallow

Herbicide: Sonalan at 1 qt/acre applied October 2, 2008

Fertilizer: 20-20-10-24

Table 38. Effect of Accolade™ and Nitrogen on Genou winter wheat.
Western Triangle Ag. Research Center. 2009.

Accolade	N Rate	Grain yield	Grain Protein	Test Weight	Autumn Stand Ct
	lbs N/ac	bu/ac	%	lb/bu	plants/ft
No	0	62.1 c	9.1 e	63.6 ab	15 a
No	20	75.4 ab	10.1 cd	63.5 ab	12 a
No	40	71.7 bc	9.9 cd	63.5 ab	15 a
No	60	74.3 ab	10.2 cd	63.4 ab	20 a
No	80	81.8 a	11.0 a	63.2 b	15 a
Yes	0	74.6 ab	9.0 e	63.7 a	13 a
Yes	20	74.6 ab	9.8 d	63.6 ab	15 a
Yes	40	78.2 ab	10.2 cd	63.7 a	12 a
Yes	60	73.4 ab	10.4 bc	63.4 ab	15 a
Yes	80	77.5 ab	11.0 ab	63.3 ab	13 a
Accolade™ Summary					
No		73.1 a	10.0 a	63.4 a	15 a
Yes		75.7 a	10.1 a	63.5 a	14 a
N Rate Summary					
	0	68.4 a	9.1 c	63.6 a	14 a
	20	75.0 ab	9.9 b	63.6 a	13 a
	40	74.9 ab	10.1 b	63.6 a	14 a
	60	73.9 ab	10.3 b	63.4 ab	17 a
	80	79.6 b	11.0 a	63.2 b	14 a
Statistical Summary					
	Mean	74.4	10.1	63.5	14
	CV (%)	9.3	4.1	0.48	24.9
	Interaction p-value	0.131	0.534	0.985	0.439

Means with the same letter are not significantly different accord to the LSD (p=0.05).

Title: Evaluation of the effect of Actosol® (humic acid) on irrigated and dryland spring wheat.

Year: 2009

Locations: Western Triangle Ag. Research Center

Personnel: Grant Jackson and John Miller, Western Triangle Ag. Research Center, Conrad, MT 59425;

Objectives: To evaluate the response of Actosol® with and without N on the yield and quality of spring wheat.

Procedures: A coal based, humic acid product Actosol® (as supplied) was applied at times and rates indicated in Tables 39 and 40. Nitrogen, as urea and at rates indicated in Tables 1 and 2, was topdressed while planting. All plots received 30 lbs P₂O₅/acre as 11-52-0 and 10 lbs K/acre as KCl applied with seed. In the irrigated experiment, irrigation followed the boot stage Actosol® treatment. Soils were sampled initially for water and nitrate-N in one foot increments to a depth of three feet. Surface soil samples (0-6") were collected for standard soil analyses of pH, organic matter, phosphorus, etc. Results are shown below with other site characteristics. Plots were harvested with a small plot combine, and the grain weighed and tested for protein content and test weight. Plot size was four rows wide (12 inch spacing) and 12 feet long.

Irrigated

Planting Date: May 18
Actosol® Treatment dates: May 18 and July 6
Harvest Date: September 22
Number of Irrigations: 3
Soil Analysis: pH = 8.0; O.M. = 2.8 %; P = 14 ppm; K = 311 ppm; EC = 0.47 mmhos/cm;
Nitrate N = 52 lbs/acre (0-3')

Previous Crop: Fallow

Growing Season Rainfall: 7.34"

Total irrigation water applied: 5.05"

Dryland

Planting Date: May 18
Actosol® Treatment date: May 18
Harvest Date: September 22
Soil Analysis: pH = 7.5; O.M. = 2.8 %; P = 17 ppm; K = 350 ppm; EC = 0.50 mmhos/cm;
Nitrate N = 81 lbs/acre (0-3')

Previous Crop: Fallow

Growing Season Rainfall: 7.34"

Results: The 2009 growing season was cooler and received significant more July precipitation than average (see weather summary); consequently, yield and protein content of late seeded spring crops were higher than expected.

The irrigated results are shown in Table 39. Statistically significant yield and protein differences were due to N fertilizer. However protein content tended to increase with the Actosol® treatments.

