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MEMORANDUM

TO: Wheat Cultivar Release & Recommendation Committees (MT & ND)

FROM: Phil Bruckner and Jim Berg, Winter wheat breeders, & Neil Riveland, Agronomist

DATE: January 5, 2010

RE: Proposal for protected MAES public (F.2.b) cultivar release of MT0552 HRWW

The following motion and supporting documentation is presented for consideration at the 2010 MAES Cultivar Release & Recommendation Meeting in January and NDSU Variety Release meeting in February:

Motion: That MT0552 hard red winter wheat (HRWW) be approved for release in 2010.

Pedigree: MT0552 was selected from a composite of three closely related single cross F₁ populations: N95L159/CDC Clair, N95L159/MT9602, and N95L159/MT9609. N95L159 is a sib of 'Wesley' with the pedigree KS831936-3//Colt/Cody. MT9602 has the pedigree NuWest/Tiber and MT9609 has the pedigree Froid/SD1287//Redwin/3/NuWest.

Recommendation: Protected MAES Public Release (F.2.b). Joint release with NDSU.

Name: To be named 'Decade' denoting the extended time period (1997-2009) of cooperative winter wheat cultivar development research conducted by the MSU winter wheat breeding program and the Williston Research Extension Center that resulted in release of this cultivar.

Selection history: MT0552 originated from a composite of three single crosses (pedigrees denoted previously) made in 1996. The F₁ populations were grown in the greenhouse or field in 1997. A composite of F₂ seed of the three closely related populations was made and grown as an F₂ space-planted population (96X79c) at Fort Ellis in 1998 under heavy stem rust selection pressure. The F₃, F₄, and F₅ bulk populations were grown at Williston, north Havre, and Fort Ellis in 1999, 2000, and 2001, respectively, with mass selection for survival, reduced plant height, favorable head morphology, and kernel plumpness. Survival of F₃ populations at Williston in 1999 was relatively low. Seventy heads which were selected from the F₅ population grown at Fort Ellis in 2001 were grown as F₆ headrows at Fort Ellis in 2002. Headrow 96X79cE31 was selected based on visual criteria for uniformity, productivity, and acceptable agronomic type and harvested in bulk after reselection of individual heads from the F₆ row. F₇ reselection headrow 96X79cE31-3 was selected at the Bozeman Post Farm in 2003 and harvested in bulk. 96X79cE31-3 was subsequently tested in the 2004 Single Rep Observation Nursery A (SROA) grown at Bozeman, Havre, and Fort Ellis. In 2005, 96X79cE31-3 was designated MT0552 and tested in the Preliminary A yield trial at four locations averaging 66.4 bu/a (13th), 58.5 lb/bu (12th), 164.5 Julian day heading date (5th earliest), 35.2 inches height (4th shortest), and 14.9% protein (17th) in the 64 entry trial. In 2006, MT0552 was tested in the MT Advanced trial at six locations averaging 65.3 bu/a (6th), 62.3 lb/bu (5th), 154.2 Julian day heading date (4th earliest), 30.6 inches height (6th shortest), and 13.0% protein (14th) in the 36 entry trial. MT0552 distinguished itself from other lines due to outstanding performance at Williston, ND under high cold stress conditions. From 2007 through 2009,

MT0552 was evaluated in the Montana Intrastate trial planted at eight locations (total 22 LY), NDSU winter wheat trials planted at nine locations (total 17 LY), and from 2008 through 2009 in the Montana Off-station nursery planted at 14 on-farm locations (total 23 LY). Quality has been evaluated in multi-location Montana trials since 2005. In 2008, MT0552 was an entry in the USDA Northern Regional Performance Nursery (NRPN) planted at approximately 20 sites across the Northern Great Plains.

Purification/seed stocks: Purification and increase of MT0552 was initiated in 2007 when 120 F₁₀-derived F₁₁ headrows was grown at Bozeman with selection for height, maturity, and visual uniformity. In 2008, 102 line row plots of MT0552 were grown at the Post farm in Bozeman and the Williston Research Extension Center. Bozeman linerows were discarded due to heavy hail damage. Williston linerows were uniform and were harvested in bulk as the source of breeder seed (Fig. 1). In 2009 breeder seed of MT0552 (1.0 acre) was increased at the Post Farm in Bozeman. Plants rogued from the breeder seed increase included variant plants taller in height and red chaffed plants. MT0552 contains a tall plant variant (up to 30 cm taller under conditions favorable for maximum height expression) at a frequency less than 25 per 10,000 plants. Under conditions of maximum height expression, MT0552 is visibly non-uniform for height. MT0552 is planted at Williston, ND (13A), Sidney (7A irr.), and Havre (20A) for 2010 Foundation seed production.

Figure 1. MT0552 linerow plots at Williston, ND in 2008. These plots were bulked as a source of breeder seed.



Table 1. Description of nurseries and data sets describing the performance of MT0552 in Montana, 2005-2009.

Year	Trial	Loc. planted	Loc. harvested	Loc. For Quality Eval.
2005	Preliminary A	4	4	3
2006	Advanced	6	6	4
Combined data set				
2007	Intrastate	8	8	4
2008	Intrastate	8	7	4
2008	Off-station	14	12	0
2009	Intrastate	8	7	4 pending
2009	Off-station	14	11	0

Description: MT0552 is an awned, white-glumed, semi-dwarf hard red winter wheat. MT0552 has medium-early maturity, 163.2 d heading from 1 January, 1.3d earlier than ‘CDC Falcon’ and 2.2d earlier than ‘Jerry’

(Table 2). MT0552 is semi-dwarf (*Rht1*) and medium-short (30.8 inches, n=44), 1.4 inches taller than CDC Falcon and 4.3 inches shorter than Jerry. Coleoptile length of MT0552 under controlled conditions is 3.1 inches, longer than that of CDC Falcon (2.8 inches) and equivalent to that of Jerry (3.1 inches). Straw strength of MT0552 is good. MT0552 is resistant to prevalent races of stem rust (Sr24) and stripe rust but susceptible to leaf rust. MT0552 is hollow-stemmed and susceptible to wheat stem sawfly. Winterhardiness of MT0552 is high, similar to that of CDC Falcon and Jerry (Tables 2 and 3). MT0552 is most similar to CDC Falcon and is best adapted to western North Dakota and eastern Montana which require higher levels of winter hardiness (Table 4).

