



Phil L. Bruckner, Professor
Department of Plant Sciences & Plant Pathology
Montana State University
Bozeman, MT 59715-3140
bruckner@montana.edu
PHONE 406-994-5127, FAX 406-994-1848

MEMORANDUM

TO: Wheat Cultivar Release & Recommendation Committee

FROM: Phil Bruckner, Winter wheat breeder

DATE: January 6, 2005

RE: Proposal for license (F.2.c) cultivar release of three one-gene Clearfield WW lines

The following motion and supporting documentation is presented for consideration at the 2005 Cultivar Release and Recommendation Meeting in Bozeman:

MTCL0306, MTCL0316, MTCL0318

Motion: That MTCL0306 imidazolinone-tolerant hard white winter wheat (HWWW) be approved for release in 2005.

That MTCL0316 imidazolinone-tolerant hard red winter wheat (HRWW) be approved for release in 2005.

That MTCL0318 imidazolinone-tolerant, solid-stemmed hard red winter wheat (HRWW) be approved for release in 2005.

<u>Pedigree:</u>	MTCL0306	composite cross	Hard white winter
	MTCL0316	BigSky//TAM 110'S'*4/FS2	Hard red winter
	MTCL0318	Rampart/Fidel//CDC Kestrel	Hard red winter

Recommendation: License Release (F.2.c).

Potential names: To be named by licensee

Selection history: **MTCL0306** originated from crosses 98X78 (MTW9727/Fidel//NuWest), 98X88 (MTW9722/3/NuWest//TAM 110'S'*4/FS2), and 98X93 (NuSky//TAM 110*4/FS2/3/3/N95S004) made in 1998. F₁ populations were grown in the greenhouse in 1998 and sprayed with imazamox (=Beyond) herbicide to remove susceptible topcross segregants. A composite of F₂ seed of the three related populations was made and planted as an F₂ bulk population (98X78c) at Kalispell in 1999 and subsequently as an F₃ bulk population at Kalispell in 2000. Both the F₂ and F₃ bulk nurseries at Kalispell were sprayed with Beyond to remove additional herbicide-susceptible segregants. Resistant F₂ plants were selected and composited to generate the F₃ population and 60 to 100 individual heads from resistant F₃ plants were selected from each population at harvest maturity to derive lines. F₃-derived F₄ headrows were grown at Fort Ellis in 2001 and sprayed with Beyond at a 2X rate. Herbicide-tolerant headrow 98X78cC86 was selected based on visual criteria for herbicide tolerance, uniformity, productivity, and acceptable agronomic type and harvested in bulk. 98X78cC86 was subsequently tested in sprayed (2X) and non-sprayed segments of the 2002 Single Rep IMI Observation

Nursery (SROIMI) grown at Bozeman, Havre, and Moccasin. In 2003, 98X78cC86 was designated MTCL0306 and tested in the Preliminary Clearfield screening nursery at six sites (2 sprayed, 4 non-sprayed). In 2004, MTCL0306 was planted in the Clearfield qualification trial (0X, 1X, 2X rates) at four locations (3 loc-harvested) and in the non-sprayed Montana Advanced nursery at six locations. Quality has been evaluated in multi-location Montana trials in 2003 and 2004 (15LY).

Table 1. Description of nurseries and data sets describing the performance of MTCL lines in comparison to elite and Clearfield check cultivars in Montana, 2003-2004.

Year	Trial	Loc. planted	Loc. harvested	Loc. For Quality Eval.	Neeley	Rampart	Above	MT1159CL
2003	Prel. CL screening-2X	2	2	0			x	
	Combined data set – vs. elite checks							
2003	Prel. CL screening-0X	4	4	3	x	x	x	
2004	Advanced	6	6	4	x	x		
2004	CL qualification-0X	4	3	2 ⁺	x	x	x	x
	Combined data set- vs. Clearfield checks							
2004	Westbred-9KI	4	4	2		(x)	x	x
2004	CL qualification-0X	4	3	2 ⁺			x	x
2004	CL qualification-1X	4	3	2			x	x
2004	CL qualification-2X	4	3	2			x	x
	Total	29	25	15				