In the dryland experiment (Table 40), yield and protein levels were all non-significant; therefore, single degree of freedom contrasts were run to test for significant differences, and differences in protein content were the only ones detected. The protein differences

were mixed (2.5 gal/acre of Actosol® decreased protein and 5 gals/acre increased protein) as shown in Table 40.

Table 39. Effect of nitrogen and Actosol® on agronomic characteristics of irrigated spring wheat. Western Triangle Ag. Research Center. 2009.

Treat.	Actosol® Rate @ Planting	Actosol® Rate @ Boot Stage	Fertilizer N-P ₂ O ₅ -K	Grain yield	Grain Protein	Test Weight
No.	Gal/acre		lbs/acre	bu/acre	%	lb/bu
1	0	0	0-0-0	80 cd	10.1 d	63.7 a
2	0	0	6-30-10	83 bcd	12.0 bcd	63.6 a
3	0	0	256-30-10	109 ab	14.6 ab	62.2 bc
4	0	0	171-30-10	109 ab	14.3 ab	62.5 bc
5	2.5	2.5	0-0-0	84 bcd	11.3 d	63.7 a
6	2.5	2.5	6-30-10	82 cd	11.6 cd	63.7 a
7	2.5	2.5	256-30-10	114 a	14.7 a	62.4 bc
8	2.5	2.5	171-30-10	106 ab	13.8 abc	62.6 b
9	5.0	2.5	0-0-0	76 cd	11.4 cd	63.8 a
10	5.0	2.5	6-30-10	75 d	11.2 d	64.0 a
11	5.0	2.5	256-30-10	106 ab	14.6 ab	62.1 bc
12	5.0	2.5	171-30-10	101 abc	14.6 ab	61.8 c
Fertilizer Summary						
	0-0-0			80	10.9	63.7
	6-30-10			80	11.6	63.8
	171-30-10			106	14.2	62.3
	259-30-10			110	14.6	62.2
Actosol Summary						
	0			95	12.8	63.0
	5 Gal/acre			97	12.9	63.1
	7.5 Gal/acre			90	13.0	62.9
Statistical Summary						
	Mean			96	13.0	62.9
	LSD (0.05)			29	2.9	1.0
	CV (%)			14.5	11.0	0.8

Means with the same letter are significantly different accord to the LSD (p=0.05).

Table 40. Effect of nitrogen and Actosol® on agronomic characteristics of dryland spring wheat. Western Triangle Ag. Research Center. 2009.

Treat.	Actosol® rate	Fertilizer	Grain yield	Grain Protein	Test Weight
No.	gal/acre	N-P ₂ O ₅ -K lbs/acre	bu/acre	%	lb/bu
1	0	0-0-0	76.8	14.2 a	63.7
2	0	6-30-10	75.7	13.2	63.8
3	0	76-30-10	78.6	12.9 b	63.9
4	0	51-30-10	78.5	13.3	63.7
5	2.5	0-0-0	74.3	13.2 a	63.8
6	2.5	6-30-10	80.2	13.1	63.6
7	2.5	76-30-10	78.1	14.4	63.8
8	2.5	51-30-10	77.5	13.8	63.6
9	5.0	0-0-0	77.4	12.7	64.0
10	5.0	6-30-10	72.3	12.8	63.8
11	5.0	76-30-10	77.8	14.8 b	63.9
12	5.0	51-30-10	79.0	13.7	63.8
Fertilizer Summary					
		0-0-0	76.2	13.3	63.8
		6-30-10	76.1	13.0	63.8
		51-30-10	78.4	13.6	63.7
		76-30-10	78.2	14.0	63.9
Actosol® Summary					
	0 gal/acre		77.4	13.4	63.8
	2.5 gal/acre		77.5	13.6	63.7
	5.0 gal/acre		76.6	13.5	63.9
Contrast Treatment P values					
Contrast 1 thru 4 and 5 thru 8			0.983	0.170	0.366
Contrast 1 thru 4 and 9 thru 12			0.598	0.029*	0.827
Contrast Check and Starter Fert.			0.439	0.223	0.625
Contrast Check and 76 N			0.604	0.707	0.622
Contrast Check and 51 N			0.194	0.754	0.573
Contrast 1 and 5			0.917	0.039*	0.314
Contrast 1 and 9			0.806	0.691	0.776
Contrast 2 and 6			0.511	0.517	0.855
Contrast 2 and 10			0.716	0.369	0.372
Contrast 3 and 7			0.402	0.718	0.498
Contrast 3 and 11			0.500	0.024*	0.672
Contrast 4 and 8			0.742	0.718	0.759
Contrast 4 and 12			0.817	0.388	0.531
Statistical Summary					
Mean			77.2	13.5	63.8
LSD (0.05)			ns	ns	ns
CV (%)			6.4	7.0	0.3

