The 34th

ANNUAL RESEARCH REPORT

of the

WESTERN TRIANGLE AGRICULTURAL RESEARCH CENTER

Montana Agricultural Experiment Station

Conrad, Montana

2011 Crop Year

Submitted by

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INTRODUCTION

The information and data reported 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.

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 '10-'11 crop year (September thru August) at the Western Triangle Agricultural Research Center, Conrad, MT.

Month	Precipitation (inches)		Mean Temperature (°F)	
	Current Year	Average (26-yr)	Current Year	Average (26-yr)
September, 2010	1.54	1.20	51.7	56.8
October, 2010	.19	0.57	48.4	45.0
November, 2010	.49	0.28	25.3	32.4
December, 2010	.43	0.20	18.4	24.0
January, 2011	.08	0.19	17.1	22.9
February, 2011	.51	0.23	12.8	24.4
March, 2011	.32	0.41	24.0	32.9
April, 2011	1.47	1.01	36.3	42.8
May, 2011	3.83	1.93	46.8	59.4
June, 2011	5.36	3.00	54.8	59.6
July, 2011	.57	1.43	65.1	66.8
August, 2011	.44	1.23	68.0	66.0
Total	15.23	--		--
Average	--	11.55	40.8	43.9

Last killing frost in Spring (32°F)
2011---------- May 18
Average 1986-2011---------- May 19

First killing frost in Fall (32°F)
2011----------Oct 15
Average 1986-2011---------- Sept 25

Frost free period (days)
2011---------- 150
Average---------- 129

Maximum summer temperature------- 97°F (July 17, 2011)

Minimum winter temperature------- -24°F (February 26, 2011)

2011 Winter Wheat Variety Evaluations in the Western Triangle Area.

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

Personnel: John H. Miller, WTARC, Conrad, MT, Dave Wichman, CARC, Moccasin, MT, and Phil Bruckner and Jim Berg, MSU Plant Science Dept., Bozeman, MT.

The uniform, winter wheat intrastate and preliminary variety nurseries, along with four off station locations were grown 2011. Off station trials were grown north of Cut Bank, MT, north of Devon, MT, near the 'Knees' east of Brady, MT, and northeast of Choteau, MT in Choteau county.

Results: Winter wheat variety data are shown in Tables 1 thru 8.

The growing season in 2011 began with a cool wet spring, followed by a dry and warm summer at Western Triangle Ag. Research Center. Grain yields were about 20 bu/acre higher than average with good test weights, and grain protein levels were a bit below average. (Tables 1 thru 4) The harvest was about three weeks later than normal.

All off station plots were harvested and the data are presented in Tables 5 thru 8. The Cut Bank and Devon plots had stripe rust until shortly after heading when precipitation decreased and the temperature increased. The winter wheat plots at the Knees and Pendroy were farmer sprayed for rust.

Top yielding varieties at the Cut Bank were WB-Quake, MT0871, and Yellowstone. Judee, Yellowstone, and MT0871 were the high yielding varieties at Devon. Top yielders at the Knees include MT0871, Yellowstone, and MTCL1067, with Yellowstone, MT0871, and MTCL1068 being the top yielders at Pendroy. Yellowstone was in the top three at all off station locations.

Off station cooperators: Bradley Farms, north of Cut Bank, MT
Brian Aklestad, north of Devon, MT
Aaron Killion, east of Brady, MT
Lindsey Martin, northeast of Choteau

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.

Bearpaw (MSU, 2011): Awned, white-glumed, solid-stem (stem solidness score = 21.8), semi-dwarf hard red winter wheat. Maturiety similar to CDC Falcon, and a day earlier than Genou and Rampart. About 3.5 inches shorter than Genou and Rampart, with yields similar to CDC Falcon and higher than Genou and Rampart. Susceptible to strip and leaf rust. Resistant to prevalent races of stem rust and UG99.

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.

Decade (MSU/NDSU, 2009): White chaffed, hard red winter wheat, with winter hardiness almost equal to Jerry. High yield potential, medium to high test weight, early maturity, and medium to high grain 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.

Judee (MSU, 2011): Awned, white-glumed, solid-stem (stem solidness score = 20.1), semi-dwarf hard red winter wheat with good straw strength. Maturiety similar to CDC Falcon, and a half day earlier than Genou and Rampart. About 2.5 inches shorter than Genou and Rampart, with yields similar to CDC Falcon and higher than Genou and Rampart. Winter hardiness is medium to low. Susceptible to prevalent races stem and leaf rust, but is resistant to stripe rust.

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): Winterhardiness 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. Winterhardiness is marginal (2-). Should not be grown in areas where high levels of winterhardiness 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. Winterhardiness = 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). Winterhardiness = 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. Winterhardiness 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 winterhardiness are needed unless protected by stubble. See Genou.

Wahoo (Nebr & Wyo, 2000): Winterhardiness = 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. Winterhardiness = 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): Winterhardiness = 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. Winterhardiness 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. Winterhardiness = 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. Winterhardiness = 2. Medium stiff straw. Medium coleoptile. Very late maturity. Yield similar to NuWest. Low test weight.

NuDakota (AgriPro, 2005): Hard white. Winterhardiness = 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. Winterhardiness = 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 kernal/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. Winterhardiness 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. 2011 Intrastate Winter Wheat Variety Nursery, Western Triangle Ag. Research Center, Conrad, MT.

Variety and Class	Source	Solid Stem score*	Yield bu/ac	Test weight lb/bu	Heading date Julian	Plant height in	Protein %
SY Wolf	Syngenta (AgriPro), 2010		109.7	63.5	176.6	33.9	10.3
MT0871			105.4	61.0	179.0	37.2	9.3
MTW08168			104.0	61.0	182.7	40.2	10.3
MT08146			103.9	6038	179.4	35.6	9.0
Art	AgriPro, 2007		102.8	63.0	174.6	34.4	10.0
MTS0819		17.5	102.2	62.7	178.6	33.6	9.8
Pryor	WestBred, 2002		102.1	63.5	179.7	34.1	9.6
Robidoux	Nebraska, 2010		101.6	63.8	174.3	35.6	9.7
Settler CL	Nebraska (SD, WY), 2008		101.6	62.5	174.5	32.9	9.8
McGill	Nebraska, 2010		101.5	62.0	174.7	37.5	8.9
MT0954			101.3	62.1	178.9	38.4	9.3
Yellowstone	Montana, 2005		100.9	60.7	180.0	38.3	9.1
MT08189			100.8	61.6	180.7	37.6	9.6
MT0866			100.2	63.8	179.0	38.5	11.0
MT08172			99.7	59.2	180.7	36.8	9.7
Promontory	Utah, 1990		99.5	63.7	179.0	36.1	9.3
MT0978			99.4	61.7	179.7	36.6	10.3
Overland	Nebraska, 2007		99.0	63.5	176.5	38.0	10.0
MT0990			97.8	61.8	180.9	37.5	9.5
Judee	Montana, 2011	21.3	97.4	64.1	175.4	35.2	9.2
Jagalene	AgriPro, 2002		96.9	64.5	176.1	35.4	9.9
Broadview	Alberta, 2009		96.8	62.1	178.1	35.0	9.8
MTCL1068			95.6	61.1	178.8	38.5	9.6
MTCL1067			95.5	60.9	178.5	38.2	10.2
Accipiter	Saskatchewan, 2008		95.2	62.8	179.5	36.6	8.7
Curlew	Utah, 2009		94.7	62.2	177.9	38.5	10.0
MTS0808		21.3	94.2	62.2	178.0	36.2	10.1
Wahoo	Nebraska, 2001		93.3	60.8	176.3	36.7	9.5
Decade	Montana/North Dakota, 2010		91.6	61.6	174.9	34.1	10.9
Carter	WestBred, 2006	11.4	91.2	63.4	177.5	33.6	10.1
WB-Matlock	WestBred, 2010		90.8	63.4	179.3	39.8	11.0
Bearpaw	Montana, 2011	19.7	90.5	61.5	176.7	33.1	10.1
Ledger	WestBred, 2004	6.0	89.4	62.4	176.2	34.2	9.8
MTS0832		18.5	89.4	61.0	180.3	39.6	10.0
CDC Falcon	Sask/WestBred, 1999	5.8	89.2	61.9	178.5	33.6	9.7

Table 1 continued on next page

Variety and Class	Source	Solid Stem score*	Yield bu/ac	Test weight lb/bu	Heading date Julian	Plant height in	Protein %
Norris (CL)	Montana/WestBred, 2005		89.1	62.3	175.6	38.6	10.9
Boomer	WestBred, 2009		89.0	61.5	179.1	35.7	9.2
Rediant	Alberta, 2002		87.6	61.1	178.8	38.4	10.2
WB-Quake	WestBred, 2011	18.9	87.1	62.9	179.8	35.1	9.5
Hyalite (CL, HWW)	Montana/WestBred, 2005		86.0	62.0	174.8	37.5	9.5
Peregrine	Saskatchewan, 2008		85.2	62.5	178.8	42.5	10.6
Jerry	North Dakota, 2001		85.0	61.6	178.7	41.2	10.3
Genou	Montana, 2004	17.3	84.1	63.4	178.5	38.7	10.5
MTS0826		22.6	82.6	62.2	180.9	38.0	11.2
AP 503 CL2	Agripro, 2007		82.4	63.7	175.1	32.3	10.1
BZ9WM07-1516			79.9	62.2	173.6	29.1	11.0
MTCL1003		23.1	78.8	60.2	178.2	38.5	10.4
Rampart	Montana, 1996	20.3	76.3	63.1	178.4	39.2	11.5
Bynum (CL)	Montana/WestBred, 2005	18.5	72.8	62.6	176.9	36.8	11.9
Average		17.3	93.7	62.2	177.9	36.6	10.0
LSD (0.05)		4.5	10.9	1.3	1.6	1.9	
C. V. (%)		15.4	6.6	1.3	0.5	3.1	
P-value (Varieties)		<.0001	<.0001	<.0001	<.0001	<.0001	

Planted: 9/27/2010 on conventional fallow and harvested on 8/22/2011.
Fertilized with actual pounds/a of N-P-K: 150-22.5-20.
* Solid stem score of 19 or higher is generally required for reliable sawfly resistance.
HWW = Hard White Wheat
CL = Clearfield System

Table 2. 2011 Intrastate Winter Wheat Variety Test Condensed list, Western Triangle Ag. Research Center, Conrad, MT.

Variety and Class	Source	Solid stem score*	Yield bu/ac	Test weight lb/bu	Heading date Julian	Plant height in	Protein %
SY Wolf	Syngenta (AgriPro), 2010		109.7	63.5	176.6	33.9	10.3
Art	AgriPro, 2007		102.8	63.0	174.6	34.4	10.0
Pryor	WestBred, 2002		102.1	63.5	179.7	34.1	9.6
Robidoux	Nebraska, 2010		101.6	63.8	174.3	35.6	9.7
Settler CL	Nebraska (SD, WY), 2008		101.6	62.5	174.5	32.9	9.8
McGill	Nebraska, 2010		101.5	62.0	174.7	37.5	8.9
Yellowstone	Montana, 2005		100.9	60.7	180.0	38.3	9.1
Promontory	Utah, 1990		99.5	63.7	179.0	36.1	9.3
Overland	Nebraska, 2007		99.0	63.5	176.5	38.0	10.0
Judee	Montana, 2011	21.3	97.4	64.1	175.4	35.2	9.2
Jagalene	AgriPro, 2002		96.9	64.5	176.1	35.4	9.9
Broadview	Alberta, 2009		96.8	62.1	178.1	35.0	9.8
MTCL1068			95.6	61.1	178.8	38.5	9.6
MTCL1067			95.5	60.9	178.5	38.2	10.2
Accipiter	Saskatchewan, 2008		95.2	62.8	179.5	36.6	8.7
Curlew	Utah, 2009		94.7	62.2	177.9	38.5	10.0
MTS0808		21.3	94.2	62.2	178.0	36.2	10.1
Wahoo	Nebraska, 2001		93.3	60.8	176.3	36.7	9.5
Decade	Montana/North Dakota, 2010		91.6	61.6	174.9	34.1	10.9
Carter	WestBred, 2006	11.4	91.2	63.4	177.5	33.6	10.1
WB-Matlock	WestBred, 2010		90.8	63.4	179.3	39.8	11.0
Bearpaw	Montana, 2011	19.7	90.5	61.5	176.7	33.1	10.1
Ledger	WestBred, 2004	6.0	89.4	62.4	176.2	34.2	9.8
MTS0832		18.5	89.4	61.0	180.3	39.6	10.0
CDC Falcon	Sask/WestBred, 1999	5.8	89.2	61.9	178.5	33.6	9.7
Norris (CL)	Montana/WestBred, 2005		89.1	62.3	175.6	38.6	10.9
Boomer	WestBred, 2009		89.0	61.5	179.1	35.7	9.2
Rediant	Alberta, 2002		87.6	61.1	178.8	38.4	10.2
WB-Quake	WestBred, 2011	18.9	87.1	62.9	179.8	35.1	9.5
Hyalite (CL, HWW)	Montana/WestBred, 2005		86.0	62.0	174.8	37.5	9.5
Peregrine	Saskatchewan, 2008		85.2	62.5	178.8	42.5	10.6
Jerry	North Dakota, 2001		85.0	61.6	178.7	41.2	10.3
Genou	Montana, 2004	17.3	84.1	63.4	178.5	38.7	10.5

Table 2 continued on next page

Variety and Class	Source	Solid stem score*	Yield bu/ac	Test weight lb/bu	Heading date Julian	Plant height in	Protein %
AP 503 CL2	Agripro, 2007		82.4	63.7	175.1	32.3	10.1
MTCL1003		23.1	78.8	60.2	178.2	38.5	10.4
Rampart	Montana, 1996	20.3	76.3	63.1	178.4	39.2	11.5
Bynum (CL)	Montana/WestBred, 2005	18.5	72.8	62.6	176.9	36.8	11.9
Mean			93.7	62.2	177.9	36.6	10.0
LSD (0.05)			10.9	1.3	1.6	1.9	
C. V. (%)			6.6	1.3	0.5	3.1	
P-value (Varieties)			<0.0001	<0.0001	<0.0001	<0.0001	

Planted: 9/27/2010 on conventional fallow and harvested on 8/22/2011.
Fertilized with actual pounds/a of N-P-K: 150-22.5-20.
* Solid stem score of 19 or higher is generally required for reliable sawfly resistance.
HWW = Hard White Wheat
CL = Clearfield System

Table 3. Six-year averages, Winter Wheat varieties, Western Triangle Ag. Research Center, Conrad, MT. 2006 - 11.

Variety	Source	Class	Solid stem* score	6-Year Average Yield bu/a	Test wt	Height in.	Head date	Protein %	Winter survival class
Decade				79.3	61.7	32	167	12.1	
Pryor	WestBred			79.2	62.7	31	169	10.4	3
Wahoo	Nebraska			78.7	60.2	33	165	11.4	3
Judee	MSU		21.3	78.0	63.2	32	167	11.5	
Yellowstone	MSU			76.2	61.2	34	170	11.2	4
Norris	WestBred	CL		75.7	62.0	35	166	12.0	3
Bearpaw	MSU		19.7	75.1	61.7	30	168	11.8	
Ledger	WestBred		6.0	74.1	62.5	31	168	11.5	2
Genou	MSU		17.3	73.8	62.0	36	169	12.0	2
Jagalene	AgriPro			73.8	63.8	31	167	11.8	2
Falcon	WestBred		5.8	73.2	62.2	30	169	11.4	4
Hyalite	WestBred	CL HW		73.0	61.4	34	166	12.1	3
Carter	WestBred		11.4	72.6	62.2	29	167	12.0	3
Promontory	Utah			70.0	62.8	34	169	11.0	2-
Jerry	N. Dakota			66.6	61.2	37	169	12.1	5
Rampart	MSU		20.3	66.4	62.0	34	169	12.7	2-
Bynum	WestBred	CL	18.5	64.8	61.7	34	167	13.3	2
Mean				74.0	62.0	32.8	167.7	11.8	

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.

Table 4. 2011 Advanced Yield Nursery, Western Triangle Ag. Research Center, Conrad, MT.

ID or Variety	Yield bu/ac	Test weight lb/bu	Heading date Julian	Plant height in	Lodging %	Protein %
MT08177	123.7	61.1	179	36.1	0.0	11.4
MT0994	121.5	57.8	177	38.2	7.0	10.6
MT08172	118.9	59.9	176	37.3	1.1	12.0
MT08181	118.2	59.0	177	37.0	0.9	11.4
MT0977	115.9	60.2	178	35.6	0.9	11.6
MT08146	114.8	57.4	178	36.1	1.9	12.9
MT08189	114.8	60.0	178	36.5	1.5	11.8
MT08136	114.2	58.3	176	36.9	1.7	11.6
MT0951	113.2	60.3	174	37.3	3.3	11.8
MT0978	111.6	60.0	177	35.1	1.4	11.5
MT0972	111.5	61.2	179	32.6	0.7	12.4
MT0966	109.8	59.0	177	37.7	2.6	11.9
MT0993	109.6	59.3	178	35.6	0.9	12.2
Yellowstone	109.3	59.9	176	37.4	1.0	12.0
MT0948	107.8	59.8	177	36.9	3.9	12.2
MT0950	107.4	61.4	175	37.1	10.8	12.1
MT0990	107.2	60.1	178	34.8	0.0	11.6
MT08186	106.5	59.3	177	35.3	1.8	12.0
MT08180	106.3	61.6	179	34.8	1.0	11.7
MTS0921	104.7	60.6	181	35.7	1.5	12.4
MTS0924	103.9	58.5	178	34.3	1.9	12.3
MTCL1001	103.9	59.1	178	36.0	0.6	11.7
MTS0919	103.4	60.8	179	40.8	0.0	11.8
MTS0901	102.6	59.5	178	42.0	10.1	12.9
MTW08168	102.3	60.6	179	40.2	2.7	11.6
CDC Falcon	101.8	60.5	175	31.7	0.2	12.0
MT0954	100.5	59.4	177	38.2	5.6	11.2
MT0974	100.4	61.4	176	39.2	12.6	13.1
MTW0981	100.2	59.7	176	36.4	5.6	12.1
Genou	99.5	59.4	175	38.4	8.8	12.8
MT0949	96.0	60.6	175	36.1	3.3	12.3
MTW0980	94.4	58.5	175	32.7	22.5	12.0
MTS0915	93.7	60.6	176	36.0	22.3	12.6
MTS0925	92.6	56.8	178	34.0	1.1	13.0
MTS0916	88.6	59.0	176	32.1	0.9	12.4
Jagalene	86.9	59.4	177	33.5	1.2	12.6

Table 4 continued on next page

ID or Variety	Yield bu/ac	Test weight lb/bu	Heading date Julian	Plant height in	Lodging %	Protein %
Average	106.0	59.7	177.1	36.3	3.9	12.0
LSD (0.05)	11.7	1.6		1.9	11.1	
C.V. (%)	6.1	1.5		2.9	165	
P-value (Varieties)	<.0001	<.0001		<.0001	0.0064	

Planted: 9/27/2010 on conventional fallow and harvested on 8/22/2011.
Fertilizer, actual pounds/a of N-P-K: 150-22.5-20.

Table 5. Off-station winter wheat variety trial (Exp. 3864) located north of Cut Bank, MT. Glacier county. Western Triangle Ag. Research Center. 2011.

Cultivar	Stem Solidness Score*		Yield bu/ac	Test weight lb/bu	Plant height in	Protein %
WB-Quake	18.9	+	103.8	61.8	33.7	12.3
MT0871		+	101.5	60.5	33.0	12.1
Yellowstone			97.6	59.2	34.0	11.3
Judee (MTS0713)	21.3		96.6	62.9	30.0	12.3
MT S0808	21.3	+	92.7	61.0	31.0	13.7
AP 503 CL2		+	84.7	58.6	29.7	12.2
MTCL1067		+	83.8	58.4	37.0	12.1
MTCL1068		+	83.1	56.6	34.7	11.7
Rampart	20.3		78.0	59.7	36.0	12.5
Jagalene			75.0	58.1	33.3	11.5
MT S0826	22.6		71.8	58.1	34.7	11.8
CDC Falcon			67.4	59.0	27.7	11.3
Bearpaw (MTS0721)	19.7		65.3	55.0	30.3	12.1
Bynum (CL)	18.5		63.5	61.5	32.7	12.4
Ledger			61.2	56.6	30.0	11.2
Accipiter			58.9	56.2	30.3	11.4
Decade			57.4	53.5	29.3	12.8
Genou	17.3		57.2	58.0	32.3	11.5
Norris (CL)			56.8	55.9	34.3	12.3
Pryor			55.3	52.7	29.0	12.0
MTCL1003	23.1	+	49.7	53.4	36.0	12.2
Jerry			46.9	50.8	37.0	11.9
Wahoo			45.6	48.7	31.0	11.6
MT S0832	18.5		42.1	51.3	33.7	11.9
Average			70.7	57.0	32.5	12.0
LSD (0.05)			10.9	3.1	2.5	
C.V. (%)			9.4	3.4	4.6	
P-value (Varieties)			<0.0001	<0.0001	<0.0001	

Cooperator and Location: Bradley Farms, northern Glacier county.
Planted: October 4, 2010 on chem-fallow Harvested: September 28, 2011
Fertilizer, actual lbs/a: 161-20-20; 11-52-0 applied with seed and urea blended with potash were topdressed on 6/6/2011. Soil test values, Table 34.
Sprayed with Huskie at 11 oz/a and Axial XL at 16.4 oz/a on 6/13/2011.
Precipitation from 5/11/2011 until harvest was: 6.75 inches.
* = Solid stem sawfly-resistant (solid stem score of 19 or higher) and were determined at the on station intrastate winter wheat nursery. + = New to off station trial for 2010.
Conducted by MSU Western Triangle Ag. Research Center.

Table 6. Off-station winter wheat variety trial (Exp. 3865) located north of Devon, MT. Toole county. Western Triangle Ag. Research Center. 2011.

