

PROJECT TITLE: Evaluation and selection of superior winter triticale lines for grain production and winter hardiness

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OBJECTIVES:
Identify and select winter triticale lines that exhibit superior grain yield and winter hardiness in central Montana and throughout the state.

RESULTS:
In 2002, several winter triticale lines had grain yields (pounds/acre) greater than Tiber winter wheat at Moccasin (Tables 56 and 57), Bozeman (Table 58), and Sheridan (Table 59). However, the winter triticale yields were not overwhelmingly higher than Tiber yields, as has occurred some years. Tiber yields were relatively similar to most of the triticale lines at Moccasin and Sheridan, where drought conditions resulted in lower grain yields. At the Bozeman site, where the nursery average was 4218 lbs/a, ten of fifteen triticale entries produced more grain than Tiber.

In multi-year comparisons for the Moccasin fallow site (1995-2002), 18 of 20 winter triticale development lines and varieties produced more grain (lbs per acre) than Tiber hard red winter wheat for the same trial in the same years (Table 60). Similar multi-year results occurred at the non-Moccasin fallow sites over the 1997 to 2002 period (Table 61).

SUMMARY:
Several triticale lines have proven to have grain yield potentials greater than Tiber winter wheat. Unfortunately, we have not had winters suitable for the evaluation of winter hardiness. Some of these lines would be suitable for production in areas of Montana with marginal winter stress or for seeding into undisturbed stubble. The line 91T113C125 comes from germplasm put together in Georgia. It was one of two lines showing acceptable survival in its initial screening year. Other lines have a higher degree of winter hardiness. The "facultative" character, which is the ability to produce reproductive parts whether the seed is fall or spring germinated, has not been evaluated for these lines. It is assumed the facultative character would be undesirable in triticale produced for grain as it may increase the incidence of volunteer triticale in subsequent crops.

Market development is the major limiting factor in the introduction of triticale in to Montana cropping systems.

FUTURE PLANS:
We had hoped to release SR94719 or SR94721 as a variety in 2003. We currently have seed under increase. The data showed other lines with far superior grain yield potentials. Thus, these lines will not be released as varieties.

Table 56 2002 Winter triticale statewide nursery on no-till fallow at CARC
 Exp. WTSW Central Agricultural Research Center, Moccasin, Montana

Trt	ID	Pedigree	Plant Height	Heading Date	Forage Yield	Grain Yield	Grain TestWt	Grain Moisture	Grain Protein
				d of y	t/a	lbs/a	lbs/b	%	%
11	TR01	91T113C125	37.2	167	3.343	2472	53.2	8.7	16.04
3	KT25	92E005	30.8	172	3.589	2459	52.0	8.7	14.98
12	KT06G	99SRT6	31.1	176	2.857	1920	52.7	8.8	18.72
6	KT119	K99SRT119	35.5	173	3.123	2282	52.9	8.9	14.30
15	KT27	KT940794	35.6	173	3.152	2086	51.2	8.9	16.92
2	K944	KT940874-8001, 8002, 8003	31.9	175	2.844	1932	48.2	8.4	16.87
9	KT30	KT940874-8002	36.4	177	3.299	1812	46.0	8.4	18.66
16	KT35	KT941256	34.0	176	2.861	2516	51.5	9.2	15.03
13	K950	KT941276-8004	29.2	177	2.294	1969	49.1	8.8	16.29
4	KT32	KT941289	34.8	173	3.174	2285	51.9	8.7	14.92
5	KT33	KT941776	33.9	174	3.384	2331	51.4	8.4	14.91
10	KT3	KT941864	33.7	174	3.207	2342	50.2	8.6	16.30
1	K940-K81	KT943112	29.3	174	3.427	2337	52.0	8.9	14.55
14	K809	KW941531-6005	29.3	174	3.352	2513	52.3	8.9	15.31
8	TR18	SR94719	34.4	177	3.452	2237	47.8	8.4	13.94
7	WW	Tiber	32.3	177	2.431	2392	61.0	9.7	13.96
OVERALL MEAN			33.1	174.3	3.112	2243	51.45	8.769	15.73
F-RATIO TRTS df=30			1.817	72.04	2.456	3.63	8.096	4.307	.@8% moist
P-VALUE TRTS			0.0769	0	0.0164	0.0011	0	0.0003	
CV (S/MEAN) %			10.08	0.3002	13	9.274	3.859	3.247	
LSD (0.05 by t)			5.564	0.8722	0.6744	346.8	3.311	0.4747	

