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

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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 spring 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 11. 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.

At the research center, this years' overall crop year temperatures were slightly higher than the 30 year average at the research center, being 1.2 degrees warmer than normal. With November being 0.9 degrees warmer that the 30 year average. December and January average temperatures were very close to the long term average. February was exceptionally warmer, with the temperature being 11.4 degrees warmer than the 30 year average. March and April were also warmer by 4.6 and 2.4 degrees above the 30 year average. May temperatures were cooler than the average by 1.6 degrees. June was also above average by 1.9 degrees. With July and August being slightly cooler than normal by 2.1 and 2.7 degrees.

Precipitation at the research center was surprising with 5.18 inches more moisture than the 30 year average. We received above average moisture the fall of 2015, resulting in good soil moisture at planting. September was 1.82 inches above the 30 year average. October through December were 0.5 inches of precipitation above normal. January was ahead of the average with 2.1 inches more than the normal precipitation. February was exceedingly dry reporting no moisture for the month. With March close behind only receiving 0.2 of inch. April brought some much needed moisture with about an inch above the 30 year average, while May was only slightly above the 30 year average. June precipitation was 2.3 inches below normal. July received 1.4 inches over the 30 year average for precipitation.

The top three yielding varieties at Choteau were 39.3, 37.6, and 37.6 bu/ac, respectively (Table 3). Alum, Montana State University lines MT 1401, and MT 1316 were the high yielding varieties at Devon, 37.2, 36.6, and 34.5 bu/ac (Table 7) The 'Knees' high yielders at 25.5, 24.6, and 23.9 bu/ac, were Duclair, Alum, and Choteau. All entries at the 'Knees' were affected by stripe and tan rust. The best yielding varieties, at the Cut Bank location were Alum, Montana State University line MT1316, and Duclair. Yields at Cut Bank were 55.5, 52.6, and 48.1 bu/ac (Table5). Top yielders in the irrigated trial were Alum, at 98.9 bu/ac, Duclair at 90.4 bu/ac and Fortuna at 79.2 bu/ac (Table 1).

Yields in the irrigated off-station spring wheat trial ranged from 98.9 bu/ac to 56.3 bu/ac. When compared to the five year averages, the irrigated off-station spring wheat nursery had higher yields, with lower test weight, and slightly higher grain protein by 0.5% (Tables 1 and 2). At Devon the 2016 yield was up by 1.4 bu/ac from the five year average; with 2.2% lower grain protein and 1 lb/bu higher test weight than the five year average (Tables 7 and 8). The 'Knees' location had much lower yields, higher grain protein and much lower test weight when compared to the five year mean (Tables 9 and 10). All entries at the 'Knees' were affected by stripe and tan rust. Yields at Cut Bank ranged from 55.5 to 30.9 bu/ac, with slightly higher grain protein for the year, with slightly higher test weights (Tables 5 and 6).

No insect incidence (wheat stem sawfly or wireworms) was noticed in any of the spring wheat varieties at Devon or Cut Bank. The plots at Choteau and the 'Knees' had sawfly cutting, and the plot at the 'Knees' had stripe and tan rust. Because of the high number of parasitoids of the wheat stem sawfly at the research center very little cutting was observed. Insignificant amount of adult of 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 is unique to the western triangle area.

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 Special Projects will provide expenditure information. No other grants support this project.

MWBC FY2016 Grant Submission Plans: A similar project will be proposed for FY 2017. 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. 2016.

Variety	Class	Yield bu/ac[1]	Test Wt lb/bu[1]	Height inch	Protein %
Alum	-	98.9	61.6	33.0	12.8
Duclair	**	90.4	58.6	32.3	13.1
Fortuna	**	79.2	60.3	39.7	14.0
Egan	-	79.1	59.6	32.3	14.4
WB Gunnison	*	78.6	60.2	32.0	11.9
WB9879CLP	CL	77.2	58.5	33.0	13.4
MT 1348	-	76.8	59.8	34.7	13.1
Corbin	*	75.7	60.0	33.7	12.7
Reeder	-	75.4	60.9	37.0	11.7
SY Tyra	*	75.1	58.8	30.3	13.0
MT 1316	-	74.2	61.1	31.3	13.2
Vida	*	73.5	58.0	34.0	12.8
SY Soren	-	73.4	59.9	30.3	14.0
Choteau	**	68.1	57.2	31.7	13.3
MT1401	-	68.1	60.5	33.0	13.0
McNeal	-	67.9	57.4	34.7	12.4
MT 1173	-	67.8	55.5	36.0	12.6
Brennan	-	65.7	60.9	30.7	14.2
Mott	-	59.7	57.4	38.0	13.2
ONeal	-	56.3	55.3	34.3	13.1
Mean		74.1	59.1	33.6	13.1
LSD (.05)		8.1	1.5	1.9	0.7
C.V. 1 (%) (S/mean)*100		6.7	1.6	3.4	3.1
P-Value		<0.0000	<0.0000	<0.0000	<0.0000

