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## **MEMORANDUM**

**TO:** Wheat Cultivar Release & Recommendation Committee  
**FROM:** Phil Bruckner, Winter wheat breeder  
**DATE:** September 2, 2004  
**RE:** Proposal for CLEARFIELD cultivar release

The following motion and supporting documentation are presented for consideration by the 2004 Cultivar Release and Recommendation Committee:

### **MTCL01159**

**Motion:** That MTCL01159 imidazolinone-tolerant hard red winter wheat (HRWW) be approved for release in 2004.

**Pedigree:** Fidel/Tiber

**Type of release:** Recommended for exclusive release

**Potential names:** To be named by licensee if approved for release.

**Selection history:** MTCL01159 originated from a doubled haploid plant derived from an F<sub>1</sub> population grown in the greenhouse in 1998. In 1999, 29 doubled haploid selections were grown in non-replicated 4-row plots at Fort Ellis. The nursery was sprayed with Beyond herbicide (imazamox) at the labeled rate on 5/18/2000. Based on agronomic appearance, herbicide tolerance, uniformity, and milling and baking quality, three of the lines were selected and bulk harvested for further testing. Ten heads were also taken from each selected line prior to harvest. In 2001 the lines were grown in a replicated Preliminary C yield trial planted only in Bozeman. Headrow families of each selected line were simultaneously grown at Fort Ellis in 2001 for initial seed increase. MTCL01159 was relatively low yielding in the 18 entry trial and was not tested further till 2003. MTCL01159 was not tested in MSU trials in 2003 but was used as a check plot in Westbred trials at four locations. MTCL01159 was further tested in 2004 in the MSU Intrastate trial at 8 locations, the off-station yield trial at 10 locations, and in crop tolerance trials at four locations. Westbred also tested MTCL01159 in yield and crop tolerance trials in Montana at five locations in 2004. Quality of MTCL01159 was tested in comparison to cultivars 'Above' and 'Tiber' from four locations in 2003 and 11 locations in 2004.

**Purification/seed stocks:** The increase of MTCL01159 was initiated in 2001. A 10 member headrow family of MTCL01159 was harvested in bulk as breeder seed at Fort Ellis in 2001. Through a mislabeling error, we labeled this breeder seed as MTI01158, another Clearfield line we were extensively testing in the program in 2002 and 2003. In 2002, we further increased the breeder seed of MTCL01159 at Bozeman in

a 4-row, 200 foot strip, sprayed at a 12 oz/acre rate of Beyond herbicide. The 2002 strip increase was rogued carefully to remove any phenotypic variants. In the fall of 2002, we sent one bushel of MTCL01159 breeder seed to Yuma, AZ and increased it on 5 acres, producing approximately 420 bushels of seed. Through a memorandum of understanding between Montana Agricultural Experiment Station, BASF, and Westbred, LLC, WB further increased breeder seed of MTCL01159 on approximately 320 acres in 2004. This seed should be downgraded from breeder to registered or certified class. Additional breeder seed (~40 bushels) was also produced at SARC under irrigation in 2003. This breeder seed should serve as the source of future foundation seed if additional seed production is desired and warranted.

**Description:** MTCL01159 is a CLEARFIELD<sup>®</sup> winter wheat line with tolerance to imidazolinone herbicide, developed by Montana Agricultural Experiment Station. MTCL01159 is a doubled-haploid genetically uniform line developed from the cross Fidel/Tiber. The line is phenotypically uniform with exception that it contains a white-chaffed, imidazolinone-tolerant variant at the frequency of 1 per 40,000 plants.

MTCL01159 is a medium maturity, semi-dwarf line heading approximately 1 to 2 days earlier than 'Neeley' and 5 to 6 days later than Above. MTCL01159 is approximately four inches shorter than Neeley at maturity and has good straw strength and resistance to lodging. MTCL01159 has only moderate winter hardiness (Table 1), similar to 'Promontory' and 'Rampart', and production should be restricted to regions where winter kill risk is moderate. Juvenile plant growth is erect. Plant color at boot stage is pale green compared to winter wheat cultivars 'Morgan' and Neeley, which are darker green. The flag leaf at boot stage is large, wide, and recurved. Heads are awned, erect, middense to dense, and oblong. Glume and head color is red (sometimes called brown, ranging to black in some environments). Crop tolerance of MTCL01159 to Beyond herbicide (imazamox) is equal or superior to Above winter wheat under Montana conditions (Tables 2 to 4) and approved by BASF. Coleoptile length of MTCL01159 is relatively long, comparable to parental line Tiber.

