

A MOTION TO RELEASE MT1173 AS A CLEARFIELD SPRING WHEAT FOR DISTRICTS 2-6 UNDER DRYLAND CONDITIONS

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We propose licensing the line to a BASF-approved entity partner for commercialization.

MT1173 was derived from the cross of Vida//8209-1/Vida made in 2004 to be used as a Clearfield wheat. '8209-1' was an experimental line derived from the cross of CDCTeal11A/McNeal/SWP965001 made in 2003. SWP965001 is a WestBred line descended from 'Fidel' with TaAHASL1D (als1) gene for resistance to imidazolinone herbicides. CDCTeal11A is a Canadian wheat variety with TaAHASL1B (als2) gene for resistance to imidazolinone herbicides. The experimental line that became MT1173 was assayed for herbicide resistance and presence of the two resistance genes via PCR. MT1173 was tested following BASF protocols for herbicide resistance in qualification trials managed by Ed Davis (Land Resources and Environmental Sciences)

Four sets of data provided justification for release of MT1173. These include two years of results from the statewide Advanced Yield Trial (AYT), one year of data from the Preliminary Yield Trial, six locations of data from herbicide qualification trials, and data from the Montana Cereal Quality Lab.

Data from the AYT in 2012 and 2013 shows that MT1173 had grain yield (Table 1) similar to Vida and higher than most other varieties at most sites. Test weight of MT1173 was lower than Vida, and most similar to Duclair (Table 3). Grain protein was similar to Vida (Table 4). MT1173 heads slightly later than Vida is approximately the same height (Table 5). MT1173 has hollow stems similar to Reeder and McNeal (data not shown).

Data from the Preliminary Yield Trial (PYT) grown in 2011 are shown in Tables 5 and 6. Table 5 shows the grain yield of MT1173 was lower than Vida though higher than most other varieties. Table 6 shows that MT1173 was a little later and shorter than Vida, with lower test weight.

End-use quality parameters were measured over a two year period in four locations each year for the AYT (Tables 7 and 8). MT1173 was similar to Vida for most end-use quality characteristics. Data from a sister line to MT1173, designated MT1172, is included in the CQL analysis. MT1173 tended to have higher values for most characteristics associated with dough strength than MT1172. These traits included mixing time and tolerance, as well as water absorption for bake analysis and mixograph analysis. The higher strength of MT1173 relative to MT1172 and Vida was the basis for selecting this line for release instead of MT1172.

The rights to use of the genes for resistance to imidazolinone are owned by BASF. BASF requires six herbicide qualification trials over a two-year period to insure that the genes provide ample herbicide resistance. The qualification trials were conducted in 2012 and

2013 by Ed Davis (LRES). Data on herbicide tolerance and grain yield is shown in Table 9. The key data from these trials are that there was no injury due to herbicide in any of the trials. BASF has approved the use of MT1173 as a Clearfield variety.

This variety will need to be licensed to an entity with an approved commercialization license from BASF.

Table 1. 2012 and 2013 GRAIN YIELD (BU/AC) SUMMARY FOR THE ADVANCED SPRING WHEAT NURSERY GROWN ACROSS MONTANA

PEDIGREE	KALISPELL	BOZEMAN	HUNTLEY	MOCCASIN	CONRAD	HAVRE	SIDNEY-D	SIDNEY-I	AVERAGE
	2012-2013	2012-2013	2012-2013	2012-2013	2012-2013	2012-2013	2012	2012	14 ENVIRONMENTS
MT1173	64.7	56.1	53.2	35.1	82.4	50.8	38.4	66.7	56.4
THATCHER	48.1	41.2	38.4	25.3	62.2	36.0	26.7	53.3	41.6
FORTUNA	73.7	47.4	47.7	30.4	68.6	41.0	36.5	50.3	50.3
REEDER	83.2	52.5	53.3	32.8	75.7	47.1	41.3	71.2*	57.2
MCNEAL	82.0	50.4	52.6	33.6	78.9	43.1	35.8	67.8	56.0
CHOTEAU	74.9	50.0	51.4	31.2	74.7	42.2	37.3	56.3	53.0
VIDA	81.5	55.8	55.7	38.3	79.8	51.3	40.0	66.8	59.4
DUCLAIR	84.9	53.3	55.8	35.4	74.4	47.8	39.8	60.7	57.4
EGAN	98.0	52.1	47.8	32.0	71.9	43.6	34.9	48.2	55.3
MEAN	79.0	52.3	51.9	33.8	75.2	45.5	36.6	60.9	55.2
C.V.	14.8	7.1	6.4	9.2	7.2	9.2	8.54	16.33	11.9
PROBABILITY (LINE)	<0.05	<0.01	<0.001	<0.05	NS	NS	<0.01	<0.01	<0.001
LSD	23.7	7.5	6.7	6.3	-	-	5.29	16.35	4.9

