We propose the release of MT1621 as a public, PVP, Title V protected variety

The rationale for release of MT1621 includes high yield potential across the state, higher grain protein than Vida, improved end-use quality, and solid stems.

Pedigree Information

MT1621 was a selection from the cross MT1133/MT1148. MT1133 descended from the cross MT0628 (Choteau (PI633974)/Oxen (PI 596770) and MT0626 (Outlook (PI632252)//Reeder/Scholar (PI607577). MT 1148 descended from the cross 06SR149/06SR175. Parents of 06SR149 were MT0220 (McNeal (P1 574642)/Reeder (PI 613586) and MT0248 (Reeder/Scholar). Parents of line 06SR175 were MT0266 (Reeder//MTRWA141/Pondera (CI17828) and MT0248. Choteau and Scholar are solid-stemmed cultivars. The cultivar Reeder and its descendants in the pedigree of MT1621 exhibit extended green leaf duration after heading in hot dry environments. Solid stems and extended green leaf duration after heading were selection criteria during development of MT1621. Cultivars Choteau, Outlook, Scholar, McNeal, Pondera, and MTRWA141 were released by the Montana Agricultural Experiment Station. The North Dakota Agricultural Experiment Station released Reeder, and the South Dakota Agricultural Experiment Station released Oxen.

Description

The selection program that led to the development of MT1621 was designed to maintain the high grain yield conferred by the stay-green trait exhibited by Vida and Reeder. The stay-green trait is defined as the time between heading and senescence, and is associated with high yield in dryland environments. The trait is also associated with lower gluten strength. A possible reason for this is late senescence during the hottest part of the summer, which has been shown decrease polymerization of the different glutenin proteins. Thus, selection during the development of MT1621 was for earlier heading date, while still maintaining a long stay-green period. The goal was to maintain high yield while improving end-use quality relative to Vida by having senescence occur earlier in the summer.

Key attributes of MT 1621 are shown in the following Tables. Table 1 shows that MT1621 showed high grain yield across all Advanced Yield Trial (AYT) locations in 2017 and 2018. Only Vida was statistically similar to MT1621.

This result is similar the results from the Preliminary Yield Trial (PYT) in 2016 (Table 4) where MT1621 yielded numerically higher and statistically similar to Vida.

Table 2 shows that grain protein of MT1621 was 0.8 % points higher than Vida in the AYT in 2017 and 2018, and statistically similar to Lanning. MT1621 was not significantly different than Vida in the 2016 PYT.

Table 3 shows that MT1621 has an intermediate level of stem solidness, higher than semi-solid Vida, and lower than solid-stemmed checks Choteau and Duclair. Height of MT1621 is similar to Vida and taller than Lanning and Choteau.

MT1621 heads significantly earlier than Vida (Table 3). Based on the 2018 Bozeman AYT, senescence date of MT1621 is also two days earlier than Vida. Thus, the stay-green period represented by the time between heading and senescence of MT1621 and Vida is the same.

End-use quality characteristics of MT1621 (Table 6) in 2016 and 2017 include greater dough strength than Vida, as determined by mixing tolerance, mixing time, and bake water absorption. Dough strength is not as high as seen for McNeal.

Table 7 shows performance on MT1621 in 18 off-station nurseries in Montana in 2018. Results are similar to the Advanced Yield Trial data. MT1621 was one bushels lower in yield than Vida over all locations, possessed higher grain protein, and higher test weight.

MT1621 was found to be susceptible to Fusarium head blight (similar to McNeal and more susceptible than Vida) based on an inoculated trial in Idaho in 2018. An inoculated trial in 2018 in Sidney conducted by Dr. Frankie Crutcher showed that MT1621 was moderately resistant (similar to Vida and less susceptible than McNeal).

MT1621 was found to be moderately resistant/moderately susceptible to stripe rust based on trial in Washington in 2018. MT1621 was similar to Lanning and Duclair, and more resistant than McNeal.

Table 1. Grain yield (Bu/Ac) of MT1621 compared to other commonly grown cultivars in Montana. For combined analysis over 2017 and 2018, the number of entries common in both years and used in the analysis was 31. For sites where only one year was analyzed, the number of entries was 64. Underlined values indicates that the value was not significantly different than the highest-yielding line in the experiment.