Cooperator and Location: WTARC, Pondera County.
Planted on April 14, 2016 on chemical fallow barley stubble. Harvested on September 2, 2016.
Fertilizer: actual pounds/ac of N-P-K: 11-22-0 applied with seed and a 237-0-20 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 4/14/2016. Sprayed on 6/3/2016 with Bison @ 4 pts/ac, Axial XL @ 16.4 oz/ac, and Affinity @ 1.2 oz/ac.
Growing season precipitation: 7.46 inches. Irrigation: 12.3 inches
** = Solid stem sawfly-resistant (solid stem score of 19 or higher).
* = Less preferred by sawfly (behavioral preference) in small plots.
CL= Clearfield
[1] Yield and test weight are adjusted to 13% seed moisture.
Conducted by MSU Western Triangle Ag. Research Center.

Table 2. 5-year means, on station irrigated spring wheat varieties, Conrad, MT, 2012-2016.

Variety	Yield bu/ac	Test Wt lb/bu	Height inch	Head[1] Date	Protein %
Duclair	93.2	61.1	30.1	184.2	14.3
WB Gunnison	88.3	62.5	31.7	186.1	13.7
SY Tyra	87.8	62.0	29.5	186.3	13.5
WB9879CL	86.6	61.3	33.1	185.9	12.8
Choteau	82.6	60.8	31.2	185.3	13.7
Corbin	80.5	62.4	32.8	185.4	13.4
Egan	80.2	61.4	32.5	186.4	15.0
ONeal	78.1	61.0	33.9	186.3	13.4
Vida	77.1	61.1	34.0	186.6	13.0
McNeal	76.8	61.1	33.1	186.0	12.8
Brennan	76.3	62.5	29.5	185.1	14.5
Reeder	74.5	62.2	33.9	186.1	13.5
Fortuna	71.1	61.8	39.0	186.1	13.5
Means	81.2	61.6	32.8	185.8	13.6

[1] Heading date is from 2011 to 2015 as there is no heading data for 2016 on the irrigated off station spring wheat trial.
Location: MSU Western Triangle Ag. Research Center, Conrad, MT.

Table 3. Off-station spring wheat variety trial located north of Choteau, MT. Teton County. Western Triangle Ag. Research Center. 2016.

Variety	Class	Yield[1] bu/ac	Test Wt[1] lb/bu	Height inch	Lodging %	Protein %
Duclair	**	39.3	55.6	27.7	2.7	15.5
Alum	-	37.6	57.4	28.3	7.3	15.1
MT1401	-	37.6	58.0	25.7	5.7	14.5
Vida	*	36.0	55.3	26.3	2.7	14.8
McNeal	-	35.7	53.7	28.3	13.3	15.2
MT1348	-	35.7	57.1	27.3	6.0	16.0
WB9879CLP	CL	35.5	55.0	26.7	0	15.4
Corbin	*	35.2	56.9	28.0	1.7	15.2
Choteau	**	35.0	56.3	27.3	1.0	15.3
Egan	-	34.4	55.6	26.0	13.3	16.4
Brennan	-	33.7	58.2	23.7	9.3	15.8
ONeal	*	33.0	55.2	29.0	3.3	15.3
MT1316	-	32.5	55.7	26.0	8.0	16.0
Reeder	-	32.5	56.0	28.0	10.0	15.6
MT1173	-	32.5	53.7	27.3	6.7	14.6
WB Gunnison	*	32.0	56.4	26.7	0	14.5
Fortuna	**	31.4	56.6	32.0	6.0	15.7
Mott	-	31.3	55.2	27.7	4.0	15.9
SY Soren	-	30.7	56.3	24.0	10.0	15.8
SY Tyra	*	30.7	56.6	23.0	11.7	14.7
Mean		34.1	56.1	26.9	6.1	15.4
LSD (.05)		5.6	0.9	3.1	6.5	0.7
C.V. 1 (%) (S/mean)*100		9.9	1.0	6.9	64.1	2.6
P-Value		NS	<0.0000	<0.0005	<0.0006	<0.0000