MT0552 has prostrate juvenile plant growth habit with a green plant color at the boot stage. MT0552 has a middense, erect head with white awns. Kernels are red and hard-textured. MT0552 has been genetically uniform and stable over four generations of seed increase with visually obvious tall plant variants under environmental conditions favorable for height expression. MT0552 contains a tall plant variant (up to 30 cm taller under conditions favorable for maximum height expression) at a frequency less than 25 per 10,000 plants. Evidence from molecular markers for *Rht1* and height segregation in progeny of MT0552 indicates these tall off-types result from aneuploidy of chromosome 4D which occurs spontaneously at a low frequency (hemizygous for *Rht1*). Similar spontaneous aneuploidy and height variation has been reported for *Rht1* semi-dwarf hard red spring cultivars including ‘Grandin’, ‘Hi-Line’, and ‘Len’ (0.14 to 0.26% tall monosomic plants, Crop Science 36:1521-1522).

Characteristics/comparisons:

Yield. In 45 location-years (LY) of testing in the Montana Winter Wheat Intrastate and Off-station nurseries average yield of MT0552 (65.1 bu/a) was the 2nd highest among tested cultivars, statistically similar to the yields of Yellowstone, Wahoo, CDC Falcon, Pryor, Jagalene, and Norris (Table 2). The line performed well at all Montana locations (Tables 5 – 12) indicating broad adaptation and good winter hardiness. MT0552 also yielded well across 17 trials in North Dakota (Table 3), averaging 58.7 bu/a, statistically similar to yields of Darrell, CDC Falcon, Yellowstone, and Millenium. In western North Dakota and eastern Montana where this line appears to be best adapted, MT0552 was the highest yielding line compared to seven adapted cultivars (Table 4). Performance of MT0552 in central and eastern North Dakota over five trials was average but not outstanding (Table 13). For comparison purposes, MT0552 appears to be most similar to CDC Falcon with reduced plant height and relatively high cold tolerance. MT0552 and CDC Falcon are similar for grain yield in both Montana and North Dakota.

Test weight. Test weight of MT0552 (61.1 lb/bu over 44 MT LY and 58.9 lb/bu over 17 ND LY) was medium to high relative to other cultivars (Tables 2 and 3). Relative to CDC Falcon, test weight of MT0552 was higher in MT (+0.9 lb/bu) and similar in ND (+0.2 lb/bu).

Winter survival. Based on nine environments where differential winter survival occurred, MT0552 exhibited good winter survival similar to CDC Falcon and Jerry (Table 4).

Maturity. MT0552 is medium to early, heading about the same date as Jagalene in both Montana and North Dakota, about 1.5d earlier in heading than CDC Falcon, 2.2d earlier than Jerry, and 3.0d earlier than Yellowstone (Tables 2 and 3).

Plant height. MT0552 is an *Rht1* semi-dwarf similar in height to Jagalene, averaging 30.8 inches in MT (Table 2) and 28.3 inches in ND (Table 3). MT0552 was 1.0 to 1.4 inches taller than CDC Falcon and 3.5 to 4.3 inches shorter than Jerry. Straw strength of MT0552 is excellent with significant lodging occurring only twice in 45 MT trials under high-yield, irrigated conditions (Table 11).

Table 2. Mean performance of MT0552 in the Montana, 2007-2009.

Variety	Yield	Test weight	Winter survival	Heading date	Plant height	Lodging score	Sawfly cutting	Stripe rust	Protein	Coleoptile length
	bu/a	lb/bu	%	Julian	in	(0-9)	%	%	%	in
Yellowstone	67.0*	60.3	33.9	166.0	33.1	4.3	42.7	0.3	12.1	2.6
MT0552	65.1*	61.1	52.8**	163.2	30.8	4.3	28.2	2.0	12.7	3.1
Wahoo	65.0*	59.6	32.0	161.1	31.7	5.8	43.4	5.5	12.0	2.8
CDC Falcon	63.7	60.2	45.0*	164.5	29.4	3.4	36.2	9.9	12.2	2.8
Pryor	63.7	60.3	39.0	166.4	29.8	3.3	22.6	13.5	11.6	2.8
Jagalene	63.0	62.3**	27.0	162.7	30.9	5.4	40.5	3.8	12.4	3.1
Norris (CL)	62.9	61.7	30.6	161.7	34.0	6.4	44.5	6.5	12.2	3.4
Promontory	61.8	62.1*	24.8	164.8	32.9	6.1	60.1	1.1	11.6	2.7
Ledger	60.9	61.1	24.8	164.6	30.6	5.5	25.3	8.5	11.9	3.2
Neeley	60.6	60.2	42.6*	166.9	34.3	7.2	42.7	21.8	12.2	3.5
Rocky	59.8	61.8	29.0	164.3	35.4	8.5	29.8	4.1	11.9	3.5
Carter	59.5	60.5	30.1	164.4	28.3	5.4	20.9	17.2	12.7	2.6
NuSky (HWW)	58.5	60.7	43.9*	166.5	34.4	6.8	46.4	40.6	12.2	2.6
Genou	58.1	60.5	26.3	165.0	34.2	7.4	19.6	8.9	12.6	4.0
Rampart	53.2	60.4	17.8	165.4	33.8	8.2	10.2	3.3	13.1*	4.4**
Jerry ^{1/}			52.6*	(165.4)	(35.1)		45.2	3.4		3.1
LSD (0.05)	2.4	0.4	12.0	0.7	0.6	2.6	13.3	10.1	0.2	0.2
# envs.	45	44	3	25	44	3	5	4	46	2

^{1/} Jerry not grown at SARC Off Station locations in 2008, heading date & height reported for Jerry are based on n=24 & n=39, respectively.