Loc.	Conrad	Havre	Huntley	Kalispell	Moccasin	Bozeman	Sidney	Sidney (Irrigation)	Mean
Year	17-18	17-18	17-18	17	17-18	17-18	17-18	17-18	N=15
MT1621	**<u>77.6</u>**	**<u>36.7</u>**	**81.3**	**<u>61.9</u>**	**<u>49.1</u>**	**85.1**	**42.6**	**<u>97.8</u>**	**<u>66.5</u>**
REEDER	<u>68.5</u>	<u>36.7</u>	74.1	54.0	<u>44.7</u>	82.7	44.3	<u>95.6</u>	62.6
MCNEAL	58.5	<u>36.2</u>	71.0	55.5	<u>45.2</u>	72.3	42.2	<u>91.0</u>	59.0
CHOTEAU	63.5	31.5	73.8	51.0	42.5	78.1	34.7	87.3	57.8
VIDA	64.4	<u>40.3</u>	79.6	<u>61.0</u>	44.2	<u>92.3</u>	<u>45.9</u>	<u>97.4</u>	<u>65.6</u>
DUCLAIR	67.0	30.7	78.6	55.9	42.4	84.2	36.2	<u>91.9</u>	60.9
EGAN	59.3	34.2	76.3	52.7	41.2	71.8	37.7	83.2	57.1
LANNING	<u>67.5</u>	<u>35.9</u>	78.0	55.4	<u>45.9</u>	79.1	42.0	<u>94.0</u>	62.2
Mean (n=31)	**64.6**	**34.8**	**74.9**	**-**	**43.9**	**80.8**	**39.5**	**92.2**	**60.8**
Prob. (line)	**<0.01**	**<0.001**	**ns**	**-**	**<0.01**	**ns**	**ns**	**<0.01**	**<0.001**
LSD (0.05)	**10.2**	**4.6**	**-**	**-**	**4.7**	**-**	**-**	**12.9**	**3.7**

Table 2. Grain protein content (%) of MT1621 compared to other commonly grown cultivars in Montana. For combined analysis over 2017 and 2018, the number of entries common in both years and used in the analysis was 31. For sites where only one year was analyzed, the number of entries was 64. Underlined values indicates that the value was not significantly different than the highest-yielding line in the experiment.

Loc.	Conrad	Havre	Huntley	Kalispell	Moccasin	Bozeman	Sidney	Sidney (Irrigation)	Mean
Year	17-18	17-18	17-18	17	17-18	17-18	17-18	17-18	N=15
MT1621	**15.1**	**16.1**	**15.1**	**14.9**	**12.4**	**15.6**	**14.7**	**14.4**	**14.8**
REEDER	<u>15.3</u>	16.0	15.5	15.5	12.7	15.5	14.5	14.6	15.0
MCNEAL	14.6	16.0	15.4	15.0	12.3	16.0	14.2	14.0	14.7
CHOTEAU	<u>15.3</u>	16.3	15.1	15.0	13.2	15.3	14.7	13.5	14.8
VIDA	14.3	15.3	14.4	14.4	12.0	14.5	13.6	13.1	14.0
DUCLAIR	14.8	16.2	14.6	13.9	12.6	14.9	14.7	13.5	14.4
EGAN	<u>15.9</u>	<u>17.2</u>	<u>17.1</u>	<u>16.4</u>	<u>14.0</u>	<u>17.2</u>	<u>16.1</u>	14.7	<u>16.1</u>
LANNING	<u>15.4</u>	16.5	15.3	15.4	12.5	15.7	15.0	14.2	15.0
Mean (n=31)	**15.0**	**16.1**	**15.0**	**-**	**12.8**	**15.2**	**14.6**	**13.9**	**14.7**
Prob. (line)	**<0.001**	**<0.001**	**<0.001**	**-**	**<0.001**	**<0.001**	**<0.001**	**ns**	**<0.001**
LSD (0.05)	**0.7**	**0.6**	**0.8**	**-**	**0.8**	**0.8**	**0.8**	**-**	**0.3**

Table 3. Agronomic characteristics of MT1621 compared to commonly grown cultivars in Montana from the Advanced Yield Trial grown in a total of 15 locations in 2017 and 2018. For combined analysis over 2017 and 2018, the number of entries common in both years and used in the analysis was 31. Underlined values indicates that the value was not significantly different than the highest-yielding line in the experiment.