**Table 1. Winter survival of MTCL01159 and check cultivars in the 2004 Intrastate Winter Wheat Test at 4 locations.**

Entry	Cultivar/Line	Pedigree	Sidney LAT	Williston LAT	Moccasin LAT	Conrad LAT	4 Loc Avg.
<b>Morgan</b>		WPB/Sask, 1996	17-May 47.3	18-May 19.3	6-May <b>87.8*</b>	4-May <b>63.2*</b>	<b>54.4*</b>
<b>CDC Falcon</b>		Sask/WPB, 1999	<b>55.0*</b>	11.8	84.9	<b>60.3*</b>	<b>53.0*</b>
<b>BigSky</b>		Montana, 2001	<b>53.0*</b>	5.3	<b>88.0*</b>	<b>61.9*</b>	<b>52.0*</b>
<b>Rocky</b>		Agripro, 1978	<b>61.6**</b>	2.5	82.0	57.4	<b>50.9*</b>
<b>Paul</b>		Montana, 2003 (MT8030/Neeley)	<b>51.2*</b>	2.8	<b>88.8*</b>	<b>58.9*</b>	<b>50.4*</b>
<b>Tiber</b>		Montana, 1988	<b>56.8*</b>	7.5	83.4	52.8	<b>50.1*</b>
<b>Pryor</b>		WPB, 2002 (BZ9W96-919)	<b>53.1*</b>	2.8	<b>87.0*</b>	55.8	<b>49.7*</b>
<b>Neeley</b>		Idaho, 1980	48.5	9.8	<b>86.5*</b>	54.1	<b>49.7*</b>
<b>Vanguard</b>		Montana, 1995	38.1	7.1	83.4	52.6	45.3
<b>Above (IMI)</b>		Colorado, 2001 (CLEARFIELD)	44.8	5.5	70.3	54.6	43.8
<b>Rampart</b>		Montana, 1996	33.7	2.7	82.8	52.2	42.9
<b>Promontory</b>		Utah, 1990	42.0	1.2	78.1	46.0	41.8
<b>MTCL01159 (IMI)</b>		Fidel/Tiber	30.3	6.7	72.2	44.3	38.4
<b>Average</b>			<b>46.7</b>	<b>7.0</b>	<b>84.0</b>	<b>53.3</b>	<b>47.7</b>
<b>LSD (0.05)</b>			<b>12.6</b>	<b>9.2</b>	<b>5.8</b>	<b>12.6</b>	<b>7.5</b>
<b>C.V. (%)</b>			<b>15.5</b>	<b>78.2</b>	<b>4.1</b>	<b>13.8</b>	<b>11.2</b>