Seeding Date: October 5, 2001

No-till in chemical fallow

Soil Temperature: 43.7 F

Fertilizer: 50 lbs 20-20-20-10 w/seed; 60 lbs N top dressed in March

Broadleaf weed control: Bronate applied May 10, 2002

Growing season precipitation (April-July): 7.49"

Growing season precipitation (April-July) 94 yr avg: 8.62"

Harvest Dates

Forage: July 16, 2002

Grain: Aug. 6, 2002

Table 57 2002 No-Till recrop winter triticale vareity trial in SW1
 Exp. WTRNTRC Central Agricultural Research Center, Moccasin, Montana

Trt	ID	Pedigree /line number	Test Weight	Grain Yield	Grain Yield
#	Code		lbs/bu	lbs/a	bu/a
14	K809	KW941531-6005	52.3	1579	31.6
11	TR01	91T113C125	53.3	1570	31.4
16	KT35	KT941256	51.7	1550	31.0
3	KT25	92E005	52.0	1516	30.3
1	K940-K810	KT943112	52.0	1467	29.3
10	KT3	KT941864	50.3	1457	29.1
5	KT33	KT941776	51.7	1445	28.9
7	WW	Tiber	61.0	1433	23.9
6	KT119	K99SRT119	52.7	1405	28.1
4	KT32	KT941289	51.7	1390	27.8
8	TR18	SR94719	47.7	1388	27.8
15	KT27	KT940794	51.3	1281	25.6
2	K944	KT940874-8001, 8002, 8003	48.3	1218	24.4
13	K950	KT941276-8004	49.0	1201	24.0
12	KT06G	99SRT6	52.7	1195	23.9
9	KT30	KT940874-8002	46.0	1046	20.9
OVERALL MEAN			51.48	1384	27.68
F-RATIO 30=df			8.008	3.837	
P-VALUE TRTS			0	0.0007	
CV (S/MEAN)			3.886	9.867	
LSD (0.05 by t)			3.336	227.7	4.55

Seeding Date: October 5, 2001

Cropping: No-till in chemical fallow

Soil Temperature: 42.8 F

Fertilizer: 50 lbs 20-20-20-10 w/seed; 60 lbs N top dressed in March

Weed Control (broadleaf): Bronate applied May 10, 2002

Growing Season precipitation (Sept-July): 11.14"

Growing Season precipitation (Sept-July) 94 yr avg: 13.78"

Harvest Dates

Forage: July 3, 2002

Grain: Aug. 6, 2002

Table 58 2002 Statewide Triticale Nursery (Exp. TR01): Bozeman
 Exp. WTSWB Plant Science Post Agronomy Farm, Bozeman, Montana