Means with the same letter are significantly different accord to a single df contrast (p=0.05).

Title: Effect of nitrogen, phosphorus, and sulfur on camelina seed yield and oil content.

Year: 2009

Locations: Western Triangle Ag. Research Center

Personnel: Grant Jackson and John Miller, Western Triangle Ag. Research Center, Conrad, MT 59425;

Objectives: To determine the optimum rates of N, P, and S fertilizers for producing high quality camelina oil.

Procedures: Nitrogen rates of 0, 30, and 60 lbs N/acre, P₂O₅ rates of 0, 15, and 30 lbs/acre, and S rates of 0, and 15 lbs/acre were applied to Camelina in a RCB, factorial design. Nitrogen as urea, S as potassium sulfate, and 50 lbs/acre of KCl were applied broadcast while seeding. Phosphorus fertilizer as 0-45-0 was applied with seed. Soils were sampled initially for water and nitrate-N in one foot increments to a depth of three feet. Surface soil samples (0-6") were collected for standard soil analyses of pH, organic matter, phosphorus, etc. Results are shown in Table 41. Plot size was 5 rows wide with 12 inch row spacing and 25 feet long. Plots were swathed with a Swift small plot swather and threshed with a Hege small plot combine.

Results: Seed yield, oil content, and oil yield data are shown in Table 42. The highest camelina seed yields and the lowest oil contents were measured in 2009, and 120 lbs of N were needed for maximum seed yield. There was no response to P (P soil test was very high) or S.

Table 41. Site characteristics and soil test results. Western Triangle Ag. Research Center. 2009.

Character	
Planting Date	4/9
Previous Crop	Fallow
Growing Season Precipitation(inches)	8.88
Spray Date*	October 2, 2008
Test	
pH	7.7
O.M. (%)	2.8
P (ppm)	29
K (ppm)	442
EC (mmhos/cm)	0.5
S (0-2', lbs/acre)	115
NO ₃ -N (0-3', lb/ac)	65

* Sonolan @ 2 pt/a

Table 42. Effect of nitrogen, phosphorus, and sulfur on camelina yield and oil content. Western Triangle Ag. Research Center. 2009.

N-P ₂ O ₅ -S	Seed Yield	Oil Content	Oil Yield
lbs/acre	lbs/acre	%	lbs/acre
0 - 0 - 0	1947	37.5	727.8
0 - 15 - 0	1852	38.9	719.6
0 - 30 - 0	1983	38.7	766.4
30 - 0 - 0	2086	38.0	791.4
30 - 15 - 0	1783	36.5	655.9
30 - 30 - 0	1944	38.4	743.3
60 - 0 - 0	1999	37.7	753.4
60 - 15 - 0	2225	37.7	839.4
60 - 30 - 0	2213	37.2	821.8
0 - 0 - 15	2024	39.1	789.6
0 - 15 - 15	1880	38.9	730.2
0 - 30 - 15	1916	38.8	742.2
30 - 0 - 15	2119	38.3	812.4
30 - 15 - 15	2070	38.0	788.6
30 - 30 - 15	2113	38.4	812.3
60 - 0 - 15	1941	37.8	733.1
60 - 15 - 15	1916	38.1	861.6
60 - 30 - 15	2311	37.2	862.6
Nitrogen Summary			
0	1933 a	38.6 a	745.9 a
30	2019 a	37.9 b	767.3 ab
60	2158 b	37.6 b	812.0 b
Phosphorus Summary			
0	2014 a	38.0 a	765.1 a
15	2017 a	38.1 a	768.9 a
30	2080 a	38.1 a	765.1 a
Sulfur Summary			
0	2004 a	37.8 a	757.7 a
15	2070 a	38.3 a	792.5 a
Statistical Summary			
Mean	2037	38.1	775.1
CV (%)	11.1	3.1	11.3
Interaction Summary			
N rate X P rate	0.061	0.147	0.073
N rate x S rate	0.364	0.654	0.314
P rate x S rate	0.841	0.554	0.845
N x P x S	0.873	0.482	0.716

Yield means with the same letter are not significantly different according to the LSD (p=0.05)

Title: Evaluation of winter wheat response to JumpStart® (*Penicillium bilaii*) and phosphorus fertilization.