Cultivar	Stem Solidness Score*		Yield bu/ac	Test weight lb/bu	Plant height in	Protein %	Lodging %
Judee (MTS0713)	21.3		42.9	58.1	26.0	12.7	1.7
Yellowstone			39.9	56.3	25.7	12.5	10.0
MT0871		+	38.4	56.6	24.3	12.0	10.0
WB-Quake	18.9	+	38.2	58.3	26.0	13.8	0.7
MTCL1067		+	38.1	56.4	27.7	12.7	16.7
Bearpaw (MTS0721)	19.7		37.4	59.1	23.7	12.6	0.0
MT S0826	22.6		36.4	58.0	26.3	13.2	0.0
CDC Falcon			34.6	58.0	22.7	12.5	5.7
Accipiter			34.3	56.8	24.0	12.7	6.0
Jerry			32.8	57.5	27.3	12.4	10.0
Decade			32.7	57.4	24.3	12.8	6.7
MTS0808	21.3	+	32.3	57.7	23.3	13.1	0.0
Jagalene			32.2	58.9	26.3	12.4	23.3
MTCL1068		+	32.0	53.5	27.3	12.6	20.0
Genou			29.2	59.0	27.0	12.5	0.7
Wahoo			28.9	54.4	25.0	12.7	12.3
MT S0832	18.5		28.2	55.2	28.3	11.8	0.0
MTCL1003	23.1	+	26.8	55.7	27.0	12.8	0.0
Bynum (CL)	18.5		26.6	59.0	27.7	13.3	0.7
AP 503 CL2		+	26.5	58.2	25.3	13.7	18.3
Rampart	20.3		24.8	57.8	26.3	13.2	0.0
Ledger			24.0	59.5	24.0	12.1	0.0
Pryor			21.5	57.1	24.7	12.2	4.0
Norris (CL)			21.4	56.5	25.0	12.1	13.3
Average			31.7	57.3	25.6	12.7	6.7
LSD (0.05)			10.3	2.3	2.6		6.4
C.V. (%)			19.9	2.5	6.1		58.4
P-value (Varieties)			0.0022	0.0002	0.0008		<.0001

Cooperator and Location: Brian Aklstad Farm, Toole county.
Planted: October 5, 2010 on chem-fallow. Harvested: August 16, 2011
Fertilizer, actual lbs/a: 161-22-20; 11-52-0 applied with seed and urea blended with potash were topdressed on 5/20/2011. Soil test values, Table 34.
Sprayed with Huskie at 11 oz/a and Axial XL at 16.4 oz/a on 6/13/2011.
Precipitation from 4/27/2011 until harvest was: 10.15 inches.
* = Solid stem sawfly-resistant (solid stem score of 19 or higher) and were determined at the on station intrastate winter wheat nursery. + = New to off station trial for 2010.
Conducted by MSU Western Triangle Ag. Research Center.

Table 7. Off-station winter wheat variety trial (Exp. 3862) located at the Knees. Chouteau
county. Western Triangle Ag. Research Center. 2011.

Cultivar	Stem Solidness Score*		Yield bu/ac	Test weight lb/bu	Plant height in	Protein %	Lodging %
MT0871		+	65.6	58.2	31.0	12.9	2.7
Yellowstone			62.6	58.4	36.0	13.4	6.0
MTCL1067		+	62.5	58.3	36.7	13.0	5.0
MT S0808	21.3	+	60.7	59.3	32.3	12.9	1.7
CDC Falcon			54.9	58.8	31.0	13.4	5.0
MTCL1068		+	54.8	55.7	36.0	13.4	8.3
WB-Quake	18.9	+	54.7	58.5	34.0	13.3	6.0
Judee (MTS0713)	21.3		52.5	59.7	28.3	14.0	8.3
Bearpaw (MTS0721)	19.7		52.3	58.8	33.3	13.2	10.0
MT S0826	22.6		51.2	59.5	34.7	13.9	4.3
Ledger			51.1	59.5	31.3	12.6	25.0
Jagalene			51.0	60.4	33.7	12.3	9.3
Rampart	20.3		51.0	59.6	35.0	14.1	5.7
Accipiter			50.8	58.7	34.0	13.7	2.7
AP 503 CL2		+	50.2	59.1	30.7	14.4	14.0
Decade			49.2	58.2	33.3	13.2	2.3
Norris (CL)			49.0	59.5	36.7	12.7	7.7
Bynum (CL)	18.5		48.8	61.1	37.0	13.2	31.0
Pryor			47.9	58.0	31.0	13.9	1.3
Genou	17.3		46.3	58.8	37.0	13.9	10.7
MTCL1003	23.1	+	45.5	57.9	35.0	13.1	3.7
MT S0832	18.5		45.0	57.0	35.7	12.8	1.7
Jerry			44.3	58.1	33.7	13.0	4.7
Wahoo			43.6	56.7	33.7	12.6	3.3
Average			51.9	58.7	33.8	13.3	7.5
LSD (0.05)			4.5	1.2	3.3		12.9
C.V. (%)			5.3	1.2	6.0		104
P-value (Varieties)			<.0001	<.0001	<.0001		0.0044

Cooperator and Location: Aaron Killion, eastern Chouteau county.
Planted: October 1, 2010 on chem-fallow Harvested August 17, 2011
Fertilizer, actual lbs/a: 41-22-20; 11-52-0 applied with seed and urea blended with potash were topdressed on 6/6/2011. Soil test values, Table 34.
Sprayed with Huskie at 11 oz/a and Axial XL at 16.4 oz/a on 6/13/2011. Tebustar was flown on at a rate of 4 oz/a on July 4, 2011 to control rust.
Precipitation, rain gauge cracked.
* = Solid stem sawfly-resistant (solid stem score of 19 or higher) and were determined at the on station intrastate winter wheat nursery. + = New to off station trial for 2010.

Conducted by MSU Western Triangle Ag. Research Center.

Table 8. Off-station winter wheat variety trial (Exp. 3863) located North East of Pendroy, MT. Teton county. Western Triangle Ag. Research Center. 2011.

Cultivar	Stem Solidness Score*	Yield bu/ac	Test weight lb/bu	Plant height in	Protein %
Yellowstone		50.9	60.9	30.3	12.3
MT0871		48.7	60.0	29.0	13.0
MTCL1068		48.7	60.2	30.3	12.3
Wahoo		48.3	60.4	30.7	12.1
Genou	17.3	42.4	61.6	33.3	13.1
MTCL1067		42.1	61.2	29.7	12.0
Decade		42.0	62.1	27.3	13.2
Pryor		42.0	63.1	25.7	12.8
Jagalene		41.6	64.1	29.7	13.4
MT S0826	22.6	41.3	62.1	29.3	13.0
Norris (CL)		40.4	62.3	30.3	12.1
WB-Quake	18.9	39.2	61.8	26.3	13.3
Rampart	20.3	38.4	61.0	31.7	13.0
MTCL1003	23.1	38.2	59.7	29.0	13.3
MT S0832	18.5	38.0	61.1	28.3	13.0
Ledger		37.8	63.0	26.3	12.2
Accipiter		37.7	61.1	26.3	12.9
Jerry		34.6	60.9	28.7	13.0
MT S0808	21.3	34.3	61.4	27.0	13.3
CDC Falcon		34.1	61.0	25.3	13.6
Bynum (CL)	18.5	33.5	62.0	31.3	13.6
Bearpaw (MTS0721)	19.7	33.3	61.8	26.7	13.1
AP 503 CL2		32.7	62.7	26.7	13.3
Judee (MTS0713)	21.3	31.2	61.0	26.3	14.2
Average		39.6	61.5	28.6	13.0
LSD (0.05)		Ns	1.2	2.5	
C.V. (%)		18.2	1.1	5.4	
P-value (Varieties)		0.0563	<.0001	<.0001	

Cooperator and Location: Lindsey Martin, North East Teton county.
Planted: September 30, 2010 on chem-fallow Harvested: August 18, 2011
Fertilizer, actual lbs/a: 150-22-20; 11-52-0 applied with seed and urea blended with potash were top-dressed on 6/6/2011.
Sprayed with Huskie at 11 oz/a and Axial XL at 16.4 oz/a on 6/13/2011. The plot was sprayed with Monsoon at 4 oz/a on 6/25/2011 for rust control.
Precipitation: N/A.
* = Solid stem sawfly-resistant (solid stem score of 19 or higher) and were determined at the on station intrastate winter wheat nursery. + = New to off station trial for 2010.

Conducted by MSU Western Triangle Ag. Research Center.

2011 Spring Wheat & Durum Variety Evaluations Grown In the Western Triangle Area.

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

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

The advanced spring wheat and durum nurseries were planted on fallow and grown under dryland conditions in 2011. Off-station spring wheat variety nurseries were planted on chemical fallow and grown in Teton County near Choteau, Glacier County north of Cut Bank, Choteau County near the Knees and Toole County north of Devon. 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 drowning.

Results: The spring wheat data are presented in Tables 9 -18. The durum nursery data are shown in Tables 19 and 20.

The growing season began with a cool wet spring, followed by a warm dry summer at the Western Triangle Agricultural Research Center. Grain yields were 12 bu/acre higher than the six year average, and grain protein levels were slightly below average with test weights being about the same as the six year average. The spring wheat plants headed later and grew taller than the six year average. Harvest was about three weeks later than normal.

Durum grain yields were almost equal to the six year average, and grain protein levels were 0.4% above average with test weights slightly below the six year average. The durum plants headed 10 days later and grew slightly taller than the six year average (Tables 19 and 20). Tables 21 and 22 are dryland and irrigated Arizona Plant Breeders variety nurseries.

Yields ranged from 25 to 63 bu/acre at the Cut Bank location and 26 to 43 bu/acre north of Devon (Tables 15 and 16). Yields and the Knees ranged from 21 to 45 bu/a. The Choteau location was lost due to drowning.

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 preferred by sawfly (behavioral preference) in small plots.

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.

Duclair (MSU, 2011): Solid stemmed hard red spring wheat, with stem solidness score of 20, slightly less than Choteau and slightly more than Fortuna. Yields were comparable to Choteau, Reeder, and Vida. Maturiety is day earlier than Choteau. Plant heights average about 31 inches. Yields (66 bu/a) tend to be similar to Choteau (65 bu/a), Reeder (66 bu/a) and Vida (68 bu/a). The average test weight is 60 lbs/bu, with grain protein averaging 13.7%. Duclair showed good resistance to stripe rust at Kalispell in 2010.

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 Far-go. 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.

WB Gunnison (WestBred): Gunnison is intended to replace Conan and Corbin acres. Gunnison is hollow stemmed, but shows good tolerance to cutting by the wheat stem sawfly. The yield (55) is similar to Corbin and slightly higher than Conan. Average test weight is 60 lbs/bu, with grain protein levels of 13.8%, a bit lower than both Conan and Corbin. Average plant height is 30 inches with similar maturity to Conan and Corbin. Gunnison has moderate resistance to stripe rust.

Hollow-Stem, 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**.

ONeal (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, ONeal, 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 durums 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 9. 2011 Advanced Spring Wheat variety nursery, Conrad Dryland.

Variety	Class	Yield bu/a	Test Wt lb/bu	Height in.	Head date	Protein %
MTHW1069		88.3	59.9	31.6	192	12.6
Choteau	**	80.6	60.4	32.8	189	13.2
VidaWHT1		79.7	61.6	34.8	192	12.7
MT 1053		78.6	60.7	32.3	192	12.7
Duclair	**	78.2	59.9	32.6	189	13.2
MTHW1057		78.1	60.1	34.2	193	12.8
MT 1073		78.1	61.6	30.9	190	13.3
MT 0972		76.3	60.6	34.9	193	12.9
Buckpronto		76.3	59.9	32.3	190	14.1
MT 1007		76.0	62.3	32.2	192	12.3
SY Soren		75.2	60.3	33.2	191	13.8
MT 1016		75.1	60.2	32.7	192	13.3
MT 1008		74.5	59.5	32.8	195	12.5
MTHW1064		74.2	60.3	34.6	191	12.9
CHOTWHT1		72.9	59.3	34.0	191	13.4
Volt		72.5	61.5	31.4	195	13.0
Brennan		72.2	62.3	29.1	190	13.8
LIMAGR2		71.9	60.9	31.7	190	12.4
MT 1027		71.9	59.9	33.7	194	13.2
MT 1049		71.7	60.6	32.2	192	14.3
MT 1028		71.1	59.8	33.0	193	13.7
MT 1035		71.0	59.5	33.5	192	13.6
MT 0928		70.5	60.1	33.3	193	13.3
MTHW1065		70.3	61.4	33.8	190	13.0
AGRIPRO13		70.0	61.6	34.5	189	14.3
MT 1036		69.9	59.7	32.7	193	13.4
MT 1003		69.5	59.8	32.9	193	13.5
Reeder		69.4	60.7	33.5	191	13.8
MT 1020		69.4	59.2	31.7	192	12.9
MT 1002		69.3	57.9	32.8	193	13.1
Kuntz		69.2	60.1	29.8	192	12.8
Corbin	*	68.9	58.6	33.2	192	14.7
MTWT1060		68.8	59.8	31.6	189	12.8
MT 1030		68.5	60.4	34.1	194	12.9
MT 1015		68.2	59.2	31.1	193	13.9
SY Tyra		68.1	59.4	29.3	194	12.0
WB Rockland		68.0	60.6	24.4	190	14.6

Table 9 continued on next page

Variety		Yield	Test Wt	Height	Head	Protein
Kelby		67.1	61.3	28.7	191	13.6
MT 1038		66.9	60.0	33.1	193	13.0
McNeal		66.8	59.4	34.0	192	13.1
MT 1072		66.6	59.1	32.1	191	13.4
Vida	*	66.4	59.8	33.8	193	12.5
MT 1005		66.4	59.7	33.0	192	13.2
MT 0802		66.2	59.6	34.3	194	13.6
Breaker		66.0	61.5	33.4	193	13.6
MT 1004		65.4	58.9	32.2	194	14.0
WB Gunnison	*	65.2	59.5	30.3	192	13.3
AGRIPRO11		64.9	59.2	30.4	193	13.6
ONeal	*	64.9	59.6	32.4	193	13.8
MT 1013		63.9	59.8	32.0	191	13.3
MT 1010		63.7	59.1	33.5	193	13.4
AP604 CL		63.3	60.4	32.3	191	14.0
MT 0967		62.7	60.8	32.5	189	14.1
Fortuna	**	62.6	61.3	39.4	194	13.6
IMICHT79		62.5	59.4	30.8	192	13.9
Conan	*	62.1	60.3	31.7	192	13.1
Vantage		62.1	62.5	32.7	197	14.6
MT 1011		60.2	57.4	30.5	191	14.2
HANKWHT1		59.3	55.0	29.6	189	14.4
MT 0852		58.8	58.6	34.0	192	13.4
Hank		58.8	56.3	30.4	190	13.3
Mott		58.3	58.8	37.4	194	13.9
Jedd	CL	56.8	58.1	27.7	191	13.1
Thatcher		46.4	56.4	40.9	197	13.8
Mean		68.7	59.8	32.5	192	13.4
LSD (.05)		11.6	1.9	2.2	1.8	
C.V (%)		9.7	1.8	4.0	0.6	

Planted May 3, 2011. Harvested September 11, 2011.
Fertilizer, actual: 150-22.5-20.
Sprayed with Huskie @ 11 oz/a and Axial @ 16.4 oz/a on 6/17/2011 using a spray volume of 10 gal/a.
Growing season ppt.: 10.2 inches.
** = Solid stem sawfly-resistant (solid stem score of 19 or higher). * = Less preferred by sawfly (behavioral preference) in small plots.
Location: MSU Western Triangle Ag Research Center, Conrad, MT

Table 10. 2011 Advanced Spring Wheat variety nursery, Conrad Dryland. Condensed List

Variety	Class	Yield bu/a	Test Wt lb/bu	Height in.	Head date	Protein %
Choteau	**	80.6	60.4	31.6	189	13.2
Duclair	**	78.2	59.9	32.6	189	13.2
Volt		72.5	61.5	31.4	195	13.0
Brennan		72.2	62.3	29.1	190	13.8
Reeder		69.4	60.7	33.5	191	13.8
Kuntz		69.2	60.1	29.8	192	12.8
Corbin	*	68.9	58.6	33.2	192	14.7
SY Tyra		68.1	59.4	29.3	194	12.0
WB Rockland		68.0	60.6	24.4	190	14.6
Kelby		67.1	61.3	28.7	191	13.6
McNeal		66.8	59.4	34.0	192	13.1
Vida	*	66.4	59.8	33.8	193	12.5
WB Gunnison	*	65.2	59.5	30.3	192	13.3
ONeal	*	64.9	59.6	32.4	193	13.8
AP604 CL	CL	63.3	60.4	32.3	191	14.0
Fortuna	**	62.6	61.3	39.4	194	13.6
Conan	*	62.1	60.3	31.7	192	13.1
Hank		58.8	56.3	30.4	190	13.3
Mott		58.3	58.8	37.4	194	13.9
Jedd	CL	56.8	58.1	27.7	191	13.1
Thatcher		46.4	56.4	40.9	197	13.8
Mean		65.9	59.7	32.1	192	13.4

Planted April 5, 2010. Harvested September 11, 2010.
Fertilizer, actual: 150-22.5-20.
** = Solid stem sawfly-resistant (solid stem score of 19 or higher). * = Less preferred by sawfly (behavioral preference) in small plots. CL = Clearfield System.
Location: MSU Western Triangle Ag Research Center, Conrad, MT.

Table 11. Six-year averages, dryland Spring Wheat varieties, Conrad area, Pondera Co. 2006 - 2011.

Variety	Source	Class	6-Year Average				
			Yield bu/a	Test Weight	Height in.	Head date	Protein %
Duclair	MSU	**	65.7	59.9	32	181	13.8
Choteau	MSU	**	63.8	60.1	30	183	14.0
Vida	MSU	*	61.4	60.0	32	184	13.3
WB Gunnison	WestBred	*	60.5	60.6	30	182	13.5
Oneal	WestBred	*	60.3	60.7	31	184	13.6
Corbin	WestBred	*	59.0	59.6	32	182	14.0
Reeder	N. Dak.		56.6	60.6	32	183	14.1
McNeal	MSU		56.5	59.6	33	184	13.5
Hank	WestBred		54.5	58.5	30	182	13.7
Kuntz	AgriPro		54.4	60.8	29	183	13.3
Volt	WestBred		54.2	62.3	29	186	13.5
Jedd	WestBred	CL	54.1	60.6	27	182	13.3
Conan	WestBred	*	54.0	60.5	30	183	13.9
Kelby	AgriPro		51.6	61.9	28	181	14.6
AP604 CL	AgriPro	CL	51.6	61.4	31	181	14.4
Fortuna		**	50.3	60.6	38	184	14.1
Mean			56.5	60.5	31	183	13.8

** = Solid stem sawfly-resistant (solid stem score of 19 or higher). * = Less preferred by sawfly (behavioral preference) in small plots. CL = Clearfield System (2-gene). HW = Hard White
Location: MSU Western Triangle Ag. Research Center, Conrad, MT.

Table 12. 2011 Irrigated Spring Wheat variety trial, Conrad, MT.

Variety	Class	Yield bu/a	Test Wt lb/bu	Height in.	Head date	Protein %
Duclair	**	90.3	62.0	31.3	196	13.7
WB Gunnison	*	85.0	61.8	32.0	199	12.6
SY Tyra		81.9	62.8	31.0	200	12.2
Volt		81.2	63.2	31.3	201	13.2
IMICHT79		80.8	61.2	33.0	199	13.4
Kuntz		77.5	62.4	30.3	199	12.5
Corbin	*	76.9	63.3	31.7	198	13.2
ONeal	*	71.8	61.5	34.3	199	12.2
AP 604CL		71.8	63.5	32.7	197	12.7
Choteau	**	71.6	61.5	32.0	197	14.2
McNeal		70.7	61.7	34.0	199	11.9
Vida	*	69.6	61.6	33.0	199	12.6
Hank		69.3	60.4	29.3	196	12.1
Jedd	CL	68.5	61.6	27.0	197	11.5
Fortuna	**	67.0	63.0	40.0	200	13.3
Reeder		66.1	62.8	33.7	199	12.7
Conan	*	66.1	61.4	32.0	198	12.9
Kelby		61.6	62.4	26.7	195	14.3
Outlook		55.4	60.5	36.0	199	13.7
Mott		54.8	61.8	35.7	198	11.8
mean		71.9	62.0	32.4	198	12.8
LSD (.05)		11.5	0.9	2.14	1.8	
C.V. (s/mean)*100		9.7	0.9	4.01	0.5	

Planted May 14, 2011 on fallow. Harvested September 23, 2011.
Fertilizer, actual: 221-22.5-20, 11-52-0 placed with seed, Urea and potash broadcast on 5/19/2011.
Sprayed with: Huskie @ 11 oz/a and Axial @ 16.4 oz/a on 6/18/11.
Total precipitation from planting to harvest: 10.34 inches with 8.75 inches irrigation water applied.
** = Solid stem sawfly-resistant (solid stem score of 19 or higher). * = Less preferred by sawfly (behavioral preference) in small plots.
Location: MSU Western Triangle Ag Research Center, Conrad, MT

Table 13. Five-year averages, irrigated Spring Wheat varieties, Conrad area, Pondera County. 2004 - 07 and 2009 -2010.

Variety	Source	Class	5-Year Average				
			Yield bu/a	Test wt.	Height in.	Head date	Protein %
Choteau	MSU	**	85.9	61.8	33	183	14.1
Hank	WestBred		83.3	60.0	32	181	14.2
Vida	MSU	*	79.1	60.5	34	183	14.2
Reeder	ND		75.2	61.7	36	182	14.6
Outlook	MSU		73.0	60.0	35	184	13.8
McNeal	MSU		74.2	60.7	35	183	14.1
Conan	WestBred	*	71.8	60.9	33	182	14.0
Freyr	AgriPro		66.7	62.0	35	182	14.5
Fortuna	ND	**	65.3	61.7	41	182	14.5
Corbin	WestBred	*	77.2	61.5	36	181	14.0
nursery mean			75.2	61.1	35	182	14.2

** = Solid stem sawfly-resistant (solid stem score of 19 or higher). * = Less preferred by sawfly (behavioral preference) in small plots.
Location: MSU Western Triangle Ag. Research Center, Conrad, MT.

Table 14. Off-station spring wheat variety trial located north of Cut Bank, MT. Glacier county. Western Triangle Ag. Research Center. 2011.

Variety	Class	Yield bu/a	Test Wt lb/bu	Height in.	Protein %
Volt		62.7	62.8	31.7	13.3
Choteau	**	56.9	55.4	31.0	14.0
Kelby		55.0	60.6	31.7	14.1
AP604CL	CL	55.0	59.8	34.0	12.9
WB Gunnison	*	54.2	59.2	31.0	12.7
Corbin	*	51.7	57.3	32.3	13.2
Kuntz		51.3	56.6	33.0	13.1
Reeder		46.4	58.0	32.3	13.4
Vida	*	46.3	54.6	32.3	14.3
IMICHT79		46.1	55.7	30.3	13.8
Duclair	**	45.9	51.6	32.3	14.6
Conan	*	43.4	55.4	29.7	13.6
Fortuna	**	42.4	60.9	36.3	13.2
Mott		41.6	58.0	35.7	13.3
SY Tyra		40.5	52.3	28.7	12.8
Outlook		38.5	50.4	32.3	13.7
ONeal	*	34.5	50.1	33.0	15.6
Hank		30.7	48.4	30.0	15.6
McNeal		29.7	50.8	31.0	13.9
Jedd	CL	25.2	46.8	27.0	15.2
mean		44.9	55.2	31.8	13.8
LSD (.05)		10.7	2.2	4.1	
C.V. 1 (%) (S/mean)*100		14.4	2.4	4.8	

Cooperator and Location: Bradley Farms, northern Glacier county.
Planted May 11, 2011 on chem-fallow. Harvested September 28, 2011.
Fertilizer, actual lbs/a: 11-22.5-0 with seed at planting, topdressed with 150-0-20 on 6/6/2011. Soil test values, Table 34.
Sprayed with Huskie at 11 oz/a and Axial XL at 16.4 oz/a on 6/22/2011.
Precipitation from 5/11/2011 until harvest was: 6.75 inches.
** = Solid stem sawfly-resistant (solid stem score of 19 or higher). * = Less preferred by sawfly (behavioral preference) in small plots.
Conducted by MSU Western Triangle Ag. Research Center.

