

**PROJECT TITLE:** Evaluation of winter triticale lines for grain yield and adaptation to dryland cropping in Central Montana.

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**OBJECTIVES:**

To identify winter triticale selections which exhibit high yield, quality and winter hardiness when grown in Montana. To develop a winter feed grain adapted to livestock production areas in eastern Montana because seeding spring grains conflicts with calving and lambing.

**RESULTS:**

Germplasm for all three nurseries originated from Mathias Kolding's breeding program and/or Phil Bruckner. One nursery was submitted directly from Kolding, one managed by Pat Hensleigh (evaluated at CARC since 1995) and one managed by Gil Stallknecht. The nurseries were seeded on black fallow to insure maximum exposure to potential winter kill. Many of the lines in the nurseries exhibit off-types due to contamination or out-crossing.

**KWTR** yields ranged from 3500 to 6200 lbs/a with the average equal to 4938 lbs/a. Experimental lines KT941776-5002, KT941864-5002 and KT943322-6003 have the highest two-year yield average at 5226, 5104, and 5079 lbs/a, respectively. Test weights were above average at 53 lbs/bu. Seventy-three percent of the triticale lines in the nursery headed earlier than Tiber and 70 percent of the lines were taller. Five lines were chosen for a statewide triticale trial in 1999. The current year's data and multi-year yield and test weight summaries are presented in Tables 1 and 2.

**TRWT** yields ranged from 1756 to 5258 lbs/a with the average equal to 4154 lbs/a. Experimental line SR94721 has the highest four-year yield average at 4027 lbs/a and the second highest four-year test weight average at 53.3 lbs/bu. Test weights were slightly below normal. Eighty-one percent of the triticale lines in the nursery headed later than Tiber and 62 percent of the lines were taller. Five lines were chosen for a statewide triticale trial in 1999. The current year's data and multi-year yield and test weight summaries are presented in Tables 3 and 4.

**GWTR:** Yields, test weights and agronomic traits of winter triticale selections are compared in Table 5. Five winter triticale selections, four Polish and one from Oregon State University significantly out-yielded Tiber hard red winter wheat. The 1998 yields are similar to results observed in previous years. Winter triticale selections often produce significantly higher or equal yields to Tiber winter wheat. Multi-year yield and test weight summaries are compared in Table 6.

**SUMMARY:**

Of the three winter triticale nurseries, the KWTR triticale nursery was the earliest to head and had the highest average yield and test weight. Within these triticale nurseries there are lines that show promise for forage potential. Should producer interest in triticale production become a reality, the data indicates that selections are available which produce high yields, lodging resistance and winter hardiness.

**FUTURE PLANS:**

Five lines from each of the nurseries were selected to comprise a statewide triticale nursery in 1999. There will be one location at Sidney, Bozeman and Huntley. Moccasin will have one nursery on fallow and one seeded into winter wheat stubble, for a total of 5 locations. Data gathered at these locations should provide more complete information on yield, quality and winter hardiness. Information gleaned may result in a variety/line selected for entry into the Montana Foundation Seed Program.

Table 1. 1998 Evaluation of Kolding Winter Triticale Lines – Exp. KWTR. Central Agricultural Research Center. Moccasin, MT.