Year: 2009

Location: North of Conrad (near WTARC at the Kronebusch farm)

Personnel: Grant Jackson and John Miller, Western Triangle Ag. Research Center, Conrad, MT 59425;

Objectives: To evaluate the response of winter wheat to phosphorus fertilization with and without *Penicillium bilaii* seed inoculant (JumpStart®).

Procedures: JumpStart® was applied (6 oz/bu) to Genou winter wheat, and P fertilizer treatments of 0, 10, 20, and 30 lbs P₂O₅/acre as monoammonium phosphate (11-52-0) were applied with the seed with and without JumpStart® in a RCB design with six replications. Nitrogen as urea and KCl were applied while seeding in a band approximately one inch above and to the side of the seed row at the rates indicated in Table 44. Nitrogen fertilizer rates were adjusted to account for the varying N content of the P fertilizer rate. Soil test results and other site characteristics are shown in Table 43. Plots were harvested with a small plot combine, and grain samples were cleaned, allowed to air dry to about 10 % moisture, weighted, and sampled for grain protein analysis.

Results: Grain yield, test weight, protein content, and stand count data are summarized in Table 45 and were unaffected by Jump-Start® and P fertilization.

Table 43. Site characteristics and soil test results. Western Triangle Ag. Research Center. 2009.

Planting Date	9-18-2008
Previous Crop	Chemical fallow
Blanket Fertilizer	80-0-25
Growing Season Precipitation(inches)	8.88
Harvest Date	8-17-2009
Autumn Stand Count Date	10-29-2008
Soil Test	
pH	7.5
O.M. (%)	2.8
P (ppm)	17
K (ppm)	320
EC (mmhos/cm)	0.73
NO ₃ -N (0-3', lb/ac)	76

Table 44. Effect of JumpStart® and Phosphorus on Genou winter wheat. Western Triangle Ag. Research Center. 2009.

Jump Start	P Rate	Grain yield	Grain Protein	Test Weight	Autumn Stand Ct
	lbs P ₂ O ₅ /ac	bu/ac	%	lb/bu	plants/ft
No	0	71.1 a	11.5 a	61.4 a	14 a
No	10	75.4 a	11.5 a	61.4 a	13 a
No	20	68.7 a	11.3 a	61.2 a	14 a
No	30	68.1 a	11.4 a	61.5 a	13 a
Yes	0	69.3 a	11.5 a	61.5 a	11 a
Yes	10	69.1 a	11.6 a	60.9 a	15 a
Yes	20	69.3 a	11.3 a	61.1 a	14 a
Yes	30	70.2 a	11.2 a	61.3 a	11 a
JumpStart® Summary					
No		70.8 a	11.4 a	61.4 a	13 a
Yes		70.6 a	11.4 a	61.2 a	13 a
P Rate Summary					
	0	72.4 a	11.4 a	61.5 a	13 a
	10	72.3 a	11.5 a	61.2 a	14 a
	20	70.0 a	11.3 a	61.1 a	14 a
	30	69.2 a	11.3 a	61.4 a	12 a
Statistical Summary					
	Mean	70.7	11.4	61.3	13
	CV (%)	10.5	2.8	0.76	22.3
	Interaction p-value	0.444	0.794	0.602	0.294

Means with the same letter are not significantly different accord to the LSD (p=0.05).

®JumpStart is a registered trademark of Philom Bios Inc.

Table 46. Effect of Nutrisphere-N® treated urea and Avail® treated phosphorus fertilizer on winter wheat. Western Triangle Ag. Research Center. 2009.