**Table 2. MTCL01159 Crop Tolerance Data from seven sites in 2004**

Station Year	Year	Trial Code	Location	Variety	Treatment			Data				Comments	
					Herbicide	X Rate	Rate (g a/ha)	Crop Injury at 14 DAT (%)	Crop Injury at 28 DAT (%)	Heading date (d)	Yield (g/m <sup>2</sup> )		
1	2004	MSU	Kalispell, MT	Above	Control	--	--	0	3.3	148	109.1	MSU trial included 10 other lines	
1			Kalispell, MT	Above	BEYOND	1X	52.5	0	0	148	100.3		
1			Kalispell, MT	Above	BEYOND	2X	105	11.7	1.7	148	105.8		
1			Kalispell, MT	MTCL01159	Control	--	--	0	0	151.7	101.1		
1			Kalispell, MT	MTCL01159	BEYOND	1X	52.5	0	0	151.7	100.2		
1			Kalispell, MT	MTCL01159	BEYOND	2X	105	6.7	6.7	151.7	104.8		
					Statistics	LSD (0.05)		4.7	4.9	1.2	16.4		
						O/V		25	22.9	0.5	9		
2	2004	MSU	Bozeman, MT	Above	Control	--	--	0	0	158.3	90.1	height (inch)	heading date= days from Jan. 1
2			Bozeman, MT	Above	BEYOND	1X	52.5	3.3	0	157.7	82	33.9	MSU trial included 10 other lines
2			Bozeman, MT	Above	BEYOND	2X	105	3.3	0	158	83.6	32.5	Treatment date = April 12, 2004
2			Bozeman, MT	MTCL01159	Control	--	--	0	0	162.3	98.8	36.3	Feeks 5 (prejoint)
2			Bozeman, MT	MTCL01159	BEYOND	1X	52.5	0	0	161.7	100.4	34.4	Non-ionic surfactant @ 0.25% v/v
2			Bozeman, MT	MTCL01159	BEYOND	2X	105	0	0	161.3	94.4	35.6	Ammonium sulfate at rate of 10 lbs/100 gal @ 1.5% v/v
					Statistics	LSD (0.05)		7.1	4.5	1.3	11.3	2.0	Planted 10/03/04
						O/V		61	26.7	0.5	6.6	3.3	
3	2004	MSU	Moccasin, MT	Above	Control	--	--	0	0	49 DAT			Injury data not taken till 49 DAT
3			Moccasin, MT	Above	BEYOND	1X	52.5	2.3					MSU trial included 10 other lines
3			Moccasin, MT	Above	BEYOND	2X	105	60					Treatment date = May 19, 2004
3			Moccasin, MT	MTCL01159	Control	--	--	0					Feeks 7
3			Moccasin, MT	MTCL01159	BEYOND	1X	52.5	0					60F at treatment
3			Moccasin, MT	MTCL01159	BEYOND	2X	105	33.3					R-11 @ 0.25% v/v
					Statistics	LSD (0.05)		6.7					UAN @ 1.5% v/v
						O/V		15.4					
4	2004	WB	Brady, MT	Above	Control	--	--	0	0				MTCL01159 data is mean of 2 plots per rep
4			Brady, MT	Above	BEYOND	1X	52.5	-	-				WB trial included 12 other lines
4			Brady, MT	Above	BEYOND	2X	105	17	20				
4			Brady, MT	MTCL01159	Control	--	--	0	0				Planted Sept. 25, 2003
4			Brady, MT	MTCL01159	BEYOND	1X	52.5	-	-				treatment Date: May 4, 2004
4			Brady, MT	MTCL01159	BEYOND	2X	105	17	8.5				Feeks 5
4			Brady, MT	AP502CL	Control	--	--	0	0				R-11 @ 0.25% v/v
4			Brady, MT	AP502CL	BEYOND	1X	52.5	-	-				UAN @ 1.5% v/v
4			Brady, MT	AP502CL	BEYOND	2X	105	27	30				
					Statistics	LSD (0.05)		7.6	13.8				
						O/V		23.4	43.6				
5	2004	WB	Choleau, MT	Above	Control	--	--	0	0				MTCL01159 data is mean of 2 plots per rep
5			Choleau, MT	Above	BEYOND	1X	52.5	-	-				No injury data 14 DAT
5			Choleau, MT	Above	BEYOND	2X	105	15					WB trial included 12 other lines
5			Choleau, MT	MTCL01159	Control	--	--	0	0				Planted Sept. 26, 2003
5			Choleau, MT	MTCL01159	BEYOND	1X	52.5	-	-				treatment Date:
5			Choleau, MT	MTCL01159	BEYOND	2X	105	9					Feeks 4
5			Choleau, MT	AP502CL	Control	--	--	0	0				R-11 @ 0.25% v/v
5			Choleau, MT	AP502CL	BEYOND	1X	52.5	-	-				UAN @ 1.5% v/v
5			Choleau, MT	AP502CL	BEYOND	2X	105	18					
					Statistics	LSD (0.05)		13.2					
						O/V		33.9					
6	2004	WB	Denton, MT	Above	Control	--	--	0	0				MTCL01159 data is mean of 2 plots per rep
6			Denton, MT	Above	BEYOND	1X	52.5	-	-				WB trial included 12 other lines
6			Denton, MT	Above	BEYOND	2X	105	70	70				
6			Denton, MT	MTCL01159	Control	--	--	0	0				Planted Sept. 24, 2003
6			Denton, MT	MTCL01159	BEYOND	1X	52.5	-	-				Treatment Date: May 3, 2004
6			Denton, MT	MTCL01159	BEYOND	2X	105	33.5	25				Feeks 5
6			Denton, MT	AP502CL	Control	--	--	0	0				R-11 @ 0.25% v/v
6			Denton, MT	AP502CL	BEYOND	1X	52.5	-	-				UAN @ 1.5% v/v
6			Denton, MT	AP502CL	BEYOND	2X	105	70	70				
					Statistics	LSD (0.05)		14.7	12.8				
						O/V		15.6	15.4				
7	2004	WB	Havre, MT	Above	Control	--	--	0	0				MTCL01159 data is mean of 2 plots per rep
7			Havre, MT	Above	BEYOND	1X	52.5	-	-				WB trial included 12 other lines
7			Havre, MT	Above	BEYOND	2X	105	70	50				Treatment Date: May 3, 2004
7			Havre, MT	MTCL01159	Control	--	--	0	0				Feeks 5
7			Havre, MT	MTCL01159	BEYOND	1X	52.5	-	-				R-11 @ 0.25% v/v
7			Havre, MT	MTCL01159	BEYOND	2X	105	45	40				UAN @ 1.5% v/v
7			Havre, MT	AP502CL	Control	--	--	0	0				
7			Havre, MT	AP502CL	BEYOND	1X	52.5	-	-				
7			Havre, MT	AP502CL	BEYOND	2X	105	70	63				
					Statistics	LSD (0.05)		17.7	21.6				
						O/V		18.8	25.7				

**Table 3. 2004 CLEARFIELD Qualification Test: Bozeman**  
**Trial and statistic calculated with 8 additional experimental lines included (not shown)**

Line/Rate	Pedigree	Injury Rating % 14 days (Apr 26) - All			Injury Rating % 14 days (Apr 26) - IMI Only			Injury Rating % 28 days (May 10) - All			Injury Rating % 28 days (May 10) - IMI Only		
		0X	1X	2X	0X	1X	2X	0X	1X	2X	0X	1X	2X
MTCL1159	Fidel/Tiber	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Above		0.0	3.3	3.3	0.0	3.3	3.3	0.0	0.0	0.0	0.0	0.0	0.0
Rampart		0.0	43.3	43.3				0.0	83.3	86.7			
Neeley		0.0	53.3	50.0				0.0	90.0	90.0			
Mean		0.0	10.8	10.6	0.0	3.3	3.7	0.0	15.0	15.8	0.0	0.7	1.3
LSD (rate)		2.0			ns			1.3			ns		
C.V. (rate)		60.9			173.2			25.9			345.6		
LSD (lines)		7.1			ns			4.5			ns		
C.V. (lines)		61.0			174.4			26.7			383.9		
P (rate)		0.0008			0.0588			<.0001			0.6409		
P (line)		<.0001			0.2420			<.0001			0.4337		
P (line*rate)		<.0001			0.6548			<.0001			0.5990		

