‘Ray’ Forage Winter Wheat

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Ray – a hard red winter wheat developed by the Montana Agricultural Experiment Station and available to certified seed growers in fall 2018. Ray is a late maturing, tall, awnless line developed for **forage** production as a possible replacement (or supplement to) Willow Creek (MT, 2005). Compared to Willow Creek, Ray has similar forage yield and forage quality, but superior seed yield (Table 1). Compared to conventional bread wheats; Ray has average to above average yield, below average test weight, and average protein (tables 2 and 3). Ray is resistant to stripe rust and susceptible to stem rust. Ray has low PPO and average milling and baking characteristics (Table 4). PVP, Title V will be applied for.

Table 1. Agronomic characteristics of Ray vs. a set of Winter Cereals Forage lines, 2014-2017.

Variety	Field Analysis					Forage Analysis (dry)				
	Grain yield	Test weight	Heading date		Plant height	Dry matter	Protein	ADF	NDF	TDN
	lb/a	lb/bu	Julian	Calendar	in	ton/a	%	%	%	%
location-years	9	9	15		16	20	6	6	6	5
Trical 102	2976	49.4	161.8	11-Jun	52.2	**4.04**	11.4	32.8	63.8	65.2
Ray	**3896**	**58.7**	164.5	14-Jun	35.6	3.45	11.2	31.5	60.7	66.7
MTF1435	3220	**59.0**	162.7	12-Jun	39.4	3.54	11.6	32.3	62.4	65.8
Willow Creek	2383	**59.7**	168.3	17-Jun	43.8	3.37	11.4	33.0	62.6	64.9
LSD (0.05)	**388**	**1.1**	**0.9**		**2.4**	**0.31**	**ns**	**ns**	**ns**	**ns**

bold = indicates highest value within a column

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

Table 2. Grain Yield of Ray vs. a set of varieties, 2017-2018[1/]

Variety	Districts							All Locations
	1	2	3	4	5	5	6- Sidney &	
	Kalispell	Bozeman	Huntley[2/]	Moccasin[3/]	Conrad[4/]	Havre[5/]	Williston	
location-years	1	1	11	9	9	6	2	39
Keldin	**101.3**	144.6	**90.3**	**63.5**	**69.8**	47.4	68.7	**73.3**
SY Monument	**84.1**	**136.7**	**85.0**	**64.3**	**66.7**	47.5	61.2	**70.3**
Northern	78.2	**147.8**	**83.6**	**59.6**	**65.8**	48.8	64.6	69.1
Yellowstone	**83.6**	**137.3**	81.9	**59.9**	**66.9**	48.1	59.8	68.5
FourOsix	**92.4**	134.4	82.0	**60.8**	64.7	45.0	57.4	67.8
SY Wolf	71.5	117.2	**83.9**	**62.1**	64.2	44.7	57.4	67.4
Ray	**97.2**	**138.5**	78.6	**61.2**	64.9	45.2	56.8	67.2
Decade	48.4	129.3	80.0	**61.3**	60.7	46.5	58.9	65.5
MTF1435	79.8	117.8	66.6	54.7	59.5	44.1	46.2	59.3
LSD (0.05)	**19.2**	**11.6**	**7.5**	**4.7**	**4.4**	**ns**	**ns**	**3.1**

bold = indicates highest value within a column

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

1/ = 2018 Intrastate and 2017-18 Off Station tests

2/ includes data from Billings, Fort Smith, Hardin area, Hysham, Molt, Rapelje

3/ includes data from Belt, Denton, Geraldine, Highwood, Winifred

5/ includes data from Choteau, Cut Bank, The Knees, Shelby

6/ includes data from Carter, Loma, Turner

Table 3. Agronomic characteristics of Ray vs. a set of varieties, 2017-2018[1/]

Variety	Test weight	Winter survival	Heading date		Plant height	Lodging	Protein	Saw fly cutting	Stripe rust	Coleoptile length
	lb/bu	%	Julian	Calendar	in	%	%	%	%	in
location-years	39	1	11		38	6	39	9	2	1
Decade	60.9	**69**	158.9	8-Jun	29.5	27	**13.0**	41	74	2.9
FourOsix	61.0	48	159.5	9-Jun	28.4	32	12.6	52	**6**	2.8
Keldin	61.5	**57**	160.1	9-Jun	29.2	37	12.4	48	41	2.8
MTF1435	59.7	45	162.7	12-Jun	36.3	46	12.7	44	**14**	**3.4**
Northern	60.7	49	162.3	11-Jun	29.2	34	**12.9**	46	**8**	2.6
Ray	58.6	44	163.9	13-Jun	34.2	46	12.6	49	**11**	2.9
SY Monument	60.4	**60**	157.5	7-Jun	28.0	30	11.8	47	**4**	3.1
SY Wolf	**62.1**	51	156.5	6-Jun	27.7	35	12.6	35	**21**	3.1
Yellowstone	60.1	**62**	162.0	11-Jun	30.5	34	12.5	52	-	2.7
LSD (0.05)	**0.4**	**12**	**0.9**		**0.7**	**ns**	**0.2**	**ns**	**23**	**0.2**

1/ = 2018 Intrastate and 2017-18 Off Station tests

bold = indicates highest value within a column

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

Table 4. Mill and bake characteristics of Ray vs. a set of varieties, 2014-2016:

Variety	PPO [1/]	Kernel hardness	Flour yield	Flour protein	Flour Ash	Mixograph tolerance	Mixograph mix time	Mixograph absorption	Baking mix time	Baking absorption	Baking volume
			%	%	%	(1-6)	min	%	min	%	cc
location-years	8	8	8	8	8	8	8	8	8	8	8
Decade	0.259	74.7	69.9	11.6	0.40	**4.5**	8.2	**65.8**	21.7	**76.0**	1038
MTF1435	**0.079**	81.0	**71.2**	11.5	0.41	3.6	5.3	63.5	8.6	73.2	1053
Ray	0.140	81.6	**71.9**	11.5	0.41	**4.1**	9.3	64.2	20.0	**75.1**	1041
Yellowstone	0.200	79.6	70.1	11.4	0.41	3.8	7.7	64.1	14.5	**74.9**	1069
LSD (0.05)	**0.051**	**2.7**	**0.7**	**ns**	**ns**	**0.5**	**2.1**	**1.5**	**4.5**	**1.7**	**ns**

[1/] low is best for noodles

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