No.	Treatment (lbs N/acre or P ₂ O ₅ /acre)				Yield	Test WT.	Protein
	N Rate	P Rate	NSN	Avail®	bu/ac	lb/bu	%
1	6	0	No	No	62.5	62.4	9.8
2	40	0	No	No	73.4	62.2	9.8
3	80	0	No	No	80.6	62.4	10.1
4	6	15	No	No	76.4	62.1	9.9
5	40	15	No	No	76.9	62.0	9.8
6	80	15	No	No	82.3	61.8	10.9
7	6	30	No	No	65.2	61.9	9.0
8	40	30	No	No	76.8	61.7	9.8
9	80	30	No	No	78.9	62.2	10.8
10	6	15	No	Yes	62.5	61.6	8.9
11	40	15	No	Yes	73.8	61.8	9.5
12	80	15	No	Yes	81.4	62.1	10.1
13	6	30	No	Yes	76.5	62.0	8.5
14	40	30	No	Yes	73.8	61.9	9.7
15	80	30	No	Yes	80.7	61.5	10.9
16	40	0	Yes	No	72.0	62.1	10.0
17	80	0	Yes	No	79.1	62.0	11.2
18	40	15	Yes	No	76.5	61.9	9.6
19	80	15	Yes	No	79.6	61.6	10.7
20	40	30	Yes	No	76.6	62.0	9.7
21	80	30	Yes	No	74.0	61.6	10.4
22	40	15	Yes	Yes	67.5	61.8	10.2
23	80	15	Yes	Yes	75.3	61.7	10.3
24	40	30	Yes	Yes	79.4	62.2	9.8
25	80	30	Yes	Yes	79.5	61.2	11.4
26	80 no K	30 no K	No	No	75.5	61.0	11.0
Statistical Summary							
Mean					74.9	61.9	10.1
Treatment p value					0.0001	0.001	0.0001
LSD (0.05)					9.3	0.6	1.1
CV (%)					8.9	0.7	6.8
Contrast p-values							
1. Contrast Treat 9 vs. 26					0.475	0.000	0.631
2. Contrast Treat 2, 5, 8, 11, 14 vs 16, 18, 20, 22, 24					0.793	0.510	0.596
3. Contrast Treat 3, 6, 9, 12, 15 vs 17, 19, 21, 23, 25					0.122	0.002	0.585
4. Contrast Treat 1, 4, 7, 10, 13 vs 2, 5, 8, 11, 14					0.000	0.543	0.023
5. Contrast Treat 1, 4, 7, 10, 13 vs 16, 18, 20, 22, 24					0.000	0.960	0.006
6. Contrast Treat 1, 4, 7, 10, 13 vs 3, 6, 9, 12, 15					0.000	0.837	0.000
7. Contrast Treat 1, 4, 7, 10, 13 vs 17, 19, 21, 23, 25					0.000	0.004	0.000
8. Contrast Treat 2, 5, 8, 11, 14 vs 3, 6, 9, 12, 15					0.007	0.416	0.000

Table 46. Contrast p-values Continued.

	Yield	Test WT.	Protein
	bu/ac	lb/bu	%
9. Cont Treat 16, 18, 20, 22, 24 vs 17, 19, 21, 23, 25	0.144	0.003	0.000
10. Cont Treat 16, 18, 20, 22, 24 vs 3, 6, 9, 12, 15	0.003	0.877	0.000
11. Contrast Treat 1, 2, 3, 16, 17 vs 4, 5, 6, 18, 19	0.024	0.024	0.890
12. Contrast Treat 1, 2, 3, 16, 17 vs 10, 11, 12, 22, 23	0.488	0.005	0.279
13. Contrast Treat 4, 5, 6, 18, 19 vs 7, 8, 9, 20, 21	0.055	0.911	0.239
14. Cont Treat 10, 11, 12, 22, 23 vs 13, 14, 15, 24, 25	0.071	0.646	0.504
15. Contrast Treat 4, 5, 6, 18, 19 vs 10, 11, 12, 22, 23	0.004	0.559	0.661
16. Contrast Treat 7, 8, 9, 20, 21 vs 13, 14, 15, 24, 25	0.435	0.368	0.524
17. Contrast Treat 10, 11, 12, 22, 23 vs 7, 8, 9, 20, 21	0.298	0.658	0.984

Figure 1. Comparing Winter Wheat Yields: Urea vs. NutriSphere N at all P Levels.