Id	Pedigree	Grain Yield <sup>1/</sup>		Test Weight (lbs/bu)	Heading Date (Julian <sup>2/</sup> )	Plant Height (in.)	Protein Content (%)
		(bu/a)	(lbs/a)				
KT14	KT943322-6003	122.7	6201	52.5	163	37	11.2
KT08	KT941864-5002	111.4	5632	54.2	162	41	10.2
KT07	KT941776-5002	111.2	5619	54.2	163	41	10.8
KT25	92E005	106.8	5399	54.2	160	40	10.7
KT33	KT941776-5002	104.2	5265	54.0	163	41	10.8
KT32	KT941289	104.0	5255	53.1	161	40	11.6
KT35	KT943322-6001	103.6	5237	51.7	162	34	11.4
KT11	KT943127-6004	102.3	5169	51.5	162	34	10.8
KT26	92E008	101.7	5142	50.7	162	38	10.0
KT19	KT95G-01	101.1	5110	53.2	163	41	10.5
KT37	KT943536-5006	99.9	5047	54.7	159	40	11.3
KT30	EMP-1	99.7	5040	60.5	166	35	11.5
KT16	KT943736(whiter than 35)	99.2	5012	50.5	164	43	11.2
KT36	KT943322-6004	98.8	4995	51.4	162	33	11.7
KT5	KT941256-5002	96.9	4896	49.6	162	42	11.5
KT15	KT943322-6007	96.2	4862	51.7	162	33	11.3
KT39	KT95G-06 ROW-2	95.6	4829	51.2	164	40	11.6
KT20	KT95G-06	94.6	4783	50.5	163	43	11.4
KT28	95A231	93.5	4727	54.2	162	39	11.3
KT27	95A229	93.0	4698	53.8	162	40	11.4
KT40	KT95G-06 ROW-5	90.8	4591	50.7	165	45	11.6
KT31	KT940023	90.5	4573	52.7	162	39	11.6
KT34	KT942608	90.2	4560	52.6	164	40	11.2
4	TIBER	90.0	4547	61.4	164	38	12.5
KT29	96E001	73.0	3687	49.2	164	41	12.2
KT38	KT943747-6001	69.4	3507	54.8	162	39	12.3
Experimental Mean		97.7	4938	53.0	162.6	39.1	11.2
F-Value for Var. (df=25)		6.47**	6.47**	68.4**	8.9**	3.9**	-
CV 1: (S/Mean)*100		7.6	7.6	1.1	0.5	7.0	-
LSD (0.05)		12.1	612	1.6	1.3	4.5	-

1/ Triticale yield (bu/a) is based on 50 lb test weight, Tiber winter wheat, 60 lb test weight.

2/ Number of days from Jan. 1 (160 = June 9).

\*\* Denotes Statistical Significance at  $P \leq 0.01$

Planted: 9/24/1997 on fallow ground.

Harvested: 8/13/1998

Fertilizer: 60# N as Urea, pre-plant incorporated.

Growing Season Precipitation (April – July): 9.35” – 90 year avg.: 8.69”

Table 2. Winter Triticale Multi-Year Yield and Test Weight Summary of Selected Varieties, 1997-1998. Central Agricultural Research Center. Moccasin, MT.

Selected Varieties	-----Yield (lbs/a)-----			--Test Weight (lbs/bu)--		
	1997	1998	Mean	1997	1998	Mean
KT941864-5002*	4577	5632	5105	54.2	54.2	54.2
KT95G-06	4302	4783	4543	50.8	50.5	50.7
KT943736	3840	5012	4426	52.8	50.5	51.7
KT941256-5002	3672	4896	4284	50.5	49.6	50.1
KT943127-6004	3543	5169	4356	51.7	51.5	51.6
KT941776-5002*	4913	5619	5266	54.7	54.2	54.5
KT943322-6007	3372	4862	4117	51.8	51.7	51.8
KT943322-6003*	3957	6201	5079	51.5	52.5	52.0
KT95G-01	4240	5110	4675	53.0	53.2	53.1
KT940023	3497	4573	4035	53.8	52.7	53.3
KT943747-6001	3332	3507	3420	56.7	54.8	55.8
TIBER	4175	4547	4361	60.8	61.4	61.1
<b>Nursery Mean</b>	<b>3770</b>	<b>4938</b>		<b>54.0</b>	<b>53.0</b>	
<b>Crop Year</b>						
<b>(Sept-Aug)Precip.</b>	<b>18.8</b>	<b>13.8</b>		<b>18.8</b>	<b>13.8</b>	
April (in.)	1.4	0.6		1.4	0.6	
May (in.)	2.0	1.9		2.0	1.9	
June (in.)	4.1	4.8		4.1	4.8	
July (in.)	3.7	2.1		3.7	2.1	

\* Selected for the Statewide Triticale Nursery in 1999.

Table 3. 1998 Evaluation of Winter Triticale Selections – Exp. TRWT. Central Agricultural Research Center. Moccasin, MT.

