Title: Off-station spring wheat cultivar evaluations for the Western Golden Triangle area of Montana

Principle Investigator: Gadi V.P. Reddy, Superintendent, Western Triangle Ag Research Center

Personnel: John H. Miller, Research Associate and Julie Prewett, Research Assistant WTARC, Conrad, MT, and Luther Talbert and Hwa-Young Heo, MSU PSPP Dept., Bozeman, MT.

Cooperators: Bradley Farms, north of Cut Bank, MT
Brian Aklestad, north of Devon, MT
Aaron Killion, east of Brady, MT
Inbody Farms, northeast of Choteau, MT

Objectives: There are diverse cropping environments within the area served by Western Triangle Agricultural Research Center. Each off station location has its own unique environment and soils. Producers in the various locations are interested in variety performance in the local area. To this end the objective is to evaluate winter wheat varieties under the local conditions with respect to yield, test weight, plant height, and seed protein. The environmental conditions at the off station nurseries can vary greatly from those at WTARC. The research center strives to provide growers of the western triangle area unbiased information of various spring wheat varieties.

Methods: Off station spring wheat nurseries consist of 20 entries replicated three times, seeded with a four row plot seeder on one foot spacing. All plots were planted on no-till chemical fallow. Plots were trimmed, measured for length, and then harvested with a Hege 140 plot combine. Winter wheat seed was cleaned prior to collecting data. Orange wheat blossom midge pheromone traps were also installed at each off station plot.

Results: Results are tabulated in Tables 1 thru 12. Results are tabulated in Table 1 for the Irrigated off-station spring wheat nursery and Table 2 is five year averages for selected varieties in the irrigated off station spring wheat nursery. Table 3 is for the Choteau location, with multi-year data presented in Table 4. Tables 7 and 8 are for the Devon location, with Table 9 and10 representing the 'Knees' location. The Cut Bank data are presented in Tables 5 and 6.

Overall, the crop year temperature where close to the 29 year average at the research center 2.5 inches less moisture than the 29 year average. The winter temperature was close to average, with the exception of November being 8 degrees cooler than usual. March was 7 degrees warmer than the normal. Also, June was 4.6 degrees warmer compared to the 29 year average.

Soil temperatures at the station under chemical fallow stubble stayed under 40 degrees at a depth of eight inches until mid April. May was cool and wet. Early in June we received 0.95 inches, it warmed up and remained dry for about 30 days, during that time the spring wheat was running out of water as it was heading. July had normal amounts of rain.

Top yielding varieties at Choteau were WPSP2-VIDA1, Montana State University lines, MT1316, MT1338, and WB Gunnison. The top three yielding varieties at Choteau were 64.9, 60.4, and 59.6 bu/ac, respectively (Table 4). Reeder, WPSP2-VIDA1, also Duclair were the high yielding varieties at Devon, 29.0, 27.8, and 27.6 bu/ac,(Table 7) The 'Knees'high yielders at 40.6, 37.8, and 37.6 bu/ac, were Montana State University line MT1316, Duclair, Vida. The best yielding varieties, at the Cut Bank location were Montana State University line MT1316, WPSP2-VIDA1, and WB Gunnison (Table 9) Yields at Cut Bank were 48.3, 47.7, and 47.3 bu/ac (Table5). The top yielders in the irrigated trial were Duclair, at 86.0, WB Gunnison 85.5, and Choteau at 79.0 bu/ac (Table 3).

Yields in the irrigated off-station spring wheat trial ranged from 86.0 being the highest to 52.7 the lowest bu/ac. When compared to the five year averages, the irrigated off-station spring wheat nursery had lower yields by 13.1%, with average test weight, and with slightly higher grain protein at 1.8% (Tables 1 and 2). At Devon the 2015 yield was down 9.3 bu/ac from the four year average; with 2.7% higher grain protein and average test weight (Tables 7 and 8). The 'Knees' location had lower yields, higher grain protein and lower test weight when compared to the four year mean (Tables 9 and 10). Yields at Cut Bank ranged from 48.3 to 24.2 bu/ac, with lower protein for the year, with slightly higher test weights at 1.5% (Tables 5 and 6).

Insignificant amount of adult orange wheat blossom midge were found at the off station locations.

Summary: The data from the off station plots is supported by the local producers and advisory committee as well as the seed industry. It is planned to continue the off station variety plots at the same locations as the environmental conditions at each location are unique to the western triangle area. No insect incidence or damage was noticed in any of the varieties.

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. 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.

