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MEMORANDUM

TO: Wheat Cultivar Release & Recommendation Committee

FROM: Phil Bruckner and Jim Berg, Winter wheat breeders

DATE: December 28, 2010

RE: Proposal for protected MAES public (F.2.b) cultivar release of MTS0721

The following motion and supporting documentation is presented for consideration at the 2011 MAES Cultivar Release and Recommendation Meeting in Bozeman:

Motion: That MTS0721 solid-stem hard red winter wheat be approved for release in 2011. That MTS0721 be named 'Bearpaw' denoting its area of derivation and adaptation. And that Bearpaw be recommended for wheat stem sawfly-infested areas of districts 3, 4, and 5.

Pedigree: MT0721 resulted from a composite of five F₁ crosses made to the same male sterile female parent in 1999: DMS/Rampart//Pronghorn/3/2*Rampart,
DMS/Rampart//Pronghorn/3/Rampart/4/MTW9806,
DMS/Rampart//Pronghorn/3/Rampart/4/NuPlains,
DMS/Rampart//Pronghorn/3/Rampart/4/MT9513,
DMS/Rampart//Pronghorn/3/Rampart/4/MT98113

DMS was a Taigu dominant male sterile stock in a HRS wheat background obtained from Westbred in 1996. Rampart is a solid-stem HRW wheat released by MAES in 1996. Pronghorn is a hollow-stem HRW cultivar released by Nebraska in 1996. NuPlains is a semi-dwarf, hollow-stem HRW developed by USDA-ARS, Lincoln in 1998. MTW9806 (Redwin/Rio Blanco//NuWest), MT9513 (NuWest/MT8030), and MT98113 (Judith/MT8764) are unreleased hollow-stem experimental wheat lines developed by MAES.

Recommendation: Protected MAES Public Release (F.2.b).

Name: To be named 'Bearpaw' denoting the Bears Paw Mountains south of Havre and the Northern Agricultural Research Center where the cultivar was derived, selected, and tested during its development.

Selection history: MT0721 originated from five crosses made in the greenhouse in 1999. The composite F₁ population was grown in a late planted nursery at Fort Ellis in 2000. F₂, F₃, F₄, and F₅ bulk populations were grown at Bozeman, Fort Ellis, Loma, and Loma from 2001 to 2004, respectively, using a modified bulk breeding method, with mass selection for survival, reduced plant height, favorable head morphology, stem

solidness, and kernel plumpness. One hundred heads which were selected from the F₅ population grown at Loma in 2004 were grown as F₆ headrows at Bozeman in 2005. Headrow 99X96cE107 was selected based on evaluation of stem solidness and visual criteria for uniformity, productivity, and acceptable agronomic type and harvested in bulk. 99X96cE107 was subsequently tested in the 2006 Sawfly Observation Nursery (SFO) grown at Bozeman, Havre, north Havre, and Fort Ellis. In 2007, 99X96cE107 was designated MTS0721 and tested in the Sawfly yield trial at five locations. In 2008, MTS0721 was evaluated in the Montana Advanced trial planted at six locations (total 5 LY). From 2007 through 2010, MTS0721 was evaluated in Sawfly nursery (15LY), from 2009 through 2010, MTS0721 was evaluated in the Montana Intrastate trial planted at eight locations (total 13 LY), and in 2010, MTS0721 was evaluated in the Montana Off-station nursery planted at 14 on-farm locations (total 14 LY). Quality has been evaluated in multi-location Montana trials since 2007. In 2010, MTS0721 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 MTS0721 was initiated in 2009 when 117 F₅-derived F₁₀ headrows were grown at Bozeman with selection for stem solidness and visual uniformity and 86 linerows bulked as a source of breeder seed. In 2010, breeder seed of MTS0721 was increased at Yuma, AZ and the Bozeman Post Farm (~0.33 A). 12 red-chaff variants were removed from the Bozeman breeder seed increase prior to harvest. Foundation seed increases were planted from the 2010 Bozeman breeder seed increase lot. Foundation seed of Bearpaw is planted at Moccasin (x A) and Bozeman (2.8 A) for 2011 harvest. The Yuma derived breeder seed increase was used to plant field scale demonstration plots at Loma, MT.