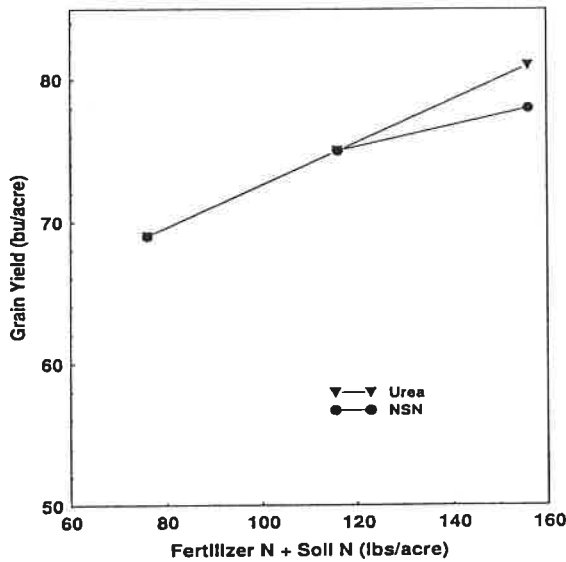


Figure 2. Comparing Winter Wheat Yields: Urea with and without Avail® treated P.

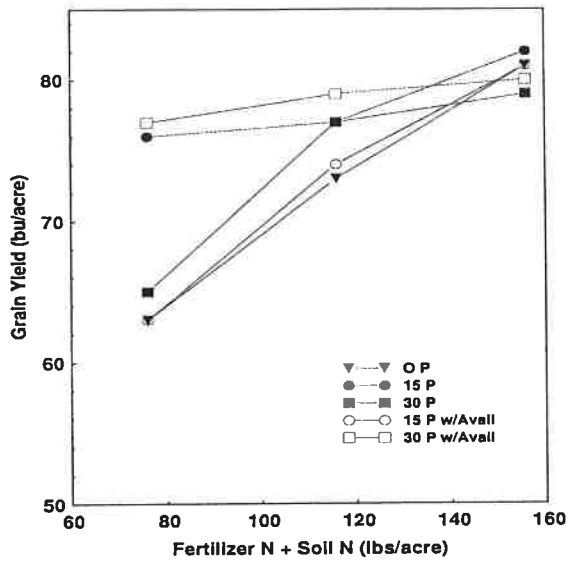


Figure 3. Comparing Winter Wheat Yields: NSN with and without Avail® treated P.

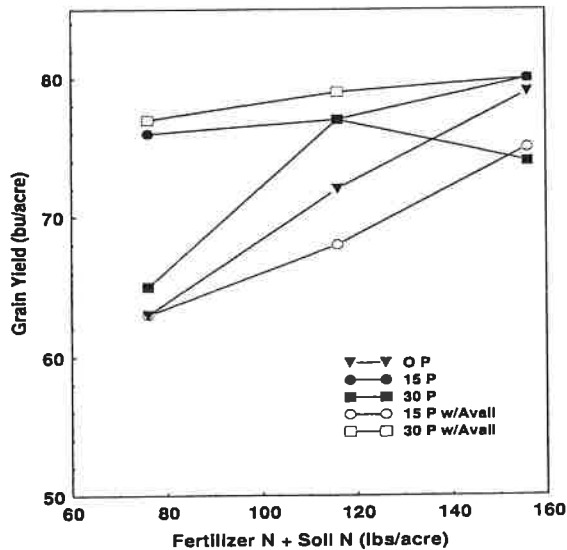


Figure 4. Comparing Winter Wheat Protein Levels: Urea vs. NutriSphere® N at all P Levels.