Id	Variety/Line	Grain Yield <sup>1/</sup>		Test Weight (lbs/bu)	Heading Date (Julian <sup>2/</sup> )	Plant Height (in.)	Protein Content (%)
		(bu/a)	(lbs/a)				
TRWT19	SR94721	104.0	5258	50.4	173	36	11.3
TRWT01	91T113-C12-5	102.3	5171	55.4	154	40	10.7
TRWT13	SR94710	100.6	5086	49.2	176	41	11.0
TRWT14	SR94712	98.6	4981	49.6	175	41	10.9
TRWT02	90T120-25-4	95.7	4836	48.5	164	39	12.3
TRWT17	SR94717	94.9	4797	51.0	176	36	10.0
TRWT16	SR94715	93.0	4700	48.8	175	39	10.8
TRWT18	SR94719	92.7	4683	47.5	174	39	11.1
TRWT12	SR94708	92.5	4677	48.6	175	39	10.7
TRWT11	SR94707	92.5	4673	50.9	175	35	11.1
4	TIBER	92.2	4660	61.8	164	37	11.4
TRWT09	88T123-E45-2	92.2	4659	45.3	169	44	12.1
TRWT10	90T99-8-1	88.1	4450	48.4	161	43	11.0
TRWT15	SR94713	86.7	4383	49.0	175	40	10.8
TRWT20	CELIA	79.7	4028	53.2	167	35	12.7
TRWT04	89T001-E09-2-3	67.8	3425	50.0	168	35	12.1
TRWT06	89T001-E05-7	60.7	3066	47.4	166	38	-
TRWT05	89T001-E08-7-4	54.0	2727	50.2	169	36	12.4
TRWT03	89T001-E09-5-1	51.6	2605	48.5	170	37	13.0
TRWT08	89T001-E05-7-5	51.5	2603	47.5	165	39	13.8
TRWT07	89T001-E05-7-4	34.8	1756	51.1	168	38	-
Experimental Mean		82.2	4154	50.1	169.5	38.4	11.5
F-Value for Var. (df=20)		20.7**	20.7**	31.7**	39.2**	15.4**	-
CV 1: (S/Mean)*100		9.3	9.3	2.1	0.9	3.0	-
LSD (0.05)		12.7	640	1.7	2.6	1.9	-

1/ Triticale yield (bu/a) is based on 50 lb test weight, Tiber winter wheat, 60 lb test weight.

2/ Number of days from Jan. 1 (160 = June 9).

\*\* Denotes Statistical Significance at P<= 0.01

Planted: 9/26/1997 on fallow ground.

Harvested: 8/13/1998

Fertilizer: 60# N as Urea, pre-plant incorporated.

Growing Season Precipitation (April – July): 9.35” – 90 year avg.: 8.69”

<u>April</u>	<u>May</u>	<u>June</u>	<u>July</u>
0.59”	1.89”	4.79”	2.08”

Table 4. Winter Triticale Multi-Year Yield and Test Weight Summary of Selected Varieties, 1995-1998. Central Agricultural Research Center. Moccasin, MT.

Selected Variety	-----Yield (lbs/a)-----					-----Test Weight (lbs/bu)-----				
	1995	1996	1997	1998	Mean	1995	1996	1997	1998	Mean
SR94707	2454	1770	4984	4673	3470	54.0	51.3	53.4	50.9	52.4
SR94708	2819	1769	4727	4677	3498	51.1	48.9	51.4	48.6	50.0
SR94710*	2332	1862	5290	5086	3643	50.9	49.1	51.6	49.2	50.2
SR94712	3030	1779	4902	4981	3673	51.8	49.4	52.4	49.6	50.8
SR94713	2018	1809	4677	4383	3222	51.2	55.5	52.5	49.0	52.0
SR94715	2589	2024	4772	4700	3521	49.5	49.3	51.1	48.8	49.7
SR94717*	2496	1899	4914	4797	3526	52.8	55.8	53.3	51.0	53.2
SR94719*	2970	1896	5470	4683	3755	50.7	47.1	49.7	47.5	48.8
SR94721*	3324	2204	5320	5258	4027	53.3	57.1	52.3	50.4	53.3
CELIA	2980	1563	3654	4028	3056	56.3	58.6	53.9	53.2	55.5
TIBER	2111	2116	4395	4660	3321	62.4	59.8	62.1	61.8	61.5
Nursery Mean	<b>2325</b>	<b>1809</b>	<b>4774</b>	<b>4154</b>		<b>51.9</b>	<b>52.9</b>	<b>52.7</b>	<b>50.1</b>	
Crop Year (Sept-Aug) Precip.	<b>20.7</b>	<b>11.2</b>	<b>18.8</b>	<b>13.8</b>		<b>20.7</b>	<b>11.2</b>	<b>18.8</b>	<b>13.8</b>	
April (in.)	2.3	1.0	1.4	0.6		2.3	1.0	1.4	0.6	
May (in.)	3.8	3.1	2.0	1.9		3.8	3.1	2.0	1.9	
June (in.)	3.7	1.3	4.1	4.8		3.7	1.3	4.1	4.8	
July (in.)	3.6	0.3	3.7	2.1		3.6	0.3	3.7	2.1	

\* Selected for the Statewide Triticale Nursery in 1999.