Cooperator and Location: Inbody Farms, Teton County.
Planted on 5/4/16 on chemical fallow. Harvested on 8/24/16
Fertilizer: actual pounds/ac of N-P-K: 11-22-0 applied with seed and a 165-22.5-20 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 5/4/16
** = Solid stem sawfly-resistant (solid stem score of 19 or higher).
* = Less preferred by sawfly (behavioral preference) in small plots.
CL = Clearfield
[1] Yield and test weight are adjusted to 13% seed moisture.
Conducted by MSU Western Triangle Ag. Research Center.

Table 4. Five-year means, Spring Wheat varieties, Inbody, Teton County. 2012-2016.

Variety or ID	5-Year Mean			
	Yield bu/ac	Test weight lbs/bu	Height inch	Protein %
McNeal	44.3	56.7	29.6	15.8
Duclair	43.9	56.7	28.5	15.4
WB Gunnison	43.4	58.3	27.3	14.7
Egan	43.3	57.2	26.8	16.8
Vida	42.9	57.2	26.9	15.1
WB9879CLP	42.8	57.1	26.9	15.5
ONeal	42.2	57.6	28.5	15.9
Corbin	42.0	58.5	27.4	15.7
Brennan	41.5	59.8	25.4	15.6
Reeder	40.9	58.5	27.7	15.7
Choteau	40.5	57.1	26.5	15.7
SY Tyra	39.4	58.0	24.3	15.6
Fortuna	34.9	59.0	33.5	15.5
Mean	41.7	57.8	33.5	15.5

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

Table 5. Off-station spring wheat variety trial located at the Cut Bank, MT. Glacier County. Western Triangle Ag. Research Center. 2016.

Variety	Class	Yield bu/ac[1]	Test Wt lb/bu[1]	Height inch	Lodging %	Protein %
Alum	-	55.5	60.0	30.0	6.7	14.0
MT1316	-	52.6	58.0	30.0	6.7	15.5
Duclair	**	48.1	56.0	29.3	15.0	14.7
Reeder	-	47.9	58.4	31.3	3.3	15.0
Egan	-	47.8	56.9	27.0	1.7	17.5
Corbin	*	47.5	58.1	29.3	3.3	14.5
WB Gunnison	*	47.2	58.0	29.0	13.3	13.0
Vida	*	45.5	57.0	29.3	3.3	14.7
MT1348	-	45.4	57.5	31.3	8.3	15.3
SY Tyra	*	45.0	55.3	27.7	0	14.0
Choteau	**	44.5	55.9	30.0	11.7	15.0
SY Soren	-	45.4	57.8	29.0	3.3	15.5
McNeal	-	42.8	53.9	31.3	5.0	13.9
WB9879CLP	CL	42.6	55.2	28.3	3.3	15.2
Fortuna	**	42.5	56.8	36.0	5.0	14.2
Brennan	-	42.0	58.4	27.3	5.0	16.4
MT1401	-	41.5	58.9	30.0	6.7	15.1
MT1173	-	36.1	51.5	32.0	6.7	13.8
Mott	-	34.8	54.7	30.3	3.3	14.7
ONeal	*	30.9	50.8	30.7	6.7	14.7
Mean		44.2	56.5	30.0	5.4	14.8
LSD (.05)		5.9	1.1	3.6	10.4	0.5
C.V. 1 (%) (S/mean)*100		8.0	1.2	7.2	116.0	2.1
P-Value		<0.0011	<0.0000	<0.0086	NS	<0.0000

Cooperator and Location: Bradley Farms, Glacier County.
Planted on 5/5/16 on chemical fallow. Harvested on 9/16/16
Fertilizer: actual pounds/ac of N-P-K: 11-22-0 applied with seed and a 148-22.5 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 5/5/16
** = Solid stem sawfly-resistant (solid stem score of 19 or higher).
* = Less preferred by sawfly (behavioral preference) in small plots.
CL = Clearfield
[1] Yield and test weight are adjusted to 13% seed moisture.
Conducted by MSU Western Triangle Ag. Research Center.