Entry	ID	Line	Grain Yield	Test weight	Heading date	Plant height	Protein bulk
a	b	c	lbs/a	lbs/bu	Julian	in	%
11	TR01	91T113C125	5139	52.4	166.3	50.9	14.5
3	KT25	92E005	4858	49.7	171.3	48.8	14.5
16	KT35	KT941256	4480	49.9	175.3	48.8	14.6
1	K940-K810	KT943112	4465	48.2	174.3	40.8	14.6
2	K944	KT940874-8001	4447	49.4	178.0	44.5	14.5
4	KT32	KT941289	4437	49.3	171.0	52.2	14.5
14	K809	KW941531-6005	4352	48.1	173.3	43.9	14.6
12	KT06G	99SRT6	4314	50.4	177.0	55.0	14.5
15	KT27	KT940794	4247	49.1	172.0	53.4	14.5
6	KT119	K99SRT119	4098	51.2	169.0	52.4	14.6
7	WW	Tiber	4022	57.9	176.3	48.0	14.8
10	KT3	KT941864	3923	48.3	175.0	48.7	14.5
13	K950	KT941276-8004	3919	48.8	178.3	48.5	14.5
5	KT33	KT941776	3699	49.2	177.0	49.2	14.6
8	TR18	SR94719	3616	47.1	179.0	43.8	14.6
9	KT30	KT940874-8002	3576	46.4	177.0	60.8	14.4
Average			4218	49.7	174.4	49.4	14.6
LSD (0.05)			598	1.0	2.1	4.8	
C.V. (%)			8.5	1.2	0.7	5.9	
F-Test (Varieties)			4.28**	55.5**	25.8**	8.51**	

Table 59 2002 Winter triticale grain variety trial near Sheridan, Wyoming
 Exp. WTWY Sheridan Research and Extension Center, Sheridan, Wyoming

Trt	ID	Pedigree/ test line	Head Date	Plant Height	Grain Yield	Grain Yield
#	code		d of y	----	lbs/a	bu/a
3	KT25	92E005	158	33	1409	28.2
11	TR01	91T113C125	156	32	1343	26.8
7	WW	Tiber	167	28	1219	20.3
14	K809	KW941531-6005	162	24	1151	23.0
4	KT32	KT941289	157	30	1121	22.4
16	KT35	KT941256	162	28	1010	20.2
5	KT33	KT941776	163	30	997	19.9
15	KT27	KT940794	160	30	989	19.8
6	KT119	K99SRT119	158	28	979	19.6
12	KT06G	99SRT6	161	33	977	56.2
8	TR18	SR94719	165	32	962	19.3
2	K944	KT940874-8001, 8002, 8003	164	29	932	18.6
1	K940-K810	KT943112	163	25	911	18.2
10	KT3	KT941864	160	29	880	17.6
13	K950	KT941276-8004	165	28	803	16.1
9	KT30	KT940874-8002	163	32	716	14.3
OVERALL MEAN			161.4	29.42	1025	22.54
CV (S/MEAN) %			0.8108	6.787	15.04	
LSD(0.05 by t			2.182	3.33	257	

^{1/} winter wheat test weight standard is 60lbs/bu. Triticale test wt standard is 50 lbs/bu.

Table 60 Moccasin fallow multi-year winter triticale yield (pounds per acre) summary of selected varieties
 Exp. WTSW Central Agricultural Research Center, Moccasin, MT

Selected Varieties	1995 Hens lbs/a	1996 Hens lbs/a	1996 Gwtr lbs/a	1997 Kold lbs/a	1997 Hens lbs/a	1997 Gwtr lbs/a	1998 Kold lbs/a	1998 Hens lbs/a	1998 Gwtr lbs/a	1999 StWide lbs/a	2001 StWide lbs/a	2002 StWide lbs/a	Average lbs/a	Tiber Same Yrs lbs/a
91T113C125								5171		3839	2842	2472	3581	3299
KT941289							5255			4316		2285	3952	3454
KT941776-5002				4913			5619			4299	2498	2331	3932	2397
KT941864-5002				4577			5632			4372	2371	2342	3859	2397
KT943322-6003				3957			6201			3070			4409	4048
SR94710	2332	1862			5290			5086		3464			3607	3335
SR94717	2496	1899			4714			4797		3487			3479	3335
SR94719	2970	1896			5470			4683		3545	2588	2237	3341	3117
SR94721	3324	2204			5320			5258		3431			3907	3335
Tiber	2111	2116	2029	4175	4395	4053	4575	4660	3900	3394	2750	2392	3379	--
RAH 173 F93			1643			4674			4429	3999	2588		3467	3225
RAH 371 F93			1924			4690			4724	3819	2775		3586	3225
92E005							5399			4253	2421	2459	3633	3278
ALMO			1975			5048			4532	4043			3900	3344
B0010			1728			4335			4699	3851	2587		3440	3225
BOB			2420.6			4011			4403				3612	3327
MALNO			2163			4614			4398				3725	3327
Pika			1992			3340			3544				2959	3327
Trillium			1403.4			3683			3930				3005	3327
UGO			2235			4770			4642	4507	2542		3739	3225
Wintri			1838.8			4056			3914				3270	3327
Nursery Mean	2324.6	1809	1979	3770	1809	4289	4938	4154	4145	3856	2536	2243	3609	3287