Table 2. 2012 and 2013 TEST WEIGHT SUMMARY FOR THE ADVANCED SPRING WHEAT NURSERY GROWN ACROSS MONTANA

PEDIGREE	KALISPELL	BOZEMAN	HUNTLEY	MOCCASIN	CONRAD	HAVRE	SIDNEY-D	SIDNEY-I	AVERAGE
	2012-2013	2012-2013	2012-2013	2012-2013	2012-2013	2012-2013	2012	2012	14 ENVIRONMENTS
MT1173	59.0	57.4	58.6	55.9	59.5	55.7	56.5	56.4	57.5
THATCHER	59.7	56.4	58.0	56.0	55.6	55.9	55.0	55.9	56.7
FORTUNA	61.7	60.7	60.0	58.8	62.1	58.3	58.5	58.3	60.0
REEDER	61.7	59.5	61.0	57.9	61.6	57.6	58.5	58.7	59.7
MCNEAL	60.1	58.5	59.3	57.0	61.1	57.0	56.0	56.4	58.4
CHOTEAU	59.1	59.9	60.9	57.0	59.7	56.7	57.5	56.9	58.6
VIDA	59.1	59.7	60.3	57.3	60.5	57.2	57.0	57.9	58.8
DUCLAIR	59.0	58.1	60.1	55.5	59.8	56.5	57.0	56.6	57.9
EGAN	61.2	58.1	59.6	56.8	60.6	57.2	57.0	56.2	58.6
MEAN	60.0	59.6	60.5	57.4	61.1	57.6	57.4	57.8	59.2
C.V.	2.5	1.8	1.4	1.4	2.6	1.8	1 REP	1 REP	1.9
PROBABILITY (LINE)	<0.05	<0.01	<0.001	<0.001	<0.05	<0.05	1 REP	1 REP	<0.001
LSD	3.1	2.2	1.8	1.7	3.2	2.1	1 REP	1 REP	0.8

Table 3. 2012 and 2013 GRAIN PROTEIN SUMMARY FOR THE ADVANCED SPRING WHEAT NURSERY GROWN ACROSS MONTANA

PEDIGREE	KALISPELL	BOZEMAN	HUNTLEY	MOCCASIN	CONRAD	HAVRE	SIDNEY-D	SIDNEY-I	AVERAGE
	2012-2013	2012-2013	2012-2013	2012-2013	2012-2013	2012-2013	2012	2012	14 ENVIRONMENTS
MT1173	14.9	14.9	11.4	16.5	12.4	16.0	12.9	15.4	14.3
THATCHER	14.8	15.7	<u>12.8</u>	17.0	13.0	16.2	14.6	15.9	15.0
FORTUNA	14.4	15.5	12.5	16.5	13.1	16.1	13.4	15.9	14.7
REEDER	15.2	15.5	11.7	16.6	13.4	16.4	13.2	16.0	14.8
MCNEAL	15.0	15.3	11.6	17.2	12.8	15.9	14.4	16.2	14.7
CHOTEAU	14.9	15.4	12.2	16.4	13.1	16.3	14.1	16.1	14.8
VIDA	15.1	14.8	10.8	15.9	12.5	15.6	13.6	14.8	14.1
DUCLAIR	14.9	15.1	11.3	16.7	13.1	16.1	13.3	15.7	14.5
EGAN	<u>16.5</u>	<u>16.3</u>	12.5	<u>18.3</u>	13.6	17.0	14.3	<u>17.3</u>	15.7
MEAN	14.8	15.2	11.8	16.5	13.1	16.0	14.5	15.8	14.6
C.V.	4.3	3.7	3.8	3.9	3.5	3.8	1 REP	1 REP	3.8
PROBABILITY (LINE)	<0.01	<0.05	<0.001	<0.01	<0.01	NS	1 REP	1 REP	<0.001
LSD	1.3	1.1	0.9	1.3	0.9	-	1 REP	1 REP	0.4