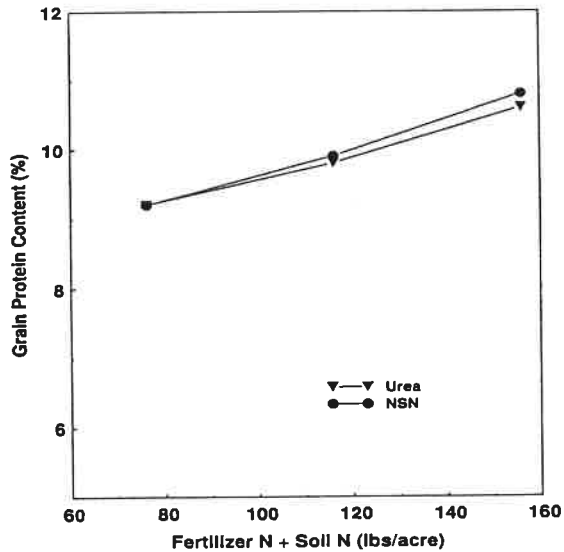


Table 47. Effect of Nutrisphere-N® treated urea and Avail® treated phosphorus fertilizer on Spring wheat. Western Triangle Ag. Research Center. 2009.

No.	Treatment (lbs N/acre or P ₂ O ₅ /acre)				Yield bu/ac	Test WT. lb/bu	Protein %
	N Rate	P Rate	NSN	Avail®			
1	6	0	No	No	103	64.0	13.0
2	125	0	No	No	122	64.0	13.1
3	250	0	No	No	123	63.2	13.8
4	6	15	No	No	102	64.2	12.1
5	125	15	No	No	123	63.8	13.2
6	250	15	No	No	125	63.5	13.9
7	6	30	No	No	103	64.2	12.7
8	125	30	No	No	120	63.8	13.4
9	250	30	No	No	127	63.3	14.1
10	6	15	No	Yes	105	64.5	11.5
11	125	15	No	Yes	126	63.5	14.0
12	250	15	No	Yes	127	63.2	13.9
13	6	30	No	Yes	105	64.3	12.3
14	125	30	No	Yes	122	63.7	12.9
15	250	30	No	Yes	130	63.5	14.1
16	125	0	Yes	No	124	63.7	13.7
17	250	0	Yes	No	129	63.5	14.5
18	125	15	Yes	No	126	63.8	13.7
19	250	15	Yes	No	136	63.3	14.2
20	125	30	Yes	No	129	63.9	13.4
21	250	30	Yes	No	127	63.2	14.2
22	125	15	Yes	Yes	124	63.9	13.3
23	250	15	Yes	Yes	127	63.5	14.2
24	125	30	Yes	Yes	120	64.1	12.9
25	250	30	Yes	Yes	130	63.3	14.1
26	250 no K	30 no K	No	No	131	63.0	14.2
Statistical Summary							
Mean					122	63.7	13.5
Treatment p value					0.000	0.000	0.000
LSD (0.05)					12	0.5	1.2
CV (%)					6.2	0.5	5.3
Contrast p-values							
1. Contrast Treat 9 vs. 26					0.541	0.156	0.769
2. Contrast Treat 2, 5, 8, 11, 14 vs 16, 18, 20, 22, 24					0.425	0.218	0.600
3. Contrast Treat 3, 6, 9, 12, 15 vs 17, 19, 21, 23, 25					0.161	0.994	0.257
4. Contrast Treat 1, 4, 7, 10, 13 vs 2, 5, 8, 11, 14					0.000	0.000	0.000
5. Contrast Treat 1, 4, 7, 10, 13 vs 16, 18, 20, 22, 24					0.000	0.001	0.000
6. Contrast Treat 1, 4, 7, 10, 13 vs 3, 6, 9, 12, 15					0.000	0.000	0.000
7. Contrast Treat 1, 4, 7, 10, 13 vs 17, 19, 21, 23, 25					0.000	0.000	0.000
8. Contrast Treat 2, 5, 8, 11, 14 vs 3, 6, 9, 12, 15					0.106	0.000	0.004

Table 47. Contrast p-values Continued.

	Yield	Test WT.	Protein
	bu/ac	lb/bu	%
9. Cont Treat 16, 18, 20, 22, 24 vs 17, 19, 21, 23, 25	0.027	0.000	0.001
10. Cont Treat 16, 18, 20, 22, 24 vs 3, 6, 9, 12, 15	0.406	0.000	0.018
11. Contrast Treat 1, 2, 3, 16, 17 vs 4, 5, 6, 18, 19	0.317	0.688	0.382
12. Contrast Treat 1, 2, 3, 16, 17 vs 10, 11, 12, 22, 23	0.645	0.846	0.322
13. Contrast Treat 4, 5, 6, 18, 19 vs 7, 8, 9, 20, 21	0.537	0.705	0.570
14. Cont Treat 10, 11, 12, 22, 23 vs 13, 14, 15, 24, 25	0.921	0.451	0.564
15. Contrast Treat 4, 5, 6, 18, 19 vs 10, 11, 12, 22, 23	0.672	0.281	0.266
16. Contrast Treat 7, 8, 9, 20, 21 vs 13, 14, 15, 24, 25	0.854	0.348	0.199
17. Contrast Treat 10, 11, 12, 22, 23 vs 7, 8, 9, 20, 21	0.935	0.864	0.189

