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MEMORANDUM

TO: Wheat Variety Release Committee

FROM: Dr. Suchismita Mondal, Mr. Ronald Ramsfield, Mr. Andrew Lehnerz

DATE: July 27, 2026

RE: Proposal for licensed release of MT2019 winter wheat variety

Motion: Licensed release of MT2019 hard red winter wheat variety

Pedigree: MT2019 is a selection from a cross of MT10114/MT10128//MTW1251

Contributors:

- Dr. Suchismita Mondal, Mr. Ronald Ramsfield, Dr. Phil Bruckner, Mr. Jim Berg, Dr. Arpit Gaur, Mr. Andrew Lehnerz, Mr. Duncan Pantos, Mr. Ricardo Leition
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- Dr. Chengci Chen, Ms. Calla Kowatch-Carlson, and Dr. Frankie Crutcher, MSU-EARC, Sidney, MT
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- Dr. Jessica Torrion, Dr. Joseph Jenson MSU-NWARC, Creston, MT
- Mr. Doug Holen, Ms Brandee Johnston, Mr. Clayton Edwards, MSU Foundation Seed, Bozeman, MT
- Dr. Gautam Pradhan, Williston Research Extension Center, Williston, ND
- Dr. Dale Clark and Mr. Trevor Schafer, Nutrien Ag Solutions, Bozeman, MT

Selection history: MT2019 is a three-way cross between advanced breeding lines in the MSU winter wheat breeding program. In 2011 a cross was conducted in the greenhouse between MT10114 and MT10128, the F1 was then crossed to MTW1251 a hard white winter wheat breeding line.

2011	Cross conducted in greenhouse between winter wheat advanced lines MT10114 and MT10128
2012	F1 backcrossed to MTW1251 (line named 12x105)
2013	F1 was advanced at Arthur H. Post Farm, MT
2014	F2 was advanced at Ft. Ellis, MT
2015	Bulked F3 was advanced at Williston, ND
2016	Selected F4 bulk was advanced at Sidney, MT
2017	Selected F5 bulk advance at Arthur H. Post Farm, MT
2018	150 heads were selected from F5 and grown as Headrows at Ft. Ellis, MT
2019	Selected breeding line 12x105E126 was grown in the single replication observation nursery at Arthur H Post Farm, MT and named MT2019
2020	MT2019 was evaluated in multilocation preliminary yield trial
2021-2024	MT2019 was evaluated in advanced yield trials, intrastate trials and offstation trials

Agronomic Performance: MT2019 was evaluated in multiple yield trials across locations in Montana between 2021-2024. MT2019 was included in the Advanced yield and tested across 7 locations across the state (Table1). It was among the top-performing entries for grain yield in Bozeman and performed similarly to the check varieties at most other locations.

From 2022 to 2024, MT2019 was evaluated in the Intrastate trial and was the top yielder across 17 locations-years (Table 2). Averaged across all locations, MT2019 yielded 81.7bu/ac, exceeding the check varieties by approximately 3% to 12%. MT2019 demonstrated high grain yields in Bozeman, Kalispell and Sidney, MT. Heading for MT2019 was like Yellowstone and approximately 4 days later than Flathead. Average plant height for MT2019 was 27.5 inches across locations, comparable to Bobcat and about 4.5 inches shorter than Yellowstone. The average test weight and grain protein content across locations were 58.9 lb/bu and 12.0%, respectively, and were comparable to those of Yellowstone. End-use quality evaluations conducted across 2023 and 2024 indicated that MT2019 has high PPO, low flour protein, and lower ash content while maintaining loaf volume comparable to the check varieties (Table3).

MT2019 shows moderate resistance to both stem and stripe rust (Table1 and 4). The line carries the *Sr2* gene for stem rust resistance, which is also linked to expression of pseudo-black chaff. In 2022 and 2025 pseudo-black chaff was observed and rated at 2 on approximately 10% of spikes in standard yield trial plots (Fig 1). MT2019 has hollow stems and is susceptible to wheat stem sawfly, with stem cutting averaging 45%

across environments evaluated over multiple years (Table1 and 4).