Table 4. 2012 and 2013 HEIGHT AND HEADING DATE SUMMARY FOR THE ADVANCED SPRING WHEAT NURSERY GROWN ACROSS MONTANA

	Height (in)		Heading Date (d from Jan. 1)	
	2012	2013	2012	2013
THATCHER	37.5	<u>40.7</u>	178.3	180.8
FORTUNA	34.9	38.3	175.9	178.6
MCNEAL	30.6	32.6	176.5	179.5
REEDER	30.4	32.5	176.0	178.6
CHOTEAU	28.7	31.0	175.8	179.1
VIDA	29.9	32.4	176.3	179.6
DUCLAIR	29.8	31.4	174.4	177.2
MT 1173	31.0	33.6	178.4	180.3
Egan	29.6	31.4	177.0	179.9
MEAN	29.2	31.3	175.7	178.7
C.V.	4.4	3.3	0.5	0.6
F-	17.84**		16.16**	
VALUE(ENTRY)		17.76***		7.66***
LSD(0.05)	1.26	1.4	0.85	1.1

Table 5. Grain Yield of MT1173 compared to check varieties in the 2011 Preliminary Yield Trial grown at four locations.

Line	Grain Yield (bu/ac)				
	Havre	Sidney	Moccasin	Bozeman	Average
MT1173	36.1	44.4	27.5	55.0	40.8
Vida	40.8	47.6	24.9	59.7	43.2
McNeal	37.3	41.7	30.6	53.7	40.8
Mean	38.9	43.1	26.3	52.6	40.2
LSD	5.3	4.4	6.9	5.6	2.1

Table 6. Agronomic characteristics of MT1173 based on means over four locations for the 2011 Preliminary Yield Trial.

Line	Grain Yield	Test Weight	Head Date	Height	Protein
MT1173	40.8	58.5	189	28.2	14.7
Vida	43.2	59.7	188	27.5	14.4
McNeal	40.8	59.1	189	28.3	15.3
Mean	40.2	59.6	187	27.0	15.1
LSD	2.1	1.2	0.95	1.7	1.2

Table 7. Cereal quality data in 2012 for four Advanced Yield Trial locations.

	Wheat Protein, % (12% m.b.)	Single Kernel Hardness	Flour Yield, %	Flour Protein, %	Flour Ash, %	Wheat Ash, %	Mixing Tolerance	Mixing Time, min	Mixing Water Absorption, %	Bake Mixing Time, min	Bake Water Absorption, %	Loaf Volume	Crumb Grain Score
FORTUNA	15.825	75.25	59.25	14.25	0.435	1.6625	3.75	4.1	65.5	6.8	75.7333	1195	7.66667
MCNEAL	16.225	95.5	56.1	14.725	0.44	1.7	6	7.425	68.075	11.7	78.5667	1310	8
REEDER	15.85	79.25	63.05	14.125	0.3775	1.595	3.5	3.975	65.325	5.775	74.65	1217.5	7.25
CHOTEAU	16.125	77.5	63.25	14.45	0.39	1.66	4.75	4.425	65.975	6.225	75.675	1216.25	6.5
VIDA	15.625	84.75	66.1	13.85	0.3875	1.54	3.25	4.15	65.25	5.725	74.825	1170	6.75
DUCLAIR	15.875	73.25	62.025	14	0.3975	1.635	4.75	5.8	65.275	8.425	75.1	1258.75	7.25
CAP400	17.1	86.75	62.225	14.925	0.395	1.79	6.5	9.6	68.575	15.9	79.775	1258.75	7.5
MT1173	15.8	81.0	65.9	13.7	0.37	1.72	3.3	4.3	64.7	6.4	73.2	1120	6.5
MT1172	15.2	77.7	64.6	13.4	0.39	1.60	3.3	3.4	64.4	3.7	72.0	1101	6.8
Mean	16.0	81.0	62.7	14.2	0.4	1.63	4.3	5.0	66.1	7.7	75.8	1189	7.3
F (all ***)	6.0	4.8	2.4	5.1	10.8	2.9	6.2	12.0	2.5	13.0	4.4	8.8	3.3
LSD (0.05)	0.76	5.1	3.2	0.65	0.02	0.11	1.1	1.4	1.92	2.5	1.97	56	1.1