Table 15. Five-year averages, Spring Wheat varieties, Cut Bank area, northern Glacier County. 2007-2011.

Variety	Class	5-Year Average			
		Yield bu/a	Test weight	Height in.	Protein %
Choteau	**	61.1	58.4	29.2	14.3
Corbin	*	57.3	59.4	31.4	13.8
Vida	*	57.0	56.5	32.3	14.3
Reeder		52.5	57.8	31.7	14.2
Fortuna	**	51.7	60.8	37.7	13.9
Outlook		51.2	55.3	31.1	13.9
Hank		51.0	55.7	30.0	14.4
Conan	*	50.4	56.7	29.7	14.5
McNeal		46.2	56.1	31.4	14.0
average		53.5	57.4	31.6	14.2

** = Solid stem sawfly-resistant (solid stem score of 19 or higher). * = Less preferred by sawfly (behavioral preference) in small plots.
Cooperator and Location: Bradley Farms, northern Glacier County.
Conducted by MSU Western Triangle Ag. Research Center.

Table 16. Off-station spring wheat variety trial located north of Devon.
Eastern Toole county. Western Triangle Ag. Research Center. 2011.

Variety	Class	Yield bu/a	Test Wt lb/bu	Height in.	Protein %	Lodging %
Volt		42.5	61.9	25.3	13.2	6.7
Fortuna	**	41.9	60.0	32.0	13.2	6.7
WB Gunnison	*	41.4	58.1	26.0	14.6	0.3
Vida	*	40.8	58.2	26.0	12.2	8.3
Corbin	*	40.0	57.5	26.7	13.3	6.0
IMICHT79		37.8	58.4	25.0	14.3	4.0
Duclair	**	36.4	54.8	26.7	12.8	4.7
Conan	*	36.0	59.5	25.3	15.4	5.0
ONeal	*	35.8	57.9	27.3	14.7	3.7
Outlook		35.3	56.0	26.7	14.2	4.3
Choteau	**	34.8	57.9	23.3	13.3	7.3
Reeder		34.4	57.2	26.0	14.6	5.7
AP604CL	CL	33.4	57.7	26.7	15.5	6.7
Kuntz		32.8	57.1	24.0	12.9	6.7
Mott		32.7	58.3	27.3	13.7	1.0
Jedd	CL	32.0	58.2	22.3	13.8	5.3
Kelby		31.8	61.2	22.7	14.2	5.0
McNeal		31.6	56.6	27.0	15.2	13.3
Hank		30.2	55.7	25.3	15.2	7.7
SY Tyra		25.7	56.3	21.7	12.9	10.0
mean		35.4	57.9	25.7	14.0	5.9
LSD (.05)		5.6	2.3	1.4		4.0
C.V. 1 (%) (S/mean)*100		9.6	2.4	3.3		41.3

Cooperator and Location: Brian Aklestad, eastern Toole county.
Planted April 27, 2011 on chem-fallow. Harvested August 16, 2011.
Fertilizer, actual lbs/a: 11-22.5-0 with seed at planting, topdressed with 150-0-20 on 5/20/2011. Soil test values, Table 34.
Sprayed with Huskie at 11 oz/a and Axial XL at 16.4 oz/a on 6/13/2011.
Precipitation from 4/27/2011 until harvest was: 10.15 inches.
** = Solid stem sawfly-resistant (solid stem score of 19 or higher). * = Less preferred by sawfly (behavioral preference) in small plots.
Conducted by MSU Western Triangle Ag. Research Center.

Table 17. Off-station spring wheat variety trial located near the Knees.
Chouteau county. Western Triangle Ag. Research Center. 2011.

Variety	Class	Yield bu/a	Test Wt lb/bu	Height in.	Protein %	Lodging %
Duclair	**	44.6	59.1	26.0	13.9	0.33
Choteau	**	41.3	59.7	24.3	13.8	1.7
IMICHT79		41.0	59.1	25.0	14.2	0.3
Outlook		40.6	57.3	26.3	13.7	3.7
WB Gunnison	*	40.5	59.9	24.7	13.3	1.0
Corbin	*	39.0	59.7	26.0	13.5	0.7
Volt		37.1	61.1	24.3	13.1	12.7
Kelby		36.0	61.9	22.7	14.6	1.3
Vida	*	35.7	60.3	26.7	13.6	2.3
Reeder		34.8	59.5	24.7	14.7	10.0
Mott		34.5	60.0	27.7	13.5	0.7
Fortuna	**	33.9	61.0	32.3	14.0	1.0
Conan		33.4	59.4	24.0	14.0	0.3
McNeal		33.1	57.4	26.7	14.2	40.0
Kuntz		32.2	57.3	23.7	13.3	8.3
AP 604 CL	CL	29.1	59.6	24.3	13.8	11.0
ONeal	*	28.8	57.9	26.0	13.3	3.0
Hank		26.6	55.7	23.0	14.3	3.0
SY Tyra		26.4	55.5	22.0	13.9	1.3
Jedd	CL	21.1	55.9	21.3	14.6	1.3
mean		34.5	58.9	25.1	13.9	5.2
LSD (.05)		3.5	1.1	1.5		7.0
C.V. 1 (%) (S/mean)*100		6.2	1.1	3.6		81.2

Cooperator and Location: Aaron Killion, western Chouteau county.
Planted May 12, 2011 on chem-fallow. Harvested September 6, 2011.
Fertilizer, actual lbs/a: 41-22.5-20; 11-22.5-0 with seed at planting, topdressed with 30-0-20 on 6/6/2011. Soil test values, Table 34.
Sprayed with Huskie at 11 oz/a and Axial XL at 16.4 oz/a on 6/22/2011. Tebustar was flown on at a rate of 4 oz/a on July 4, 2011 to control rust.
Precipitation, rain gauge cracked.
** = Solid stem sawfly-resistant (solid stem score of 19 or higher). * = Less preferred by sawfly (behavioral preference) in small plots.
Conducted by MSU Western Triangle Ag. Research Center.

Table 18. Three-year averages, Spring Wheat varieties, Knees area, western Chouteau County. 2009-2011.

Variety	Class	3-Year Average			
		Yield bu/a	Test weight	Height in.	Protein %
Duclair	**	51.2	59.7	26.9	14.1
Corbin	*	47.0	60.2	26.7	13.6
Choteau	**	46.2	59.5	26.1	14.3
Vida	*	45.3	59.9	28.0	13.8
ONeal	*	44.0	60.6	27.3	13.9
Volt		42.2	61.6	26.0	13.4
McNeal		42.1	58.5	29.0	14.1
Outlook		42.1	58.1	27.0	14.2
Reeder		41.0	60.0	27.0	14.7
Conan	*	40.6	60.4	25.0	14.5
Jedd	CL	37.6	59.3	22.0	13.9
Kelby		36.0	60.8	23.3	15.0
AP 604 CL	CL	35.1	60.3	26.0	14.3
Fortuna	**	34.9	60.6	32.3	14.6
Hank		31.1	57.8	25.0	14.3
average		40.9	59.8	26.5	14.2

** = Solid stem sawfly-resistant (solid stem score of 19 or higher). * = Less preferred by sawfly (behavioral preference) in small plots.
Cooperator and Location: Aaron Killion, western Chouteau County.
Conducted by MSU Western Triangle Ag. Research Center.

Table 19. 2011 Dryland Durum variety nursery, WTARC, Conrad, MT.

Variety	Yield bu/a	Test Wt lb/bu	Height in.	Heading, days from planting	Protein %	HAVC	100-seed Wt. gm
MT03012	76.9	60.6	29.4	67.0	13.4	84.4	3.52
Belfield	71.3	60.3	28.6	67.0	13.0	83.8	3.65
APB D1-35	70.7	54.6	24.7	68.3	14.1	67.9	3.30
Alzada	68.2	58.6	29.7	68.0	13.5	80.6	3.76
Alkabo	68.1	61.0	39.1	72.3	13.1	69.2	3.61
Grenora	67.2	60.2	36.1	71.3	13.5	77.8	3.46
Westhope	66.8	61.2	37.7	75.0	13.3	81.3	3.76
Saragolla	65.8	58.3	29.1	68.3	12.4	46.3	3.35
MT05183	64.7	59.7	28.7	70.7	13.2	80.0	3.54
APB D6-419	63.3	58.5	30.7	69.3	13.2	85.5	3.87
Strongfield	62.1	60.0	37.0	73.3	13.9	86.9	3.46
Mountrail	60.8	58.9	39.0	74.0	13.5	64.9	3.05
Divide	60.1	59.3	39.1	73.0	13.6	69.0	3.17
Tioga	60.1	59.9	38.5	71.7	13.7	83.4	3.59
MT04340	58.3	56.0	27.7	70.7	13.6	83.5	3.24
Pierce	58.2	60.1	40.0	71.7	13.7	80.9	2.97
MT04174	57.6	59.5	28.5	66.3	13.8	81.9	3.28
MT05166	55.5	58.1	29.0	71.7	14.0	85.6	2.99
Levante	39.4	58.4	26.1	76.0	13.1	78.6	4.14
Normanno	21.7	58.3	24.4	74.3	13.0	79.2	3.99
Average	60.8	59.1	32.2	71	13.4	77.5	3.49
LSD (.05) =	15.4	2.2	2	1.9			
CV, S/mean	15.3	2.2	4	0.6			
P value (0.05)	<0.001	<0.001	<0.001	<0.001			

Planted May 3, 2011. Harvested September 8, 2011.
Growing season precipitation: 10.2 inches.
Fertilizer, actual: 150-22.5-20, 11-52-0 place with seed, Urea and potash broadcast on 5/19/2011.
Sprayed with: Huskie @ 11 oz/a and Axial XL @ 16.4 oz/a on 6/18/2011.
Total precipitation from planting to harvest: 10.2 inches.
Location: Western Triangle Ag. Research Center, Conrad, MT.

Table 20. Six-year averages, dryland Durum varieties. Western Triangle Ag. Research Center, Conrad, MT, Pondera County, 2006 – 2011.

		6-Year Average				
Variety	Source	Yield bu/a	Test weight	Height in.	Head date	Protein %
Strongfield	WestBred	67.3	61.0	35	186	13.6
Grenora	N. Dak.	62.3	61.0	33	185	13.2
Alkabo	N. Dak.	60.8	61.7	34	185	13.0
Saragolla	AllStar	60.2	60.3	27	183	12.1
MT03012	MSU	59.7	60.8	28	181	13.1
Levante	AllStar	59.2	60.7	25	184	12.6
Divide	N. Dak.	57.8	61.1	35	186	13.1
MT04174	MSU	57.5	61.0	29	181	13.3
Alzada	WestBred	56.4	60.5	28	182	12.7
Pierce	N. Dak.	55.7	61.6	36	185	13.4
Normanno	AllStar	53.9	59.7	25	184	12.7
Mountrail	N. Dak.	53.2	60.1	35	186	13.4
Nursery Mean		59.6	60.8	31	184	13.0

Table 21. 2011 Dryland Arizona Plant Breeders Durum Wheat variety trial, WTARC, Conrad, MT.

Variety	Yield bu/a	Test Wt lb/bu	Height in.	Head date	Protein %
D6-419	68.8	58.3	31.3	193	14.3
Kronos	64.5	56.8	28.3	189	15.0
D7-8	59.3	55.1	27.0	189	15.2
D7-12	59.2	55.3	30.0	200	14.0
D5-48	59.1	54.3	28.7	190	15.6
D1-7	58.9	56.8	29.7	193	14.6
Sky	55.2	54.4	25.0	190	15.5
D1-35	53.1	52.1	25.0	192	16.0
Westmore	52.1	54.7	26.7	190	16.3
D11-6	49.6	52.1	25.3	189	15.7
mean	58.0	55.0	27.7	191	15.2
LSD (.05)	10.8	1.8	1.4	0.6	1.1
C.V. (s/mean)*100	10.9	1.9	3.0	0.2	4.3

Planted May 3, 2011. Harvested September 8, 2011.
Growing season precipitation: 10.2 inches.
Fertilizer, actual: 150-22.5-20, 11-52-0 place with seed, Urea and potash broadcast on 5/19/2011.
Sprayed with: Huskie @ 11 oz/a and Axial XL @ 16.4 oz/a on 6/18/2011.
Total precipitation from planting to harvest: 10.2 inches.
Location: Western Triangle Ag. Research Center, Conrad, MT.

Table 22. 2011 Irrigated Arizona Plant Breeders Durum Wheat variety trial, WTARC, Conrad, MT.

Variety	Yield bu/a	Test Wt lb/bu	Height in.	Head date	Protein %
D7-12	93.6	61.6	30.0	201	10.5
D6-419	86.9	63.7	31.3	199	11.2
Sky	85.8	60.9	25.0	193	10.7
D7-8	84.9	61.4	27.0	192	12.3
Westmore	82.7	62.2	26.7	193	12.0
D5-48	82.1	61.9	28.7	193	9.8
D1-7	74.5	63.1	29.7	198	11.0
D1-35	72.1	59.6	25.0	197	11.5
Kronos	69.8	62.6	28.3	192	11.0
D11-6	65.0	56.6	25.3	192	13.2
mean	80.3	61.3	27.7	195	11.3
LSD (.05)	21.8	1.4	1.4	1.9	2.2
C.V. (s/mean)*100	12.9	1.3	3.0	0.56	11.3

Planted May 14, 2011 on fallow. Harvested September 23, 2011.
Fertilizer, actual: 221-22.5-20, 11-52-0 place with seed, Urea and potash broadcast on 5/19/2011.
Sprayed with: Huskie @ 11 oz/a and Axial XL @ 16.4 oz/a on 6/17/2011.
Total precipitation from planting to harvest: 10.34 inches with 8.75 inches irrigation water applied.
Location: Western Triangle Ag. Research Center, Conrad, MT.

2011 Barley Variety Evaluations In The Western Triangle Area.

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

Personnel: John Miller, MSU/MAES, Western Triangle Ag. Research Center, Conrad, MT. and Dave Wichman, MSU/MAES, Central Ag. Research Center, Moccasin, MT.; 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, Toole County north of Devon, and under irrigated, conventional fallow conditions at the Research Center.

Results: Data for the various locations are presented in Tables 23 - 34, and include 2011 results and multi-year averages. The dryland intrastate nursery data are shown in Tables 23 and 24, while Tables 25 thru 28 contain data from the irrigated nurseries. The information from the off-station barley trials are shown in Tables 29 thru 34. Table 34 is of the soil test values for the off station plots. The Choteau site was lost due to drowning.

Grain yields averaged 78.8 bu/a at Cut Bank, 57.8 bu/a north of Devon, and 67.7 bu/a at the Knees. Test weight at all locations was 50 lbs/bu or greater. Kernel plumpness averaged 91.9% at Cut Bank, 83.9% at Devon, and 72.2% at the Knees. Top yielding varieties at Cut Bank were MT061035, Haxby, and Goldeneye with the top yielding malt barleys being Conrad and Hockett. Top yielding barleys north of Devon were MT020162, Goldeneye, and MT061035. While top yielding barleys at the Knees location were MT061035, MT020155, and Goldeneye.

Summary: The growing season in 2011 began with cool wet spring, followed by a warm dry summer. Plumps varied by location, possibly due to soil fertility. Lodging in the barley plot at Devon was caused by wheat stem sawfly cutting. No long term data are reported for north of Devon as this was the second year of growing plots at this location. Protiens at the Knees were high possibly due to a high soil test for nitrogen and early rain followed by hot and dry conditions, this also reduced kernel plumpness.

The dryland intrastate barley out yielded the irrigated barley by about 20 bu/a, this may be due to the late planting date for the irrigated barley nursery.

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.

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 23. Dryland Intrastate Barley variety trial, Conrad 2011.

Variety	Yield bu/a	Test Wt lb/bu	Plump %	Thin %	Protein %	Head date	Height in.
MT090181	117.9	54.2	95.0	1.0	10.3	197	28
Champion	116.5	55.0	92.2	2.8	11.2	193	27
Geraldine	111.7	53.2	86.9	6.4	12.3	197	26
MT061035	110.7	52.8	83.9	6.2	11.9	194	26
MT080279	110.5	53.2	91.6	3.3	11.8	193	23
MT020162	110.2	53.4	86.9	7.5	11.5	197	28
Pinnacle	110.2	53.2	95.1	1.3	10.4	191	27
MT090182	109.9	54.1	93.6	3.3	10.7	195	29
EM090128	109.1	52.8	86.2	4.4	12.3	200	23
MT080285	108.8	53.7	93.3	2.8	11.2	193	24
EM090081	108.1	52.5	93.9	1.9	11.8	197	28
MT090191	107.8	54.4	94.0	1.2	10.5	197	29
MT090180	107.4	52.5	93.7	2.7	10.2	197	28
MT090169	107.3	53.9	95.2	2.8	10.8	192	25
MT070175	106.5	52.9	90.2	3.1	10.7	192	29
MT080243	106.3	54.0	88.0	5.0	11.5	195	27
Baronesse	105.8	53.8	90.8	2.7	10.9	195	24
MT070161	105.1	54.3	95.6	1.5	11.0	192	25
Tradition	104.9	52.2	96.0	1.0	12.0	192	33
Craft	104.7	54.7	92.9	3.2	11.2	191	29
Conrad	104.4	53.0	95.6	1.8	12.0	195	27
MT080281	104.2	53.8	93.2	2.0	11.0	192	24
Hockett	103.9	53.7	94.7	2.3	11.4	192	27
MT010160	103.8	52.6	84.3	7.1	12.3	194	31
MT080081	103.7	49.5	75.0	11.5	12.3	197	22
MT070086	103.6	51.9	86.0	6.2	12.0	195	19
Scarlett	103.5	54.0	95.0	1.3	11.7	196	25
MT090190	103.5	54.1	94.7	1.7	10.6	194	29
Haxby	103.3	55.4	93.0	2.4	11.6	193	25
MT061169	103.1	53.6	91.7	2.2	11.1	194	24
MT090193	102.2	52.5	93.4	2.7	10.9	194	28
MT090229	102.1	53.3	91.7	4.3	11.4	192	28
Copeland	101.4	51.9	93.1	2.0	11.5	195	31
MT090192	100.9	54.3	92.8	2.0	10.6	196	28
Harrington	100.2	52.4	88.8	5.1	11.4	195	27

Table 23 continued on next page

Variety	Yield bu/a	Test Wt lb/bu	Plump %	Thin %	Protein %	Head date	Height in.
MT090227	100.1	53.8	93.5	1.9	11.6	194	29
MT070148	99.8	54.2	94.6	1.5	11.4	192	27
MT061201	99.4	54.2	94.8	2.2	12.1	196	29
MT090176	98.8	52.5	90.8	3.5	11.0	197	29
EM090117	98.7	52.1	94.3	1.3	11.0	200	24
MT090186	98.5	51.2	95.6	1.7	10.2	198	29
MT070125	98.2	54.3	96.8	1.8	11.4	198	28
MT090184	97.6	54.4	95.5	1.7	11.0	196	29
MT070111	97.4	53.0	90.6	3.9	11.5	195	27
MT090183	97.3	53.1	93.3	4.5	11.0	196	28
MT020155	97.2	53.4	93.2	3.3	12.0	190	27
MT070158	96.7	53.1	93.1	1.8	11.9	193	26
EM090105	96.5	51.9	87.9	5.2	12.6	193	26
MT090194	96.3	52.7	92.1	3.2	10.7	197	28
MT080083	95.6	50.5	85.2	6.0	12.4	197	24
MT070136	95.5	53.9	94.1	2.5	11.5	198	28
MT090188	95.5	52.9	93.1	2.6	11.0	196	28
MT090202	95.4	54.2	95.4	2.7	10.9	194	26
Metcalfe	94.9	52.5	90.3	2.7	11.7	192	30
MT080085	94.9	53.0	88.4	4.9	11.2	194	27
MT061134	94.5	52.5	97.9	1.5	11.6	196	25
MT030042	92.5	54.4	87.4	5.8	11.0	193	26
MT080261	91.8	54.2	92.4	3.5	12.1	190	26
MT061104	91.0	54.6	95.8	1.4	12.2	192	28
MT090178	90.6	53.6	93.9	2.6	10.8	195	26
MT070159	89.8	52.3	87.7	4.6	11.2	192	24
Amsterdam	88.4	53.9	98.8	1.6	13.1	194	29
MT070174	85.0	52.8	95.4	1.3	11.8	192	26
Karma	66.2	61.3	88.4	5.0	14.0	193	29
Means	100.9	53.4	92.0	3.2	11.4	195	27
LSD (.05)	14.5	2	6.4			2	3
C.V. (%)	8.4	1.7	3.9			1	3

Planted May 3, 2011 on fallow. Harvested August 30, 2011.
Fertilizer, actual: 41-22-20.
Sprayed with Huskie @ 11 oz/a and Axial @ 8.2 oz/a on 6/17/2011.
Growing season ppt.: 9.77 inches.

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

Table 24. 5-year averages, dryland Barley varieties, Conrad, MT, 2006 - 2009, 2011.

Variety [1]	5-Year Average						
	Yield bu/a	Test Wt lb/bu	Plump %	Thin %	Protein %	Head date	Height in.
Champion	96.8	53.9	80.7	3.1	11.7	183	27
Baronesse	91.6	52.4	80.0	6.2	11.4	186	26
Conrad	90.5	53.9	86.8	4.5	11.9	185	26
Haxby	87.7	55.0	84.2	3.8	11.6	182	27
Craft	87.7	53.7	91.2	2.5	11.6	183	28
Hockett	87.5	53.6	91.4	2.1	11.4	182	27
Harrington	85.7	51.4	89.0	3.4	11.8	185	27
Geraldine	85.4	52.5	75.0	9.8	11.4	186	25
MT020155	83.9	52.8	87.3	2.7	12.3	180	27
Tradition	82.8	51.5	81.3	4.2	12.0	182	31
Metcalfe	82.7	51.9	85.0	4.7	12.1	183	28
Mean	87.5	52.8	84.6	4.3	11.7	183	27

[1] Tradition is 6-row; all others are 2-row.
Location: MSU Western Triangle Ag. Research Center, Conrad, MT.

Table 25. Irrigated Intrastate Barley variety trial, Conrad 2011.