Line/Rate	Pedigree	Heading Date (Julian)			Plant Height (in)			Yield (bu/a)		
		0X	1X	2X	0X	1X	2X	0X	1X	2X
MTCL01159	Fidel/Tiber	162.3	161.7	161.3	36.3	34.4	35.6	98.8	100.4	94.4
Above		158.3	157.7	158.0	33.9	32.5	32.8	90.1	82.0	83.6
Rampart	(not part of stats)	(163.0)			(39.8)			(114.9)		
Neeley	(not part of stats)	(166.7)			(40.6)			(144.3)		
Mean		160.5	160.1	159.9	38.5	37.7	37.0	108.8	103.0	100.5
LSD (rate)		ns			0.6			ns		
C.V. (rate)		0.5			3.3			6.0		
LSD (lines)		1.3			2.0			11.3		
C.V. (lines)		0.5			3.3			6.6		
P (rate)		0.2719			0.0304			0.1052		
P (line)		<.0001			<.0001			<.0001		
P (line*rate)		0.5477			0.2820			0.5756		

**Table 4. 2004 CLEARFIELD Qualification Test: Kalispell**  
**Trial and statistics conducted with 8 additional experimental lines included (not shown)**

Pedigree Line/Rate	Injury Rating % 17 Days (May 3) - All			Injury Rating % 17 Days (May 3) - IMI Only			Injury Rating % 24 Days (May 10) - All			Injury Rating % 24 Days (May 10) - IMI Only		
	0X	1X	2X	0X	1X	2X	0X	1X	2X	0X	1X	2X
MTCL01159 Fidel/Tiber	0.0	0.0	6.7	0.0	0.0	6.7	0.0	0.0	6.7	0.0	0.0	6.7
Above	0.0	0.0	11.7	0.0	0.0	11.7	3.3	0.0	1.7	3.3	0.0	1.7
Rampart	0.0	81.7	85.0				1.7	98.0	98.0			
Neeley	0.0	81.7	85.0				3.3	98.0	98.0			
<b>Mean</b>	<b>0.0</b>	<b>13.6</b>	<b>20.8</b>	<b>0.0</b>	<b>0.0</b>	<b>8.0</b>	<b>1.5</b>	<b>16.6</b>	<b>21.3</b>	<b>1.3</b>	<b>0.3</b>	<b>6.0</b>
LSD (rate)	1.2			1.4			1.2			ns		
C.V. (rate)	22.3			97.9			19.8			100.8		
LSD (lines)	4.7			4.9			4.9			5.1		
C.V. (lines)	25.0			111.4			22.9			121.9		
P (rate)	0.0003			0.0101			0.0006			0.0737		
P (line)	<.0001			0.0115			<.0001			0.1184		
P (line*rate)	<.0001			0.0026			<.0001			<.0001		

Pedigree Line/Rate	Heading Date (Julian)			Plant Height (in)			Yield (bu/a)			Test Weight (lb/bu)		
	0X	1X	2X	0X	1X	2X	0X	1X	2X	0X	1X	2X
MTCL01159 Fidel/Tiber	151.7	151.7	151.7	39.1	38.6	42.7	101.1	100.2	104.8	61.3	61.0	60.3
Above	148.0	148.0	148.0	39.8	39.8	37.0	109.1	100.3	105.8	62.8	63.1	63.1
Rampart (not part of stats)	(151.7)			(43.8)			(115.2)			(63.0)		
Neeley (not part of stats)	(155.7)			(43.8)			(122.2)			(62.2)		
<b>Mean</b>	<b>150.5</b>	<b>149.8</b>	<b>150.0</b>	<b>43.1</b>	<b>42.5</b>	<b>41.1</b>	<b>112.0</b>	<b>110.1</b>	<b>110.9</b>	<b>63.0</b>	<b>63.0</b>	<b>62.7</b>
LSD (rate)	ns			ns			ns					
C.V. (rate)	0.5			3.3			8.8					
LSD (lines)	1.2			2.8			16.4					
C.V. (lines)	0.5			4.1			9.0					
P (rate)	0.1124			0.2676			0.8481					
P (line)	<.0001			<.0001			0.0188					

MTCL01159 has low yield potential, medium test weight, and fair end-use qualities. In 2003 trials at four locations (Table 5), MTCL01159 averaged 45 bu/acre, compared to Pryor (51 bu/acre) and Morgan (45 bu/acre). MTCL01159 averaged 62 lb/bu test weight compared to Pryor (62 lb/bu) and Morgan (60 lb/bu). Average grain protein was 14.7, 14.7, 13.9, and 13.5% for MTCL01159, Morgan, Pryor, and Above, respectively.

Exp: W03-9WJ										
Location Summary (Brady,Choteau,Denton,Havre)										
BZ										
Heading										bu/ac
	Date	Plt. Ht.	T.W.	Protein	SED					
Entry	from 6/1	(inches)	(lbs/bu)	%	(mm)	Brady	Choteau	Denton	Havre	AVG
Above	22	28	61	13.5	92	49	35	52	55	48
AP502CL	16	26	60	13.7	97	50	36	53	56	49
CDC Falcon	19	28	61	14.7	117	55	36	48	54	48
Pryor	22	28	62	13.9	105	56	42	50	57	51
Morgan	21	32	60	14.7	108	49	39	42	52	45
<b>MTCL01159</b>	<b>18</b>	<b>30</b>	<b>62</b>	<b>14.7</b>	<b>111</b>	<b>49</b>	<b>36</b>	<b>44</b>	<b>51</b>	<b>45</b>

In 2004, yield of MTCL01159 was relatively low in all trials (Tables 6 to 9), similar to Above, Rampart, and Vanguard. Limited test weight data shows test weight of MTCL01159 lower than all check cultivars except Paul. Grain protein of MTCL01159 is similar to check cultivars based on data from three locations.