+ Data used in both combined data sets

MTCL0316 originated from cross 97X369 (BigSky//TAM 110'S*4/FS2) made in 1997. The F₁ population was grown in the greenhouse in 1998. F₂ and F₃ bulk populations were planted at Kalispell in 1999 and 2000, respectively, and sprayed with Beyond to remove herbicide-susceptible segregants. Resistant F₂ plants were selected and composited to generate the F₃ population and 60 to 100 individual heads from resistant F₃ plants were selected from each population at harvest maturity to derive lines. F₃-derived F₄ headrows were grown at Fort Ellis in 2001 and sprayed with Beyond at a 2X rate. Herbicide-tolerant headrow 97X369C6 was selected based on visual criteria for herbicide tolerance, uniformity, productivity, and acceptable agronomic type and harvested in bulk. 97X369C6 was subsequently tested in sprayed (2X) and non-sprayed segments of the 2002 Single Rep IMI Observation Nursery (SROIMI) grown at Bozeman, Havre, and Moccasin. In 2003, 97X369C6 was designated MTCL0316 and tested in the Preliminary Clearfield screening nursery at six sites (2 sprayed, 4 non-sprayed). In 2004, MTCL0316 was planted in the Clearfield qualification trial (0X, 1X, 2X rates) at four locations (3 loc-harvested) and in the non-sprayed Montana Advanced nursery at six locations. Quality has been evaluated in multi-location Montana trials in 2003 and 2004 (15LY).

MTCL0318 originated from cross 98X73 (Rampart/Fidel//CDC Kestrel) made in 1998. The F₁ population was grown in the greenhouse in 1998 and sprayed with imazamox (=Beyond) herbicide to remove susceptible topcross segregants. F₂ and F₃ bulk populations were planted at Kalispell in 1999 and 2000, respectively, and sprayed with Beyond to remove herbicide-susceptible segregants. Resistant solid stem F₂ plants were selected and composited to generate the F₃ population and 60 to 100 individual heads from resistant solid stem F₃ plants were selected from each population at harvest maturity. F₃-derived F₄ headrows were grown at Fort Ellis in 2001 and sprayed with Beyond at a 2X rate. Herbicide-tolerant headrow 98X73C30 was selected based on cross sectional stem examination to determine stem solidness and visual criteria for herbicide tolerance, uniformity, productivity, and acceptable agronomic type and harvested in bulk. 98X73C30 was subsequently tested in

sprayed (2X) and non-sprayed segments of the 2002 Single Rep IMI Observation Nursery (SROIMI) grown at Bozeman, Loma, and Conrad. In 2003, 98X73C30 was designated MTCL0318 and tested in the Preliminary Clearfield screening nursery at six sites (2 sprayed, 4 non-sprayed). In 2004, MTCL0318 was planted in the Clearfield qualification trial (0X, 1X, 2X rates) at four locations (3 loc-harvested) and in the non-sprayed Montana Advanced nursery at six locations. Quality has been evaluated in multi-location Montana trials in 2003 and 2004 (15LY).

Purification/seed stocks: These MTCL lines were not purified in a conventional headrow to linerow system. A 1 lb. sample of F₃-derived F₆ seed tracing to 2002 SROIMI seed from sprayed and hand-harvested plots was used to plant a single isolated strip increase plot of each line in Yuma, AZ in 2004. Strip increase plots were sprayed with Beyond, harvested individually with a Wintersteiger combine, and shipped to Bozeman in bulk bags (500-600 lbs of seed). No rouging or close observation of these lines was done in Yuma. Seed of these lines was cleaned and treated by the MAES Foundation Seed program in Bozeman and each of the three lines was planted on 2.5 to 3 acres at Kalispell for 2005 harvest. Purity of these seed lots is unknown at the present time. Fields will be sprayed with Beyond this spring and rouged to remove off types. Analysis of seed color purity of MTCL0306 Yuma seed lot by the MSU seed laboratory indicated 17 red kernels per 100g. Purification headrow sets of these lines are also planted in Bozeman for 2005 harvest if additional purification is necessary.

Fig. 1. 2004 MTCL strip increase plots at Yuma, AZ.



Photo by Ron Larson.

Additional data needed prior to commercial release: One additional crop tolerance data point is necessary to demonstrate acceptable herbicide tolerance to BASF.