Table 8. Cereal quality data in 2013 for four Advanced Yield Trial locations

Pedigree	Wheat Protein, % (12% <i>m.b.</i>)	Flour Yield, %	Flour Protein, % (14% <i>m.b.</i>)	Flour Ash, %	Wheat Ash, %	Mixing Tolerance	Mixing Time, min	Mixing Water Absorption, %	Bake Mixing Time, min	Loaf Volume	Crumb Grain Score	Bake Water Absorption, %
THATCHER	15.4	62.6	13.5	0.40	1.59	4.3	3.8	64.4	7.5	1221.3	8.0	74.1
FORTUNA	15.2	66.9	13.2	0.40	1.54	4.0	3.3	64.2	5.8	1193.8	8.0	74.3
MCNEAL	14.9	62.6	13.1	0.41	1.62	5.5	6.4	67.4	11.7	1232.5	7.8	77.6
REEDER	15.3	62.8	13.4	0.37	1.44	4.0	3.8	65.9	5.9	1200.0	7.3	75.5
CHOTEAU	14.9	63.1	13.8	0.38	1.49	4.5	4.2	67.4	8.0	1218.8	8.0	76.9
VIDA	14.1	67.7	12.5	0.38	1.37	3.3	3.8	66.2	7.8	1163.8	7.3	75.7
DUCLAIR	14.9	62.5	13.0	0.38	1.44	4.5	5.3	66.1	9.6	1227.5	7.3	75.8
MT1173	14.5	68.0	12.6	0.36	1.51	3.0	3.9	66.5	7.6	1076.3	7.5	74.1
MT1172	14.2	66.0	12.5	0.37	1.45	3.3	3.0	65.3	4.1	1081.3	6.8	73.8
Egan	16.1	62.9	13.9	0.39	1.58	6.0	7.7	68.2	13.6	1282.5	7.8	78.8
Mean	14.9	64.0	13.1	0.38	1.50	4.3	5.1	67.0	10.0	1168	7.5	76.7
<i>F (all **)</i>	5.3	4.9	4.6	5.8	2.8	3.9	10.3	2.3	11.3	5.8	2.8	3.1
LSD	0.6	7.0	0.6	0.02	0.10	1.1	1.3	2.0	3.1	58.5	0.8	2.1

Table 9. Herbicide Qualification Trials

These trials were conducted by Ed Davis following BASF-approved protocols. The data has been sent to BASF for their approval.