Table 6. Yield of MTCL01159 and 12 check cultivars in 2004 Intrastate Winter Wheat Test at 6 locations.

Cultivar/Line * = new for 2004, # = paid e	Yield (bu/a)							Test Weight					Protein (%)			
	Bozeman LAT	Havre LAT	Kalispell LAT	Moccasin RCB	Huntley LAT	Conrad LAT	6 Loc Avg	Havre LAT	Kalispell 1 rep	Moccasin RCB	Conrad 1 rep	4 Loc Avg	Moccasin Bulk	Huntley Bulk	Conrad Bulk	3 Loc Avg
Pryor	134.4*	74.7**	119.3	59.2*	14.9**	70.8	78.9*	58.9	60.8	58.9	61.4	60.0	13.6	15.8	11.9	13.8
Promontory	132.0*	65.1	123.4*	57.6*	3.5	67.9	74.9*	61.2	64.1	59.5	63.2	62.0	13.6	17.4	12.8	14.6
CDC Falcon	120.7	71.0*	117.9	55.5*	10.2	72.0	74.6*	60.0	60.6	58.0	63.7	60.6	14.2	15.9	12.7	14.3
Neeley	128.1	65.5	112.1	53.5*	10.8	71.7	73.6*	58.8	62.1	57.6	62.8	60.3	13.5	16.2	12.1	13.9
Rocky	114.3	74.2*	116.7	50.8	5.8	76.3*	73.0*	61.9	62.2	59.5	63.7	61.8	13.3	17.5	11.0	13.9
Paul	131.5*	65.4	86.9	55.3*	11.1	71.7	70.3	57.7	57.3	55.2	61.3	57.9	14.2	16.3	11.3	13.9
BigSky	113.4	66.4	102.4	49.5	10.8	78.6*	70.2	59.0	62.4	57.8	63.0	60.6	13.4	17.2	12.2	14.3
Tiber	116.2	62.7	108.5	49.8	12.7*	64.9	69.1	59.9	62.2	58.4	62.0	60.6	14.1	16.3	13.1	14.5
Morgan	111.5	59.8	103.3	51.7	9.4	69.3	67.5	58.3	60.2	58.3	62.6	59.8	13.6	16.1	11.4	13.7
Vanguard	103.3	61.4	105.3	43.6	6.7	65.8	64.4	59.4	61.2	56.1	62.7	59.8	13.9	17.6	12.7	14.7
Rampart	99.3	63.3	103.3	45.8	11.3	62.9	64.3	59.4	60.6	56.3	62.5	59.7	14.0	16.4	14.2	14.9
Above (IMI)	80.6	69.5*	107.2	42.5	2.0	68.7	61.7	61.1	62.1	58.9	62.7	61.2	13.4	18.1	12.8	14.8
MTCL01159 (IMI)	88.8	60.0	87.4	48.3	3.9	60.3	58.1	58.2	59.3	57.7	59.4	58.6	13.0	17.6	13.2	14.6
Average	118.7	65.2	110.5	51.1	9.1	70.0	70.8	59.2	61.0	58.3	61.9	60.1	13.8	16.7	12.3	14.3
LSD (0.05)	10.7	6.9	17.3	7.8	3.2	9.6	8.5	1.8		1.5		1.3				ns
C.V. (%)	5.1	6.1	9.2	9.5	20.2	7.8	10.1	9.2		1.3		1.5				5.2
P-value (Varieties)	<.0001	<.0001	<.0001	<.0001		0.0010	<.0001	<.0001		<.0001		<.0001				0.1792

Table 7. Grain yields of MTCL01159 and check cultivars in the 2004 Montana Off-station winter wheat trials at 8 locations.

Cultivar	Forsyth	Lodge	Fly	Huntley	Denton	Moccasin	Knees	Loma	Mean
	Dryland	Grass Dryland	Creek Dryland	Irrigated	recrop	recrop	Dryland	Dryland	
	bu/a	bu/a	bu/a	bu/a	bu/a	bu/a	bu/a	bu/a	bu/a
Pryor	41.9	49.9	59.6	122.2	54.7	47.1	62.1	81.8	64.9
Paul	32	44.5	47.6	113.6	51.0	48.7	65.1	83.8	60.8
Neeley	30	37.4	47.3	119.4	55.6	47.2	59.1	82.3	59.8
CDC Falcon	31.9	35.2	47.6	107.9	55.6	47.4	65.1	81.4	59.0
Rocky	35.3	27.4	48.1	97.9	53.9	46.3	64.9	91.1	58.1
Morgan	37.5	33.6	46.5	103.1	52.2	45.9	61.1	79.1	57.4
Promontory	27.8	30	38.5	107	53.8	44.3	61.3	81	55.5
Tiber	36.8	33.6	50.2	96.5	47.8	37.7	52	74.2	53.6
BigSky	27.8	27.7	41.7	112.6	49.9	37.2	53.4	73.7	53.0
Vanguard	26.1	30.3	37	101.9	48.7	39.0	55.9	74.4	51.7
Rampart	22.3	31.1	41.6	89.7	51.7	36.6	55.3	70.5	49.9
MTCL01159	30.3	26	40.1	83.1	41.4	41.0	53.6	77.7	49.2
Average	32.7	35.3	45.9	104.1	52.8	52.8	59.8	82.4	58.2
PLSD (p=0.05)	7	8.3	10.4	17.4			ns	12.1	
cv %	13.1	14.3	13.7	10.2			11.5	5.2	

In 2004 Westbred trials, MTCL01159 was also relatively low yielding with a moderately low test weight (Tables 8 & 9). Grain protein was similar to most Montana winter wheat cultivars.