Variety	Yield bu/a	Test Wt lb/bu	Plump %	Thin %	Protein %	Head date	Height in.
MT061035	104.4	53.4	97.5	0.9	8.5	201	27
MT070086	97.2	53.4	96.3	1.5	8.9	200	23
MT080083	95.9	52.6	96.9	1.1	9.9	202	28
Baronesse	95.7	53.6	97.2	1.2	7.6	200	27
MT070111	94.8	54.1	97.3	1.1	9.3	200	29
MT090186	93.1	54.8	98.0	0.6	8.5	204	30
Harrington	92.6	53.7	97.6	1.2	9.2	201	29
MT070158	90.8	53.3	98.2	0.8	8.8	199	28
EM090128	90.8	53.5	97.1	1.2	7.7	202	24
MT080281	89.3	52.5	97.5	0.9	8.2	199	24
Champion	89.3	54.2	96.8	0.9	8.3	200	29
MT070159	88.0	53.2	97.9	0.7	9.0	199	26
MT070175	87.9	53.0	97.1	1.1	8.7	202	30
MT080279	86.6	52.5	97.6	1.1	9.0	199	25
Scarlett	86.2	53.2	98.4	0.7	7.7	204	27
Copeland	86.2	52.4	97.9	1.1	9.9	201	32
MT090176	86.1	53.5	97.7	0.8	7.4	203	31
MT020155	85.9	53.2	96.1	1.9	10.2	198	30
Craft	85.8	53.5	97.5	0.9	9.5	200	32
MT061169	85.7	54.0	96.5	1.6	8.7	201	27
Hockett	85.6	54.3	97.6	0.9	10.3	200	29
MT061134	85.2	52.6	98.3	0.7	8.5	200	27
MT070125	85.1	53.5	97.3	0.9	9.1	202	29
MT090181	84.7	53.2	98.0	0.9	9.1	202	28
MT080243	84.6	53.4	96.9	1.2	8.9	202	29
EM090105	83.7	52.9	97.4	1.1	9.2	200	28
MT090229	83.6	52.9	97.5	0.9	7.8	201	29
MT090191	83.4	54.0	98.4	0.6	7.9	202	32
MT070136	83.3	52.8	97.1	1.1	10.7	204	29
MT090190	83.2	52.9	97.9	0.8	8.2	202	29
MT020162	83.0	53.0	96.2	1.7	8.5	203	29
MT090184	83.0	54.1	97.7	0.8	8.2	204	30
EM090081	82.7	53.9	97.7	0.8	10.1	205	29
MT070148	82.5	53.5	98.9	0.5	9.2	200	29
EM090117	82.3	52.3	97.8	1.0	8.5	204	27

Table 25 continued on next page

Variety	Yield bu/a	Test Wt lb/bu	Plump %	Thin %	Protein %	Head date	Height in.
MT090194	82.3	51.7	97.1	1.3	8.7	202	31
Geraldine	82.2	53.7	95.8	1.1	7.6	203	27
MT080081	82.2	52.0	97.1	1.3	7.6	202	24
MT080261	81.8	53.8	95.0	2.0	8.9	199	30
Conrad	81.3	53.0	97.4	0.6	9.0	201	27
MT090183	80.8	52.6	97.7	0.7	9.0	202	30
MT061201	80.8	53.4	97.0	1.3	8.8	201	28
Haxby	80.7	54.0	96.9	1.3	9.6	199	26
MT090227	80.6	53.0	97.5	1.0	8.0	201	29
MT080285	80.6	53.4	97.9	1.1	8.8	201	27
MT090180	80.3	51.9	97.2	1.0	7.3	203	30
MT090193	79.9	52.1	96.9	1.2	8.5	203	30
Tradition	79.1	51.2	97.0	0.9	9.9	197	34
MT010160	78.9	53.6	94.8	2.1	9.7	203	32
Metcalfe	78.7	53.0	96.7	1.1	8.7	201	32
MT080085	78.5	53.8	93.9	2.3	8.8	202	29
MT090188	78.5	52.6	97.8	0.9	7.9	203	29
MT090192	78.4	53.0	98.0	0.5	7.7	202	30
MT090178	78.1	52.9	97.7	0.8	7.9	202	27
MT090182	78.0	53.1	97.5	0.8	7.6	202	31
MT070161	76.9	53.0	97.9	1.0	8.6	200	27
MT061104	75.1	53.2	98.1	0.8	9.0	201	30
MT070174	73.8	53.3	98.4	0.7	9.2	199	29
MT090202	73.1	53.4	98.0	0.7	8.3	201	30
MT090169	73.0	52.8	97.4	0.9	8.3	200	28
Pinnacle	72.8	53.5	98.1	0.7	8.2	201	31
MT030042	72.2	54.4	97.3	1.1	8.5	200	30
Amsterdam	68.7	53.1	96.9	1.2	9.4	202	30
Karma	50.0	42.0	94.5	2.2	12.3	199	31
Mean	82.9	53.0	97.3	1.1	8.8	201	29
LSD (.05)	14.6	3.7	1.5			1.5	1.4
C.V.	9.3	3.1	1.0			0.6	1.6

Planted May 14, 2011 on fallow. Harvested September 13, 2011.
Fertilizer, actual (lbs/a): 41-22-20
Growing season ppt: 10.04 inches Irrigation = 8.75 inches
Sprayed with Huskie @ 11 oz/a and Axial @ 8.2 oz/a on 6/17/2011.

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

Table 26. 7-year averages, irrigated Barley varieties, Conrad, MT, 2004 - 2007, 2009 and 2011.

Variety	6-Year Average						
	Yield bu/a	Test Wt lb/bu	Plump %	Thin %	Protein %	Head date	Height in.
Champion	116.8	54.3	95.9	1.4	10.9	183	32
Baronesse	115.2	53.1	91.7	3.0	11.1	185	30
Geraldine	110.3	53.1	89.0	4.3	11.1	186	30
Haxby	110.1	54.8	94.2	2.4	11.9	183	30
Conrad	108.6	52.6	93.9	2.1	12.1	185	30
Craft	102.8	54.1	92.8	3.3	11.9	183	34
Tradition	101.8	51.6	93.7	1.4	11.6	181	35
Metcalfe	96.3	52.3	92.5	2.6	11.7	185	32
Hockett	95.7	53.0	91.9	3.9	11.9	183	31
Harrington	95.3	51.8	89.4	3.6	11.4	185	31
Mean	105.1	53.0	92.4	2.8	11.6	184	31

Tradition is 6-row; all others are 2-row.
Location: MSU Western Triangle Ag. Research Center, Conrad, MT.

Table 27. Irrigated Barley variety trial, Conrad 2011.

Variety	Spike	Yield bu/a	Test Wt lb/bu	Plump %	Thin %	Protein %	Head date	Height in.
MT061035	2	100.6	54.5	98.4	0.6	8.8	200	29
Geraldine	2	99.2	54.3	96.9	0.9	9.4	203	27
MT070175	2	95.6	53.6	98.2	0.7	8.8	199	30
Conrad	2	94.7	53.9	99	0.3	10.2	203	28
MT020162	2	94.0	53.7	97.9	0.7	9.7	203	29
Hockett	2	92.2	54.0	98.4	0.6	10.1	199	29
MT020155	2	87.5	53.6	98	0.6	10.3	198	29
Harrington	2	85.9	53.4	98.4	0.6	9.2	201	31
Haxby	2	84.2	54.3	98.1	0.6	9.6	199	33
Gallatin	2	83.4	54.1	98	0.8	10.1	200	31
MT010160	2	83.0	54.0	98.7	0.3	9.7	202	33
Metcalfe	2	81.5	52.9	97.6	0.8	8.9	199	32
Tradition	6	81.4	51.1	97	0.5	10.3	198	33
Goldeneye	6	79.0	51.8	97.4	0.7	8.9	199	31
Pinnicle	2	78.0	53.6	98.6	0.4	8.5	200	31
MT010158	2	77.9	53.5	98.4	0.5	11.3	201	30
Mean		87.3	53.5	98.1	0.6	9.6	200.3	30
LSD (.05)		15.3	0.5	0.7	0.3		2.1	1.1
C.V.		10.4	0.6	0.4	33.9		0.6	2.1

Planted May 19, 2011 on fallow. Harvested September 13, 2011.
Fertilizer, actual: 82-22-20
Sprayed with Huskie @ 11 oz/a and Axial @ 8.2 oz/a on 6/18/2011.
Irrigated with 8.75 inches of water. Growing season ppt: 10.04 inches.
Location: MSU Western Triangle Ag Research Center, Conrad, MT.

Table 28. Six-year averages, irrigated Barley varieties, Conrad 2004 - 07, 2009 and 2011.

Variety	Spike	6-Year Average						
		Yield bu/a	Test Wt lb/bu	Plump %	Thin %	Protein %	Head date	Height in.
Geraldine MSU	2	109.7	53.0	89.9	3.3	11.8	186	30
Conrad BuschAg	2	103.7	52.1	91.5	3.6	12.0	185	31
Haxby MSU	2	102.9	54.5	92.7	2.7	11.7	182	32
Hockett MSU	2	95.6	52.9	91.0	4.2	12.2	182	32
Metcalfe	2	94.0	51.9	89.8	4.1	12.1	184	33
Harrington	2	93.5	49.7	82.3	6.9	11.8	185	33
Mean		100.8	52.1	89.8	3.7	11.8	183.0	32.0

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

Table 29. Off-station spring barley variety trial located north of Cut Bank, MT. Glacier County. Western Triangle Ag. Research Center. 2011.

Variety	Spike	Yield bu/a	Test Wt lb/bu	Plump %	Thin %	Plant Height (in)	Protein %
MT061035	2	87.5	50.3	93.1	2.1	23.0	12.0
Haxby	2	87.5	52.8	91.2	3.5	26.0	12.9
Goldeneye	6	86.2	49.4	93.8	1.9	27.0	11.8
Conrad	2	82.4	49.7	95.5	1.1	26.0	14.3
Hockett	2	81.9	52.4	92.6	2.3	26.3	13.4
MT070175	2	80.8	51.3	93.4	2.1	28.3	12.2
Geraldine	2	80.5	51.8	91.4	2.5	24.0	12.3
Metcalfe	2	79.7	51.4	91.6	2.5	27.3	13.9
MT010160	2	78.5	49.9	88.7	3.5	26.0	14.0
MT020155	2	77.8	49.9	89.9	3.1	24.3	13.8
Pinnacle	2	77.2	51.1	96.4	1.2	28.3	11.5
Harrington	2	76.9	50.3	92.1	2.2	26.0	13.3
Gallatin	2	76.5	51.2	92.0	2.4	25.3	13.1
MT020162	2	71.5	49.9	82.4	6.4	26.7	14.0
MT010158	2	69.7	50.9	91.6	2.4	26.7	14.1
Tradition	6	65.7	50.1	94.3	1.3	29.7	12.6
Average		78.8	50.8	91.9	2.5	26.3	13.1
LSD (.05) =		9.6	1.5	2.9	1.2	2.4	
C.V. =		7.3	1.7	1.9	25.1	5.5	
P-Value (0.05)		0.002	0.001	0.000	0.000	0.001	

Cooperator and Location: Bradley Farms, northern Glacier County.
Planted May 11, 2011 on chem-fallow. Harvested September 28, 2011.
Fertilizer, actual lbs/a: 11-22.5-0 with seed at planting, plus 46 lbs/a N applied by commercial applicator about the 1st of June.
Sprayed with Huskie at 11 oz/a and Axial XL at 16.4 oz/a on 6/22/2011.
Precipitation from 5/11/2011 until harvest was: 6.75 inches.
Conducted by MSU Western Triangle Ag. Research Center.

Table 30. 5-year averages, dryland Barley varieties, Cut Bank, MT, 2006-2009 and 2011.

Variety	5-Year Average					
	Yield bu/a	Test Wt lb/bu	Plump %	Thin %	Protein %	Height in.
Haxby	80.3	52.6	77.3	13.4	12.7	29.2
Goldeneye	80.1	48.6	79.7	9.9	11.6	28.5
Geraldine	78.9	50.5	77.4	15.6	12.5	27.8
Harrington	77.0	49.2	79.2	11.7	12.6	29.4
MT020155	76.3	49.8	78.0	16.1	13.3	25.3
Hockett	76.2	50.9	80.7	10.4	12.6	28.2
Conrad	75.5	49.2	81.3	9.3	13.0	29.1
Metcalfe	74.1	49.8	80.0	10.7	13.2	29.8
MT010158	70.4	50.2	79.2	12.1	13.2	27.4
Mean	77.2	50.2	79.3	11.9	12.8	27.3

Table 31. Off-station spring barley variety trial located in the Devon area. Eastern Toole County. Western Triangle Ag. Research Center. 2011.

Variety	Spike	Yield bu/a	Test Wt lb/bu	Plump %	Thin %	Plant Height (in)	Lodging %	Protein %
MT020162	2	64.8	52.6	84.8	5.0	25.3	4.3	9.6
Goldeneye	6	63.0	50.5	81.5	6.3	27.3	1.3	9.3
MT061035	2	61.6	51.0	76.1	10.0	22.7	3.7	8.8
Haxby	2	61.5	54.3	81.6	7.1	25.7	3.7	9.4
MT020155	2	60.1	52.2	82.5	7.4	26.3	2.3	9.8
Pinnacle	2	59.4	53.0	93.7	2.0	24.3	2.0	8.4
Conrad	2	58.8	51.4	86.3	4.6	24.0	4.7	10.4
Harrington	2	57.1	51.5	88.7	4.1	23.3	1.7	9.5
Gallatin	2	56.9	51.5	82.5	6.8	27.0	2.7	9.4
MT070175	2	56.8	52.9	89.1	4.3	26.0	1.7	9.2
Geraldine	2	56.5	51.6	70.9	13.0	24.0	3.7	9.8
Tradition	6	55.9	51.0	83.0	6.8	27.7	2.7	10.2
MT010160	2	55.7	52.3	87.0	3.6	25.3	3.7	9.4
Metcalfe	2	55.3	52.1	86.8	4.4	26.0	2.7	9.6
Hockett	2	50.5	52.0	78.5	9.6	26.3	7.0	9.9
MT010158	2	50.3	52.8	89.7	3.1	23.3	1.7	10.5
Average		57.8	52.0	83.9	6.1	25.3	3.1	9.6
LSD (.05) =		7.6	1.0	8.6	3.7	2.1	NS	
C.V. =		7.9	1.2	6.1	36.5	5.0	71.7	
P-Value (0.05)		0.024	0.000	0.001	0.000	0.000	0.254	

Cooperator and Location: Brian Aklestad, eastern Toole County.
Planted April 27, 2011 on chem-fallow. Harvested August 16, 2011.
Fertilizer, actual lbs/a: 11-22.5-0 with seed at planting.
Sprayed with Huskie at 11 oz/a and Axial XL at 16.4 oz/a on 6/13/2011.
Precipitation from 4/27/2011 until harvest was: 10.15 inches.
Conducted by MSU Western Triangle Ag. Research Center.

Table 32. Off-station spring barley variety trial located in the Knees area. Western Chouteau County. Western Triangle Ag. Research Center. 2011.

Variety	Spike	Yield bu/a	Test Wt lb/bu	Plump %	Thin %	Plant Height (in)	Protein %
MT061035	2	76.0	49.6	66.0	11.2	22.0	13.9
MT020155	2	75.7	50.1	75.0	7.9	24.7	13.4
Goldeneye	6	71.2	48.8	58.2	15.2	24.3	13.9
MT070175	2	70.5	51.6	85.1	5.6	25.7	12.1
Haxby	2	69.5	53.5	67.5	9.0	25.0	13.3
MT020162	2	69.3	51.5	66.1	12.5	25.3	14.3
Tradition	6	68.5	50.0	61.2	10.4	27.3	13.7
Harrington	2	67.5	50.8	80.0	5.7	24.0	14.1
Pinnacle	2	67.1	52.5	95.1	2.6	26.3	11.8
MT010160	2	66.2	51.9	79.2	6.3	26.0	13.8
Metcalfe	2	65.5	51.0	77.1	6.6	25.0	14.5
Hockett	2	64.4	51.9	80.1	8.4	26.0	13.2
Conrad	2	64.0	51.1	74.7	8.8	23.0	14.9
Gallatin	2	63.3	51.3	72.0	10.7	26.0	13.5
Geraldine	2	62.6	49.0	39.3	29.2	23.0	15.0
MT010158	2	61.9	52.6	82.1	5.6	25.3	14.2
Average		67.7	51.1	72.2	9.7	24.9	13.7
LSD (.05) =		7.1	0.8	7.3	3.2	1.3	
C.V. =		6.3	1.0	6.0	19.7	3.1	
P-Value (0.05)		0.005	0.000	0.000	0.000	0.000	

Cooperator and Location: Aaron Killion, western Chouteau County.
Planted: May 12, 2011 on chem-fallow. Harvested: August 25, 2011.
Fertilizer, actual lbs/a: 11-22.5-0 with seed at planting.
Sprayed with Huskie at 11 oz/a and Axial XL at 16.4 oz/a on 6/22/2011. Tebustar was flown on at a rate of 4 oz/a on July 4, 2011.
Precipitation, rain gauge cracked.
Conducted by MSU Western Triangle Ag. Research Center.

Table 33. 3-year averages, dryland Barley varieties, Knees, MT, 2009 - 2011.

Variety	5-Year Average Yield bu/a	Test Wt lb/bu	Plump %	Thin %	Protein %	Height in.
MT020155	79.2	49.5	85.8	5.2	12.9	25.3
Goldeneye	76.7	49.0	80.6	7.1	12.4	28.5
Conrad	75.3	50.5	85.5	5.3	13.8	29.1
Haxby	74.1	52.8	84.9	4.7	13.0	29.2
Harrington	72.9	50.4	87.6	4.8	13.1	29.4
Geraldine	72.3	50.2	69.5	14.4	13.5	27.8
Hockett	67.3	50.4	87.3	5.6	12.8	28.2
Metcalfe	67.2	50.5	86.4	4.9	13.3	29.8
MT010158	64.6	51.3	89.0	3.9	12.9	27.4
average	72.2	50.5	84.1	6.2	13.1	27.3

Table 34. Soil test values for off station plots, 2011.

Location	N (lbs/a)[1]	Olsen-P (ppm)	K (ppm)	pH	OM (%)	EC (mmhos/cm)
Cut Bank	60.5	18	523	7.0	3.2	0.38
Devon	25.5	22	322	7.4	0.8	0.19
Knees	139.8	38	800	7.5	3.6	1.01

[1]Nitrogen soil samples were to a depth of four feet in one foot increments. All other soil tests were for zero to six inches in depth.

Title: Spring lentil, pea and chickpea variety evaluation.

Year: 2011

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

Personnel: John Miller, MSU/MAES, Western Triangle Ag. Research Center, Conrad, MT. and
Dave Wichman, MSU/MAES, Central Ag. Research Center, Moccasin, MT.

Project Coordinators: Chengci Chen and Johnna Heser, MSU/MAES, Central Ag. Research
Center, Moccasin, MT.

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

Procedures: Twenty lentil varieties at WTARC and north of Joplin were seeded into fallow at Conrad and spring wheat stubble (no-till) at Joplin. Twenty eight pea varieties were seeded at WTARC and 18 pea varieties were seeded north of Joplin. Six chickpea varieties were planted at WTARC. All plots were seeded with a 5-row, 12 inch spaced, plot planter. Phosphorus and potash fertilizers and granular inoculant were placed with the seed while planting. Plot size was five by 25 feet with four replicates, with the exception of chickpea, where 3 replicates were used. Plots were direct cut with a Hege plot combine.

Results: The data are summarized in Tables 35, 36, 37, 38, and 39. All the pea varieties tested this year were semi-leafless with white flowers. Lentil at WTARC averaged 2207 lbs/a with Joplin lentil averaging 657 lbs/a. (Tables 35 and 36)Pea yield on station averaged 2777 lbs/a, while yields at Joplin were 964 lbs/a with a mature canopy height at Joplin being six inches shorter than for pea trials at WTARC. (Tables 37 and 38) Chickpea at WTARC averaged 2860 lbs/a. (Table 39) Grasshoppers were a major problem at Joplin after the surrounding spring wheat crop was swathed, reducing yields from 40 to 60%.

Table 35. Statewide Lentil Variety Evaluation. Western Triangle Ag. Research Center. 2011.

Variety	Lentil Color and Size	Yield (lbs/a)	Mature Canopy Height (in)	Test Weight (lbs/bu)	1000 Kernel Weight (g)	Flower Date (Julian)
Essex	sg	2842.0	14	62.1	45	192
LC03601590E	sg	2465.3	13	63.5	39	191
Eston	sg	2114.3	12	64.6	33.8	189
CDC Meteor	mg	2432.5	14	62.7	53	190
CDC Vantage	mg	2344.0	13	62.9	53.3	190
CDC Richlea	mg	2307.0	12	61.3	52.3	192
LC01602300R	mg	2226.3	13	62.7	47.3	189
Brewer	mg	2033.8	12	61.1	60.5	188
LC07600517L	lg	2604.5	14	61.4	64	191
CDC Greenland	lg	2221.3	14	59.8	68.3	193
Merit	lg	2151.3	13	60.4	64	188
Riveland	lg	1820.5	14	59.9	74.5	189
CDC Redberry	sr	2317.8	13	62.9	42.3	192
LC01602062T	sr	2275.8	12	63.4	46	189
LC06601228T	sr	2171.5	12	65.0	49.8	189
Crimson	sr	1761.8	11	63.8	34.5	191
CDC Impact	sr	1717.0	12	64.3	37.3	189
LC01602245P	sb	2295.0	11	64.4	40.8	189
Morena	sb	2117.3	13	64.9	39.5	189
Pardina	sb	1337.0	11	64.9	40.5	189
Means		2207.6	12	62.8	49.3	190
P-Value		0.15	<0.01	<0.01	<0.01	
$LSD_{0.05}$ (by t)		ns	1.67	0.85	3.14	
CV% (s/means)		20.17	9.48	0.92	4.51	

Seeding Date: May 7, 2011. Harvest Date: August 14, 2011. Fertilizer (actual): 11-22-0. Precipitation: 9.77 inches. Sprayed with Prowl H_2O @ 32 oz/a on May 5, 2011, Then sprayed with Roundup WeatherMax @ 20 oz/a on 5/13/2011.
Lentil color: Small Green = sg; Medium Green = mg; Large Green = lg; Small Red = sr; Spanish Brown (Pardina) = sb Western Triangle Ag. Research Center, Conrad, MT.

Table 36. Statewide Lentil Variety Evaluation. North of Joplin, Liberty County. Western Triangle Ag. Research Center. 2011.

Variety	Lentil Color and Size	Yield (lbs/a)	Mature Canopy Height (in)	1000 Kernel Weight (g)
LC03601590E	sg	755.7	10	44.3
Essex	sg	726.0	10	41
Eston	sg	671.0	11	35
CDC Vantage	mg	858.7	11	48.3
CDC Meteor	mg	745.0	11	50
CDC Richlea	mg	616.0	10	53.3
LC01602300R	mg	581.3	11	47.7
Brewer	mg	350.0	12	53
CDC Greenland	lg	688.3	12	62.7
Merit	lg	546.0	11	58.5
LC07600517L	lg	435.7	10	50.7
Riveland	lg	247.0	12	61.5
LC06601228T	sr	909.7	12	46.3
CDC Impact	sr	905.7	10	34.3
CDC Redberry	sr	785.0	11	39
Crimson	sr	773.7	11	35.7
LC01602062T	sr	517.0	10	42
LC01602245P	sb	745.0	10	37.3
Pardina	sb	681.3	9	38.7
Morena	sb	609.3	10	37.3
Means		657.4	11	45.2
P-Value		0.35	0.12	<0.01
$LSD_{0.05}$ (by t)		ns	ns	7.77
CV% (s/means)		43.2	9.96	10.02

Cooperator: Moog Farms, Joplin, MT.
Seeding Date: April 28, 2011. Harvest Date: August 29, 2011. Fertilizer (actual): 11-22-0.
Desiccated with Roundup WeatherMax @ 20 oz/a on 8/19/2011.
Lentil color: Small Green = sg; Medium Green = mg; Large Green = lg; Small Red = sr; Spanish Brown (Pardina) = sb
Western Triangle Ag. Research Center, Conrad, MT.