Funding Summary: Office of the Sponsored Projects will provide expenditure information. No other grants support this project.

MWBC FY2016 Grant Submission Plans: A similar project will be proposed for FY 2016. The continuation of on and off-station variety trials help to elucidate researchers and farmers which varieties are better suited for that particular region in Montana.

Table 1. Off-station irrigated spring wheat variety trial located, WTARC, MT. Pondera County. Western Triangle Ag. Research Center. 2015.

Variety	Class	Yield bu/ac	Test Wt lb/bu	Plant Height inches	Head Date Julian	Protein %
Duclair	**	86.0	61.7	31.0	171.3	14.4
WB Gunnison	*	85.5	63.2	31.7	172.7	13.8
Choteau	**	79.0	61.8	34.0	174.0	14.6
SY Tyra	*	77.7	63.1	27.3	174.3	13.9
MT 1316	-	77.3	62.2	29.7	171.3	15.6
WB9879CLP	CL	76.9	61.9	32.0	173.7	14.8
ONeal	*	71.1	60.5	33.7	173.7	14.1
WPSP2-VIDA1	-	70.8	62.6	33.7	175.0	14.2
Corbin	*	69.9	63.2	32.0	172.7	14.0
MT 1338	-	67.7	62.7	31.7	171.0	15.3
SY Soren	-	67.0	62.4	29.0	174.0	15.8
Egan	-	66.3	61.0	32.7	174.0	17.0
Brennan	-	66.2	62.2	28.3	172.0	16.3
MT1219	-	65.7	61.7	28.3	173.7	14.8
Fortuna	**	61.1	62.0	38.7	175.0	16.0
Reeder	-	59.3	61.5	34.3	174.0	15.3
McNeal	-	57.7	61.0	32.0	174.0	16.0
Vida	*	57.6	60.9	35.0	175.3	15.6
MT1337	-	57.5	61.4	31.3	171.0	16.6
Mott	-	52.7	61.0	36.3	177.3	15.0
Mean		68.7	61.9	32.1	173.5	15.2
LSD (.05)		ns	1.1	4.0	1.1	
C.V. 1 (%) (S/mean)*100		18.3	1.1	7.5	0.4	
P-Value		0.0691	<0.0001	<0.0001	<0.0000	

Cooperator and Location: WTARC, Pondera County.
Planted April 22, 2015 on chemical fallow barley stubble. Harvested August 28, 2015.
Fertilizer: actual pounds/ac of N-P-K: 11-22-0 applied with seed and a 254-0-20 blend of urea and potash was broad cast at planting. Fertilizer rates are based on a yield goal of 80 bu/ac.
Herbicide: The plot area was pre-plant sprayed with 20 oz/ac RT3 4/22/2015.
Growing season precipitation: 5.60 inches. Irrigation: 9.9 inches.
** = Solid stem sawfly-resistant (solid stem score of 19 or higher).
* = Less preferred by sawfly (behavioral preference) in small plots.
CL= Clearfield
Conducted by MSU Western Triangle Ag. Research Center.

Table 2. 5-year means, on station irrigated Spring Wheat varieties, Conrad, MT.

Variety	Yield bu/ac	Test Wt lb/bu	Plant Height inches	Head Date Julian	Protein %
Duclair	93.2	61.7	31.7	184.2	14.2
WB Gunnison	89.6	62.8	31.7	186.1	13.7
SY Tyra	89.1	62.8	29.6	186.3	13.6
WB9879CL	87.3	61.8	33.1	185.9	12.7
Choteau	83.3	61.7	31.3	185.3	13.9
Oneal	81.2	62.3	33.8	186.3	13.6
Corbin	80.7	63.0	32.5	185.4	13.5
McNeal	77.4	62.0	33.0	186.0	12.6
Vida	76.4	61.8	33.8	186.6	13.2
Reeder	72.6	62.6	33.3	186.1	13.5
Fortuna	68.7	62.3	39.1	186.1	13.4
Means	81.8	62.3	33.0	185.8	13.4

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

Table 3. Off-station spring wheat variety trial located northeast of Choteau, MT.
Teton County. Western Triangle Ag. Research Center, 2015.