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Table 61 Multi-location, multi-year grain yield (pounds per acre) summary of selected winter triticale lines and varieties
 Exp. WTSW Central Agricultural Research Center, Moccasin, MT

Selected Varieties	Mocc.	----- Huntley -----				--- Bozeman ---			Moore	Sidney	Winifred	-- Sheridan --		Average	Tiber
	Recrop 1999	Fallow 1997	Fallow 1999	Fallow 2000	Fallow 2001	Fallow 1999	Fallow 2000	Fallow 2002	1996	Fallow 1999	Fallow 2000	2001	2002		Same yrs
91T113C125	2583	--	4510	3851	2235	7862	7232	5139	--	3942	2354	1844	1343	3900	3162
KT941289			3979	3217	1726	7366	6325	4437	--	4201	2322	--	1121	3855	3434
KT941776-5002	3835	--	--	--	--	6788	6035	3699	--	4620	2262	--	--	4540	3727
KT941864-5002	3323	--	3877	3235	1916	6222	6352	3923	--	5398	2116	1676	880	3538	3162
KT943112													911	911	1219
KW941531-6005													1151	1151	1219
SR94719	2916	--	--	--	--	6034	5119	3616	--	4573	1858	1616	962	3337	3158
SR94721	2487	--	--	--	--	--	--	--	--	4213	1858	--	--	2853	2493
TIBER	2184	4308	4131	2890	2490	5878	4985	4022	1809	3517	1778	1686	1219	3146	--
RAH 173 F93	3126	--	4057	3864	1808	--	--	--	1449	4225	2714	1706	--	2869	2723
RAH 371 F93	2865	--	--	--	--	--	--	--	2189	4691	2700	1682	--	2825	2195
92 E005	2801	--	--	--	--	8224	6570	4858	--	4731	2724	1732	1409	4131	3158
B0010	2987	5067	3671	3114	1690	--	--	--	1532	4628	1954	1412	--	2895	2755
ALMO	2588	4968	4355	3333										3811	3378
FROSTAT												1108		1108	1686
TRICAL 102-(CAL)									1744					1744	1745
UGO	3353	4608	4655	3936	2184									3747	3201
Nursery Means	2826	4268	3821	3357	2052.9	6890.9	6178.1	4218	1745	4404	2265	1550	1025	3431	2651

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Table 62 2002 Winter triticale preliminary yield trials on no-till fallow in NW8
 Exp. WTPre Central Agricultural Research Center, Moccasin, MT