Table 37. Statewide Dry Pea Variety Evaluation. Western Triangle Ag. Research Center. 2011.

Variety	Pea Color	Yield (lbs/a)	Mature Canopy Height (in)	Test Weight (lbs/bu)	1000 Kernel Weight (g)	Flower Date (Julian)
Bridger	Y	3259.3	25	64.7	222.5	188
DS Admiral	Y	3070.3	27	64.5	230.3	190
Montech 4152	Y	3066.3	29	64.5	231.5	189
CDC Treasure	Y	2964.0	28	64.7	208	190
Pro 083-7406	Y	2948.0	26	63.9	206.5	191
CDC Meadow	Y	2877.8	27	64.8	197.8	189
AC Agassiz	Y	2866.8	27	63.4	217.5	190
Delta	Y	2831.5	21	65.0	233.5	189
PS03101822	Y	2809.0	21	64.1	237.5	188
PRL415	Y	2788.8	29	63.8	213.8	192
SW Midas	Y	2773.5	23	63.9	201.5	190
CDC Golden	Y	2735.5	25	64.3	209.5	190
Spider	Y	2664.0	29	65.2	228.8	189
AC Thunderbird	Y	2601.8	29	64.1	205.5	194
Arcadia	G	3178.0	24	63.6	198.8	189
Pro 081-7137	G	3041.3	25	63.8	208.3	189
Pro 081-7116	G	2900.8	24	63.8	227.3	188
PS06100760	G	2779.5	24	63.5	202.5	189
Cruiser	G	2745.5	26	62.8	204.3	188
CDC Patrick	G	2655.0	28	63.9	174.3	192
Stirling	G	2651.0	20	63.3	210.3	187
CDC Striker	G	2632.3	26	64.8	231.3	190
K2	G	2621.5	24	63.4	212	188
Pro 081-7155	G	2510.0	11	63.2	191.5	189
Aragorn	G	2507.8	22	63.1	219.3	188
Medora	G	2492.3	28	62.6	207.5	192
Pro 071-6101	G	2455.3	20	64.2	225	188
Majoret	G	2381.8	24	64.7	232	190
Means		2776.5	25	64.0	214	190
P-Value		0.01	<0.01	<0.01	<0.01	
$LSD_{0.05}$ (by t)		435	3.5	0.56	7.9	
CV% (s/means)		11.08	9.9	0.62	2.61	

Table 37 continued on next page

Seeding Date: May 7, 2011.
Harvest Date: August 14, 2011.
Precipitation: 9.77 inches.
Fertilizer (actual): 11-22-0.
Sprayed with Prowl H_2O @ 32 oz/a on May 5, 2011, Then sprayed with Roundup WeatherMax @ 20 oz/a on 5/13/2011.
Western Triangle Ag. Research Center, Conrad, MT.

Table 38. Statewide Dry Pea Variety Evaluation. North of Joplin, Liberty County, MT. Western Triangle Ag. Research Center, Conrad, MT. 2011.

Variety	Pea Color	Yield (lbs/a)	Mature Canopy Height (in)	1000 Kernel Weight (g)
PS03101822	Y	1604	19	220
SW Midas	Y	1060	17	194
Montech 4152	Y	1040	18	254.7
CDC Golden	Y	1030	19	210.3
DS Admiral	Y	1012	22	235.3
CDC Meadow	Y	952	19	180
Spider	Y	908	19	226.7
Delta	Y	775	17	220.7
Bridger	Y	773	19	200.7
PS06100760	G	1375	19	194
Stirling	G	1257	15	194
Arcadia	G	1142	19	204.3
CDC Patrick	G	989	19	171
Cruiser	G	977	22	184
K2	G	748	17	204.3
Medora	G	644	20	203.7
CDC Striker	G	606	17	198.3
Majoret	G	465	19	208.7
Means		964.3	19	205.8
P-Value		0.08	0.03	<0.01
$LSD_{0.05}$ (by t)		ns	3.2	17.81
CV% (s/means)		37.7	10.38	5.23

Cooperator: Moog Farms. Joplin, MT.
Seeding Date: April 28, 2011.
Harvest Date: August 29, 2011.
Fertilizer (actual): 11-22-0.
Desiccated on 8/19/2011 with 22 oz/a Roundup WeatherMax.
Western Triangle Ag. Research Center, Conrad, MT.

Table 39. Statewide Chickpea Variety Evaluation. Western Triangle Ag. Research Center.
2011.

Variety	Yield (lbs/a)	Mature Canopy Height (in)	1000 Kernel Weight (g)
CDC Frontier	3422.3	17	367
Sawyer	2905.7	18	456.7
Dylan	2871.7	15	539.3
Myles	2748.7	17	203.7
Sierra	2738.7	19	510.3
Dwelly	2474.0	18	519.7
Means	2860.2	17	432.8
P-Value	0.44	0.36	0
$LSD_{0.05}$ (by t)	ns	ns	25.17
CV% (s/means)	18.8	12.5	3.27

Seeding Date: May 7, 2011. Harvest Date: September 24, 2011.
Fertilizer (actual): 0-15-25.
Precipitation: 10.5 inches.
Sprayed with Prowl H_2O @ 32 oz/a on May 5, 2011, Then sprayed with Roundup WeatherMax @ 20 oz/a on 5/13/2011.
Western Triangle Ag. Research Center, Conrad, MT.

Title: Camelina, canola, and yellow mustard variety evaluation.

Year: 2011

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

Personnel: John Miller, MSU/MAES, Western Triangle Ag. Research Center, Conrad, MT. and Dave Wichman, MSU/MAES, Central Ag. Research Center, Moccasin, MT.

Project Coordinators: Camelina: Peggy Lamb, MSU/MAES, Northern Ag. Research Center, Havre, MT.

Canola and Mustard: Heather Mason and Brooke Bohannon, MSU/MAES, Northwestern Ag. Research Center, Creston, MT.

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

Procedures: Twelve camelina varieties, 18 canola varieties or hybrids, and one mustard variety were planted into fallow with a five-row, 12 inch spaced, plot. 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 direct cut and threshed with a Hege plot combine.

Results: Seed yields for camelina averaged 1264 lbs/a with a seed oil yield of 496 lbs/a. (Table 40) The canola nursery (Table 41) averaged 1861 lbs/acre with an oil yield of 948 lbs/a. There was one mustard *Brassica juncea* in the canola nursery. There was no lodging to report for either camelina or canola nurseries.

Table 40. Statewide Industry Camelina Variety Trial - Dryland, Fallow. Western Trinagle Ag. Research Center, Conrad, MT. 2011.

Entry	Grain Yield (lbs/a)	Test Weight (lb/bu)	Grain Protein (%)	Grain Oil (%)	Oil Yield (lb/a)	Flowering Date (Julian)	Maturity Date (Julian)	Plant Height (inches)
SO-40	1363	51.7	25.5	38.9	530	185	224	32.3
Yellowstone	1362	52.0	25.6	39.9	544	186	224	30.3
SO-60	1325	52.3	25.7	38.4	510	185	223	31.3
SO-50	1316	52.8	24.9	39.3	519	185	225	32.0
Clearwater Hy 101	1290	51.7	25.9	38.9	503	183	225	30.5
Calena	1256	52.9	25.0	38.9	489	185	225	29.8
SO-30	1255	52.8	25.1	39.7	500	184	223	29.3
C10-BZ-SB7-7	1238	52.4	25.0	39.6	490	185	225	31.8
Ligena	1232	52.2	24.8	39.7	491	185	223	31.0
Blaine Creek	1225	52.2	26.1	38.7	475	183	223	29.0
Suneson	1168	53.1	26.4	38.8	454	183	225	29.8
C10-BZ-SB7-6	1141	51.5	25.5	38.9	444	182	224	28.8
Mean	1264	52.3	25.4	39.2	496	184	224	30.5
LSD (p=0.05)	ns	0.5	ns	ns	ns	2.2	ns	ns
CV %	12.4	0.6	4.5	2.1	16.8	0.8	0.7	5.6
P-Value	0.877	<0.0001	0.603	0.194	0.9	0.009	0.251	0.065

Grain yield is reported "as was" at harvest - not adjusted to a uniform moisture content.
Grain protein, grain oil, and oil yield are reported on a dry matter basis.
Seeding Date: May 6, 2011.
Harvest Date: August 28, 2011.
Fertilizer (actual): 50-20-48-30.
Sprayed with Prowl H_2O @ 30 oz/a on May 5, 2011.

Table 41. Statewide Industry Canola Variety Trial - Dryland, Fallow. Western Trinagle Ag. Research Center, Conrad, MT. 2011.

Variety	Seed Yield (lb/a)	Seed Yield (bu/a)	Test Weight (lb/bu)	Oil Content (%)	Oil Yield (lb/a)	Protein Content (%)	Days to Flower	Days to Maturity	Plant Height (in)
HyClass 921	2170	41.3	52.5	51.8	1124	19.2	60	108	37
HyClass 947	2088	39.6	52.7	52.6	1099	18.2	60	106	39
HyClass 940	2067	39.7	52.1	50.8	1051	20.1	60	106	38
DKL 55-55	2052	39.1	52.4	52.6	1080	18.7	58	107	36
InVigor L130	2038	39.4	51.8	50.5	1028	19.6	59	107	38
DKL 30-42	2036	39.0	52.2	51.4	1046	19.4	57	108	35
DKL 70-07	2033	39.1	52.0	52.9	1076	18.3	59	108	38
InVigor 5440	2019	38.7	52.2	49.2	993	20.4	60	108	38
DKL 72-55	1980	38.1	51.9	52.3	1034	19.4	58	108	37
HyClass 955	1912	36.4	52.6	51.7	988	19.1	59	108	36
HyClass 988	1895	38.4	49.4	52.8	1001	17.9	60	107	40
InVigor L150	1872	35.9	52.1	50.4	944	20.1	60	107	39
DKL 52-41	1788	35.7	50.1	50.3	898	21.3	57	107	37
DKL 51-45	1784	34.6	51.5	51.4	918	19.3	59	106	38
InVigor 8440	1728	33.9	50.9	49.9	861	19.8	59	105	37
Arriba	1547	29.3	52.9	49.2	760	20.5	58	107	33
UISC00.3.1.17	1544	29.9	51.8	51.0	788	19.9	57	107	32
Oasis CL[1]	950	18.5	51.3	40.1	382	28.7	57	105	33
Mean	1861	35.9	51.8	50.6	948	20	59	107	37
LSD ($\alpha = 0.05$)	229.1	4.34	1.05	1.22	119.8	1.11	1.6	ns	2.4

Grain yield is reported "as was" at harvest - not adjusted to a uniform moisture content.
Grain protein, grain oil, and oil yield are reported on a dry matter basis.
Seeding Date: May 6, 2011.
Harvest (direct cut) Date: August 28, 2011.
Fertilizer (actual): 50-20-48-30
Sprayed with Prowl H_2O @ 32 oz/a on May 5, 2011.
[1] *Brassica juncea*
Western Triangle Ag. Research Center, Conrad, MT.

Title: A Comparison of Nitrogen Sources for Spring Wheat Production

Year: 2011

Locations: Western Triangle Ag. Research Center, Conrad, MT 59425.

Personnel: Olga Walsh and Clint Rouns, Western Triangle Ag. Research Center (WTARC), Conrad, MT 59425; Mal Westcott, Professor and Supt., Western Ag. Research Center (WARC), Corvallis; Heather Mason, Northwestern Ag. Research Center (NWARC), Kalispell, MT.

Objectives: 1. To evaluate environmentally smart nitrogen (ESN) as a nitrogen (N)fertilizer source for spring wheat production in Montana in comparison to urea.
2. To evaluate nitrogen use efficiency and grain yield and protein response to these two fertilizer materials, alone and in combination.

Procedures: Field trials were conducted at three locations in Montana: an irrigated site at WARC (data not shown) and two dryland sites, one at NWARC (data not shown) and one at WTARC. Plots were arranged in a split-plot design with N source (urea, ESN, and a 50:50 blend of urea and ESN) x N fertilizer rate (0, 50, 100, and 150 lbs N/ac) as the main plot factor and topdress (0 or 40 lb N/ac) as the subplot factor. At WTARC, hard red spring wheat (cv. Choteau) was planted at a rate of 80 lb/ac on May 5, 2011, into plots measuring 5' x 25'. There was an error in calculation of the 50:50 ESN:Urea blend at WTARC where the blend treatments received 100% of the urea and additional ESN at the 50% rate. For example, if the total rate was 100 lbs N/ac, the blend at WTARC was 100 lbs N as urea plus 50 lb N/ac as ESN.
At all locations, each plot was split into two subplots at Feekes 5 growth stage. One subplot received an additional 40 lb N/ac urea as a topdress, while the other plot received no topdress. Also at this stage, crop canopy reflectance was measured in each plot using the Greenseeker sensor at WTARC and WARC and using the PocketSensor at all locations. GreenSeeker optical sensor (model 505) developed by Oklahoma State University and later licensed to and commercialized by Trimble, and Pocket Sensor, a more portable and significantly less costly normalized difference vegetative index (NDVI) sensor recently developed in the U.S. were used to evaluate wheat nutrient status mid-season. Sensor-based reflectance measurements will contribute to the volume of reflectance measurements data collection from field experiments initiated across Montana in 2011. Following harvest, plot yield and grain protein were determined at all locations.

Results: 2011 was the first year of this study funded by the Montana Fertilizer Tax Advisory Committee. Site characteristics and soil test results are reported in Table 48. Due to the error with the fertilizer blend treatment, the blend was removed from the overall analysis. At WTARC, grain yield and protein content averaged 2,253 lb/ac and 9.4%, respectively. Grain yield was not affected by N source, where protein content was higher under ESN fertilizer than urea (Table 49). This suggests that the ESN may have been able to provide N to the crop later into the season than the urea, providing a protein boost to the harvested grain. Grain yield and protein improved with higher N application rates, up to 50 lb N/ac for yield and up to 150 lb N/ac for protein. Topdressing at 40 lb N/ac did not increase yield or protein at this location. From preliminary data, ESN and ESN:urea fertilizer blends do not result in consistent grain yield gains or increases

in wheat protein concentration compared to urea alone. Thus, there appears to be little advantage to using ESN or a ESN:urea blend on spring wheat, especially given its high cost (at the time of this report, the price of ESN/t was $1,100, compared to $600/t for urea). At all locations, N fertilizer applications of 100 lb N/ac increased grain yield and protein, but little gains in either variable were observed with higher N concentrations. The absence of any topdressing effect at WTARC could be explained by the unusually wet and cool growing year at that location.

GreenSeeker NDVI values were correlated with the Pocket Sensor-obtained NDVIs (R=0.6) at WARC and WTARC (Figure 10). While the correlation between the NDVI values obtained by the two sensors was very high (R2=0.9) at WARC, much weaker relationship was observed at WTARC (Figure 11). As illustrated in Figure 12, Pocket Sensor and GreenSeeker sensor were able to predict 40% and 50% of the variation in final spring wheat grain yield at WARC. A much weaker relationship between NDVI and yield was observed at WTARC (data not shown). The lack of consistent trend in sensor-based data reflects the need to streamline the procedure of sensor data collection. This may include ensuring that the sensors are held at the prescribed height above the canopy, and taking several sets of NDVI readings, especially with the Pocket Sensor, and then averaging the values.

Table 48. Site characteristics and soil test results, WTARC, 2011.

Character	Dryland Spring Wheat
Planting Date	05-05-2011
Topdress Date	06-12-2011
Growing Season Precipitation (inches)	8.7
Harvest Date	09-08-2011
Soil Series	Scobey Clay Loam
Soil Test	
pH	7.7
O.M. (%)	3.7
P (ppm)	20.0
K (ppm)	272
EC (mmhos/cm)	0.48
NO_3-N (0-6', lb/ac)	25

Table 49. The effects of N source, N rate and topdressing on grain yield and protein concentration of spring wheat, WTARC, 2011.

Effect/Treatment	Grain Yield, lb/ac	Protein, %
N source (S)		
Urea	2,235	9.2
ESN	2,270	9.5
Blend	-	-
F test	ns	*
LSD (α=0.05)	450	0.29
N rate (N)		
0	1,338	9.1
100	2,270	9.1
200	2,578	9.3
300	2,824	9.9
F test	**	**
LSD (α=0.05)	636.2	0.41
TD (T)		
0	2,211	9.4
40	2,294	9.5
F test	ns	ns
S x N	ns	ns
S x T	ns	ns
N x T	ns	ns
S x N x T	ns	ns
S x N x T	ns	ns

*, ** Effects are significant at P<0.05 and 0.01, respectively;
ns denotes non-significant effects.

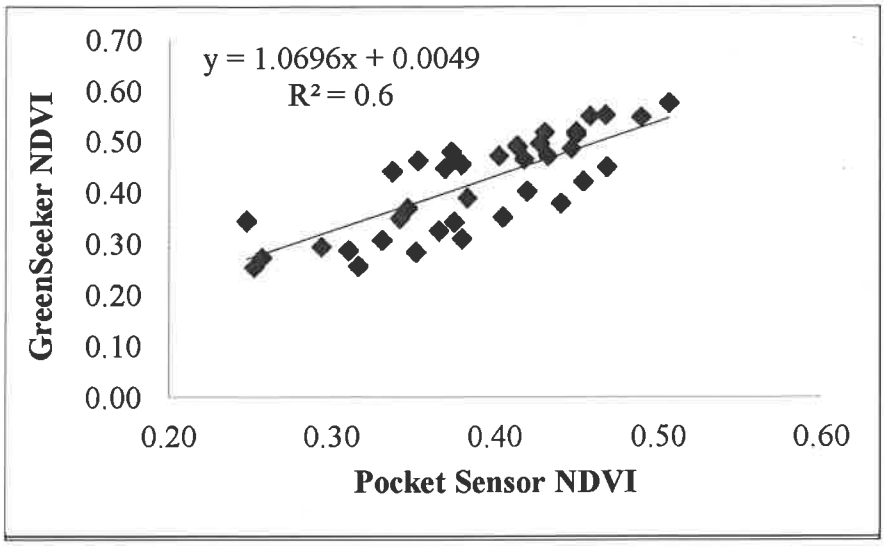


Figure 10. The relationship between Pocket Sensor NDVI and GreenSeeker NDVI WTARC and WARC (combined locations), 2011.

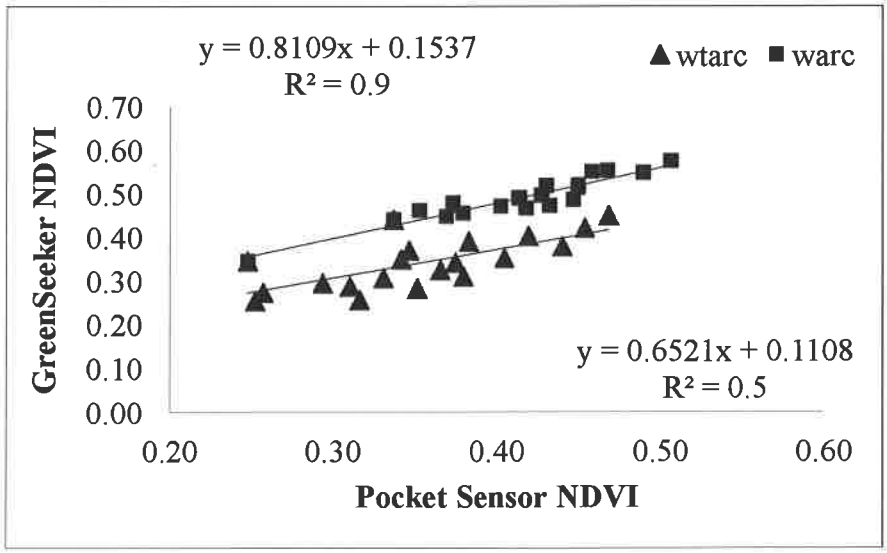


Figure 11. The relationship between Pocket Sensor NDVI and GreenSeeker NDVI WTARC and WARC, 2011.

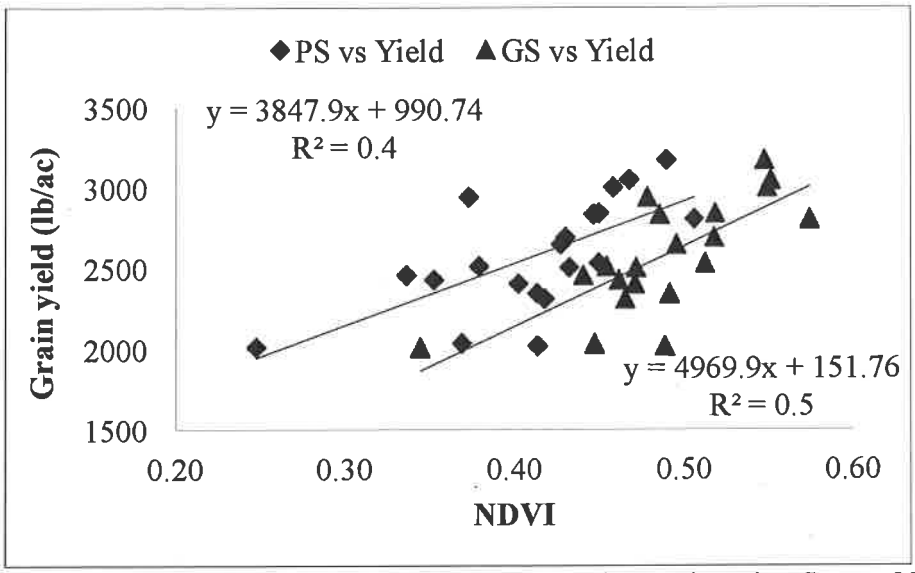


Figure 12. The relationship between GreenSeeker and Pocket Sensor NDVI and spring wheat grain yield, WARC, 2011.

Title: An examination of hard red spring wheat variety responses to wheat stem sawfly under phosphorus and nitrogen supplemented conditions.

Year: 2011

Location: Northeast of Conrad, Western Triangle Ag. Research Center, Conrad, MT. 59425.

Personnel: David Weaver, Olga Walsh, John Miller, and Kevin Delaney,

Objectives: To examine how wheat stem sawfly mining herbivory interacts with 1) phosphorus (P) deficiency and 2) nitrogen (N) deficiency in a factorial design under field conditions using spring wheat varieties that vary in sawfly host plant resistance levels.