Table 6. Five-year means, Spring Wheat varieties, Cut Bank, Glacier County. 2011-2016.

Variety or ID	5-Year Mean			
	Yield bu/ac	Test weight lbs/bu	Height inch	Protein %
Duclair	52.1	56.0	30.1	14.1
WB Gunnison	52.1	52.1	29.3	13.0
Choteau	50.1	56.3	29.3	14.2
Corbin	48.4	58.3	29.8	13.5
Vida	47.9	56.8	30.6	13.6
Reeder	47.2	57.6	30.9	14.3
WB9879CL	47.1	56.2	29.4	14.4
Brennan	46.9	58.6	27.6	14.5
SY Tyra	45.9	56.1	27.4	13.1
Egan	45.2	56.8	28.7	16.0
McNeal	42.5	55.4	30.7	13.8
ONeal	39.6	54.0	30.5	14.4
Fortuna	39.0	58.3	35.5	14.2
Mean	46.5	56.8	30.1	14.0

Cooperator and Location: Bradley Farms, Glacier County.
Conducted by MSU Western Triangle Ag. Research Center.

Table 7. Off-station spring wheat variety trial located north of Devon, MT. Toole County. Western Triangle Ag. Research Center. 2016.

Variety	Class	Yield[1] bu/ac	Test Wt[1] lb/bu	Height inch	Protein %
Alum	-	37.2	61.3	25.3	11.7
MT1401	-	36.6	62.1	26.7	11.1
MT1316	-	34.5	59.8	24.0	12.3
Egan	-	34.1	58.5	25.3	12.8
MT1348	-	33.3	60.5	25.0	12.0
Duclair	**	33.0	58.7	24.3	11.9
WB Gunnison	*	33.0	60.0	25.7	10.9
MT1173	-	32.2	57.2	26.7	11.2
Reeder	-	32.0	59.9	26.0	11.6
Vida	*	31.7	59.2	25.7	11.6
Fortuna	**	31.3	59.8	30.3	12.1
Brennan	-	30.6	60.9	23.7	13.5
Choteau	**	29.5	59.3	23.3	12.7
SY Soren	-	29.2	59.4	24.0	12.7
WB9879CLP	CL	28.7	59.6	22.7	12.5
Mott	-	28.2	59.3	25.7	12.9
SY Tyra	*	28.1	59.3	23.0	12.1
McNeal	-	26.0	57.0	26.3	12.2
ONeal	*	25.6	59.0	26.3	11.6
Corbin	*	25.1	60.4	23.7	12.0
Mean		31.0	59.5	25.1	12.1
LSD (.05)		7.5	1.1	1.9	1.2
C.V. 1 (%) (S/mean)*100		14.6	1.1	4.6	6.3
P-Value		NS	<0.0000	<0.0000	<0.0167

Cooperator and Location: Brian Aklestad, Toole County.
Planted on 4/18/16 on chemical fallow. Harvested on 8/7/16
Fertilizer: actual pounds/ac of N-P-K: 11-22-0 applied with seed and a 108-22.5 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 4/18/16
** = Solid stem sawfly-resistant (solid stem score of 19 or higher).
* = Less preferred by sawfly (behavioral preference) in small plots.
CL = Clearfield
[1] Yield and test weight are adjusted to 13% seed moisture.
Conducted by MSU Western Triangle Ag. Research Center.

Table 8. Five-year means, Spring Wheat varieties, Devon, Toole County. 2012-2016.

Variety or ID	5-Year Mean			
	Yield bu/ac	Test weight lbs/bu	Height inch	Protein %
Vida	35.7	58.6	24.9	13.6
Duclair	34.6	57.3	24.7	14.1
WB Gunnison	34.6	58.9	24.3	13.8
Reeder	34.3	59.2	25.6	14.3
Egan	33.7	57.1	25.3	15.3
Brennan	31.9	59.6	22.7	15.0
Choteau	31.3	58.3	23.2	14.5
Corbin	31.0	58.8	24.5	14.2
ONeal	30.9	59.4	24.6	14.4
Fortuna	30.7	58.7	28.5	14.5
McNeal	30.5	57.4	26.0	14.7
SY Tyra	30.0	59.2	22.1	13.7
Mean	32.4	58.6	24.8	14.3

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

Table 9. Off-station spring wheat variety trial located at the Knees area, Chouteau County. Western Triangle Ag. Research Center. 2016.