Pedigree	Head Date	Plant Height	Dry Mat Yield	Grain Yield	Test Weight
	d of y	cm	t/a	lbs/a	lbs/bu
KT981146p9033	173	82	3.956	1690	50.4
KT981146p9001	173	82	3.345	1796	51.8
KT940608p9003	173	89	3.901	1820	49.4
KT940874p8012	174	89	3.933	2115	47.1
KT991034	172	74	3.285	1951	46.9
KT991402	175	85	3.233	1715	48.1
KT981146p9006	173	83	2.133	1747	52.6
KT981146p9007	172	83	3.332	1650	50.5
KT940506-5004	173	88	3.509	1525	46.0
KT990174	171	100	4.26	1993	53.0
KT940608p9029	173	90	4.188	1825	48.5
D98SRT993	173	90	3.678	1876	48.3
KT981146p9036	172	90	3.627	1879	52.2
KT940872p8006	174	89	4.015	2003	47.3
KT94087p9035	174	67	2.616	1614	47.9
KT941276-8004	174	81	3.114	1834	47.5
D98SRT997	173	107	3.297	1601	51.7
KT981146p9031	173	79	3.388	1798	51.2
OVERALL MEAN	173.1	86.07	3.489	1802	49.46
F-RATIO df=34	1.139	12.88	5.213	3.767	48.4
P-VALUE TRTS	0.3604	0	0	0.0004	0
CV (S/MEAN) %	0.8811	5	11.72	7.686	1.121
LSD(0.05 by t)	2.531	7.141	0.6786	229.8	0.9201

Seeding Date: Sept 27, 2001

Harvest dates: Forage: July 3, 2002 Grain: Aug. 6, 2002

Fertilizer: 50 lbs 20-20-20-10 w/seed; 60 lbs N top dressed in March

Previous Crop: Fallow

Weed Control (broadleaf): Bronate applied May 10, 2002

Soil Temperature: 43.7 F

Growing Season precipitation (Sept-July): 11.14"

Growing Season precipitation (Sept-July) 94 yr avg: 13.78"

Table 63 2002 Winter triticale Increase #4 in NW8
 Exp. WTrit Incr 4 Central Agricultural Research Center, Moccasin, Montana

PLOT		ENTRY	Heading	Plant	Forage	16-Jul-02	17-Aug-02
2002	2001	Pedigree	Date	Height	DryMat	DM Yld	Grain
Plot #	Plot#		d of y	cm	Content	t/a	lbs/a
101	101	D98SRT99-7	177	104	0.512	3.449	1979
102	102	D98SRT99-3	177	91	0.489	3.016	2306
103	118	KT940506-5004	178	90	0.489	3.078	1910
104	119	KT940516-5005	176	90	0.489	2.394	1859
105	120	KT940608p8013	176	86	0.489	2.826	1550
106	122	KT940608p9003	176	85	0.489	2.656	1735
107	131	KT940872p8006	176	84	0.489	3.000	2027
108	133	KT940874p8012	178	82	0.489	3.605	1898
109	137	KT940608p9029	176	92	0.489	3.316	1822
110	149	KT940874p9035	178	71	0.489	2.467	1618
111	154	KT941276-8004	176	87	0.489	3.396	2072
112	160	KT981146p9001	176	87	0.489	2.856	1817
113	161	KT981146p9006	175	83	0.489	3.123	2081
114	162	KT981146p9007	176	85	0.489	2.709	1807
115	167	KT981146p9033	177	83	0.489	3.374	1779
116	170	KT981146p9036	177	85	0.489	3.176	2150
117	174	KT981146p9031	177	73	0.489	2.850	1534
118	176	KT982021	179	82	0.489	3.317	1792
119	177	KT982022	179	76	0.489	3.883	2006
120	178	KT982034	178	75	0.479	3.066	1799
121	179	KT982088hd-902	178	63	0.496	2.567	1563
122	187	KT990174	174	97	0.564	3.098	2177
123	193	KT991034	176	69	0.488	3.423	2083
124	199	KT991402	178	83	0.474	3.167	1973

Bold dry matter contents are actual.

The rest are projected from the similarly mature weighed entries.

101 101 D98SRT99-7 Need to select heads A comment from 2001 notes

102 102 D98SRT99-3 As is mixed types

135 The first plot on the west end is to be harvested as ?

152, 169, 186, 118 apparently were not harvested or other unique factors. Review harvests notes.

Seeding Date: Oct. 5, 2001

Soil Temperature: 42.8 F