Line/Variety	Test weight (lb/bu)	Heading date (julian)	Plant height (inch)	Stem solidness (5-25) : Bozeman	Lodging (Conrad)
MT1621	**61.1**	**<u>170.5</u>**	**29.5**	**15.1**	**6.0**
REEDER	60.3	173.7	30.5	6.1	21.3
MCNEAL	59.1	174.7	30.5	7.0	21.7
CHOTEAU	60.1	172.9	28.5	<u>22.2</u>	7.5
VIDA	60.0	173.7	29.1	10.0	8.9
DUCLAIR	59.7	<u>170.6</u>	29.0	19.5	7.1
EGAN	58.8	174.0	29.3	6.9	20.0
LANNING	59.9	171.9	28.5	5.6	21.0
Mean (n=31)	**60.2**	**172.8**	**29.7**	**11.7**	**14.2**
Prob. (line)	**<0.001**	**<0.001**	**<0.001**	**<0.001**	**<0.001**
LSD (0.05)	**0.6**	**0.8**	**1.0**	**3.0**	**10.6**

Table 4. Grain yield (bu/ac) in the Preliminary Yield Trial in 2016 of MT1621 compared to check varieties.

Line / Variety	Bozeman	Moccasin	Havre	Sidney	Mean
MT1621	**<u>56.0</u>**	**<u>38.6</u>**	**<u>48.7</u>**	**43.6**	**<u>46.7</u>**
FORTUNA	45.1	33.7	37.9	36.4	38.3
MCNEAL	48.0	34.8	34.1	<u>46.6</u>	40.8
REEDER	<u>54.0</u>	<u>38.1</u>	40.3	<u>49.5</u>	<u>45.5</u>
CHOTEAU	48.2	34.9	35.9	<u>45.1</u>	41.0
VIDA	<u>58.5</u>	<u>37.7</u>	37.4	<u>47.6</u>	<u>45.3</u>
Mean (n=81)	**49.6**	**35.1**	**35.3**	**42.6**	**40.7**
Prob. (line)	**<0.001**	**<0.05**	**<0.001**	**<0.05**	**<0.001**
LSD(0.05)	**6.9**	**6.6**	**5.1**	**8.6**	**4.9**

Table 5. Agronomic data for MT1621 compared to checks from four dryland locations of the Preliminary Yield Trial in 2016.

Line / Variety	Test weight (lb/bu)	Grain protein (%)	Heading date (julian)	Plant height (inch)
MT1621	<u>**61.4**</u>	**14.3**	**173.9**	**27.6**
FORTUNA	60.7	14.5	175.3	<u>32.4</u>
MCNEAL	59.4	14.1	176.2	29.3
REEDER	<u>60.9</u>	14.3	176.1	28.2
CHOTEAU	59.9	14.7	175.2	26.1
VIDA	59.6	14.1	175.8	27.3
Mean (n=81)	**60.0**	**14.6**	**174.7**	**27.2**
Prob. (line)	**<0.001**	**<0.001**	**<0.001**	**<0.001**
LSD	**1.0**	**0.7**	**1.2**	**1.5**

Table 6. End-use quality of MT1621 compared to other popular varieties in 2016 and 2017.

Line / Variety	Flour Yield (%)	Flour Protein (%, 14% m.b.)	Mixing Tolerance	Mixo Mixing Time (min.)	Bake Mix Time (min.)	Loaf Volume (cc)	Bake Water Absorption (%)
2016 (Bozeman, Havre)							
MT1621	**69.9**	**13.9**	**4.0**	**5.9**	**13.1**	**1185**	**82.4**
FORTUNA	72.3	14.1	3.5	3.6	7.3	1188	76.4
MCNEAL	67.9	13.9	4.5	7.6	14.0	1228	80.2
REEDER	70.1	14.1	3.0	4.5	12.2	1093	79.1
CHOTEAU	70.3	14.7	3.0	5.0	10.3	1148	81.3
VIDA	71.6	13.8	2.0	3.9	11.2	1193	79.3
Mean (n=81)	**69.7**	**14.5**	**2.8**	**4.2**	**8.2**	**1144**	**78.5**
2017 (Bozeman, Havre, Conrad)							
MT1621	**70.6**	**14.3**	**3.7**	**5.2**	**10.5**	**1110**	**84.0**
FORTUNA	71.8	13.9	2.7	3.6	6.0	1130	77.9
MCNEAL	67.4	14.0	5.0	9.3	15.2	1268	82.7
REEDER	69.3	14.4	2.0	3.3	5.5	1160	78.8
CHOTEAU	69.9	14.6	2.0	4.0	6.7	1170	80.1
VIDA	72.3	13.6	2.7	4.9	8.6	1120	79.7
Mean (n=64)	**70.2**	**14.4**	**2.6**	**4.1**	**7.7**	**1103**	**79.0**

Table 7. Agronomic performance of MT1621 in the 2018 Spring Wheat Off-Station Nursery grown in 18 environments, including 13 dryland sites and five irrigated sites.