Description: Bearpaw is an awned, white-glumed, solid-stem, semi-dwarf hard red winter wheat. Bearpaw has medium maturity, 167.8 d heading from 1 January, similar to ‘CDC Falcon’ and 1.1 d earlier than ‘Genou’ and ‘Rampart’ (Table 1). Bearpaw is semi-dwarf (*Rht1*) and medium-short (32.2 inches, n=41), 1.1 inches taller than CDC Falcon and 3.8 and 3.4 inches shorter than Genou and Rampart, respectively. Bearpaw is resistant to prevalent races of stem rust and UG99 (Sr36) but susceptible to stripe and leaf rust. Bearpaw is solid-stemmed, averaging 21.8 on the 5 (hollow) to 25 (solid) stem solidness scale, significantly more solid than Judee (20.0) and Genou (18.2) and similar in stem solidness to Rampart (21.4) (Table 2). Cutting by wheat stem sawfly of Bearpaw (10.0%, n=8) is intermediate to Genou (21.8%) and Rampart (6.3%, Table 3). Under severe cutting by wheat stem sawfly at Loma in 2010, cutting of Bearpaw by wheat stem sawfly was similar to Rampart and significantly lower than that of Judee and Genou (Fig. 1) Bearpaw is most similar to Rampart and is targeted toward wheat stem sawfly-infested areas of north central Montana currently in Rampart and/or Genou production.

Table 1. Agronomic characteristics of Bearpaw (MTS0721) and check cultivars, 2007-2010.

Variety	Test weight lb/bu	Winter survival %	Heading date		Plant height in	Lodging %	Protein %	Sawfly cutting %	Stripe rust %	Coleoptile length in
			Julian	Calendar						
location-years	42	1	27		41	3	42	8	5	1
CDC Falcon	59.6	66**	168.2	17-Jun	31.1	1	12.2	40	7	2.8
Genou	59.7	48	168.9	18-Jun	36.0	15	12.4	22	14	3.9
Judee (MTS0713)	60.4**	55	168.3	17-Jun	32.8	0	12.4	18*	1	3.5
MTS0721	60.0	47	167.8	17-Jun	32.2	19	12.4	10*	11	3.1
Rampart	59.9	32	168.9	18-Jun	35.6	18	13.0**	6**	5	4.2
LSD (0.05)	0.4	11	0.5		0.6	ns	0.2	14	ns	0.2

** = indicates highest value within a column

* = indicates varieties with values equal to highest variety within a column based on Fisher's protected LSD (p=0.05)

Table 2. Stem solidness ratings of Bearpaw (MTS0721) and check cultivars, 2007-2010.

	Stem Solidness Rating (scale 5-25, higher = more solid)					Stem Solidness by location, 2007-2010				
	2010	2009	2008	2007	2007-10	Bozeman	Conrad	Havre	Moccasin	Sidney
location-years	9	6	5	5	25	6	4	9	5	1
MTS0721	22.0**	21.5*	22.1**	21.8*	21.8**	19.6**	23.3**	22.8*	21.5**	23.1**
Rampart	20.3	22.1**	21.4*	22.8**	21.4*	18.5*	23.3*	22.8**	20.8*	22.8*
Judee (MTS0713)	19.2	21.1*	21.0*	19.6	20.0	17.3	21.3*	21.3	19.8*	22.8*
Genou	17.3	18.6	19.2*	18.4	18.2	14.2	20.0	19.7	18.6	19.2
CDC Falcon	7.0	7.9	6.5	7.2	7.2	5.9	7.1	8.2	7.0	6.7
LSD (0.05)	1.4	1.6	2.9	1.4	0.9	1.7	2.4	1.3	2.5	2.6

** = indicates highest yielding variety within a column

* = indicates varieties yielding equal to highest yielding variety within a column based on Fisher's protected LSD (p=0.05)

Table 3. Yield Performance and % Sawfly Cutting of Bearpaw (MTS0721) under Sawfly Pressure (average cutting > 10%, 2007-2010)