Table 3. Mean performance of MT0552 in North Dakota, 2007-2009.

2009 nurseries include Dickinson, Hettinger, Mandan, Minot, Prosper, Williston fallow, and Williston no-till.

2008 Nurseries include Carrington, Dickinson, Hettinger, Langdon, Mandan, Prosper, Williston fallow, and Williston no-till.

2007 Nurseries include Williston fallow and Williston no-till.

Variety	Yield	Test weight	Winter survival	Heading date	Plant height	Lodging score	1000 kernel wt	Protein
	bu/a	lb/bu	%	Julian	in	(0-9)	g	%
MT0552	58.7**	58.9	80.6**	165.1	28.3	0.0	30.3	13.1*
Darrell	57.4*	59.0	75.6*	164.7	29.4	1.2	33.4*	12.8
CDC Falcon	57.4*	58.7	79.0*	166.7	27.3	0.5	27.1	12.5
Yellowstone	56.5*	57.7	76.0*	168.4	30.6	0.5	33.7**	12.7
Millennium	56.2*	59.4	79.4*	164.9	31.2	0.5	31.9	12.7
Jerry	55.4	58.4	79.3*	167.3	31.8	1.3	32.4*	12.8
Radiant	55.3	58.0	77.4*	168.1	31.2	0.5	31.2	12.6
Jagalene	53.9	59.5*	68.5	164.9	28.2	0.8	31.1	12.7
CDC Buteo	53.6	60.1**	80.0*	166.8	30.3	2.2	29.2	12.8
Alice (HWW)	53.3	59.3	72.6	162.5	26.4	1.0	30.5	12.5
Hawken	52.7	58.9	66.7	162.2	25.7	0.5	30.9	12.7
Expedition	52.6	59.3	73.0	161.6	28.2	1.0	33.5*	12.5
Wesley	51.4	58.4	77.1*	161.4	25.4	0.0	32.7*	13.2**
LSD (0.05)	3.3	0.7	5.6	1.1	1.1	ns	1.5	0.3
# envs.	17	17	7	13	16	2	8	16

Maximum **coleoptile length** of MT0552 is medium (~3.1 inches), similar to Jerry and significantly longer than that of CDC Falcon (Table 2).

Grain protein content of MT0552 is medium to high, lower than Rampart in Montana (Table 2) but relatively high in North Dakota, equivalent to that of Wesley, Darrell, CDC Buteo and Jerry (Table 3). Grain protein content of MT0552 is about 0.5 percentage points higher than grain protein content of CDC Falcon.

Table 4. Mean performance of MT0552 in western North Dakota and eastern Montana, 2007-2009.

2009 North Dakota Variety tests include Dickinson, Hettinger, Mandan, Minot, Williston fallow, and Williston no-till.

2009 Montana Intrastate tests include Williston.

2008 North Dakota Variety tests include Dickinson, Hettinger, Mandan, Williston fallow, and Williston no-till.

2008 Montana Intrastate tests include Sidney and Williston

2007 North Dakota Variety tests include Williston fallow and Williston no-till.

2007 Montana Intrastate tests include Sidney and Williston

Variety	Yield	Test weight	Winter survival	Heading date	Plant height	Lodging score	1000 kernel wt	Protein
	bu/a	lb/bu	%	Julian	in	(0-9)	g	%
MT0552	53.6**	59.9	69.4**	162.7	27.1	0.0	30.6	13.5**
CDC Falcon	52.4*	58.7	65.5*	164.4	26.2	1.0	26.6	12.9
Jerry	51.9*	58.8	68.9*	165.1	30.7	2.0	32.7*	13.2*
Yellowstone	51.2*	58.5	59.5	165.9	29.3	1.0	33.7**	13.1
Darrell	51.0*	59.6	60.6	162.3	28.3	2.0	33.5*	13.0
Jagalene	47.5	60.6**	51.6	162.6	27.1	1.0	31.2	13.1
Alice (HWW)	45.4	59.9	54.9	160.0	24.9	2.0	30.4	12.7
Hawken	44.6	59.1	48.6	160.1	25.3	1.0	31.0	13.1
LSD (0.05)	3.4	0.6	6	0.9	1.1	-	1.4	0.3
# envs.	18	18	9	16	18	1	7	18

Table 5. Mean performance of MT0552 at Bozeman, 2007-2009.

2008 Bozeman was not harvested, hail
(includes Dry Creek and Willow Creek data for 2008-2009)

Variety	Yield	Test weight	Heading date	Plant height	Stripe rust	Protein
	bu/a	lb/bu	Julian	in	%	%
Yellowstone	70.8**	61.2	172.0	32.3	0.3	11.6
Wahoo	66.1*	60.1	167.4	31.2	6.1	11.8
Promontory	65.4*	62.9**	171.0	32.7	1.4	11.4
Pryor	63.4	60.8	172.0	29.3	16.7	11.3
MT0552	63.1	61.5	169.6	30.2	2.3	13.0
Neeley	61.4	61.3	172.9	33.6	24.6	11.8
Ledger	61.2	61.2	168.9	29.6	10.9	11.8
Carter	61.1	60.1	169.7	27.8	22.0	12.9
Rocky	60.9	61.9	169.9	34.6	0.8	12.2
Genou	60.2	60.9	170.8	33.4	10.4	12.5
CDC Falcon	60.0	60.7	170.8	27.9	11.9	12.0
Jerry	59.5	60.2	171.5	35.2	2.5	12.4
Jagalene	59.0	62.7*	168.7	30.5	5.0	13.4*
Norris (CL)	58.6	62.2*	168.9	33.5	3.3	12.6
Rampart	55.4	60.7	170.8	34.0	4.4	13.4*
NuSky (HWW)	54.7	61.0	172.4	33.5	47.7	12.1
LSD (0.05)	6.6	0.7	0.9	1.5	10.8	0.6
# envs.	6	6	3	7	3	6

Table 6. Mean performance of MT0552 at Havre, 2007-2009.