Purification/ Seed stock: Increase of MT2019 was initiated in 2021 when 140 individual heads were collected from a phenotypically uniform plot. Multiplication and purification plots were grown at Arthur H. Post Farm in 2022. Selected uniform rows were bulked and sown at Arthur H. Post Farm for Breeder's seed increase in 2023. Since decision was made to not release the variety that year, seed was stored by MSU Foundation seed. In Fall 2025, MT2019 was sown at Arthur H. Post Farm for Foundation seed production and will be harvested this Fall (2026).

Summary: MT 2019 is a high yielding hard red winter wheat line with adaptation across Montana though has shown excellent performance in high rainfall areas of Bozeman and Kalispell, MT. It is a medium-to late maturing line with a short height, averaging about 4.5 inches shorter than Yellowstone. No lodging has been observed in yield trials in the multi-year evaluations. It has shown moderate resistance to both stripe rust and stem rust and carries the *Sr2* gene for stem rust resistance, which may be associated with occasional expression of pseudo-black chaff on the spikes (example spike Fig 1). Being a hollow line, it is susceptible to wheat stem sawfly cutting. MT2019 has an average milling and baking quality, with test weight and grain protein comparable to Yellowstone.



Fig 1. Example of a rating scale for pseudo-black chaff in wheat.

Table 1: Grain yield and agronomic performance of MT2019 and check varieties in 2021 Advanced yield trial across locations

Varieties/Line	Grain Yield (bu/ac)								Sawfly Cutting (%)			Stripe Rust (MT Vernon, WA)				Stem Rust (St. Paul, MN)
	Bozeman	Havre	Williston	Moccasin	Huntley	Conrad	Ft Benton	Average (n=5)	Havre	Ft Benton	Average Sawfly Cutting	Stem Elongation IT ¹	Stem Elongation %	Milk stage IT	Milk stage %	%
Yellowstone	71.2	37.8	25.3	35.5	67.3	56.0	48.6	52.1	23	53	38	2	2	2	10	70S
Warhorse	60.2	30.8	27.4	27.4	55.3	48.4	43.1	43.4	18	2	10	5	10	2	5	30MS
SY Monument	<u>71.9</u>	35.5	28.0	30.3	61.1	52.4	50.4	49.8	43	35	39	5	10	2,8	10,80	20MS
Bobcat	66.6	42.1	26.3	32.8	54.2	63.8	43.8	47.9	15	3	9	5	10	5	20	70S
MT2019	69.7	38.8	25.4	32.3	51.1	67.9	47.3	47.8	50	42	46	5	10	2	5	5MS
Average (n=36)	67.6	34.5	26.0	31.2	56.1	53.9	44.5	46.8	35.3	27.1	31.2					
LSD (0.05)	7.0	4.4	ns	5.4	12.5	ns	7.2	4.6	19.4	18.8	23.1					
C.V. (%)	5.9	7.4	9.1	9.8	12.7	21.6	9.9	7.8	33.8	42.6	36.4					
P-value	<.0001	<.0001	0.4702	0.0323	0.0359	0.1408	<.0001	<.0001	<.0001	<.0001	0.0002					

^{1/} Infection Type (IT) was recorded based on the 0-9 scale with ITs 8 and 9 combined as 8 (the most susceptible reaction) in field data

***Bold** data values indicate significantly different statistically

Table 2. Grain yield and agronomic performance of MT2019 and check varieties in 2022, 2023 and 2024 Intrastate trials.