Variety	Class	Yield[1] bu/ac[2]	Test Wt[1] lb/bu[2]	Height inch	Lodging %	Protein %
Duclair	**	25.5	48.8	19.0	9.0	14.9
Alum	-	24.6	49.1	21.7	56.7	15.3
Choteau	**	23.9	48.6	21.7	5.3	14.4
Egan	-	22.7	47.4	24.0	58.3	17.2
Corbin	*	22.3	49.4	23.3	28.7	14.5
WB Gunnison	*	21.7	51.2	23.3	1.7	13.5
MT1348	-	20.4	50.7	31.3	10.0	14.7
MT1316	-	20.4	45.1	23.0	80.7	16.2
MT1401	-	19.6	50.8	23.7	6.7	14.6
McNeal	-	18.9	44.0	26.0	73.3	14.6
Reeder	-	18.8	47.1	24.6	36.7	14.8
Fortuna	**	18.6	49.2	28.0	8.7	15.7
Brennan	-	16.8	49.1	23.3	65.0	17.6
Vida	*	16.6	45.9	23.7	25.0	14.9
SY Soren	-	16.4	46.9	22.3	78.3	16.7
ONeal	*	15.9	44.6	23.3	71.7	14.0
WB9879CLP	CL	14.5	45.7	25.7	2.7	10.1
Mott	-	14.4	45.9	23.0	32.0	16.3
SY Tyra	*	14.0	42.1	22.3	9.0	17.0
MT1173	-	10.0	42.1	24.3	48.3	14.7
Mean		18.9	47.2	23.9	34.9	15.0
LSD (.05)		7.9	3.1	8.7	42.5	4.2
C.V. 1 (%) (S/mean)*100		20.6	3.2	21.9	60.2	13.9
P-Value		0.0012	<0.0000	NS	<0.0000	NS

Cooperator and Location: Aaron Killion, Chouteau County.
Planted on 4/22/16 on chemical fallow. Harvested on 8/22/2016
Fertilizer: actual pounds/ac of N-P-K: 11-22-0 applied with seed and a 165-22.5-20 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 4/22/16
** = Solid stem sawfly-resistant (solid stem score of 19 or higher). * = Less preferred by sawfly (behavioral preference) in small plots. CL = Clearfield
[1] Yield and test weight are adjusted to 13% seed moisture.
[2] Severe stripe and some yellow rust. All varieties had some level of infection.
Conducted by MSU Western Triangle Ag. Research Center.

Table 10. Five-year means, Spring Wheat varieties, Knees area, Chouteau County. 2011-2016.

Variety or ID	5-Year Mean			
	Yield bu/ac[1]	Test weight lbs/bu	Height inch	Protein %
Duclair	44.7	56.1	25.7	14.2
Vida	42.4	56.3	26.6	14.2
WB Gunnison	42.1	58.4	26.1	14.0
Egan	41.1	56.7	25.4	16.1
Choteau	40.9	56.9	24.7	14.4
WB9879CL	39.7	56.9	25.7	13.5
Reeder	39.4	57.7	26.6	14.7
McNeal	39.3	55.7	27.7	14.5
Brennan	39.0	57.8	24.6	15.6
Corbin	38.3	57.3	26.4	14.4
SY Tyra	36.3	55.2	23.7	14.4
ONeal	35.6	56.6	26.8	13.9
Fortuna	33.3	57.8	30.6	15.5
Mean	39.3	56.8	26.3	14.5

Cooperator and Location: Aaron Killion, Chouteau County.
[1]Yields were affected by stripe and yellow rust for the 2016 crop year. All varieties had some level of infection.
Conducted by MSU Western Triangle Ag. Research Center.

Table 11. Soil test values for off-station and on-station plots, 2016.

Location	N (lbs/ac)[1]	Olsen-P (ppm)	K (ppm)	pH	OM (%)	EC (mmhos/cm)
Cut Bank	39.6	17	385	7.5	2.7	0.39
Devon	12.1	14	221	7.2	0.8	0.15
Knees	21.1	28	482	6.9	2.4	0.55
Choteau	44.5	7	412	8.1	2.3	0.82
WTARC	15.6	20	318	7.8	2.4	0.56

[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