Table 8. Performance of MTCL01159 and check cultivars in 2004 Westbred trials at two locations.											
Exp: W04-9WKI											
Location Summary from Denton and Havre, MT											
Trial included 8 other experimental lines (not shown)											
		Heading		0-9	0-9						
		Date	Plt. Ht.	HA	Saw Fly	T.W.	Protein	SED			
Entry	Description	from 6/1	(inches)	Stand	Damage	(lbs/bu)	%	(mm)	DENTON	HAVRE	AVG
									bu/ac	bu/ac	bu/ac
Tiber			34	1	1	63	10.9	86	54.2	71.2	62.7
Rampart			31	3	0	62	12.2	113	51.3	62.0	56.6
<b>MTCL01159</b>	Fidel/Tiber	15	29	3	1	60	11.3	96	50.8	60.0	55.4
Above		10	26	4	2	62	11.2	92	46.0	55.7	50.8

Table 9. Performance of MTCL01159 and check cultivars in Westbred trials at four locations in 2004.											
Exp: W04-9WA											
Location Summary Bozeman, Brady, Denton, and Havre, MT											
Trial included six other lines (not shown)											
		BZ	BR,DE,HA	HV	HV	HV					
		Heading							bu/ac		4 loc.
		Date	Plt. Ht.	T.W.	Protein	SED	yield	yield	yield	yield	yield
Entry	Description	from 6/1	(inches)	(lbs/bu)	%	(mm)	BZ	BR	DE	HA	AVG
							bu/ac	bu/ac	bu/ac	bu/ac	bu/ac
Neeley		23	34	61	12.2	107	143	58.1	62.7	72.3	84.0
Pryor	Hatton/Abilene	25	31	61	11.6	104	118	60.0	68.4	71.0	79.3
CDC Falcon	Norstar *2/Vona//Abilene	18	29	62	10.8	100	117	61.3	61.5	75.5	78.9
Rocky		17	34	63	10.7	101	114	59.4	55.4	72.7	75.4
Tiber		23	38	61	12.4	112	131	55.5	58.7	55.8	75.3
Morgan		26	36	60	12.3	106	115	58.4	56.9	69.8	75.0
BigSky		21	35	62	12.4	108	121	55.5	56.3	65.8	74.7
Paul		24	31	60	11.6	112	104	55.5	58.7	70.0	72.1
<b>MTCL01159</b>	imi Fidel/Tiber	18	34	59	11.9	103	113	48.4	55.4	62.9	69.9
Rampart		17	33	62	12.4	113	109	42.9	52.7	58.1	65.8
<b>Isd</b>							<b>2.2</b>	<b>9.6</b>	<b>8.6</b>	<b>12.5</b>	
<b>cv</b>							<b>8.1</b>	<b>10.5</b>	<b>8.7</b>	<b>11.6</b>	

Milling and baking quality data from the 2003 crop (Table 10, mean of 4 locations) indicates milling and baking quality of MTCL01159 is comparable to that of Tiber but superior to that of Above. Relative to Tiber, MTCL01159 had similar mixograph mixing tolerance (4 vs. 3.5), similar bake water absorption (72.8 vs. 72.9%), longer mixing time (8.6 vs. 6.7 min), and lower loaf volume (979 vs. 1027 cc). Two single location comparisons to Above were also made in 2003 (Tables 11 & 12). Both comparisons indicate stronger gluten strength and dough mixing characteristics of MTCL01159 compared to Above. At Brady in 2003 (Table 11) MTCL01159 had higher flour protein, higher flour yield, longer dough mixing times, and higher absorption than Above and 'AP502CL'. At Bozeman in 2003 (Table 12), MTCL01159 had higher flour protein, longer mix times, higher water absorption, and greater loaf volume than Above.



Table 10. Milling and baking quality characteristics of MTCL01159 in 2003 Westbred trials at four locations.

Means Across Locations						Flour Color			Mixograph				Test Bake			
SAMPLE#	VARIETY	PEDIGREE	CLASS	Flour Yields%	Flour Protein%(14% m.b)	L* Brightness	a*Green-Red	b*Blue-Yellow	Flour Ash %	Type	Tolerance	Mixing time (Mins)	Water Absorbtion	Mixing time (Mins)	Water Absorbtion %	Loaf Volume
1	Neeley	check	HRW	63.93	12.1	90.15	-1.64	11.20	0.38		5	5.1	61.5	7.58	72.2	1047
2	Tiber	check	HRW	64.13	13.0	90.99	-1.58	9.56	0.34		3.5	4.2	62.7	6.68	72.9	1027
3	MTCL01159	Fidel/Tiber	HRW	69.33	12.1	90.20	-1.45	10.42	0.37		4	4.3	59.8	8.60	72.8	979
<b>Nursery Mean</b>				<b>65.79</b>	<b>12.4</b>	<b>90.44</b>	<b>-1.56</b>	<b>10.39</b>	<b>0.36</b>		<b>4.2</b>	<b>4.5</b>	<b>61.3</b>	<b>7.62</b>	<b>72.6</b>	<b>1018</b>

Table 11. Quality characteristics of MTCL01159 and check cultivars in the 2003 Westbred nursery at Brady, MT.