Station Year	Year	Trial Code	Location	Variety	Treatment			Data				
					Herbicide	X Rate	Rate (g ai/ha)	Crop Injury at 7-10 DAT (%)	Crop Injury at 14-21 DAT (%)	Grain Moisture %	Grain Test Wt LB/BU	Grain Yield BU/A
1	2012		Springhill	Jed	Control	--	--	0	0	8.6	57.8	24.3
1			Springhill	Jed	Beyond	1X	43.8	0	0	9.1	58.4	25.9
1			Springhill	Jed	Beyond	2X	87.6	0	0	9.1	56.8	21.6
1			Springhill	MT 1166	Control	--	--	0	0	8.7	53.9	25.7
1			Springhill	MT 1166	Beyond	1X	43.8	0	0	8.7	54.9	21.8
1			Springhill	MT 1166	Beyond	2X	87.6	0	0	9.4	49.8	18.5
1			Springhill	MT 1168	Control	--	--	0	0	8.9	56.2	23.3
1			Springhill	MT 1168	Beyond	1X	43.8	0	0	9.1	56.4	23.4
1			Springhill	MT 1168	Beyond	2X	87.6	0	0	9.8	56.2	19.8
1			Springhill	MT 1172	Control	--	--	0	0	8.9	55.3	21.6
1			Springhill	MT 1172	Beyond	1X	43.8	0	0	8.9	55.8	22.6
1			Springhill	MT 1172	Beyond	2X	87.6	0	0	8.9	56.4	19.7
1			Springhill	MT 1173	Control	--	--	0	0	8.7	53.7	21.8
1			Springhill	MT 1173	Beyond	1X	43.8	0	0	9.1	53.6	23.4
1			Springhill	MT 1173	Beyond	2X	87.6	0	0	8.7	54.7	19.2
							LSD					
							(0.05)	0	0	1.532	4.174	6.81
							CV	0	0	10.21	4.51	18.37
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1	2012		Moccasin	Jed	Control	--	--	0	0	7.8	58.2	21.6
1			Moccasin	Jed	Beyond	1X	43.8	0	0	7.7	58	22.6
1			Moccasin	Jed	Beyond	2X	87.6	0	0	7.4	57.5	23.3
1			Moccasin	MT 1166	Control	--	--	0	0	7.2	55.7	20.7
1			Moccasin	MT 1166	Beyond	1X	43.8	0	0	7.4	55.1	21.1
1			Moccasin	MT 1166	Beyond	2X	87.6	0	0	7.6	54.8	20
1			Moccasin	MT 1168	Control	--	--	0	0	6.8	53.3	19.2
1			Moccasin	MT 1168	Beyond	1X	43.8	0	0	6.7	53.5	20.5
1			Moccasin	MT 1168	Beyond	2X	87.6	0	0	6.6	52.8	19.3
1			Moccasin	MT 1172	Control	--	--	0	0	8.2	57.8	22.6
1			Moccasin	MT 1172	Beyond	1X	43.8	0	0	8.3	57.6	24.3
1			Moccasin	MT 1172	Beyond	2X	87.6	0	0	8.4	57.6	24.1
1			Moccasin	MT 1173	Control	--	--	0	0	8.2	57.7	21.5
1			Moccasin	MT 1173	Beyond	1X	43.8	0	0	7.9	57	21.8
1			Moccasin	MT 1173	Beyond	2X	87.6	0	0	8.1	56	21.1
							LSD					
							(0.05)			0.53	1.28	0.1
							CV			4.14	1.37	4.57