Procedures: 2011 was the second year of this study funded by Fertilizer Tax Advisory Committee. The experiment was conducted at two sites in the area of MT that is predominantly planted to wheat. One site was near Devon (Northeast of Conrad) and the other was near Loma (data not shown). The experimental design was a RCBD with four spring wheat varieties and four fertilizer treatments. These were, using a factorial design, four replications using randomized complete blocks of each of the four soil nutrient x phosphorus treatments will be conducted at each research site: 1) ambient low phosphorus and low nitrogen, 2) supplemented high phosphorus and ambient low nitrogen, 3) ambient low phosphorus and supplemented high nitrogen, and 4) supplemented high phosphorus and high nitrogen levels. Supplement levels of phosphorus and nitrogen will match recommended levels for growers nearby to each experimental location. Four varieties will be planted to provide variation in resistance to *C. cinctus* across the four nitrogen*phosphorus treatments: 1) 'Reeder'- hollow stemmed and highly susceptible to sawfly injury, 2) 'Conan'- slightly solid stemmed and unattractive to sawfly when other host options are available (relative antixenosis) but capable of being infested and cut, 3) 'Ernest'- medium solid stemmed variety in Montana that offers partial sawfly resistance by killing some larvae to reduce stem lodging, and 4) 'Choteau'- currently the most consistently solid stemmed Montana spring wheat variety to offer partial sawfly resistance by killing some larvae to reduce stem lodging. Near Devon, the varieties Ernest, Choteau, Conan, and Reeder were planted into chemical fallow cropped in barley in 2011 using a 5 row, 12 inch spaced, plot planter equipped with Conserv-a-Pac® openers. Nitrogen fertilizer at the rates of 0 or 120 lbs N/acre in combination with 0 or 43 lbs P_2O_5 were applied while planting to each variety. Each plot was surface broadcast with N as urea and with 25 lbs KCl. P in phosphate form was placed with the seed while planting. Plot size was 5 by 25 feet with 4 replicates. The harvesting was done using a Hege® plot combine. At both sites, 3 one foot samples of row were collected 1 week before harvest for stem dissection to determine WSS infestation, parasitism of WSS larvae, and stem cutting by WSS larvae. Samples were typically removed with a shovel due to dry overall environmental conditions and the numbered of severed stems that challenge sample integrity. Yield per sample category was also measured. Combine and laboratory yield samples (adjusted to 12% moisture content after threshing) were collected. All statistical analyses were performed using SAS 9.3 statistical software (Cary, NC). Analysis of variance (ANOVA) was performed to examine treatment differences and any interactions. Treatment differences were explored using Gabriel's multiple comparison procedure. Variety, P, and N were fixed effects. The percentage of stems infested and cut by WSS, and the percentage of WSS larvae parasitized were arcsine square root transformed. All comparisons were tested at $P<0.05$ level.

Results: Site characteristics and soil test results are reported in Table 50. There was only an effect of N on yield. At Devon N+ (mean = 28.7) was about 9 bushels acre^{-1} greater than N- (mean = 19.4). Yield is averaged per stem to account for differences in stem number per sample. There is no apparent response to N (Figure 13) when infestation exceeds 80% and infestation only exceeds 80% in the N+ treatment. At Devon, the N- mean = 0.89 (infestation was always <80%); but when infestation was <80% the N+ mean = 1.03 and when infestation >80% the mean = 0.86. It is likely that supplemental N available at >80% infestation

exceeds a threshold where the amount utilized by the plants is lower than the increased utilization by the insects.

Infestation by WSS. At the site near Devon, the percentage of stems infested (Figure 14) was higher in the N+ treatments, (N+ mean = 47.3; N- mean = 37.2) and there was an interaction between N and P with N+P+ (mean = 51.6) greater than N-P+ (mean = 34.7). The means for N-P- and N+P- were statistically intermediate in the means separation. There was a variety effect driven by Reeder (mean = 61.4) that was greater than for all other varieties. The infestation in Reeder was expected to be greater than in Conan given the findings. In terms of overall varietal response, unpublished observations indicate that the non-preference for Conan is a relatively rare thing in wheat, with most varieties including Choteau and Ernest probably being more attractive.

Parasitism of WSS larvae. Parasitoids killed over 30% of the total WSS larvae at Devon and less than 10% at Loma (Figure 15). There was a positive effect of N on the percentage of WSS parasitized at Devon (N+ mean = 36.2, N- mean = 21.9). There were no effects of variety, P, or any interactions at Devon. These data report the percentage of WSS larvae killed which corrects for the number of infested stems. There could be a possible role of increased signaling to parasitoids using wheat volatiles in this system.

Stem cutting by WSS. There was no effect of either N or P on the percentage of stems cut by WSS near Devon (Figure 16). However there was a significant effect of variety on stem cutting, with Reeder (mean = 17.7) having the greatest number. Stem cutting by WSS in Conan (mean = 10.3) and in Choteau (mean = 9.4) were lower than in Reeder, while the percentage of stems cut in Ernest (mean = 12.9) was statistically intermediate in the means separation. Conan is cut less because it is infested less and the solid stem varieties are also cut less because they kill some of the larvae before they can cut the stems

Summary: Nutrient considerations have rarely been applied to WSS infested wheat crops, and never previously for the interactions between types of host plant resistance and natural enemies in a RCBD in the field. It appears that nutrients variably impact different stages in the process of overall crop yield loss. In these experiments innate yield potential was compromised by higher levels of infestation due to enhanced host preference. Mortality caused by solid stems appeared to be less effective than non-preference in these experiments bringing varieties expected to yield greater closer to those expected to yield less. A direct effect of N on parasitoids, when sufficiently abundant, appears likely. The study will be replicated in the coming year.

Table 50. Site characteristics and soil test results, Devon, 2011.

Character	Value
Planting Date	4/27/2011
Previous Crop	Chemical Fallow
Blanket Fertilizer	0-0-25
Precipitation(in)	10.2
Harvest Date	8-29-2011
Soil Series	Assiniboine, fine sandy loam
Soil Test	
pH	7.4
O.M. (%)	0.8
P (ppm)	12.5
K (ppm)	322
EC (mmhos/cm)	0.19
NO_3-N (0-3', lb/ac)	21.0

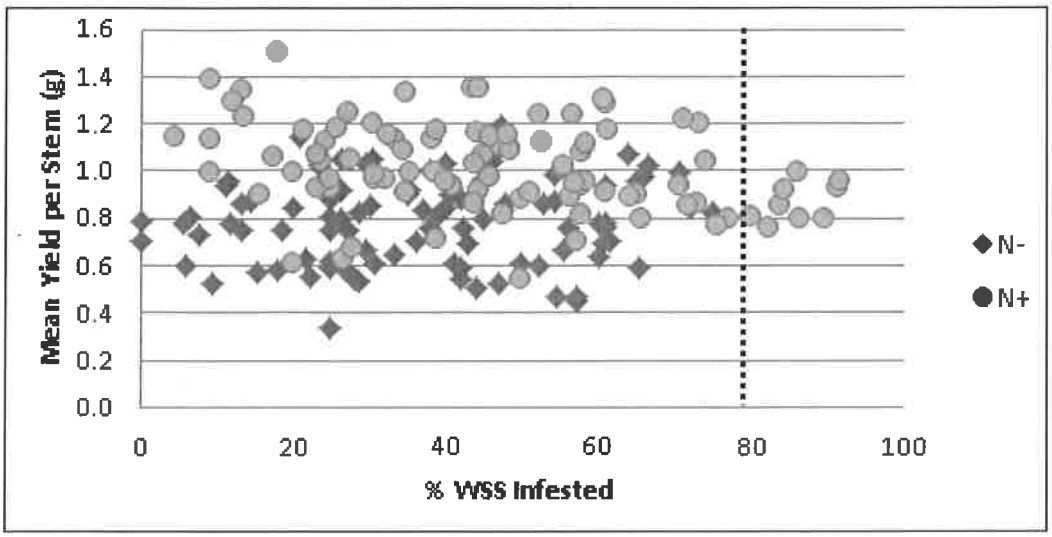


Figure 13. Yield per stem for two N treatments as a function of WSS infestation, Devon, 2011.

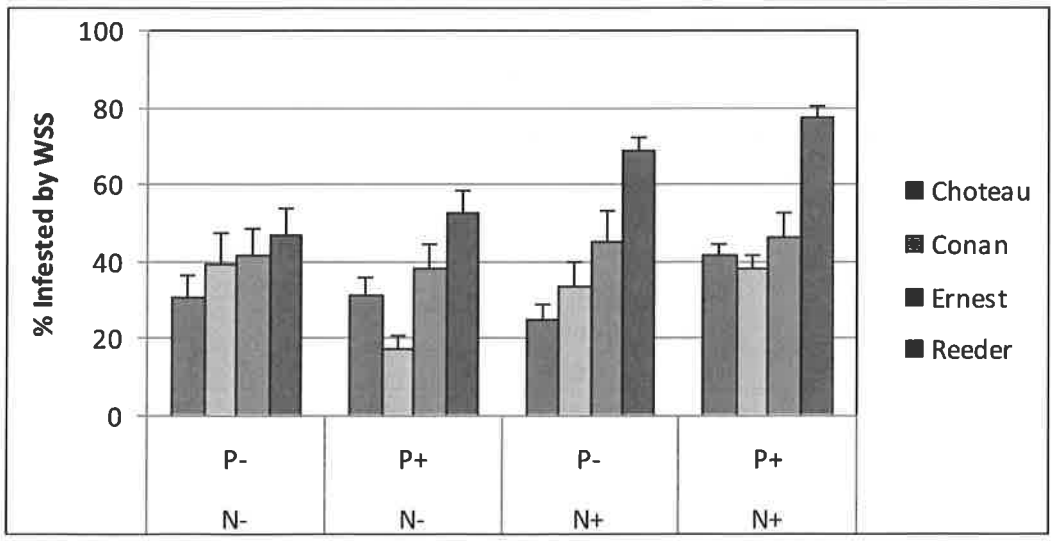


Figure 14. Stems infested with WSS, Devon, 2011.

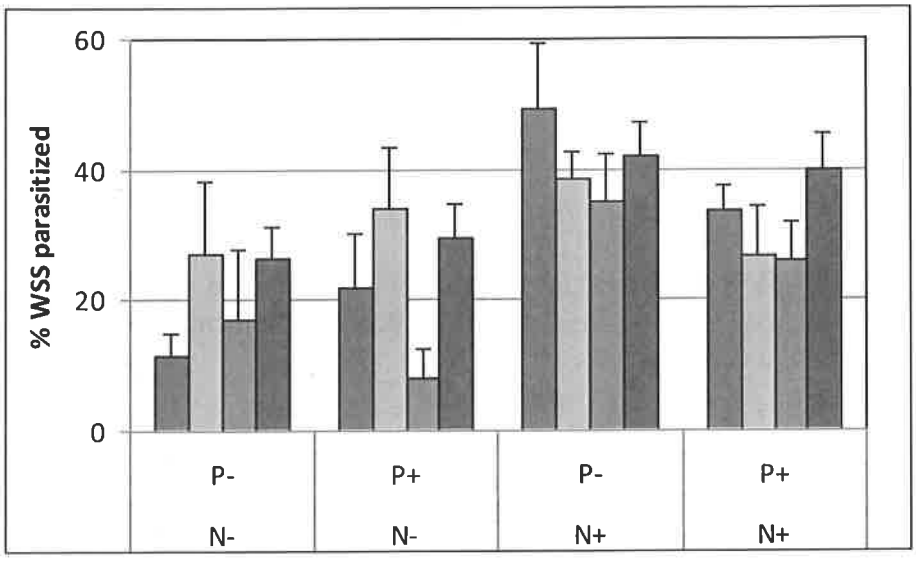


Figure 15. The percentage of WSS larvae killed by braconid parasitoids, Devon, 2011.

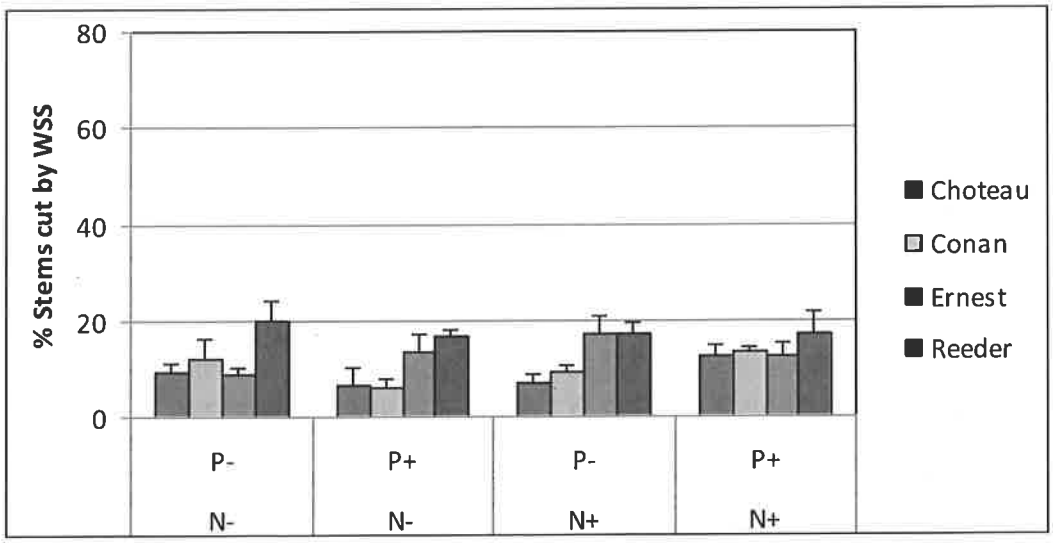


Figure 16. Stems cut by WSS, Devon, 2011.

Title: Effect of Nitrogen Sources, Rates, and Application Time on Spring Wheat Yield and Grain Protein

Year: 2011

Locations: Western Triangle Ag. Research Center, Conrad, MT 59425.

Personnel: Olga Walsh and Clint Rouns, Western Triangle Ag. Research Center (WTARC), Conrad, MT 59425; Jack Patton, Producer, Knees, Chouteau County; Pat Wheeler, Producer, Valier, Pondera County

Objective: To determine the most efficient nitrogen (N) fertilizer source, rate, and application time combination for optimizing Montana spring wheat yield while maximizing grain protein.

Procedures: 2011 was the first year for this study funded by Fertilizer Tax Advisory Committee. Three dryland experiments were established: one at WTARC and two in cooperating producers' fields (Jack Patton, Knees, Chouteau County, and Pat Wheeler, Valier, Pondera County) using Choteau spring wheat variety. The plot size was 5'x 25'. The treatment structure is reported in Table 42. A combination of 4 preplant N rates (0, 40, 80, and 120 lbs N ac), 3 topdress N rates (0, 40, and 80 lb N ac), 2 topdress N fertilizer sources (granual – urea, 46-0-0, and liquid – urea ammonium nitrate (UAN) , 28-0-0), and 2 topdress application times (before flowering and after flowering) were evaluated. Urea was manually broadcasted and UAN was applied as a foliar spray using backpack sprayers. Each treatment was replicated 4 times at each location. Treatment effect (preplant N rate, topdress N source, rate, and application time) on spring wheat grain yield, and grain protein content were evaluated using statistical procedures.

Results: Site characteristics and soil test results are reported in Table 43. 2011 was the first year of this study funded by the Montana Fertilizer Tax Advisory Committee. The data for two sites – WTARC and Patton were analyzed; the data from Wheeler site was lost due to unidentified fertilizer application error. At WTARC, the highest grain yield and highest grain protein content were achieved with the following N source/rate/time combination: 40 lbs of N/ac preplant plus 80 lbs of N/ac applied as a foliar UAN spray right before flowering. At Patton, the best combination of N source/rate/time was: 40 lbs N/ac preplant followed by application of 80 lbs N/ac topdress as urea right after flowering.

Grain Yield

Spring wheat grain yield ranged from 655 to 1641 lbs/ac at WTARC (Figure 1) and from 1320 to 1522 lbs/ac at Patton (Figure 2). Overall, yields were comparable at two sites; much more pronounced response to fertilizer N was observed at WTARC (Table 44). The unfertilized check plot yielded double and the yields were more uniform at Patton compared to WTARC. At both sites, preplant N rate had no statistically significant effect on grain yield, plots fertilized with 80 and with 135 lbs N/ac had similar yields (1641 and 1632 lbs/ac at WTARC and 1408 and 1378 lbs/ac at Patton). Also, application of all fertilizer N preplant (no topdress applied) resulted in the best yields at WTARC and one of the top-yielding plots at Patton. Because a great response to fertilizer N was observed at WTARC, preplant N application at 80 and 135 lbs N/ac (with 80 lbs

N/ac rate being sufficient) strongly benefited crop establishment and development. Topdress application of UAN before flowering at 80 lbs N/ac increased grain yield by over 215 lbs/ac compared to 40 lbs N/ac rate at WTARC. At Patton, doubling topdress rate from 40 to 80 lbs N/ac decreased yield, but only about 35 lbs/ac. At both locations, when topdress was applied as urea before flowering, grain yields were similar at both topdress rates. At Patton, when topdress fertilizer N was applied as urea after flowering, topdress rate of 80 lbs N/ac resulted in significantly higher grain yields compared to topdress rate of 40 lbs N/ac. Plots that received 40 lbs N/ac yielded almost 200 lbs less, than those that received 80 lbs N/ac rate. On the other hand, when the same fertilizer treatments were applied using UAN, grain yields decreased significantly when N rate was doubled from 40 to 80 lbs N/ac. In fact, plots sprayed with a high N rate of UAN (both before and after flowering) yielded a low as the unfertilized check plot at Patton. Similar trend was observed at WTARC, where UAN spray after flowering at 90 lbs N/ac resulted in almost 150 lbs/ac lower grain yields compared to 45 lbs N/ac.

Grain Protein Content

Grain protein content was higher at Patton site compared to WTARC. Patton protein content varied from 15.1 to 16.5%, while WTARC protein content ranged between 9.2 and 11.5% (Figures 3 and 4). Overall, at both sites, no statistically significant differences in grain protein content associated with either N fertilizer source, rate or topdress application time were observed (Table 45). The only exception was grain protein content at WTARC, where it was statistically significantly higher with urea compared to UAN.

Table 42. Treatment structure, WTARC and Patton, 2011.

Treatment	Fertilizer N Application					
	Preplant rate, lb N ac	Preplant source	Todress rate, lb N ac	Todress source	Topdress application time	Total N applied, lb N ac
1	0	n/a	0	n/a	n/a	0
2	80	urea	0	n/a	n/a	80
3	120	urea	0	n/a	n/a	120
4	40	urea	40	urea	Before flowering	80
5	40	urea	40	urea	After flowering	80
6	40	urea	80	urea	Before flowering	120
7	40	urea	80	urea	After flowering	120
8	40	urea	40	UAN	Before flowering	80
9	40	urea	40	UAN	After flowering	80
10	40	urea	80	UAN	Before flowering	120
11	40	urea	80	UAN	After flowering	120

Table 43. Site characteristics and soil test results, WTARC and Patton, 2011.

Character	Dryland Spring Wheat	
	WTARC	Patton
Planting Date	05-05-2011	05-05-2011
Topdress Date	06-12-2011	06-13-2011
Growing Season Precipitation (inches)	8.7	8.7
Harvest Date	09-08-2011	08-25-2011
Soil Series	Scobey Clay Loam	Ethridge - Lonna, Silthy Clay Loam
Soil Test		
pH	7.7	7.8
O.M. (%)	3.7	3.0
P (ppm)	20.0	9.0
K (ppm)	272	352
EC (mmhos/cm)	0.48	0.98
NO_3-N (0-6', lb/ac)	25	28

Table 44. Grain yield and grain protein content, WTARC and Patton, 2011.

Treatment	Grain yield, lb/ac		Grain Protein content, %	
	WTARC	Patton	WTARC	Patton
1	655	1319	10.3	15.8
2	1641	1411	9.2	15.2
3	1632	1381	10.3	15.2
4	1095	1351	9.6	16.0
5	1128	1327	9.5	15.7
6	1093	1426	9.8	15.3
7	1222	1526	9.4	16.5
8	1347	1377	9.7	15.1
9	1167	1466	11.1	15.8
10	1564	1340	10.3	16.3
11	1020	1224	11.5	15.6

Table 45. The effects of topdress N source, topdress N rate and application time on grain yield and grain protein content of spring wheat, WTARC and Patton, 2011.

Effect/Treatment	WTARC		Patton	
	Grain Yield, lb/ac	Protein, %	Grain Yield, lb/ac	Protein, %
Topdress N source (S)				
Urea	1275	9.6	1553	15.9
UAN	1432	10.7	1542	15.4
F test	ns	***	ns	ns
LSD (α=0.05)	291	0.8	170	1.1
CV	17.9	6.7	9.1	5.6
Topdress N rate (N)				
40	1184	10.0	1381	15.7
80	1225	10.3	1379	15.9
F test	ns	ns	ns	ns
LSD (α=0.05)	442	1.1	180	1.1
CV	26.8	9.2	9.8	5.7
Topdress N Application Time (T)				
Before Flowering	1432	9.9	1540	15.6
After Flowering	1274	10.4	1553	15.6
F test	ns	ns	ns	ns
LSD (α=0.05)	291	1.0	170	1.1
CV	17.9	8.4	9.1	5.8

*, ** Effects are significant at P<0.05 and 0.01, respectively; ns denotes non-significant effects.

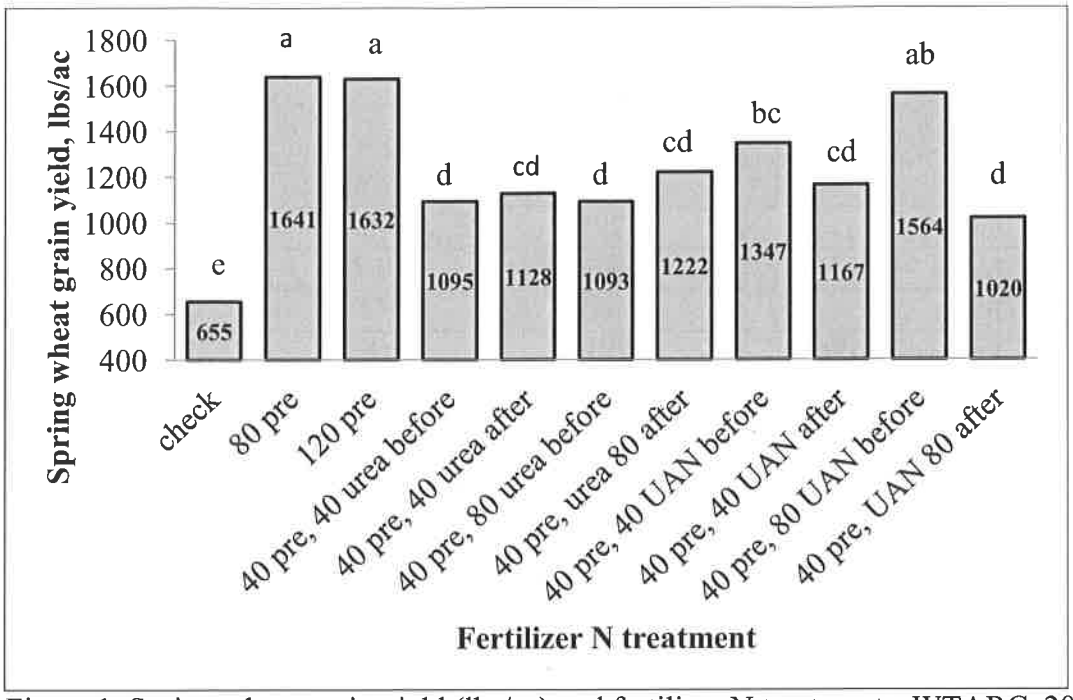


Figure 1. Spring wheat grain yield (lbs/ac) and fertilizer N treatments, WTARC, 2011. Bars with the same letters are not statistically significantly different ($p<0.05$).