Quality Report											
Montana State University											
(samples from Westbred nursery in Brady, MT, 2003)											
Entry	Wheat Protein % (12% moisture)	Flour Yield, %	Flour Protein, % (14%mb)	Mixograph			Test Bake				
				Tolerance	Mixing Time, min	H2O abs.	Bake Time, min	H2O Absorption	Loaf Volume	Crumb Grain Score	
Big Sky 2001			12.3	5	4.8	64.0	11.8	76.5	1060	4	
Above	13.4	64.2	11.6	3	2.2	58.9	2.5	67.6	950	3	
AP502CL	13.3	60.1	11.0	3	2.3	57.9	2.4	67.6	900	3	
<b>MTCL01159</b>	<b>14.5</b>	<b>67.8</b>	<b>12.9</b>	<b>4</b>	<b>2.5</b>	<b>58.2</b>	<b>4.2</b>	<b>69.4</b>	<b>955</b>	<b>4</b>	
Neeley	14.0	60.7	12.0	5	3.2	60.0	4.7	70.2	1015	4	
Crumb Grain Score											
0-unsatisfactory to 5-excellent											

Table 12. Quality characteristics of MTCL01159 and check cultivars at Bozeman, MT in 2003. MTCL01159 from border plots surrounding trial.

Location :Bozeman,MT

SAMPLE#	VARIETY	PEDIGREE	CLASS	Flour Yields%	Flour Protein%(14% m.b)	Flour Color			Flour Ash %	Mixograph				Test Bake		Loaf Volume
						L* Brightness	a*Green-Red	b*Blue-Yellow		Type	Tolerance	Mixing time (Mins)	Water Absorbion %	Mixing time (Mins)	Water Absorbion %	
9	Above	check	HRW	65.10	11.2	90.12	-1.87	11.57	0.37	M	4	2.8	54.8	2.7	64.5	976
10	Rampart	check	HRW	67.10	12.9	90.11	-2.21	12.56	0.42	MH	4	3.9	59.7	7.1	70.4	1135
11	NuWest	check	HWW	68.50	12.7	90.22	-1.85	11.24	0.38	MH	6	4.4	62.4	7.8	73.1	1134
12	Neeley	check	HRW	64.70	12.7	90.27	-1.88	11.58	0.39	MH	5	4.8	61.8	9.1	72.0	1118
13	MTCL01159	Fidel/Tiber	HRW	65.80	11.9	90.22	-1.91	11.36	0.38	MH	3	3.5	57.2	3.8	66.9	1012
<i>Nursery Mean</i>				<b>66.24</b>	<b>12.28</b>	<b>90.19</b>	<b>-1.94</b>	<b>11.66</b>	<b>0.39</b>		<b>4.40</b>	<b>3.88</b>	<b>59.18</b>	<b>6.10</b>	<b>69.4</b>	<b>1075</b>

In 2004, end-use quality of MTCL01159 was intermediate to that of Tiber and Above (Table 13). Although most of the statistical comparisons in the 2 cultivar, 11 location were non-significant, MTCL01159 had higher flour yield and longer bake dough mixing time than Above. In the 3 cultivar, 9 location comparisons, MTCL01159 had higher flour yield, shorter mix times, lower water absorption, and lower loaf volume in comparison to Tiber. MTCL01159 had higher flour yield than Above. Although not statistically superior to Above, MTCL01159 was more similar to Tiber than to Above for wheat protein, flour protein, mixograph tolerance, and crumb grain score. In summary, milling and baking quality of MTCL01159 is intermediate to Above and Tiber.