(includes Loma and North Havre data for 2008-2009)

Variety	Yield	Test weight	Heading date	Plant height	Protein
	bu/a	lb/bu	Julian	in	%
Wahoo	58.2*	58.5	161.0	29.0	13.3
MT0552	56.6*	59.5	161.9	28.0	14.1*
Yellowstone	55.9*	58.4	165.8	30.4	13.8
Jagalene	55.6*	60.7**	162.3	27.5	13.6
CDC Falcon	55.4*	58.6	164.2	27.4	13.5
Norris (CL)	53.2	60.5*	160.5	30.9	13.3
Rocky	52.8	60.4*	162.9	31.5	13.0
Ledger	52.7	59.6	164.9	27.3	12.8
Promontory	52.5	60.7**	164.2	29.8	12.9
NuSky (HWW)	52.5	59.5	166.7	31.9	13.8*
Genou	52.2	58.6	165.4	30.9	14.1*
Carter	52.0	58.8	164.8	25.4	14.3**
Jerry	51.9	58.6	165.5	31.9	13.5
Pryor	51.9	58.2	166.9	27.8	13.5
Neeley	48.6	58.1	166.3	30.9	13.7
Rampart	47.8	59.0	165.5	30.0	14.3**
LSD (0.05)	5.1	0.8	1.4	1.6	2.0
# envs.	6	6	3	6	6

Table 7. Mean performance of MT0552 at Sidney, 2007-2009.

Sidney nursery was not harvested in 2009, severe winterkill.

Variety	Yield	Test weight	Winter survival	Heading date	Plant height	Protein
	bu/a	lb/bu	%	Julian	in	%
Jerry	52.6	59.2	40.5	165.7	32.7	13.3
MT0552	50.4	60.6*	51.7	161.7	29.1	13.4
CDC Falcon	50.3	58.6	36.7	163.4	27.9	12.5
Yellowstone	46.7	58.8	33.4	165.7	30.3	12.6
Pryor	46.0	58.8	41.8	165.9	28.3	12.2
Wahoo	44.9	58.2	28.9	162.1	28.2	12.3
Carter	44.1	60.6*	21.9	164.2	27.3	12.7
NuSky (HWW)	41.8	59.5	43.1	165.9	32.7	12.4
Jagalene	41.6	61.5**	23.9	162.9	27.3	12.6
Neeley	41.3	59.3	43.3	166.2	32.6	11.9
Rocky	41.0	60.0	22.3	163.0	34.0	12.9
Ledger	40.3	60.4*	20.6	165.1	27.4	12.0
Norris (CL)	38.0	60.0	18.8	160.8	31.5	13.1
Promontory	37.1	61.4*	25.1	163.4	28.8	11.8
Genou	35.5	58.7	18.3	166.0	31.4	14.1
Rampart	31.4	60.0	10.2	165.9	30.7	13.3
LSD (0.05)	ns	1.2	-	3.1	3.8	ns
# envs.	2	2	1	2	2	2

Table 8. Mean performance of MT0552 at Williston (Montana Intrastate trial), 2007-2009.

Variety	Yield	Test weight	Winter survival	Heading date	Plant height	Protein
	bu/a	lb/bu	%	Julian	in	%
Jerry	54.5**	60.3*	58.7**	162.3	31.1	14.1
CDC Falcon	54.1*	58.8	49.2*	161.4	25.8	14.3
MT0552	50.7*	61.6**	53.4*	159.0	26.7	14.8
Yellowstone	49.6*	59.9*	34.2	162.2	28.4	14.2
Norris (CL)	47.9*	61.2*	36.5	158.8	28.5	13.6
Wahoo	45.5	59.1	33.5	158.1	27.0	13.7
Neeley	45.0	59.7*	42.3*	164.2	28.8	14.1
NuSky (HWW)	44.5	60.0*	44.4*	164.4	30.6	14.8
Carter	44.3	60.2*	34.2	163.6	25.3	15.1*
Pryor	43.8	59.8*	37.7	165.1	26.0	13.9
Jagalene	41.8	61.5*	28.5	159.5	26.6	14.3
Promontory	41.1	61.4*	24.7	160.6	27.3	13.7
Rocky	40.2	60.7*	32.3	163.4	29.9	13.6
Ledger	37.9	60.9*	26.9	162.3	26.7	13.8
Genou	37.3	59.6	30.3	163.3	29.3	14.8
Rampart	33.5	60.0*	21.7	162.8	28.2	15.5**
LSD (0.05)	8.6	1.9	16.8	2.9	2.1	0.7
# envs.	3	3	2	3	3	3

Table 9. Mean performance of MT0552 at Kalispell, 2007-2009.