Variety	Yield (bu/a)				Sawfly Cutting (%)			
	Havre	North Havre	Loma	Average	Havre	North Havre	Loma	Average
location-years	5	2	1	8	5	2	1	8
Judee (MTS0713)	60.4*	58.5	55.4	59.3**	7.0*	26.0	53.3	17.6*
CDC Falcon	61.3**	53.4	56.0	58.6*	23.1	52.5	99.7	40.0
MTS0721	58.5*	49.5	54.7	55.8	7.7*	16.5	8.3**	10.0*
Genou	56.2	52.7	51.6	54.8	11.5*	32.5	51.7	21.8
Rampart	52.8	50.0	52.7	52.1	4.1**	10.0	10.0*	6.3**
LSD (0.05)	3.9	ns	ns	3.0	8.7	ns	10.6	13.7

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Table 4. Yield of Bearpaw (MTS0721), and check cultivars, 2007-2010. (Sawfly, 2007-2010; Intrastate, 2009-10; Off Stations, 2010)

Variety	Districts							All Locations
	1 Kalispell	2 Bozeman ^{1/}	3 Huntley ^{2/}	4 Moccasin ^{3/}	5 Conrad ^{4/}	5 Havre ^{5/}	6- Sidney & Williston	
location-years	2	5	7	9	6	11	2	42
CDC Falcon	115.3	89.6	71.5*	52.5**	66.6**	62.3**	54.7	67.8**
Judee (MTS0713)	116.0	98.6**	72.5*	49.6*	65.5*	60.8*	45.9	67.4*
MTS0721	114.3	91.1*	78.2**	51.7*	63.1*	59.1	42.8	66.9*
Genou	109.6	89.3	66.4	45.8	63.7*	57.8	45.4	63.1
Rampart	106.3	83.5	67.2	44.5	56.2	54.3	40.8	59.9
LSD (0.05)	ns	9.0	7.0	3.2	6.0	3.1	ns	2.2

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1/ includes data from Dry Creek, Willow Creek