**Table 13. Quality characteristics of MTCL01159 and check cultivar from 11 locations in 2004.**

Variety	Class	Pedigree				Mixograph				Test Bake			
			Wheat Protein, % (12%mb)	Flour Yield, %	Flour Protein, % (14%mb)	Type	Tolerance	Mixing Time, min	Water Absorption, %	Mixing Time, min	Water Absorption, %	Loaf Volume	Crumb Grain Score
Above	HRW	3503-Sidney	12.4	68.2	11.1	MH	4	2.0	55.2	3.3	65.4	980	3
MTCL01159	HRW	3503-Sidney	13.8	71.2	12.1	MH	5	2.6	56.4	4.5	66.1	1075	4
Tiber	HRW	3503-Sidney	14.1	65.8	12.1	M	4	3.0	58.5	6.1	68.7	1085	4
Above	HRW	3518-Conrad	12.5	68.7	10.9	MH	4	1.6	54.5	3.0	64.2	905	3
MTCL01159	HRW	3518-Conrad	13.3	72.4	11.6	MH	3	2.4	57.4	3.4	67.1	985	4
Tiber	HRW	3518-Conrad	12.9	67.9	11.6	MH	4	3.1	58.2	5.3	70.4	1020	4
Above	HRW	Denton-Barber Seed	15.1	63.1	13.6	M	1	1.4	58.4	1.5	66.1	905	1
MTCL01159	HRW	Denton-Barber Seed	11.4	67.8	10.4	M	4	2.9	52.5	3.9	62.2	840	4
Above	HRW	Denton-WestBred	13.0	66.6	11.6	MH	4	2.4	56.7	3.0	66.4	860	2
MTCL01159	HRW	Denton-WestBred	13.1	69.3	11.8	MH	4	2.3	55.8	3.9	65.5	980	2
Tiber	HRW	Denton-WestBred	12.5	66.6	11.7	MH	5	3.5	59.4	7.3	69.6	1075	3
Above	HRW	Havre-WestBred	11.3	67.5	10.3	MH	4	2.5	54.8	3.8	65.5	845	4
MTCL01159	HRW	Havre-WestBred	11.6	70.2	10.2	MH	5	2.0	53.3	4.1	64.5	800	4
Tiber	HRW	Havre-WestBred	10.6	67.8	9.8	M	4	2.9	56.3	5.3	67.5	870	3
Above	HRW	3502-NARC	12.5	68.6	11.5	MH	4	2.3	54.2	4.6	64.4	885	2
MTCL01159	HRW	3502-NARC	14.6	70.5	12.8	MH	3	2.7	56.5	4.1	66.7	1000	3
Tiber	HRW	3502-NARC	14.0	66.2	12.5	MH	4	3.6	59.3	6.8	69.5	1070	4
Above	HRW	3505-NWARC	12.6	68.8	11.2	MH	3	2.4	54.7	3.0	64.4	830	2
MTCL01159	HRW	3505-NWARC	12.7	72.4	11.4	MH	4	2.0	54.3	3.5	64.5	890	4
Tiber	HRW	3505-NWARC	12.6	69.6	11.3	MH	5	3.0	57.0	4.3	66.7	945	4
Above	HRW	3507-CARC	14.3	66.3	13.2	MH	4	2.0	58.7	3.0	68.4	950	3
MTCL01159	HRW	3507-CARC	13.5	68.6	12.0	MH	4	3.0	54.5	4.1	64.2	905	3
Tiber	HRW	3507-CARC	14.8	63.1	13.1	M	4	3.7	60.5	8.1	71.7	1155	4
Above	HRW	3501-Boz	14.5	65.9	12.7	MH	2	1.6	57.2	2.2	67.4	900	3
MTCL01159	HRW	3501-Boz	13.3	72.0	12.0	MH	3	2.1	57.0	3.0	66.7	960	4
Tiber	HRW	3501-Boz	13.0	70.8	11.3	M	3	2.2	58.7	3.4	68.4	960	4
Above	HRW	BZ-NonTreated-West	12.8	68.9	11.3	MH	2	2.0	55.1	1.8	63.8	885	2
Tiber	HRW	BZ-NonTreated-West	13.1	72.2	11.7	M	1	2.3	59.5	3.0	67.2	1025	3
MTCL01159	HRW	BZ-NonTreated-West	12.8	74.4	11.3	MH	1	1.7	54.7	1.7	62.9	910	2
Above	HRW	BZ-Treated-Westbred	11.9	74.5	11.3	M	1	1.4	55.3	2.2	64.0	985	3
MTCL01159	HRW	BZ-Treated-Westbred	12.7	69.8	10.6	MH	3	1.6	52.2	1.6	60.9	820	2

**Mean milling and baking quality characteristics from 11 and 9 Montana locations in 2004.**

Variety	Class	Pedigree				Mixograph				Test Bake			
			Wheat Protein, % (12%mb)	Flour Yield, %	Flour Protein, % (14%mb)	Type	Tolerance	Mixing Time, min	Water Absorption, %	Mixing Time, min	Water Absorption, %	Loaf Volume	Crumb Grain Score
MTCL01159	11 sites		13.0	70.8	11.5	-	3.5	2.3	55.0	3.44	64.7	924.1	3.3
Above	11 sites		13.0	67.9	11.7	-	3.0	2.0	55.9	2.85	65.5	902.7	2.5
		LSD (5%)	ns	1.9	ns		ns	ns	ns	0.6	ns	ns	ns
		CV (%)	8.4	2.9	7.6		27.9	20.9	3.4	19.1	2.5	7.0	26.8
MTCL01159	9 sites		13.2	71.2	11.7	-	3.6	2.3	55.5	3.6	65.4	945.0	3.3
Above	9 sites		12.9	67.7	11.5	-	3.4	2.1	55.7	3.1	65.5	893.3	2.7
Tiber	9 sites		13.1	67.8	11.7	-	3.8	3.0	58.6	5.5	68.9	1022.8	3.7
		LSD (5%)	ns	1.9	ns		ns	0.3	0.7	0.8	1.0	56.3	0.6
		CV (%)	5.1	2.8	4.5		18.6	11.0	1.3	19.9	1.5	5.9	18.6

**In summary**, MTCL01159 is a CLEARFIELD® winter wheat line with tolerance to imidazolinone herbicide. In 2003 and 2004, MTCL01159 was evaluated in comparison to adapted Montana check cultivars in over 24 field trials. Quality was evaluated on grain produced at least 16 sites. The line has excellent crop tolerance to Beyond herbicide but is low yielding and only partially adapted to Montana growing environments having marginal winterhardiness. Test weight is somewhat low but grain protein is in the acceptable range. Milling and baking quality of MTCL01159 is improved over the cultivar Above but still not where we need to be. This cultivar will be useful in the short term as a weed management tool in problem fields but should be replaced in the near future with upgrades for quality, yield potential, and adaptation.