Variety	Yield	Test weight	Heading date	Plant height	Lodging score	Stripe rust	Protein
	bu/a	lb/bu	Julian	in	(0-9)	%	%
Jagalene	114.5*	63.9*	157.9	34.1	0.2	0.0	12.5
Yellowstone	114.4*	61.4	161.3	35.7	0.5	0.0	12.5
CDC Falcon	111.3*	60.8	159.7	32.0	0.2	3.7	12.2
Promontory	108.9*	64.0**	159.9	35.6	3.1	0.3	11.6
Ledger	108.6*	62.6*	157.8	34.3	0.6	1.3	12.0
Pryor	107.6*	61.9	160.6	31.5	0.0	4.0	11.5
MT0552	107.4*	61.7	159.0	34.4	0.5	1.0	12.5
Wahoo	106.6*	60.3	156.5	33.5	2.3	3.7	12.0
Carter	102.9*	61.5	159.2	30.8	0.4	2.7	12.6
Norris (CL)	99.5	62.8*	158.0	37.7	3.9	16.0	12.5
Neeley	99.4	61.8	162.4	38.4	5.7	13.3	11.8
Genou	97.8	62.1	159.7	37.6	7.2	4.3	12.9*
Rocky	95.7	63.1*	159.8	39.8	9.1	14.0	12.0
NuSky (HWW)	93.9	61.8	161.3	38.1	4.3	19.3	11.8
Jerry	93.3	60.9	160.0	39.2	8.0	6.0	12.7
Rampart	87.1	61.6	160.1	38.0	7.4	0.0	13.8**
LSD (0.05)	12.8	1.5	1.3	1.5	-	-	0.9
# envs.	3	3	3	3	1	1	3

Table 10. Mean performance of MT0552 at Moccasin, 2007-2009.

(includes Moccasin No-Till, Geraldine, and Winifred data for 2008-2009)

Variety	Yield	Test weight	Heading date	Plant height	Protein
	bu/a	lb/bu	Julian	in	%
Yellowstone	55.0**	60.4	170.1	31.5	12.3
MT0552	53.8*	61.3	167.6	28.0	12.4
Pryor	52.4*	60.4	169.9	27.3	11.8
Rocky	51.9*	62.4*	167.9	34.5	11.5
Promontory	51.6*	62.8**	169.2	31.6	11.5
Jagalene	51.5*	62.2*	167.1	29.2	12.4
NuSky (HWW)	51.5*	61.5	170.7	31.9	11.9
Norris (CL)	51.0	61.8*	166.5	32.3	12.3
Neeley	50.7	60.3	169.9	32.4	12.0
CDC Falcon	50.6	60.2	169.3	27.4	12.2
Wahoo	50.4	60.1	164.5	29.8	12.4
Jerry	49.2	59.8	169.9	34.2	12.2
Carter	48.9	60.8	167.6	26.9	12.7*
Ledger	47.6	61.3	168.7	29.0	11.9
Genou	47.5	60.1	168.4	31.4	12.5*
Rampart	42.0	60.2	169.6	32.0	12.7*
LSD (0.05)	3.9	1.0	1.3	1.4	0.6
# envs.	8	7	3	6	9

Table 11. Mean performance of MT0552 at Huntley, 2007-2009.

(includes Forsyth, Hardin, Huntley Irrigated, Lodgegrass, Molt, and Rapelje data for 2008-2009)

Variety	Yield	Test weight	Heading date	Plant height	Lodging score	Protein
	bu/a	lb/bu	Julian	in	(0-9)	%
Norris (CL)	73.3*	62.0*	160.3	37.2	7.7	10.9
Yellowstone	72.3*	60.5	165.8	35.9	6.2*	10.9
Wahoo	71.8*	59.6	160.6	34.8	7.5	10.9
MT0552	70.5*	61.1	163.9	33.9	6.2*	11.6
Pryor	70.5*	60.4	166.4	32.6	5.0**	10.4
Jagalene	69.6*	62.3**	162.1	34.2	8.0	11.1
Ledger	67.8	60.8	165.3	34.0	8.0	11.1
CDC Falcon	67.8	60.6	164.4	32.1	5.0**	11.3
Neeley	67.5	60.4	167.2	37.2	8.0	11.4
Promontory	67.1	61.6	165.1	35.8	7.7	10.8
Rocky	63.3	61.9*	164.8	38.2	8.2	11.0
NuSky (HWW)	63.3	60.8	166.4	36.9	8.0	11.2
Genou	62.2	61.2	165.7	37.7	7.5	11.2
Carter	61.6	60.3	163.7	30.7	7.9	11.5
Rampart	58.8	60.7	164.7	36.8	8.7	12.2*
Jerry ^{1/}						
LSD (0.05)	5.1	0.6	2.0	1.0	2.0	0.4
# envs.	14	14	5	14	2	14

^{1/} Jerry not grown at SARC Off Station locations in 2008

Table 12. Mean performance of MT0552 at Conrad, 2007-2009.

Variety	Yield	Test weight	Heading date	Plant height	Protein
	bu/a	lb/bu	Julian	in	%
Pryor	69.7**	63.0	167.3	29.3	10.4
Wahoo	67.1*	60.9	163.0	31.3	11.5
MT0552	65.8*	62.2	165.7	30.0	12.1
CDC Falcon	65.5*	62.4	167.0	29.3	11.6
Yellowstone	65.5*	61.5	169.0	32.7	11.4
Rocky	63.9	63.4*	166.0	34.7	11.2
Carter	62.9	62.7	166.0	27.0	12.2
Genou	62.1	61.8	166.7	33.7	11.9
Norris (CL)	61.8	62.6	164.3	32.3	11.7
Jagalene	60.4	64.3**	165.0	29.0	11.8
Ledger	60.3	63.2	167.0	28.7	11.3
Neeley	59.9	61.1	169.3	33.3	11.5
Jerry	58.2	61.1	167.7	33.7	11.9
Promontory	58.0	63.2	167.7	32.7	11.0
NuSky (HWW)	57.3	60.7	168.7	33.0	12.0
Rampart	56.2	61.4	167.7	31.0	12.3
LSD (0.05)	5.1	1.1	1.9	2.7	0.6
# envs.	3	3	3	3	3

Table 13. Mean performance of MT0552 in central and eastern North Dakota, 2008-2009.