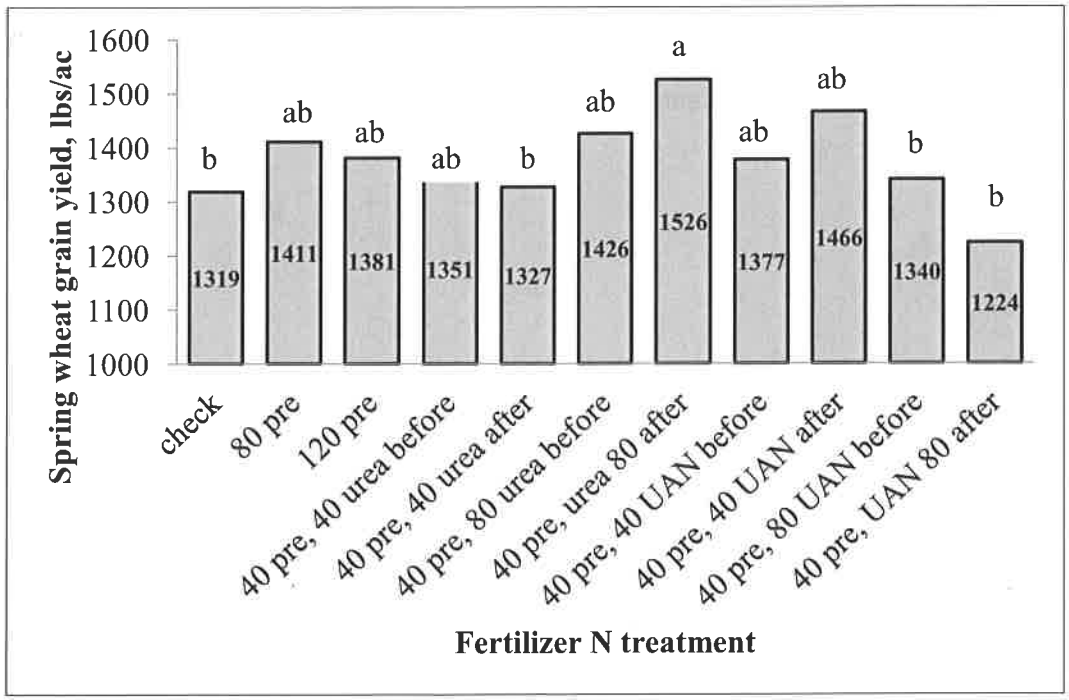


Figure 2. Spring wheat grain yield (lbs/ac) and fertilizer N treatments, Patton, 2011. Bars with the same letters are not statistically significantly different ($p<0.05$).

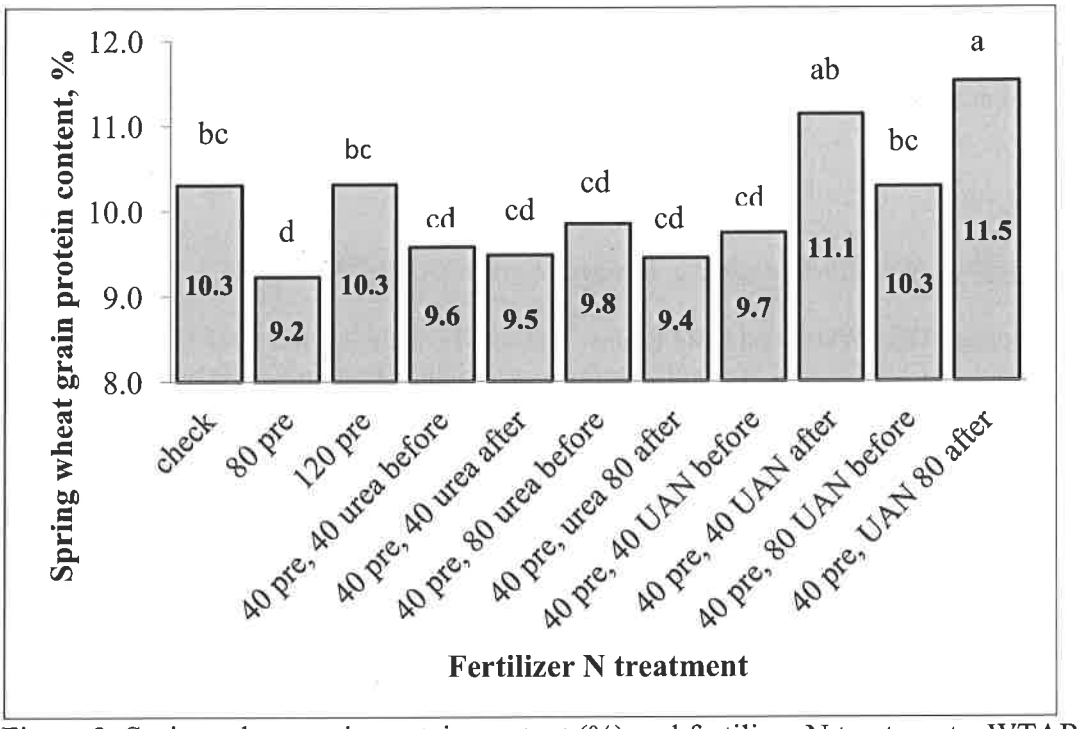


Figure 3. Spring wheat grain protein content (%) and fertilizer N treatments, WTARC, 2011. Bars with the same letters are not statistically significantly different ($p<0.05$).

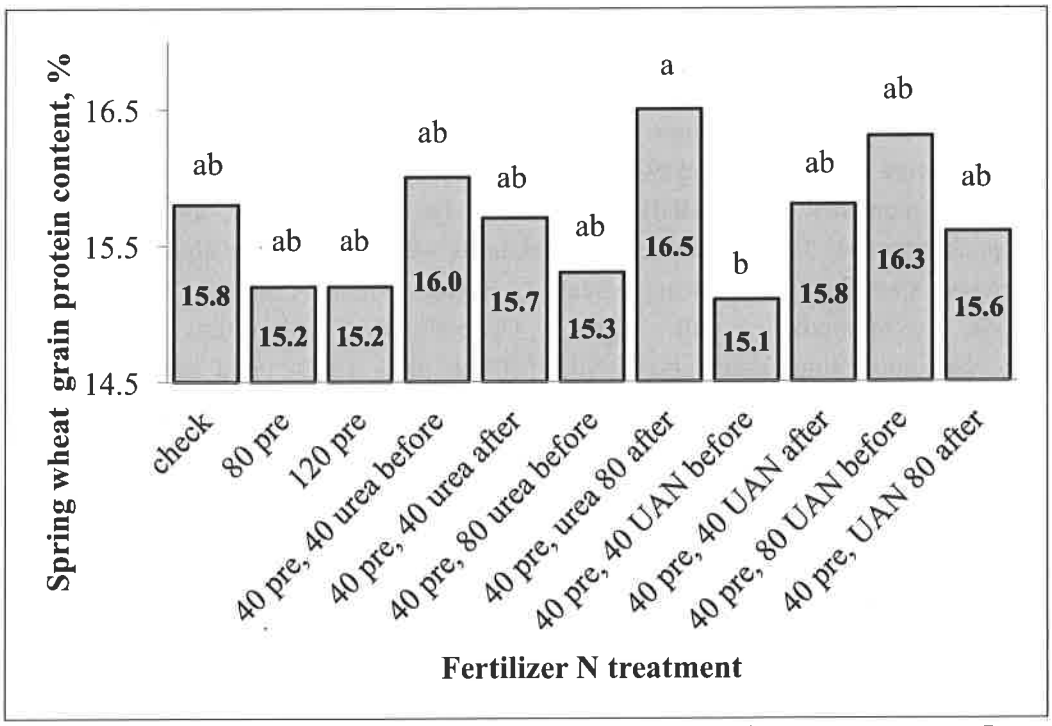


Figure 4. Spring wheat grain protein content (%) and fertilizer N treatments, Patton, 2011. Bars with the same letters are not statistically significantly different ($p<0.05$).

Title: Evaluation of Sensor-Based Technologies and Nitrogen Sources for Improved Recommendations for Dryland and Irrigated Spring Wheat Production in Montana

Year: 2011

Locations: Western Triangle Ag. Research Center, Conrad, MT 59425.

Personnel: Olga Walsh and Clint Rouns, Western Triangle Ag. Research Center (WTARC), Conrad, MT 59425; Mal Westcott, Professor and Supt., Western Ag. Research Center (WARC), Corvallis; Pat Wheeler, Producer, Valier, Pondera County.

Objectives: 1. To evaluate two sensors (GreenSeeker, and Pocket Sensor) for developing normalized difference vegetative index (NDVI)-based topdress fertilizer nitrogen (N) recommendations in spring wheat in Montana.

2. To determine whether sensor-based recommendations have to be adjusted depending on what N fertilizer source (liquid urea ammonium nitrate (UAN), or granular urea) is used.

Procedures: 2011 was the first year for this study funded by Fertilizer Tax Advisory Committee. Three experiments: two dryland studies - at WTARC near Conrad, MT and in cooperating producer's field (Pat Wheeler, Valier, Pondera County) and one irrigated study at WARC, near Corvallis, MT, were initiated in spring 2011 using the spring wheat variety Choteau. Treatment structure is reported in Table 46. Four preplant N rates - 20, 40, 60, and 80 lb N ac^{-1} were applied as broadcasted urea. Treatment 1 was established as an unfertilized check plot. Treatment 2 received 220 lb N ac^{-1} preplant as urea and served as a non-limiting N-rich reference. Each treatment was replicated 4 times. The plot size was 5'x 25'. The NDVI readings from each treatment were collected at Feekes 5 growth stage. Topdress N fertilizer was supplied as urea (as dry prills, manually broadcasted) and as UAN (as a foliar spray, using a battery operated backpack sprayer). Topdress N recommendations were made using algorithms experimentally developed specifically for spring wheat: 1. Spring Wheat (Canada), 2. Spring Wheat (US, Canada, Mexico), and 3. Generalized Algorithm. (available at: http://www.soiltesting.okstate.edu/SBNRC/SBNRC.php). Grain yield and protein content data were analyzed to determine whether there were statistically significant differences depending what sensor was used to make fertilizer N recommendations.

Results: 2011 was the first year of this study funded by the Montana Fertilizer Tax Advisory Committee. The data for two sites – WTARC and WARC were analyzed; the data from Wheeler site was lost due to unidentified fertilizer application error. Spring wheat grain yield and protein data is reported in Table 46. Site characteristics and soil test results are summarized in Table 47. There was a noted response to fertilizer N at both sites (Figure 5). Spring wheat mean grain yields ranged from 829 to 2378 lbs/ac at WTARC and from 1822 to 3558 lbs/ac at WARC. Overall, wheat's maximum yield potential has not been attained due to fact that not sufficient topdress fertilizer N rates were prescribed based on all 3 algorithms tested. The highest yielding treatments at both locations were those that received the highest preplant N rates (treatments 2, 6,

and 10). While at dryland location (WTARC), the source of topdress N did not affect grain yield (treatment 6 vs treatment 10), at irrigated location (WARC), application of topdress as urea (treatment 6) resulted in significantly higher yields compared to yields for plots that received topdress as UAN (treatment 10). Similar trend was observed for treatments that received 60 lbs N/ac preplant. At the irrigated site, supplying topdress N as urea (treatment 5) resulted in significantly higher yields compared to treatment 9 (topdressed with UAN). On the other hand, at the dryland site, plots topdressed with UAN yielded higher (treatment 9) compared to those topdressed with urea (treatment 5). Treatments 3 and 7 (20 lbs N/ac preplant) yielded the lowest at both locations. Grain protein content ranged from 9.1 to 10.8 % at WTARC and from 13.5 to 16.4 % at WARC. At both locations, the highest protein content was achieved with the highest preplant N rate applied (treatment 2).

GreenSeeker NDVI values obtained at Feekes 5 growth stage were strongly correlated with spring wheat grain yield (R^2 = 0.73) (Figure 6). Pocket Sensor NDVI values collected at Feekes 5 growth stage were able to predict 51% of spring wheat grain yield (R^2 = 0.51) (Figure 7). Interestingly, both GreenSeeker- and Pocket Sensor-based NDVI were able to predict grain yield better at WTARC (dryland site) compared to WARC (irrigated site) (Figures 8 and 9). The NDVI values ranged from 0.3 to 0.7 at both locations. At both sites, NDVI values obtained with either GreenSeeker of Pocket Sensor were not useful in predicting grain protein content (data not shown).

The Spring Wheat Algorithm (Canada) suggested that no topdress N was needed to reach crop's yield potential no matter what NDVI value was registered for the plots at both locations. Similar situation was observed when computing topdress N rates using Generalized Algorithm. The Spring Wheat Algorithm (USA/Canada/Mexico) recommended application of 31 to 140 lbs N/ac at WTARC and from 26 to 71 at lbs N/ac WARC depending on the NDVI values. At WARC, the plots with NDVI of 0.3, 0.4, and 0.5 were prescribed 26, 51, and 71 lbs N/ac topdress rates respectively. At WTARC, the plots with NDVI values of 0.4 and 0.5 were prescribed 31 and 140 lbs N/ac rates respectably. No topdress was recommended for plots with NDVI values greater than 0.5 at both locations. At both sites, topdress fertilizer N rates were applied as prescribed by the Spring Wheat Algorithm (USA/Canada/Mexico) algorithm.

Initial results suggest that urea might be more efficient in irrigated systems, while UAN might be a better N source choice in dryland conditions. Spectral measurements were correlated with final grain yield, and the variation in NDVI values was reflected in wide-ranging topdress rates prescribed by the Spring Wheat Algorithm (USA/Canada/Mexico) algorithm. On the other hand, topdress rates were not adequate and did not result in maximized grain yields. Results support the reports that algorithms developed in other regions are not feasible for Montana growing conditions and emphasize the urgent need to develop crop-specific and region-specific fertilizer optimization algorithms for the benefit of Montana wheat producers.

Table 46. Preplant N (lbs N/ac), topdress N, grain yield (lbs/ac), and grain protein content (%), WTARC and WARC, 2011.

Treatment	Preplant N Fertilizer Rate, lb N ac^{-1}*	Topdress N Fertilizer Source**	Grain Yield, lbs N ac^{-1}		Grain Protein, %	
			WTARC	WARC	WTARC	WARC
1	0	-	829	1822	10.5	14.1
2	220	urea	2378	3335	10.8	16.4
3	20	urea	1369	2488	9.8	14.6
4	40	urea	1388	3061	9.5	13.1
5	60	urea	1662	3453	9.5	15.2
6	80	urea	1925	3558	9.5	15.1
7	20	UAN	1298	2907	10.0	14.5
8	40	UAN	1465	3136	9.8	13.5
9	60	UAN	1771	3004	9.1	14.3
10	80	UAN	1935	3210	9.5	15.1

* Preplant fertilizer N was applied as urea. ** Todress fertilizer N rates were determined based on the NDVI values obtained using GreenSeeker and Pocket Sensor.

Table 47. Site characteristics and soil test results, WTARC and WARC, 2011.

Character	Dryland Spring Wheat	
	WTARC	WARC
Planting Date	05-05-2011	04-22-2011
Topdress Date	06-12-2011	06-24-2011
Growing Season Precipitation (inches)	8.7	5.4 Plus irrigation - 4.5
Harvest Date	09-08-2011	12-08-2011
Soil Series	Scobey Clay Loam	Burnt Fork silt Loam
Soil Test		
pH	7.7	7.8
O.M. (%)	3.7	1.5
P (ppm)	20.0	18
K (ppm)	272	221
EC (mmhos/cm)	0.48	0.35
NO_3-N	25(0-6', lb/ac)	86(0-3', lb/ac)

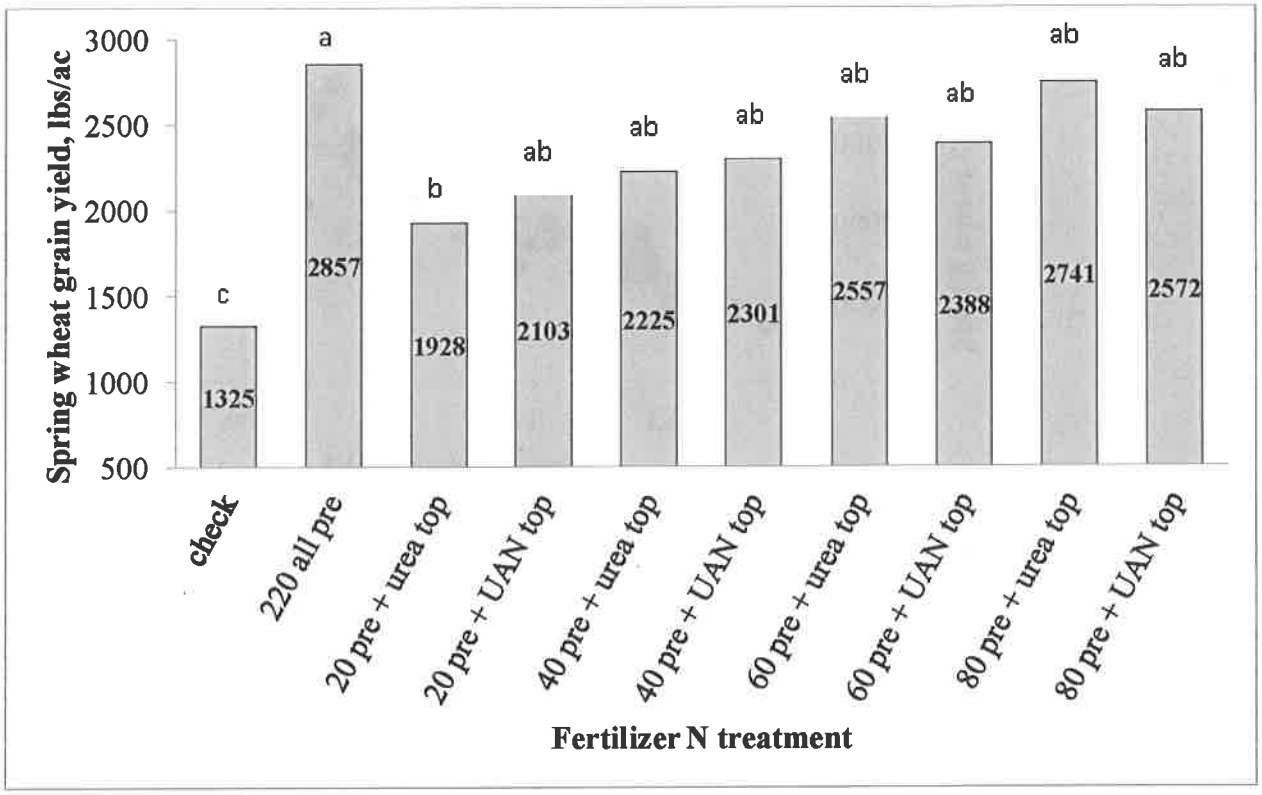


Figure 5. Spring wheat grain yield for WARC and WARC (averaged over both locations) and fertilizer treatments, 2011. Bars with the same letters are not statistically significantly different ($p<0.05$).

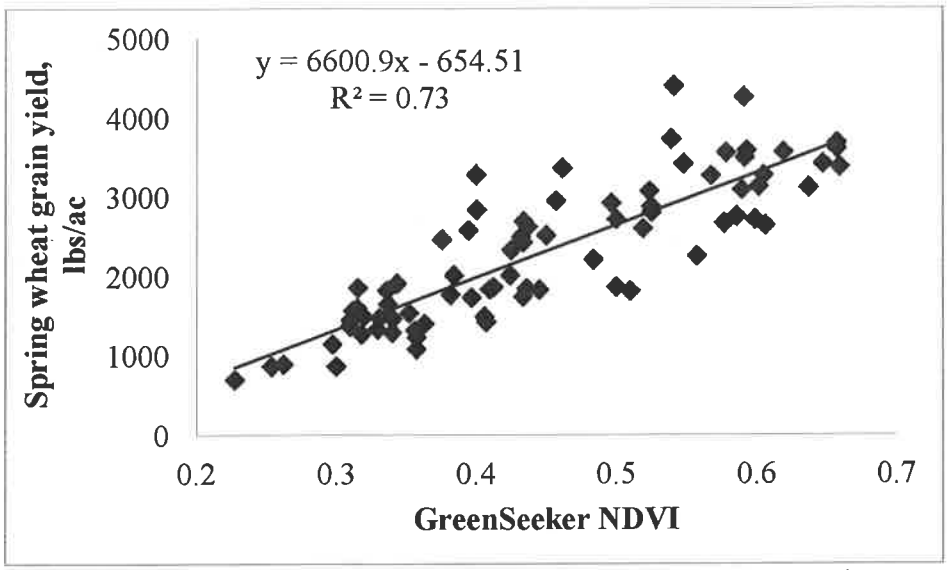


Figure 6. Relationship between GreenSeeker NDVI and spring wheat grain yield at WTARC and WARC (combined locations), 2011.

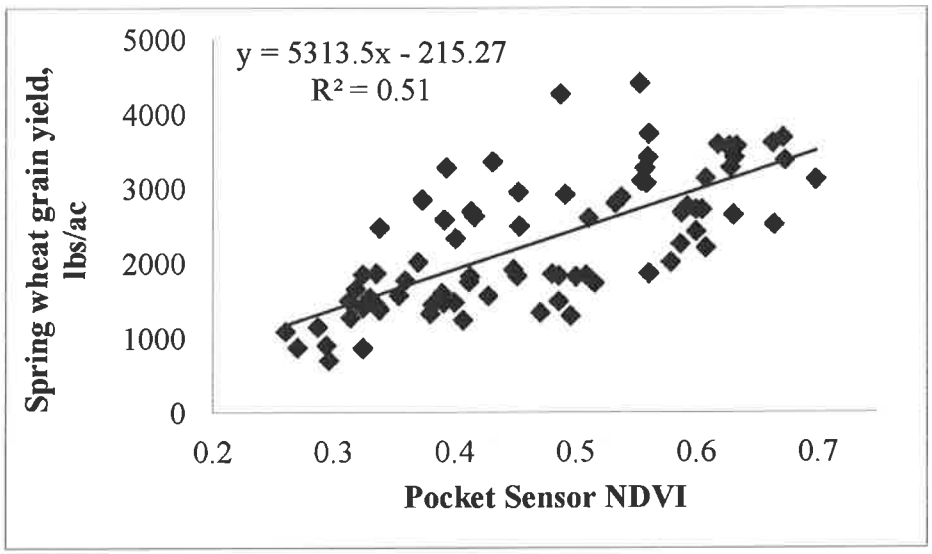


Figure 7. Relationship between Pocket Sensor NDVI and spring wheat grain yield at WTARC and WARC (combined locations), 2011.