Table 5. 1998 Evaluation of Winter Triticale lines and selections – Exp. GWTR. Central Agricultural Research Center. Moccasin, MT.

Id	Variety/Line	Grain Yield <sup>1/</sup>		Test Weight (lbs/bu)	Heading Date (Julian <sup>2/</sup> )	Plant Height (in.)	Protein Content (%)
		(bu/a)	(lbs/a)				
KT24	PRESTO	97.0	4902	55.1	153	37	11.0
T37	RAH371-F93	93.5	4724	51.9	160	39	9.9
T26	B0010	93.0	4699	49.1	169	41	9.8
T34	UGO	91.9	4642	51.4	161	38	10.0
T32	ALMO	89.7	4532	51.6	160	37	10.0
T35	RAH173-F93	87.6	4429	53.8	159	38	10.0
T27	BOB	87.1	4403	49.6	174	44	10.3
T33	MALNO	87.0	4398	51.9	162	41	11.2
GWT11	McGUIRE	80.4	4064	61.2	160	34	13.8
KT20	KT95G-06	78.9	3990	51.4	165	43	10.7
T28	TRILLIUM	77.8	3930	50.8	162	47	11.5
T29	WINTRI	77.4	3914	50.5	170	51	11.2
4	TIBER	77.2	3900	62.3	164	36	11.8
GWT04	88DL01233	76.9	3888	51.3	162	41	12.3
GWT03	88DL01230	75.5	3815	52.1	162	38	12.7
GWT02	88DL01222	70.2	3549	49.0	162	39	13.0
T30	PIKA	70.1	3544	50.8	174	48	11.1
GWT01	88DL01196	64.9	3281	52.1	164	41	12.0
Experimental Mean		82.0	4145	52.6	163.4	40.6	11.2
F-Value for Var. (df=17)		5.0**	5.0**	245.3**	89.5**	21.0**	-
CV 1: (S/Mean)*100		8.7	8.7	0.8	0.6	4.1	-
LSD (0.05)		11.8	598	0.7	1.6	2.7	-

1/ Triticale yield (bu/a) is based on 50 lb test weight, Tiber winter wheat, 60 lb test weight.

2/ Number of days from Jan. 1 (160 = June 9).

\*\* Denotes Statistical Significance at P<= 0.01.

Planted: 9/24/1997 on fallow ground.

Harvested: 8/13/1998

Fertilizer: 60# N as Urea, pre-plant incorporated.

Growing Season Precipitation (April – July): 9.35" – 90 year avg.: 8.69"

April	May	June	July
0.59"	1.89"	4.79"	2.08"

Table 6. Winter Triticale Multi-Year Yield and Test Weight Summary of Selected Varieties, 1996-1998. Central Agricultural Research Center. Moccasin, MT.

Selected Varieties	-----Yield (lbs/a)-----				-----Test Weight (lbs/bu)-----		
	1996	1997	1998	Mean	1997	1998	Mean
TIBER	2029	4053	3900	3327	61.2	62.30	61.7
ALMO*	1975	5048	4532	3852	52.2	51.60	51.9
UGO*	2235	4770	4642	3882	51.6	51.40	51.5
MALNO	2163	4614	4398	3725	51.9	51.90	51.9
RAH371-F93*	1924	4690	4724	3779	51.3	51.90	51.6
RAH173-F93*	1643	4674	4429	3582	52.8	53.80	53.3
BOB	2421	4011	4403	3612	51.4	49.60	50.5
B0010*	1728	4335	4699	3587	49.1	49.10	49.1
PRESTO	1240	3853	4902	3332	55.1	55.10	55.1
WINTRI	1839	4056	3914	3270	52.5	50.50	51.5
TRILLIUM	1403	3683	3930	3005	52.4	50.80	51.6
PIKA	192	3340	3544	2359	53.5	50.80	52.2
KT95G-06		4327	3990	4159	51.0	51.40	51.2
Nursery Mean	1979	4289	4145		52.8	52.6	
Crop Year (Sept-Aug)Precip.	11.2	18.8	13.8		18.8	13.8	
April (in.)	1.0	1.4	0.6		1.4	0.6	
May (in.)	3.1	2.0	1.9		2.0	1.9	
June (in.)	1.3	4.1	4.8		4.1	4.8	
July (in.)	0.3	3.7	2.1		3.7	2.1	

\* Selected for the Statewide Triticale Nursery.