	HEADING DATE (Julian)			HEIGHT (Inches)			YIELD (bu/ac)			TEST WEIGHT (lb/bu)			GRAIN PROTEIN (%)		
\	DRY	IRRI	TOTAL	DRY	IRRI	TOTAL	DRY	IRRI	TOTAL	DRY	IRRI	TOTAL	DRY	IRRI	TOTAL
MT1621	**173.2**	**184.4**	**178.8**	**27.1**	**36.2**	**29.4**	**47.8**	**92.8**	**60.3**	**61.1**	**60.9**	**61.0**	**14.7**	**14.5**	**14.7**
FORTUNA	175.7	188.5	182.1	33.5	41.3	35.4	39.0	76.4	49.4	60.7	59.8	60.4	14.4	14.5	14.4
REEDER	176.2	189.5	182.8	27.6	38.0	30.2	43.3	86.4	55.3	60.3	61.2	60.6	14.7	14.6	14.7
CHOTEAU	174.7	187.0	180.8	26.4	35.0	28.5	46.2	89.4	58.2	60.3	59.8	60.2	14.8	14.3	14.7
VIDA	175.9	187.7	181.8	27.7	35.5	29.6	50.8	89.0	61.4	60.1	59.7	60.0	14.1	14.1	14.1
DUCLAIR	173.0	184.2	178.6	27.7	35.2	29.5	45.2	89.2	57.4	59.5	60.0	59.6	14.5	14.0	14.3
CORBIN	174.0	185.7	179.8	26.8	34.6	28.8	46.6	76.5	54.9	60.8	60.1	60.6	14.7	14.5	14.6
ONEAL	176.7	188.4	182.5	27.6	36.7	29.9	45.4	91.3	58.1	60.7	61.6	60.9	14.5	13.5	14.2
WB9879CLP	175.5	187.5	181.5	26.0	35.1	28.2	43.6	88.3	56.0	60.5	60.3	60.4	14.9	14.1	14.6
WB GUNNISON	174.0	186.5	180.3	26.6	34.5	28.6	45.5	88.4	57.4	60.7	61.5	60.9	14.0	13.7	13.9
BRENNAN	172.9	184.9	178.9	25.1	32.6	27.0	42.5	81.4	53.3	61.9	61.0	61.6	15.0	15.1	15.0
SY SOREN	174.0	186.5	180.3	25.5	32.7	27.3	44.5	83.9	55.5	60.9	61.6	61.1	15.2	14.8	15.1
EGAN	176.4	188.5	182.4	28.1	37.3	30.4	43.8	83.0	54.7	59.4	60.4	59.7	16.0	15.9	15.9
LANNING	174.9	187.8	181.3	27.0	35.5	29.1	47.3	88.7	58.8	59.1	60.8	59.6	14.8	14.9	14.8
NS PRESSER CLP	179.2	191.4	185.3	28.6	36.9	30.7	47.3	86.0	58.1	59.1	59.2	59.1	14.4	14.3	14.4
SY INGMAR	174.7	186.3	180.5	26.4	34.1	28.3	45.3	90.8	58.0	61.0	61.7	61.2	15.1	14.9	15.0
LCS PRO	174.3	187.0	180.7	30.6	38.3	32.6	47.0	83.3	57.1	60.2	60.9	60.4	14.5	14.3	14.4
ALUM	176.2	188.4	182.3	27.4	36.7	29.8	43.8	90.9	56.9	61.1	61.6	61.2	14.3	13.7	14.1
Mean(n=20)	**174.9**	**187.1**	**181**	**27.5**	**35.8**	**29.6**	**45.5**	**86.5**	**56.8**	**60.3**	**60.6**	**60.4**	**14.7**	**14.5**	**14.7**
Proba. (Line)	**<0.001**	**<0.001**	**<0.001**	**<0.001**	**<0.001**	**<0.001**	**<0.001**	**<0.01**	**<0.001**	**<0.001**	**<0.001**	**<0.001**	**<0.001**	**<0.001**	**<0.001**
LSD (0.05)	**1.6**	**2.4**	**1.2**	**0.9**	**1.5**	**0.8**	**3.5**	**8.6**	**3.5**	**0.7**	**0.9**	**0.6**	**0.4**	**0.6**	**0.3**
No. of environments	**2**	**2**	**4**	**12**	**4**	**16**	**13**	**5**	**18**	**13**	**5**	**18**	**12**	**5**	**17**