Figure 5. Comparing Spring Wheat Yield Levels: Urea vs. NutriSphere® N at all P Levels.

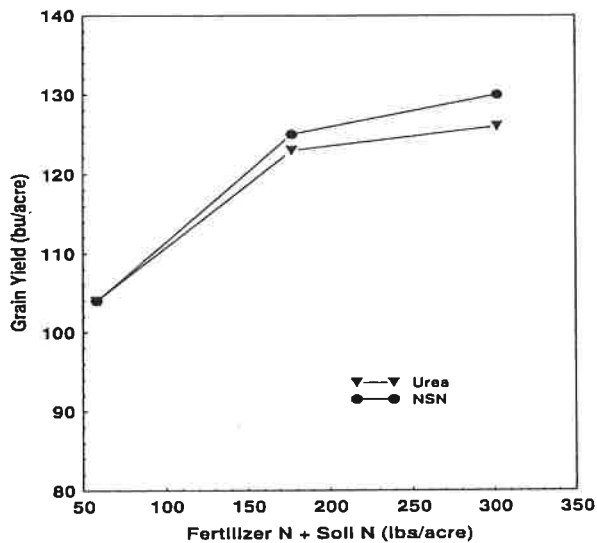


Figure 6. Comparing Spring Wheat Yields: Urea with and without Avail® treated P.

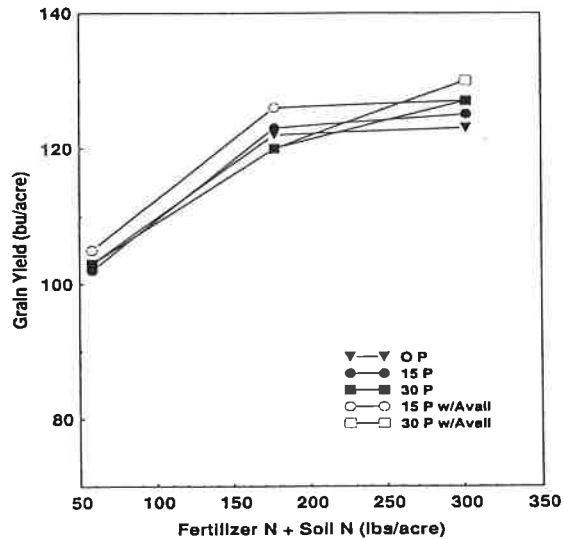


Figure 7. Comparing Spring Wheat Yields: NSN with and without Avail® treated P.

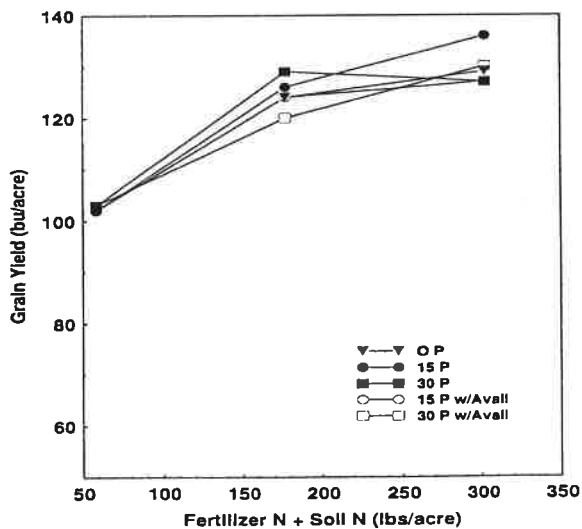


Figure 8. Comparing Spring Wheat Protein Levels: Urea vs. NutriSphere® N at all P Levels.