All three of these lines are homozygous for a single gene conferring imidazolinone tolerance to wheat (TaAHASL1D, previously designated ALS1, FS4, and FS2). A requirement for future Clearfield wheat varieties will be selection of two genes conferring imidazolinone tolerance (TaAHASL1D + TaAHASL1B). These homeologous genes work in an additive fashion and will allow lines to tolerate higher doses of Beyond without crop injury. Thus we are phasing out development of one-gene Clearfield lines and will release 2-gene Clearfield lines in the future.

Description: These three one-gene Clearfield lines offer improved adaptation, yield potential, and end-use quality relative to currently available Clearfield cultivars. The three lines are unique, representing different market classes and production niches in Montana.

MTCL0306 is a low PPO hard white Clearfield line with a dual-purpose quality package similar to NuWest and NuSky. It is significantly higher in yield than Above and MT1159CL (Tables 2, 3) and equivalent in yield to Neeley (Tables 2, 5). The line has good adaptation and crop tolerance to herbicide (Tables 3, 5) and good milling and baking quality (Tables 4, 6).

MTCL0316 is a much higher yielding HRW Clearfield line and could replace MT1159CL once seed becomes available. MTCL0316 is a single cross between BigSky and a sister selection of Above and AP502CL. MTCL0316 is significantly higher in yield than the Clearfield checks and similar in yield to Neeley (Tables 2, 3, 5). MTCL0316 has high test weight, good crop tolerance to herbicide, and is relatively early in heading compared to Montana cultivars (Tables 3, 5). Grain protein of MTCL0316 is relatively low (Tables 3, 5). Milling and baking quality characteristics of MTCL0316 are acceptable (Tables 4, 6).

MTCL0318 is a solid stem “Rampart-type” Clearfield HRW line similar in most characteristics to Rampart (Table 5, 6) but with the addition of herbicide tolerance. MTCL0318 is lower yielding than MTCL0306 and MTCL0316, but similar in yield to MT1159CL (Table 3). In summary, MTCL0318 has a solid stem, relatively low yield potential, high grain protein, and excellent bread baking quality.

Table 2. Grain yield of MTCL lines and check cultivars in six Montana trials in 2003-04 and averaged across various combinations of those trials.

Grain yield	all trials	vs. Clearfield	vs. elite	vs. Above	2003 PreICL-NT	2003 PreICL-T	2004 CQL-NT	2004 CQL-T	2004 Advanced	2004 Westbred
Neeley			69.3		47.9		106.4		65.0	
MTCL0316	74.3	87.7	67.1	77.9	49.8	70.5	98.3	94.4	63.0	61.3
MTCL0306	72.4	86.3	65.5	76.1	49.8	62.3	95.9	92.3	60.9	62.8
MTCL0318	65.2	77.9	59.1	68.5	44	56.1	87.7	83.6	55	54.9
Rampart			59.2		42.6		91.1		54.3	55.5
MT1159CL		74.7					83.3	80.7		52.1
Above		67.5		64.8	52.6	71.3	79.6	69.3		51.2
LSD 5%	2.1	4.2	4.0	4.7	6.5	ns	14.7	5.9	5.5	5.7
CV %	5.1	6.8	7.9	10.0	9.0	5.3	9	6.3	7.7	5.5
# envir.	25	13	13	19	4	2	3	7	6	3

Table 3. Mean grain yield and agronomic characteristics of MTCL lines and Clearfield check cultivars in four Montana trials in 2003-04 (13 location-years).

vs. Clearfield Checks

Line	Grain yield	Test weight	Head date	Plant height	Grain protein	Crop tolerance
	bu/a	lb/bu	Julian	inch	%	2x/0x
MTCL0316	87.7	62.2	156.5	38.8	12.8	0.930
MTCL0306	86.3	61.9	156.6	37.8	13.5	0.933
MTCL0318	77.9	61.6	156.8	37.3	13.8	0.896
MT1159CL	74.7	59.6	158.3	35.3	13.0	0.904
Above	67.5	61.0	154.4	33.1	13.4	0.778
LSD 5%	4.2	0.5	0.4	1.3	0.4	ns
CV %	6.8	0.9	0.2	3.7	3.9	11.6
# envir.	13	13	7	9	13	3