Variety	Class	Yield bu/ac	Test Wt lb/bu	Plant Height inches	Protein %
WPSP2-VIDA1	-	64.9	62.2	26.0	13.6
MT 1316	-	60.4	61.7	25.0	15.1
MT 1338	-	59.6	61.9	25.3	15.1
Duclair	**	59.5	59.6	26.0	15.2
Egan	-	59.5	60.5	26.7	16.1
McNeal	-	59.4	60.3	28.0	15.4
Corbin	*	58.6	61.4	24.7	15.1
Reeder	-	58.6	61.9	25.3	15.3
Vida	*	58.5	61.2	25.7	14.5
ONeal	*	56.1	60.8	27.0	14.9
MT1337	-	56.0	59.9	24.7	15.5
SY Soren	-	55.8	61.5	25.0	15.2
WB Gunnison	*	55.6	61.3	25.3	14.1
MT 1219	-	55.6	60.4	25.3	14.9
WB9879CLP	CL	54.8	59.9	24.7	15.5
SY Tyra	*	54.3	61.8	24.7	13.8
Choteau	**	52.7	59.9	25.0	15.5
Mott	-	52.3	61.4	27.3	15.4
Brennan	-	50.4	62.8	25.3	15.3
Fortuna	**	33.6	61.0	30.0	16.3
Mean		55.8	61.1	25.9	15.1
LSD (.05)		5.4	0.7	2.6	
C.V. (%)		5.9	0.7	6.2	
P-Value		<0.0000	<0.0000	0.0193	

Cooperator and Location: Inbody Farms, Teton County.
Planted April 24, 2015 on chemical fallow. Harvested August 25, 2015.
Fertilizer: actual pounds/ac of N-P-K: 11-22-0 applied with seed and a 100-0-20 blend of urea and potash was broadcast at planting. Fertilizer rates are based on a yield goal of 50 bu/ac.
Herbicide: Preplant sprayed with RT3 at 32 oz per acre on 4/24/15. Huskie at 11 oz/ac and Axial XL at 16.4 oz/ac were sprayed on 6/1/15.
Precipitation: N/A
** = Solid stem sawfly-resistant (solid stem score of 19 or higher).
* = Less preferred by sawfly (behavioral preference) in small plots.
CL = Clearfield Conducted by MSU Western Triangle Ag. Research Center.

Table 4. Four-year means, spring wheat varieties, Choteau area, Teton County. 2012-2015.

Variety	4-Year Mean			
	Yield bu/ac	Test weight	Plant Height inches	Protein %
McNeal	46.5	57.5	29.9	15.8
WB Gunnison	46.2	58.8	27.4	14.7
Duclair	45.1	57.0	28.8	15.4
Vida	44.7	58.1	27.1	15.1
WB9879CL	44.7	57.7	26.9	15.5
ONeal	44.5	58.2	29.3	15.9
Corbin	43.7	58.9	27.3	15.7
Reeder	43.1	59.2	29.6	15.7
Choteau	41.8	57.3	26.3	15.7
SY Tyra	41.5	58.3	24.7	14.5
Fortuna	35.8	59.7	33.8	15.5
Mean	43.4	58.2	28.0	15.4

Cooperator and Location: Inbody Farm, Teton County.
Conducted by MSU Western Triangle Ag. Research Center.

Table 5. Off-station spring wheat variety trial located north of Cut Bank, MT. Glacier county. Western Triangle Ag. Research Center. 2015.

Variety	Class	Yield bu/ac	Test Wt lb/bu	Plant Height inches	Protein %
MT1316	-	48.3	60.4	24.7	12.1
WPSP2-VIDA1	-	47.7	61.2	27.0	12.2
WB Gunnison	*	47.3	59.5	24.7	12.8
MT1338	-	46.5	60.7	26.3	13.7
Duclair	**	46.1	60.0	25.7	12.7
SY Tyra	*	45.3	60.6	24.3	12.0
SY Soren	-	44.7	60.7	23.0	12.1
ONeal	*	43.4	61.2	26.0	12.5
Brennan	-	43.3	60.1	24.3	13.1
Vida	*	43.0	59.5	29.6	11.8
Reeder	-	42.5	60.2	24.0	12.9
Choteau	**	42.3	58.3	25.0	13.5
WB9879CLP	CL	42.0	58.4	26.3	13.7
MT1337	-	38.8	59.0	26.0	14.4
Egan	-	38.6	57.9	26.0	14.6
Corbin	*	38.4	59.4	25.0	13.1
McNeal	-	36.9	57.8	27.7	13.1
Mott	-	36.6	58.2	26.7	13.7
MT 1219	-	33.5	59.3	24.7	12.9
Fortuna	**	24.2	57.9	26.3	14.3
Mean		41.5	59.4	25.7	13.1
LSD (.05)		6.7	0.8	ns	
C.V. (%) (S/mean)*100		9.7	0.8	9.2	
P-Value		<0.0000	<0.0000	0.3154	