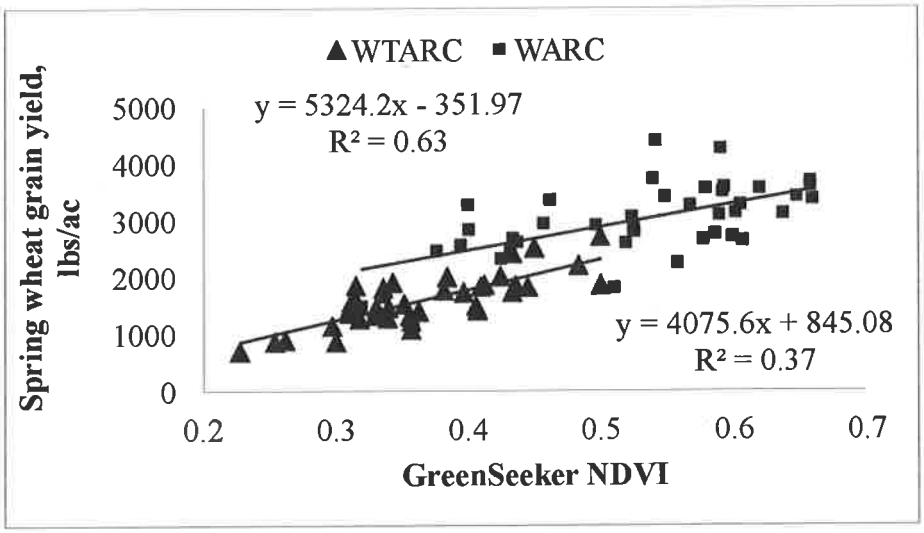


Figure 8. Relationships between GreenSeeker NDVI and spring wheat grain yield at WTARC and WARC, 2011.

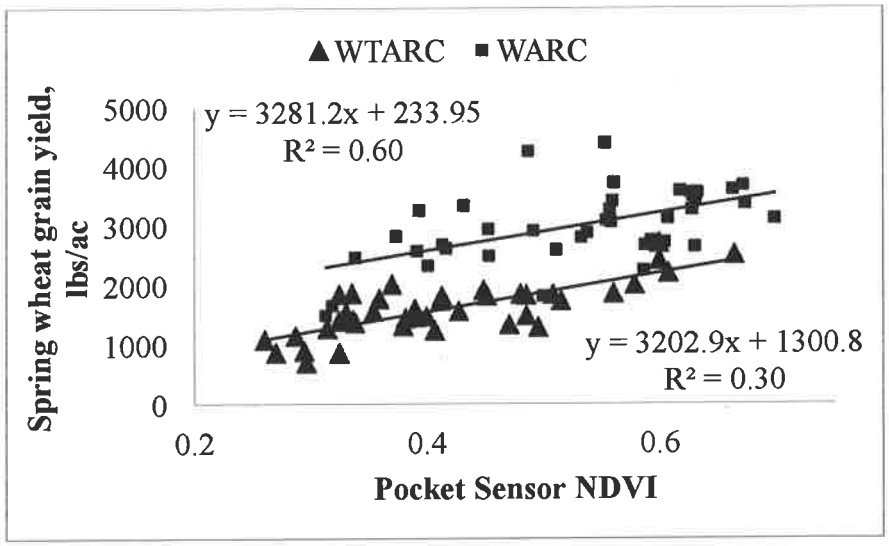


Figure 9. Relationships between Poket Sensor NDVI and spring wheat grain yield at WTARC and WARC, 2011.

Title: Improving Nitrogen Use Efficiency in Winter Wheat Using Sensor-Based Technologies and Split Nitrogen Application

Year: 2011

Locations: Western Triangle Ag. Research Center, Conrad, MT 59425.

Personnel: Olga Walsh and Clint Rouns, Western Triangle Ag. Research Center (WTARC), Conrad, MT, 59425; Jeff Whitmus, Research Assistant III, Northern Ag. Research Center (NARC), Havre; Mal Westcott, Professor and Supt., Western Ag. Research Center (WARC)Corvallis; Chengci Chen, Assistant Professor, Central Ag. Research Center (CARC), Moccasin.

Objectives: 1. To determine which sensor bands or combination of bands forming vegetation indices are optimum for predicting N status in Montana winter wheat.

2. To establish relationships between vegetation indices calculated using crop canopy reflectance measurements obtained with Crop Circle hand-held sensor, preplant soil N, flag leaf N, SPAD chlorophyll meter readings, total plant biomass, grain yield, and grain protein content of irrigated and dryland winter wheat.

Procedures: This project has been funded by Fertilizer Tax Advisory Committee and was originally initiated in 2009-2010, and continued in 2010-2011 growing season. Two dryland studies at WTARC and CARC (data not shown), and two irrigated studies at WARC and NARC (data not shown) were established using winter wheat cultivars of Rampart and Yellowstone with four preplant N rates based on the initial soil N status and individual location yield goal. Crop N indices were calculated using crop canopy reflectance measurements obtained with a Crop Circle ACS-470 hand-held sensor at tillering, heading, and flowering. The Crop Circle ACS-470 multi spectral sensor measures three narrow spectral bands of the electromagnetic spectrum. Flag leaf N measurements and SPAD chlorophyll meter readings were taken at heading. At irrigated locations, the plots were divided into three subplots to receive 0 lbs N/ac, 40 lbs N/ac at tillering, and 40 lbs N/ac after flowering followed by irrigation. At dryland sites, two subplots were established to receive 0 and 40 lbs N/ac at tillering. Total yield and total crop N uptake were determined at crop maturity and grain yield and protein content were determined after ripening. Grain yield and protein content response to N were regressed against the measures of crop N status and vegetation indices to determine their effectiveness in detecting crop N deficiencies.

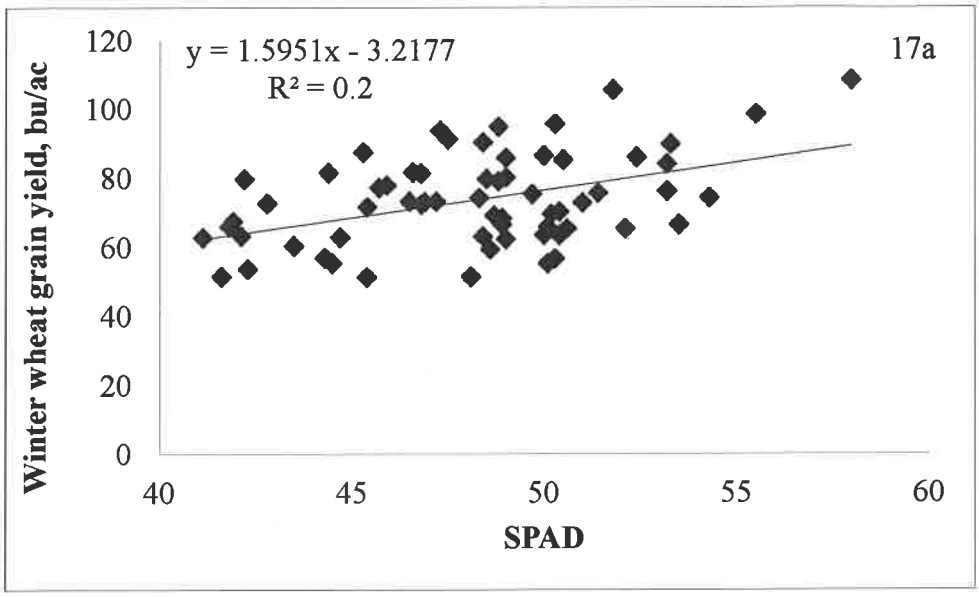
Results: SPAD readings, plant height, biomass, grain yield and grain protein content are reported in Table 51. Site characteristics and soil test results are summarized in Table 52. Great volume of agronomic and spectral reflectance data from four experimental sites has been compiled and is being analyzed. This report contains summarized results of some of agronomic data and raw measured data. The NDVI-based spectral indices are currently being analyzed for all four experimental sites. In 2011 at WTARC, winter wheat grain yields ranged from 67 to 81 bu/ac. Very little response to fertilizer N was observed. Grain protein varied from 8.7 to 14.9 %. SPAD relative chlorophyll readings varied from 41 to 58 with an average of 48. These results are

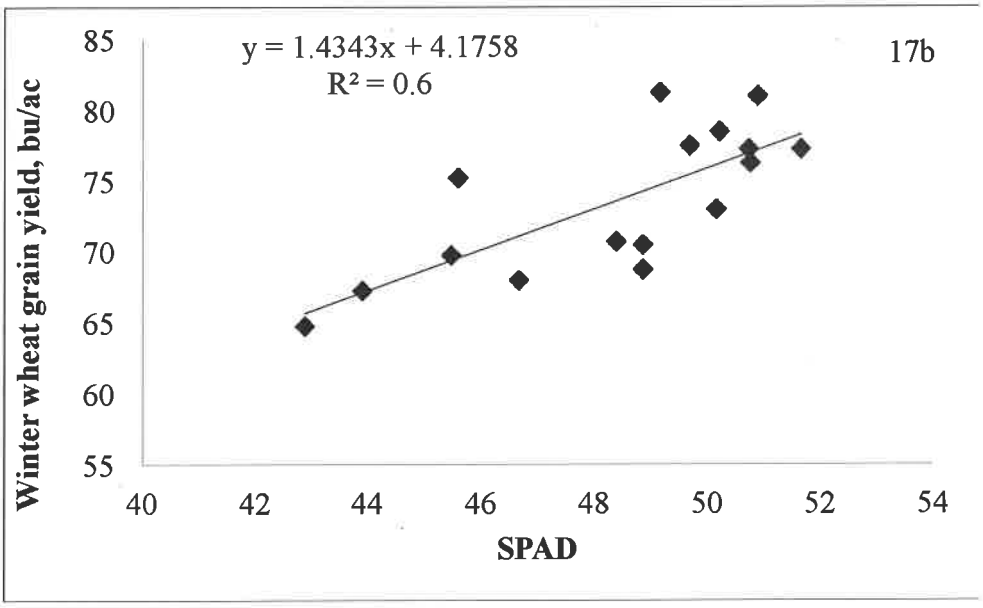
Table 51. Treatment, variety, topdress rate, SPAD readings, plant height, biomass, winter wheat grain yield and grain protein content, WTARC, 2011.

Trt	Variety	Topdress N, lb/ac	SPAD	Plant height, in	Biomass (heading)	Biomass (maturity)	Grain yield, bu/ac	Grain protein content, %
1	Rampart	0	44	36	2.5	134	67	11.7
2	Rampart	40	45	37	2.7	129	70	12.4
3	Rampart	0	50	38	3.0	138	73	11.2
4	Rampart	40	49	37	2.8	125	69	9.9
5	Rampart	0	46	39	2.9	144	75	12.2
6	Rampart	40	50	37	3.2	148	79	12.3
7	Rampart	0	51	37	3.3	152	81	12.3
8	Rampart	40	49	39	3.2	143	71	12.0
9	Yellowstone	0	43	32	2.8	127	65	12.5
10	Yellowstone	40	49	34	3.3	158	81	11.8
11	Yellowstone	0	47	36	3.9	167	68	12.7
12	Yellowstone	40	51	36	4.3	164	76	13.4
13	Yellowstone	0	48	36	4.5	157	71	12.1
14	Yellowstone	40	50	36	4.1	180	78	13.3
15	Yellowstone	0	51	36	4.4	170	77	12.0
16	Yellowstone	40	52	36	4.3	173	77	12.2

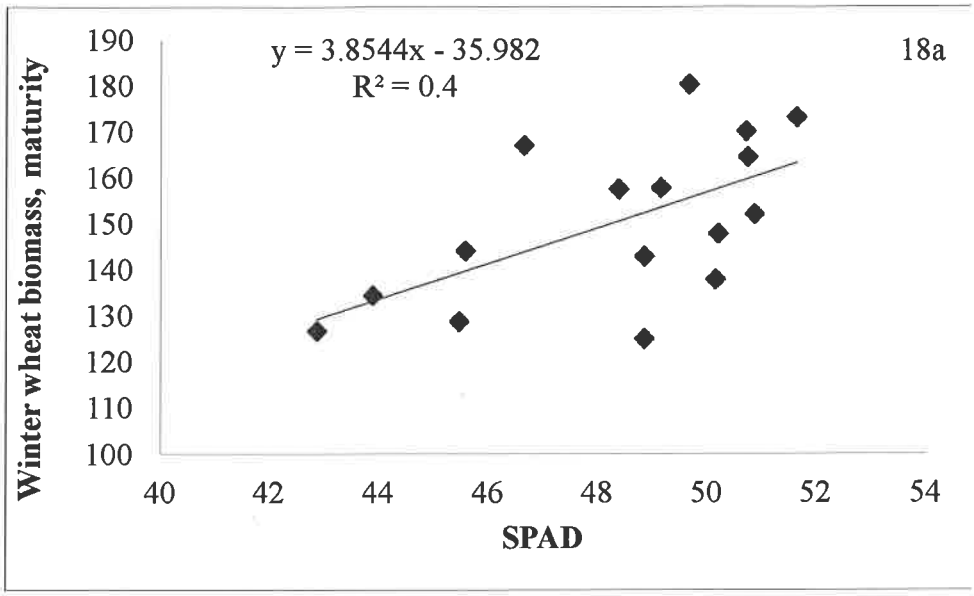
Table 52. Site characteristics and soil test results, WTARC, 2011.

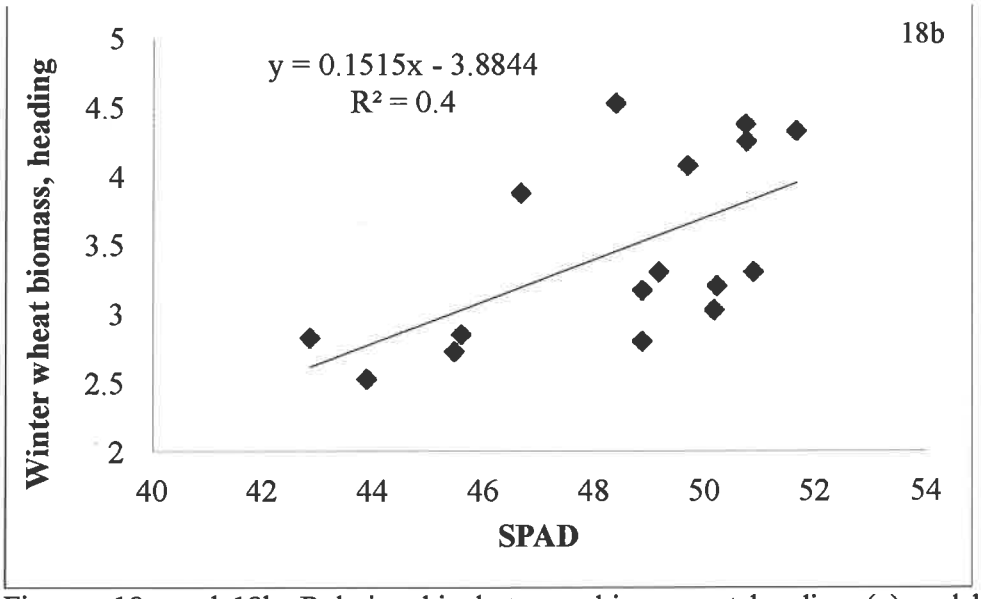
Character	Value
Planting Date	10-01-2010
Totdress Date	06-15-2011
Crop Circle Scan Date (tillering)	06-17-2011
Crop Circle Scan Date (heading)	07-06-2011
Crop Circle Scan Date (flowering)	07-19-2011
SPAD Date	07-19-2011
Biomass sampling Date (flag leaf, tillering)	06-18-2011
Biomas sampling Date (foot of row, maturity)	08-08-2011
Precipitation(in)	10.2
Harvest Date (Rampart)	08-08-2011
Harvest Date (Yellowstone)	08-22-2011
Soil Series	Scobey Clay Loam
Soil Test	
pH	7.7
O.M. (%)	3.7
P (ppm)	20.0
K (ppm)	272
EC (mmhos/cm)	0.48
NO_3-N (0-2', lb/ac)	42





Figures 17a and 17b. Relationship between SPAD readings (a - not averaged among replications; b – averaged among replications) and winter wheat grain yield, WTARC, 2011.





Figures 18a and 18b. Relationship between biomass at heading (a) and biomass at maturity (b) and SPAD measurements, WTARC, 2011.

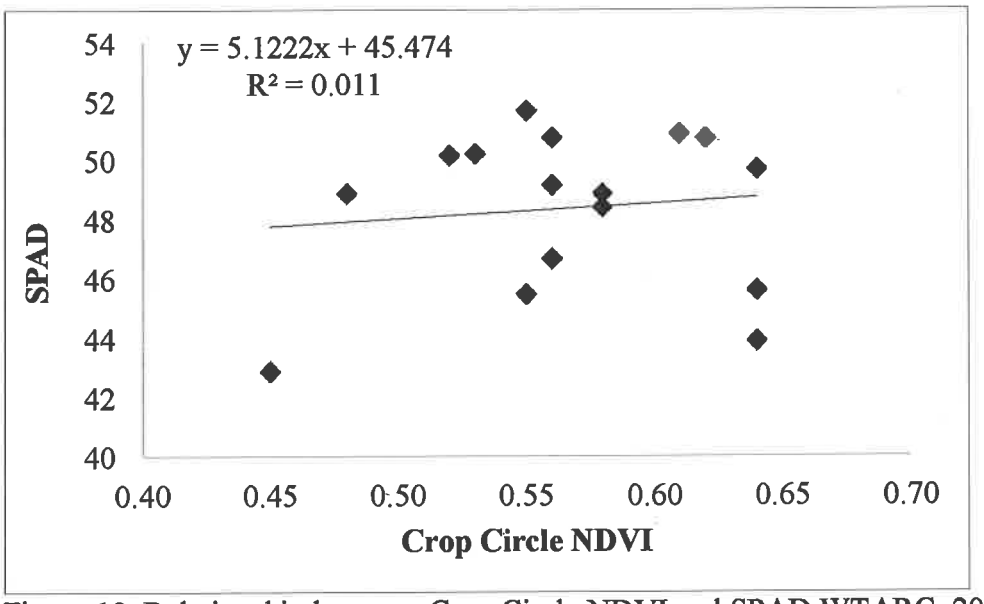


Figure 19. Relationship between Crop Circle NDVI and SPAD,WTARC, 2011.

Title: Winter Wheat Fertility Trial

Year: 2011

Locations: Lindsay Martin, Teton County, MT.

Personnel: Olga Walsh and Clint Rouns, Western Triangle Ag. Research Center (WTARC), Conrad, MT 59425;

Procedures: This study was conducted at one dryland experimental site located at Martin's farm, Teton County, MT. The study was established in the fall of 2010 with the plot size of 26 x 5 feet. The treatment structure is detailed in Table 53. Three preplant rates – 40, 80, and 120 lb N ac, 3 topdress rates – 20, 60, and 100 lb N ac, and 3 fertilizer sources: urea, Environmentally Smart Nitrogen (ESN), and NutriSphere-N™ coated urea (NSN) were evaluated. ESN is a controlled release N fertilizer; ti consists of a urea granule contained within a proprietary polyurethane coating. The N fertilizer is encased and isolated from its surrounding environment which makes it different from conventional N fertilizers. NutriSphere-N™ coated urea inhibits nitrogen volatilization, nitrification and potential leaching throughout the growing season.

Results: 2011 was the first year of this study. Site characteristics and soil test results are reported in Table 54. Response to applied fertilizer N was apparent at Martin site in 2011. Preplant N rate significantly affected grain yield. Treatments that received 40, 80, and 120 lbs N ac yielded 1093, 1330, and 1394 lbs per ac respectively. Todress N rate also had a significant effect on grain yields: 1090, 1356, and 1369 lbs per acre yields were obtained with application of 20, 60, and 100 lb N ac topdress. Fertilizer N source had no statistically significant effect on winter wheat grain yields, urea, ESN, and NSN performed similarly yield-wise. On the other hand, application time (fall vs spring) significantly affected yields. Spring application of topdress N fertilizer resulted in significantly higher grain yields compared to yields observed with fall topdress. Fall applied topdress resulted in 1236 lb per acre yield compared to 1489 lb per acre yield achieved with spring applied topdress, independent of N source (Table 55).

Table 53. Treatment structure and winter wheat grain yield, Martin, 2011.

Treatment	Preplant Fertilizer Rate, lb N ac	Topdress Fertilizer Rate, lb N ac	Fertilizer Source	Fertilization Method	Code	Grain yield, lb/ac
1	40	20	urea	Sidedress, Fall	USDF	995
2	80	60	urea	Sidedress, Fall	USDF	1195
3	120	100	urea	Sidedress, Fall	USDF	1307
4	40	20	NSN	Sidedress, Fall	NSDF	1293
5	80	60	NSN	Sidedress, Fall	NSDF	1608
6	120	100	NSN	Sidedress, Fall	NSDF	1305
7	40	20	ESN	Sidedress, Fall	ESDF	1231
8	80	60	ESN	Sidedress, Fall	ESDF	1259
9	120	100	ESN	Sidedress, Fall	ESDF	1422
10	40	20	urea	Topdress, Fall	UTDF	1363
11	80	60	urea	Topdress, Fall	UTDF	1351
12	120	100	urea	Topdress, Fall	UTDF	1173
13	40	20	ESN	With Seed, Fall	EWSF	1203
14	80	60	ESN	With Seed, Fall	EWSF	1352
15	120	100	ESN	With Seed, Fall	EWSF	1088
16	40	20	urea	Topdress, Spring	UTDS	1197
17	80	60	urea	Topdress, Spring	UTDS	1149
18	120	100	urea	Topdress, Spring	UTDS	1444
19	40	20	NSN	Topdress, Fall	NTDF	988
20	80	60	NSN	Topdress, Fall	NTDF	1478
21	120	100	NSN	Topdress, Fall	NTDF	1317

Table 54. Site characteristics and soil test results, Martin, 2011.

Character	**Value**
Planting Date	09-30-2010
Spring fertilization Date	04-12-2011
Precipitation(in)	8.7
Harvest Date	08-18-2011
Soil Series	Fine-loamy, carbonatic Aridic Calciboroll
Soil Test	
pH	8.0
O.M. (%)	3.4
P (ppm)	27
K (ppm)	287
EC (mmhos/cm)	0.47
NO_3-N (0-2', lb/ac)	26

Table 55. The effects of topdress N rate, topdress N source and topdress N application time on winter wheat grain yield, Martin, 2011.

Effect	Grain yield, lb/ac
Preplant N rate	
40	1093
80	1330
120	1394
F test	***
LSD (α=0.05)	318
CV	21.3
Topdress N rate	
20	1090
60	1356
100	1369
F test	***
LSD (α=0.05)	319
CV	21.3
Topdress N source	
urea	1270
ESN	1256
NSN	1309
F test	ns
LSD (α=0.05)	354
CV	23.6
Topdress N application time	
Fall	1236
Spring	1489
F test	***
LSD (α=0.05)	336
CV	22.5

*, ** Effects are significant at P<0.05 and 0.01, respectively;
ns denotes non-significant effects.