Station Year	Year	Trial Code	Location	Variety	Treatment			Data				
					Herbicide	X Rate	Rate (g ai/ha)	Crop Injury at 7-10 DAT (%)	Crop Injury at 14-21 DAT (%)	Grain Moisture %	Grain Test Wt LB/BU	Grain Yield BU/A
1	2012		Bozeman	Jed	Control	--	--	0	0	9.1	60.2	35.7
1			Bozeman	Jed	Beyond	1X	43.8	0	0	9.7	59.9	31.3
1			Bozeman	Jed	Beyond	2X	87.6	0	0	8.9	60.2	34.6
1			Bozeman	MT 1166	Control	--	--	0	0	9.1	57.9	35.3
1			Bozeman	MT 1166	Beyond	1X	43.8	0	0	8.9	59.2	34.4
1			Bozeman	MT 1166	Beyond	2X	87.6	0	0	8.9	59.7	34.7
1			Bozeman	MT 1168	Control	--	--	0	0	10	56.9	39.7
1			Bozeman	MT 1168	Beyond	1X	43.8	0	0	9.2	57.9	40
1			Bozeman	MT 1168	Beyond	2X	87.6	0	0	9.2	59	42.6
1			Bozeman	MT 1172	Control	--	--	0	0	9	57.7	40.4
1			Bozeman	MT 1172	Beyond	1X	43.8	0	0	9.8	57.3	43.1
1			Bozeman	MT 1172	Beyond	2X	87.6	0	0	10.6	56.8	41.1
1			Bozeman	MT 1173	Control	--	--	0	0	8.8	59.5	34.3
1			Bozeman	MT 1173	Beyond	1X	43.8	0	0	9.2	58.8	32.2
1			Bozeman	MT 1173	Beyond	2X	87.6	0	0	9.4	59.5	31.9
					Statistics		LSD (0.05)	0	0	1.64	2.63	9.05
							CV	0	0	10.53	2.68	24.64
1	2013		Rapelje	AP 605	Control	--	--	0	0	10.1	57.9	23.1
1			Rapelje	AP 605	Beyond	1X	43.8	0	0	10	57.8	22.2
1			Rapelje	AP 605	Beyond	2X	87.6	0	0	10	57.7	21.8
1			Rapelje	MTCL 1172	Control	--	--	0	0	9.8	57.5	22.6
1			Rapelje	MTCL 1172	Beyond	1X	43.8	0	0	9.9	57.6	21.8
1			Rapelje	MTCL 1172	Beyond	2X	87.6	0	0	9.9	57.4	22
1			Rapelje	MTCL 1173	Control	--	--	0	0	9.9	57.5	21.4
1			Rapelje	MTCL 1173	Beyond	1X	43.8	0	0	9.7	57.8	21.9
1			Rapelje	MTCL 1173	Beyond	2X	87.6	0	0	10	57.8	21.3
					Statistics		LSD (0.05)	0	0	0.36	0.7	1.41
							CV	0	0	2.52	0.84	4.41

Station Year	Year	Trial Code	Location	Variety	Treatment			Data				
					Herbicide	X Rate	Rate (g ai/ha)	Crop Injury at 7-10 DAT (%)	Crop Injury at 14-21 DAT (%)	Grain Moisture %	Grain Test Wt LB/BU	Grain Yield BU/A
2	2013		Bozeman	AP 605	Control	--	--	0	0	10.2	63.7	63.2
2			Bozeman	AP 605	Beyond	1X	43.8	0	0	10.1	62.6	63.7
2			Bozeman	AP 605 MTCL	Beyond	2X	87.6	0	0	10.1	63.7	56.8
2			Bozeman	1172 MTCL	Control	--	--	0	0	9.63	61.6	71
2			Bozeman	1172 MTCL	Beyond	1X	43.8	0	0	9.78	61.2	70.7
2			Bozeman	1172 MTCL	Beyond	2X	87.6	0	0	9.85	60.7	68.4
2			Bozeman	1173 MTCL	Control	--	--	0	0	9.75	60.2	77.2
2			Bozeman	1173 MTCL	Beyond	1X	43.8	0	0	9.7	60.6	72
2			Bozeman	1173 MTCL	Beyond	2X	87.6	0	0	9.9	60.9	71.7
					Statistics		LSD (0.05)	0	0	0.41	2.22	6.29
							CV	0	0	2.84	2.46	6.31
2	2013		Springhill	AP 605	Control	--	--	0	0	9.6	55.7	20.3
2			Springhill	AP 605	Beyond	1X	43.8	0	0	9.65	55.8	20
2			Springhill	AP 605 MTCL	Beyond	2X	87.6	0	0	9.68	55.6	20.2
2			Springhill	1172 MTCL	Control	--	--	0	0	9.58	56	19.8
2			Springhill	1172 MTCL	Beyond	1X	43.8	0	0	9.63	56	20.1
2			Springhill	1172 MTCL	Beyond	2X	87.6	0	0	9.7	56.1	20.2
2			Springhill	1173 MTCL	Control	--	--	0	0	9.8	55.8	20
2			Springhill	1173 MTCL	Beyond	1X	43.8	0	0	9.73	55.9	19.8
2			Springhill	1173 MTCL	Beyond	2X	87.6	0	0	9.4	55.9	19.8
					Statistics		LSD (0.05)	0	0	0.33	0.49	0.5
							CV	0	0	2.35	0.61	1.71