2009 North Dakota Variety tests include Minot and Prosper

2008 North Dakota Variety tests include Carrington, Langdon, and Prosper

Variety	Yield	Test weight	Winter survival	Heading date	Plant height	Lodging score	1000 kernel wt	Protein
	bu/a	lb/bu	%	Julian	in	(0-9)	g	%
Peregrine	78.6	59.6*	98.3	174.7	38.5	1.5	31.4	10.4
Overland	77.9	59.7*	99.5	168.5	33.7	0.5	33.3*	11.7*
Millennium	77.5	59.4*	99.5	171.2	35.3	0.0	33.9*	11.2
Accipiter	77.3	58.8*	97.8	174.1	32.3	0.0	28.5	11.5*
Darrell	76.3	58.7*	99.5	170.4	33.2	0.3	34.7*	11.6*
Alice (HWW)	74.2	59.2*	97.0	168.1	29.6	0.0	31.6	11.5*
CDC Falcon	74.2	58.7*	98.3	172.4	30.6	0.0	30.1	11.5*
MT0552	73.8	58.0	98.3	170.3	32.2	0.0	31.8*	12.0*
Lyman	73.4	59.7*	94.0	167.9	33.3	0.8	35.2**	12.2**
Yellowstone	72.5	57.1	97.8	174.8	33.7	0.0	34.3*	11.5*
Radiant	71.9	57.6	96.0	174.0	35.0	0.0	33.4*	11.9*
Expedition	71.8	59.5*	95.3	166.8	32.1	0.0	34.9*	11.3
Jagalene	71.4	58.0	95.8	171.6	31.1	0.5	33.1*	11.9*
CDC Buteo	70.9	60.2**	98.3	173.2	36.4	2.3	33.0*	11.5*
Jerry	70.2	58.5	93.3	173.2	36.2	0.5	33.5*	11.7*
Hawken	67.6	59.1*	98.3	168.0	27.9	0.0	33.0*	12.0*
Wesley	66.6	58.3	96.5	167.5	28.1	0.0	34.6*	12.0*
LSD (0.05)	ns	1.6	-	2.0	1.6	-	3.5	0.7
# envs.	5	5	1	3	4	1	2	4

Disease reaction of MT0552. Based on **stripe rust** reaction in three Bozeman trials and one Kalispell trial, MT0552 shows high resistance to predominant stripe rust races in Montana (Table 2). However, MT0552 was susceptible to stripe rust races predominant at Pullman and Mt. Vernon, WA in 2008 and 2009 (data not shown, data collected by Dr. Xianming Chen, USDA, Pullman). MT0552 is resistant to **stem rust** based on field and seedling evaluations (conducted by Dr. Mareike Johnston) by MSU using races TLMK and QFCS (Table 14). In seedling stem rust evaluations conducted by the USDA-ARS Cereal Disease Lab by Dr. Yue Jin in 2008 and 2009 (Table 15 and 16) MT0552 was resistant to multiple stem rust races including TTKSK (UG99). Based on reaction to differential races, MT0552 is postulated to carry the *Sr24* gene for stem rust resistance. MT0552 appears to have resistance to **physiological leaf spot** relative to that of CDC Falcon based on data from Bozeman in 2008 and 2009 (Table 14). Based on screening evaluations in the 2008 NRPN, MT0552 is susceptible to leaf rust (rest. to 3 of 8 leaf rust isolates), Russian wheat aphid, greenbug, and the Great Plains biotype of Hessian fly (data not shown). Based on DNA marker analysis in the 2008 NRPN, MT0552 carries diagnostic markers for Sr2, Lr24/Sr24, Al tolerance, and Rht1 (data not shown).

Stem solidness & Tolerance to sawfly cutting. MT0552 has a hollow stem and no tolerance to wheat stem sawfly has been observed (Table 2).

End-use quality. Based on experimental milling using a Brabender Automat Mill, flour yield of MT0552 is medium, with relatively low flour ash content (Tables 17, 18, and 19). MT0552 has strong dough mixing characteristics with high mixing tolerance, high water absorption, and relatively long mixing time. **Baking qualities** of MT0552 are within acceptable ranges with relatively high water absorption and excellent loaf volume similar to Yellowstone and Genou (Tables 19). MT0552 has relatively high PPO content and average to poor Asian noodle noodle brightness (L24) and color stability (data not shown).

Although not outstanding for flour yield, MT0552 has significantly higher flour yield and significantly lower flour ash than comparable cultivar CDC Falcon (Table 19).

Table 14. Stem rust & physiological leaf spot reaction of MT0552 and check cultivars in Montana, 2005-2010.