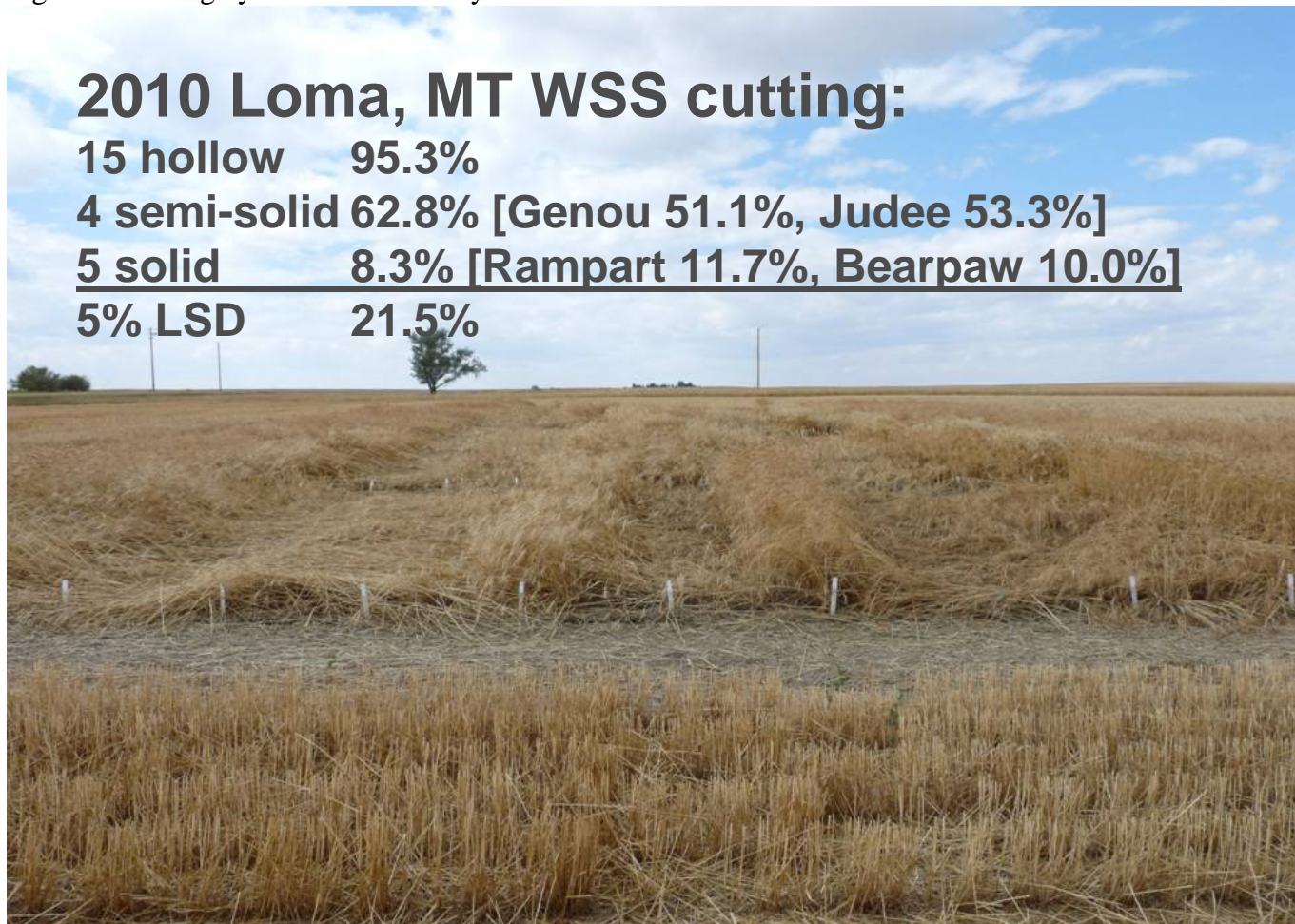
4/ includes data from The Knees, Shelby

2/ includes data from Forsyth, Hardin area, Lodge Grass, Molt, Rapelje

5/ includes data from North Havre, Loma

3/ includes data from Denton, Geraldine, Winifred

Figure 1. Cutting by wheat stem sawfly at Loma in 2010.



Characteristics/comparisons:

Yield. In 42 location-years (LY) of testing in the Montana Winter Wheat Intrastate, Sawfly, and Off-station nurseries average yield of Bearpaw (66.9 bu/a) was similar to the yield of CDC Falcon and Judee, but greater than the yields of Genou and Rampart (Table 4). In districts 4 and 5 where wheat stem sawfly is prevalent, Bearpaw performed well, out yielding Rampart at Moccasin (+7.2 bu/a), Conrad (+6.9 bu/a) and Havre (+4.8 bu/a, Table 4). In 8 north-central Montana sawfly-infested environments, Bearpaw out yielded Rampart by 3.7 bu/a (Table 3).

Test weight. Test weight of Bearpaw (60.0 lb/bu, n=42) was similar to Genou and Rampart (Table 1).

Grain protein content of Bearpaw is medium to high, lower than Rampart but similar to that of Genou (Table 1).

Milling and baking quality of Bearpaw is acceptable and similar to currently deployed Montana cultivars (Table 5). In summary, Bearpaw is a hard red winter wheat with high PPO, intermediate flour yield and flour protein content, medium dough strength and water absorption, and average loaf volume similar to CDC Falcon (Table 5), Neeley, and Rocky (data not shown).

Table 5. Milling and baking characteristics of Bearpaw (MTS0721), and check cultivars, 2007-2009.

Variety	PPO ^{1/}	Kernel hardness	Flour yield %	Flour protein %	Flour Ash %	Mixograph mix time min	Mixograph absorption %	Baking mix time min	Baking absorption %	Loaf volume cc
location-years	14	14	14	14	14	14	14	14	14	14
CDC Falcon	1.125	67.7	66.1	11.4	0.44	5.3	62.7	9.9	72.5	1075
Genou	0.895	74.4	69.8	11.9	0.42	5.4	64.3*	11.7	74.2*	1098
MTS0713	0.869	77.4	68.4	11.6	0.41**	5.9	63.0	9.0	72.9	1129*
MTS0721	0.915	77.5	70.0*	11.6	0.42*	4.8	62.8	7.4	72.9	1040
Rampart	0.779	75.8	70.6**	12.5**	0.42	5.2	64.7**	10.2	75.1**	1136**
LSD (0.05)	0.144	2.9	0.7	0.4	0.01	0.5	1.0	1.7	1.1	29

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^{1/} low is best for noodles

Bearpaw is proposed as a potential replacement for Genou, with similar yield potential but greater stem solidness, lower cutting by wheat stem sawfly, and shorter plant height. Relative to Rampart, Bearpaw is higher in yield potential and shorter with similar high stem solidness and low cutting by wheat stem sawfly.