Cooperator and Location: Bradley Farms, northern Glacier County.
Planted April 30, 2015 on chemical fallow. Harvested September 11, 2015.
Fertilizer: actual pounds/ac of N-P-K: 11-22-0 applied with seed and a 75-0-20 blend of urea and potash was broadcast at planting. Fertilizer rates are based on a yield goal of 50 bu/ac.
Herbicide: The plots were sprayed with Huskie at 11 oz/ac and Axial XL at 16.4 oz/ac on 6/4/15.
Precipitation from planting to harvest: 6.25 inches.
** = Solid stem sawfly-resistant (solid stem score of 19 or higher).
* = Less preferred by sawfly (behavioral preference) in small plots.
CL = Clearfield
Conducted by MSU Western Triangle Ag. Research Center.

Table 6. 5-year means, off station spring wheat varieties, Cut Bank, MT, Glacier county 2010-2015

Variety	Yield bu/ac	Test Wt lb/bu	Plant Height inches	Protein %
WB Gunnison	61.7	59.4	29.4	12.9
Duclair	61.4	57.1	30.3	13.8
Choteau	59.8	57.6	29.2	13.9
Corbin	56.2	59.4	30.0	13.2
Vida	56.0	57.7	31.0	13.4
WB9879CL	55.7	57.6	29.7	14.1
Reeder	53.4	58.1	30.8	13.9
ONeal	53.4	55.9	30.5	14.0
SY Tyra	53.3	57.3	27.3	12.9
McNeal	50.1	57.1	30.6	13.5
Fortuna	43.2	59.7	35.4	13.9
Means	54.9	57.9	30.4	13.6

Location: Bradley farm, Cut Bank, MT

Table 7. Off-station spring wheat variety trial located Devon, MT. Toole county. Western Triangle Ag. Research Center. 2015.

Variety	Class	Yield bu/ac	Test Wt lb/bu	Plant Height inches	Protein %
Reeder	-	28.0	59.2	22.7	16.1
WPSP2-VIDA1	-	27.8	60.4	21.3	14.8
Duclair	**	27.6	58.8	23.3	15.9
McNeal	-	26.9	56.8	24.7	16.1
MT 1316	-	26.6	57.4	20.3	16.8
Vida	*	26.1	58.2	21.3	15.6
SY Tyra	*	25.8	60.2	20.0	15.3
WB Gunnison	*	25.8	58.2	22.3	14.6
MT 1337	-	25.6	57.8	22.3	15.4
Egan	-	25.6	56.7	22.7	17.0
Sy Soren	-	25.2	58.5	18.7	16.5
Choteau	**	24.9	58.4	22.0	16.2
ONeal	*	24.2	59.8	20.7	16.4
WB9879CLP	CL	23.8	57.9	19.7	16.6
Corbin	*	23.3	58.3	21.7	15.8
Mott	-	23.2	58.1	22.0	16.8
MT 1219	-	23.0	57.7	20.3	16.1
Brennan	-	23.0	59.4	20.7	16.2
MT1338	-	18.5	60.7	21.0	16.2
Fortuna	**	16.9	56.6	22.6	16.8
Mean		24.6	58.5	21.5	16.1
LSD (.05)		ns	0.8	2.3	
C.V.		14.8	0.8	6.4	
P-Value		0.0553	0.0000	0.0014	

Cooperator and Location: Brian Aklestad
Planted April 27, 2015 on chemical fallow barley stubble. Harvested August 15, 2015.
Fertilizer: actual pounds/ac of N-P-K: 11-22-0 applied with seed and a 109-0-20 blend of urea and potash was broadcast at planting. Fertilizer rates are based on a yield goal of 35 bu/ac.
Herbicide: The plot area was pre-plant sprayed with 32 oz/ac RT3 on 4/27/2015. The plots were sprayed with Huskie at 11 oz/ac and Axial XL at 16.4 oz/ac on 6/11/2015.
Growing season precipitation: 1.25 inches rain gauge was cracked at some point during the growing season.
** = Solid stem sawfly-resistant (solid stem score of 19 or higher).
* = Less preferred by sawfly (behavioral preference) in small plots.
CL = Clearfield
Conducted by MSU Western Triangle Ag. Research Center.

Table 8. Five-year means, spring wheat varieties, Devon area, Eastern Toole County. 2010-2015.