Cultivar/Line	Ft Ellis Stem Rust	Ft Ellis Stem Rust	Ft Ellis Stem Rust	Bozeman		Bozeman	Bozeman	Bozeman
	Reaction - 2005	Reaction - 2008	Reaction - 2009	StemR rxn 2009-1	2009-2	Stem Rust rxn 2010	Physiol. Leaf Spot %	Physiol. Leaf Spot %
	PYT-A						2008	2009
CDC Falcon		MR	R	4	4	1	23.3	21.4
Genou		S	S	4	4	4	0.0	0.2
Jagalene		MR	R	2	2	1	0.0	0.1
Jerry		R	R	1	1	0	2.0	0.0
Ledger		S	S	3	3	4	0.0	0.0
MT0552	R	R	R	1	1	1	0.0	0.0
Neeley	S	S	S	4	4	2	0.7	1.0
Norris (CL)		S	S	3	1	2-3	0.3	0.0
NuSky (HWW)	R	R	R	2+	2+	---	0.0	0.0
Promontory		VS	S	3	3	2, 2 plants = 4	8.3	0.8
Pryor		S	VS	4	4		4	0.0
Rampart	R	MR	R	1	1	2	0.7	0.1
Rocky		R	R	1	1	0-1	0.7	0.0
Wahoo		R	R	2-3	3	1	0.0	0.0
Yellowstone		MS	S	4	3	4	0.0	0.3
Race	TLMK	TLMK	TLMK	TLMK	TLMK	QFCS		
Growth stage	adult plant	adult plant	adult plant	seedling	seedling	seedling		
Average							1.5	1.3
LSD (0.05)							3.5	3.7
C. V. (%)							144	175
P-value (Varieties)							<.0001	<.0001
				1-2=Rest	1-2=Rest	0-2=Rest		
				3-4=susc	3-4=susc	3-4=susc		

Table 15. Seedling stem rust reactions of MT0552 and check cultivars as determined by Dr. Yue Jin, USDA Cereal Disease Laboratory in 2008.

07-08 Nursery CDL#	Line	US races Bulk	Preliminary TTKSK rep1 04KEN156/04	Repeated test of selections				Postulated genes	
				TTKSK 04KEN156/04	TTKST 06KEN19v3	TTTSK 07KEN24-4	TRTT 06YEM34-1		
			12/18/2003	2/3/08	2/3/08	2/3/08	2/3/08	genes	
726	MT 6	MT0552	2+	2	2	2+3	2	2-	Sr24
737	MT 17	Rampart	S	S					
738	MT 18	Yellowstone	S	S					
739	MT 19	CDC Falcon	2++	2	2	2+3-	2	2-	Sr24
740	MT 20	NuSky	S	S					
741	MT 21	Neeley	S	S					
Notes and explanations:									
Bulk:	a composite of US races: QFCS, QTHJ, RCRS, RKQQ, TPMK, TTTT								
Ratings:	"S" denotes susceptible infection type (IT) 3 or 4.								
	"/" denotes heterogeneous, the predominant type given first.								
	"LIF" denotes low infection frequency, or fewer number of pustules.								
Gene postulation was tentative and done for genes effective against TTKSK (Ug99) only.									

Table 16. Seedling stem rust reactions of MT0552 and check cultivars as determined by Dr. Yue Jin, USDA Cereal Disease Laboratory in 2009.

Line	QFCS	QTHJ	MCCF	RCRS	RKQQ	TPMK	TTTT	Bulk	RFCS	QCCL	QCCSM	TTKSK rep 1	TTKSK rep 2	TTKST	TTTSK	TRTT	Postulated genes
Genou	2+	S/2+	S	2+3-	S	S	;2	S	S	0;	S	S	S/2+	S	S	S	
CDC Falcon	;1	2	;2-	2-	2	2	2-	2-	2	2	S	2	2-	2+3	2-	2-	Sr24
Yellowstone	S	S	2/S	S	S	2++	S	S	S/2	2/S	2	S	S	S	S	S	
Rampart	;1	S	2-N	;2	S	2+	;2	S	2-	0	2+	S	S	S	S	S	
Ledger	S	S	S	0;1	S	S	;13	S	S	S	S	S	S	S	S	S	
Jagalene	;1	;	;	;	;	;2-	2-	2-	;	S	;13-	2-	2-	2+	2-	2-	Sr24
Neeley	2++	2+	2++	2+	2+3-	S	S	S	S	2+	2+	2++	2+	2+	2+/S	S	Tmp?
Pryor	S	2+	2+	2+3-	S	S	S	S	S	S	S	S	S	S	S	S	
Jerry	;S	2++	0	;	S	0;	2++	S/2-	;	0	0;	S/2	S	S	S	S	
Rocky	0;	2++	0	0	S	0;	;2	S	0;	0	;	S	S	S	S	S	
Promontory	2	2+	2++	2+	2++	S	S	S	2+	;1	2	2	2	2+	2+/S	2+/S	
Norris (CL)	;2++	2++	0/S	;	;2	0;/S	S	S	0/2+;	0	;	2+3	22+	2+	2+3	S	
NuSky (HWW)	;	S	0	;	S	0;	S	S	;1	0;	;	S	S	S	S	S	
Wahoo	;	2N	;	;	2+3-	0;/S	S	S/2-	;	0	;	S/2	2	2+	2+/S	2-/S	Sr24
MT0552	;	2	0	;	2	0;	2	2/S	;	0;	;	2	2	2+	2-	2-	Sr24
Notes and explanations:																	
Bulk:	a composite of US races: QFCS, QTHJ, RCRS, RKQQ, TPMK, TTTT																
Ratings:	"S" denotes susceptible infection type (IT) 3 or 4.																
	"/" denotes heterogeneous, the predominant type given first.																
	"LIF" denotes low infection frequency, or fewer number of pustules.																
Gene postulation was tentative and done for genes effective against TTKSK (Ug99) only.																	

Table 17. Average milling and baking quality attributes of MT0552 and check cultivars in the 2005 MT Preliminary A yield trial from three locations.