Varieties/line	Grain Yield (2022-2024, bu/ac)								Across Locations (2022-2024)				
	Bozeman	Ft Benton	Havre	Huntley	Kalispell	Moccasin (2022,2024)	Sidney	Williston (2022,2023)	Grain Yield ¹ (bu/ac)	Days to Heading (Julian)	Plant Height (in)	Test Weight (lb/bu)	Protein (%)
Locations years (n)									n=17	n=12	n=12	n=10	n=11
Bobcat	107.0	51.0	61.1	47.1	164.2	42.5	85.9	36.3	77.6	165.1	27.9	59.9	12.6
Flathead	109.4	43.1	59.1	50.4	174.5	43.7	86.5	36.2	79.2	160.9	29.8	59.7	12.1
FourOsix	115.7	43.5	59.9	45.4	172.8	43.1	88.7	36.9	78.7	164.4	29.4	59.1	12.3
Warhorse	101.8	50.3	51.3	56.4	143.5	43.2	80.8	36.6	72.4	165.5	30.2	58.2	12.9
Yellowstone	116.2	36.7	63.2	48.3	168.5	43.7	91.2	36.2	78.7	165.4	32.0	58.4	12.2
MT2019	115.0	40.9	59.2	58.6	180.7	44.4	95.4	36.6	81.7	164.8	27.5	58.9	12.0
Mean	110.9	44.3	58.9	51.0	167.4	43.4	88.1	36.5	78.1	164.3	29.5	59.0	12.4
LSD (0.05)	18.4	14.9	5.9	13.9	10.2	4.2	7.4	2.7	4.1	0.62	0.80	1.1	0.36
CV (%)	7.3	17.2	6.8	8.3	4.1	12.9	6.8	15.3	7.7	0.74	0.92	3.1	4.2
Gen significance	0.001	ns	0.00	ns	0.001	ns	0.001	ns	0.02	<0.001	<0.001	0.008	<0.001

***BOLD** data values indicate significantly different statistically; for height, short varieties are highlighted

Table 3: End use quality parameters of MT2019 and check varieties from 2022 and 2023 Intrastate Trial across 4 locations.

Cultivar/Line	PPO	Single Kernel Hardness	Wheat protein, % (12 m.b.)	Flour Yield %	Flour Protein%(14%m.b)	L*brightness	A*green-red	B*blue-yellow	Wheat Ash, %	Flour Ash, %	Tolerance	Mixing Time Min	Water Absorption%	Mixing Time Min	Water Absorption%	Loaf Volume	Crumb Grain Score
Warhorse	0.234	78.5	14.7	67.3	13.2	89.6	-1.79	10.54	1.42	0.45	1.7	3.7	64.3	6.5	74.3	1149.2	5.5
Yellowstone	0.247	68.7	13.3	69.5	11.8	89.4	-1.67	10.32	1.55	0.43	4.2	6.8	64.8	13.4	74.9	1048.3	5.7
Flathead	0.233	64.7	13.9	71.5	12.8	89.5	-1.42	9.57	1.52	0.43	4.7	7.1	65.9	17.3	76.9	1058.3	5.7
Bobcat	0.261	61.0	13.8	71.4	12.3	89.6	-2.32	12.52	1.48	0.41	4.0	5.0	63.8	11.4	73.9	1102.5	5.8
MT2019	0.249	68.0	12.9	70.9	11.5	89.2	-2.00	11.59	1.36	0.45	3.3	5.2	63.8	9.6	73.5	1070.0	5.3
Mean	0.245	68.2	13.7	70.1	12.3	89.5	-1.84	10.91	1.47	0.43	3.6	5.5	64.5	11.6	74.7	1085.7	5.6
Standard Deviations	0.010	5.842	0.610	1.581	0.611	0.127	0.305	1.033	0.070	0.014	1.041	1.243	0.777	3.607	1.201	36.611	0.170

Table 4: Disease ratings and sawfly cutting data for MT2019 and check varieties.

Varieties/Line	Stripe Rust, Pullman, WA				Stripe Rust, Mt Vernon, WA				Stem Rust, St Paul, MN		Ft. Benton, Conrad
	6/16/2023		6/22/2023		4/27/2023		6/6/2023		2022		2022,2023
	Fks 11		Fks 11.2		Fks 6		Fks 11		X-14 field	M-9E field	
	IT ¹	%	IT	%	IT	%	IT	%	Severity IR ²	Severity IR	% Sawfly Cutting
Warhorse	5	15	2	5	5	50	2	10	30MS	40MSS	12%
Yellowstone	5	10	3	20	3	30	2	10	70S	90S	46%
Flathead	3	5	2	5	2	5	2	10			40%
Bobcat	3	5	2	5	2	20	2	10	70S	90S	8%
MT2019	2	5	2	10	2	20	2	10	5MS	0	44%

¹ Infection Type (IT) was recorded based on the 0-9 scale with ITs 8 and 9 combined as 8 (the most susceptible reaction) in field data

² Stem rust disease severity (estimated % of stem tissue covered by rust pustules) and infection responses, IR (R, MR, MS, and S) were noted at growth stages between milk and soft dough.