Variety	5-Year Mean			
	Yield bu/ac	Test weight	Plant Height inches	Protein %
Vida	38.2	58.4	25.3	14.0
WB Gunnison	36.9	58.4	24.4	14.6
Duclair	36.7	56.6	25.7	14.7
Reeder	35.7	58.7	26.1	15.0
ONeal	34.5	59.8	25.0	15.0
McNeal	34.0	57.7	26.5	15.2
Choteau	33.8	57.5	23.8	15.0
Corbin	33.8	58.5	25.3	14.9
Fortuna	32.9	58.2	29.0	15.1
SY Tyra	32.1	59.0	22.6	14.2
Mean	34.9	58.3	25.3	14.8

Cooperator and Location: Brian Aklestad, Eastern Toole County.
Conducted by MSU Western Triangle Ag. Research Center.

Table 9. Off-station spring wheat variety trial located near the Knees. Chouteau County. Western Triangle Ag. Research Center. 2015.

Variety	Class	Yield bu/ac	Test Wt lb/bu	Plant Height inches	Protein %
MT1316	-	40.6	58.0	23.0	15.5
Duclair	**	37.8	58.9	26.7	13.9
Vida	*	37.6	57.8	25.3	14.8
Reeder	-	36.5	58.2	26.7	15.3
McNeal	-	35.7	54.4	27.0	15.4
MT1338	-	35.7	60.1	25.0	15.3
WB9879CLP	CL	34.3	57.4	25.3	15.2
SY Tyra	*	33.9	56.8	24.0	14.5
MT1219	-	33.1	56.0	24.7	14.4
MT1337	-	32.8	58.2	28.3	15.5
Choteau	**	32.6	57.8	24.7	14.7
WPSP2-VIDA1		32.5	58.9	24.7	13.9
Egan	-	32.3	54.6	24.0	16.5
SY Soren	-	32.0	57.7	23.3	15.3
Brennan	-	31.5	58.7	23.7	15.6
WB Gunnison	*	31.1	58.0	24.3	14.8
Corbin	*	30.5	57.6	29.3	14.3
Mott	-	25.5	55.4	26.3	15.3
ONeal	*	20.1	56.2	26.3	14.3
Fortuna	**	17.0	55.3	29.0	17.2
Mean		32.5	57.3	25.6	15.1
LSD (.05)		9.1	1.9	3.5	
C.V. 1 (%) (S/mean)*100		16.9	2.0	8.3	
P-Value		<0.0080	<0.0000	<0.0175	

Cooperator and Location: Aaron Killion, western Chouteau County.
Planted April 24, 2015 on chemical fallow. Harvested August 31, 2015.
Fertilizer: actual pounds/ac of N-P-K: 11-22-0 applied with seed and a 114-0-20 blend of urea and potash was broadcast at planting. Fertilizer rates are based on a yield goal of 45 bu/ac.
Herbicide: The plot area was pre-plant sprayed with 20 oz/ac RT3 on 4/24/2015. The plots were sprayed with Huskie at 11 oz/ac and Axial XL at 16.4 oz/ac on 6/1/2015.
** = Solid stem sawfly-resistant (solid stem score of 19 or higher).
* = Less preferred by sawfly (behavioral preference) in small plots.
CL = Clearfield System
Conducted by MSU Western Triangle Ag. Research Center.

Table 10. 5-year Means, Off station spring wheat varieties, Knees, MT,

Variety	Yield bu/ac	Test Wt lb/bu	Plant Height inches	Protein %
Duclair	48.5	58.1	27.1	14.0
Vida	46.2	59.3	27.3	13.9
WB Gunnison	45.8	60.1	26.4	14.0
WB9879CL	45.0	59.3	25.5	14.3
Choteau	44.3	59.1	25.3	14.3
Reeder	42.6	60.2	26.7	14.6
McNeal	42.2	58.4	27.9	14.4
Corbin	41.7	59.3	26.9	14.2
SY Tyra	38.8	57.9	23.6	13.8
ONeal	38.2	59.3	27.4	13.7
Fortuna	36.3	60.1	31.4	15.1
Means	42.7	59.2	26.9	14.2

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

Table 13. Soil test values for off-station and on-station plots, 2015.

Location	N (lbs/ac)[1]	Olsen-P (ppm)	K (ppm)	pH	OM (%)	EC (mmhos/cm)
Cut Bank	8.3	21	355	7.7	2.1	0.61
Devon	11.4	11	388	7.2	1.1	0.33
Knees	23.3	11	652	8.1	2.8	0.69
Choteau	67.6	10	664	8.1	2.9	0.59
WTARC	15.1	17	375	7.8	2.4	0.47

[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.
WTARC- Western Triangle Ag. Research Center