Sample No.	Variety	Single kernel hardness	Wheat Protein, % (12% m.b.)	Flour Yield, %	Flour Protein, % (14% m.b.)	Wheat Ash, %	Flour Ash, %	Mixing Tolerance	Mixing Time, min	Mixing Time, min	Mixing Time, min	Bake Water Absorption, %	Bake Water Absorption, %	Loaf Volume
1	Paul	79	14.0	65.8	12.0	1.80	0.44	4.3	5.5	61.3	8.2	71.8	1100	
2	Neeley	77	13.2	67.2	11.3	1.63	0.39	4.3	4.3	60.4	7.9	71.6	1013	
3	Morgan	81	13.5	64.5	11.3	1.67	0.42	3.7	4.4	58.9	5.6	69.8	1007	
4	NuSky	84	14.2	70.0	12.7	1.69	0.42	4.0	5.1	63.7	9.3	73.5	1125	
5	Rampart	82	15.4	68.0	13.3	1.67	0.43	3.7	4.9	63.3	9.4	74.2	1172	
7	MT0552	78	14.2	67.2	12.3	1.70	0.38	5.0	6.8	64.9	15.2	76.9	1087	
	<i>Nursery Min</i>	77	13.2	64.5	11.3	1.63	0.38	3.7	4.3	58.9	5.6	69.8	1007	
	<i>Nursery Max</i>	84	15.4	70.0	13.3	1.80	0.44	5.0	6.8	64.9	15.2	76.9	1172	
	<i>Nursery Ave</i>	80	14.1	67.1	12.2	1.69	0.41	4.2	5.2	62.1	9.3	73.0	1084	

Table 18. Average milling and baking quality attributes of MT0552 and check cultivars in the 2006 MT Advanced yield trial from four locations.

Sample No.	Variety	PPO	Single Kernel Hardness	Wheat Protein, % (12% <i>m.b.</i>)	Flour				Mixograph			Test Bake			
					Flour Yield, %	Flour Protein, % (14% <i>m.b.</i>)	Wheat Ash, %	Flour Ash, %	Tolerance	Mixing Time, min	Water Absorption, %	Mixing Time, min	Water Absorption, %	Loaf Volume	Crumb Grain Score
1	Rampart	0.576	82	13.78	70.75	12.50	1.28	0.44	2.75	4.8	64.5	10.1	74.6	1079	3.50
2	Yellowston	0.562	79	12.45	69.95	11.23	1.36	0.45	4.50	6.0	62.0	10.1	73.8	1004	3.75
3	Morgan	0.650	79	12.33	67.05	10.85	1.40	0.44	3.50	4.2	58.9	4.6	68.5	974	3.50
4	NuSky	0.265	84	12.80	69.30	11.25	1.33	0.43	3.00	4.5	61.3	6.6	71.8	985	4.00
5	Neeley	0.525	79	11.75	66.95	10.38	1.37	0.44	3.00	4.8	59.7	5.9	70.1	923	3.50
10	MT0552	0.769	78	13.18	69.28	11.80	1.38	0.42	4.25	5.8	64.8	11.5	75.3	1024	4.00
	MIN	0.265	78	11.75	66.95	10.38	1.28	0.42	2.75	4.2	58.9	4.6	68.5	923	3.50
	MAX	0.769	84	13.78	70.75	12.50	1.40	0.45	4.50	6.0	64.8	11.5	75.3	1079	4.00
	AVE	0.558	80	12.71	68.88	11.33	1.35	0.44	3.50	5.0	61.9	8.1	72.3	998	3.71

Table 19. Average milling and baking quality attributes of MT0552 and check cultivars in the 2007 and 2008 MT Intrastate yield trial (4 locations per year).

Variety	PPO	Kernel hard-ness	Flour yield	Flour protein	Ash (Flour)	Mixo. Mixo. time	Mixo. abs.	Baking mix time	Baking abs.	Loaf volume
			%	%	%	min	%	min	%	cc
Carter	0.625	81.1	69.4	11.7	0.43	6.6	63.3	12.5	75.7*	1093*
CDC Falcon	0.816	69.1	65.1	11.1	0.43	5.0	61.0	8.7	71.0	1074
Genou	0.764	76.3	69.8	12.1*	0.42	4.8	63.1	8.9	72.9	1103*
Jagalene	0.888	77.7	70.2	11.4	0.41	4.6	61.8	6.1	72.0	1039
Ledger	0.741	73.0	71.6**	10.9	0.40	5.0	61.0	9.2	71.2	1050
MT0552	0.865	76.4	68.2	11.7	0.40	7.4	65.2**	15.0	75.9**	1078
Neeley	0.654	76.8	65.7	11.3	0.42	4.9	60.8	7.1	70.9	1029
Norris (CL)	0.747	75.1	68.3	11.2	0.40	4.9	61.2	7.5	72.1	1012
NuSky (HWW)	0.334*	78.3	68.0	11.1	0.42	5.4	61.3	7.8	71.4	1029
Promontory	0.259**	79.4	69.7	10.6	0.41	5.0	60.6	6.4	70.3	1031
Pryor	0.829	75.9	68.3	10.9	0.41	3.4	59.9	4.3	69.2	1015
Rampart	0.616	79.1	69.5	12.5**	0.43	5.2	63.9	9.6	73.7	1128**
Wahoo	0.794	73.1	67.2	11.0	0.42	4.6	60.5	6.3	70.3	978
Yellowstone	0.624	79.8	68.1	11.1	0.42	8.2	62.8	12.5	73.5	1092*
LSD (0.05)	0.111	3.3	0.9	0.4	0.01	0.9	1.2	1.7	1.4	42
# envs.	8	8	8	8	8	8	8	8	8	8

In summary, ‘Decade’ (MT0552) is a very high-yielding, winter hardy HRW wheat line well adapted to western North Dakota and eastern Montana. Decade has with medium to high test weight, early maturity, reduced height, and medium to high grain protein. Decade has excellent milling and baking quality. The line is resistant to prevalent races of stem and stripe rust. Relative to CDC Falcon, MT0552 is equivalent in yield potential and winter survival, with improved test weight, earlier maturity, higher grain protein content, better physiological leaf spot resistance, superior milling characteristics and higher water absorption. Decade potentially could occupy acreage currently planted to CDC Falcon, Jerry, and Morgan.