

'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). To be sold by variety name only as a class of certified seed. Montana State University Research Fees due on seed sold. PVP, Title V is pending (Certificate# 201900058).

Table 1. Agronomic characteristics of Ray vs. a set of Winter Cereals Forage lines, 2014-2018.

Variety	Field Analysis					Forage Analysis (dry)				
	Yield	Test weight	Heading date		Plant height	Dry matter	Protein	ADF	NDF	TDN
	lb/a	lb/bu	Julian	Calendar	in	ton/a	%	%	%	%
location-years	12	12	18		21	25	6	6	6	5
MTF1435	3122	59.5	163.3	12-Jun	39.0	3.81	11.6	32.3	62.4	65.8
Ray	3867	59.1	165.0	14-Jun	35.4	3.60	11.2	31.5	60.7	66.7
Trical 102	3020	49.8	162.0	11-Jun	51.4	4.42	11.4	32.8	63.8	65.2
Willow Creek	2444	59.7	169.3	18-Jun	44.4	3.62	11.4	33.0	62.6	64.9
LSD (0.05)	316	0.9	1.1		2.0	0.36	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, 2017-2019^{1/}

Variety	Districts							All Locations
	1 Kalispell	2 Bozeman	3 Huntley ^{2/}	4 Moccasin ^{3/}	5 Conrad ^{4/}	5 Havre ^{5/}	6- Sidney & Williston	
location-years	2	2	16	14	13	10	4	61
Keldin	118.4	148.7	90.1	64.2	69.7	52.0	64.2	74.7
Northern	108.7	146.5	83.3	64.2	66.9	53.3	67.2	72.4
SY Monument	102.6	133.8	81.9	67.0	66.1	52.8	54.9	71.0
Yellowstone	105.8	139.9	81.3	62.2	66.5	52.3	62.1	70.5
FourOsix	110.8	131.5	81.0	62.8	64.6	50.7	59.0	69.6
Ray	114.3	138.7	77.6	59.4	64.5	50.1	57.7	68.0
Decade	81.7	128.4	80.5	63.9	61.0	51.2	58.5	67.9
LSD (0.05)	ns	9.3	5.6	3.9	4.0	ns	ns	2.4

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/ = 2018-19 Intrastate and 2017-19 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, 2017-2019^{1/}

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	61	3	19		59	9	61	16	2	1
Decade	60.9	58	162.0	11-Jun	30.2	21	12.9	40	74	2.9
FourOsix	60.9	46	162.7	12-Jun	28.7	23	12.5	56	6	2.8
Keldin	61.5	50	163.7	13-Jun	29.5	27	12.3	50	41	2.8
Northern	60.9	47	165.4	14-Jun	29.6	27	12.7	46	8	2.6
Ray	59.0	45	167.5	17-Jun	34.8	42	12.4	50	11	2.9
SY Monument	60.3	53	161.0	10-Jun	28.2	23	11.8	49	4	3.1
Yellowstone	60.3	54	164.9	14-Jun	31.1	25	12.4	55	-	2.7
LSD (0.05)	0.3	ns	0.6		0.5	12	0.1	8	23	0.2

1/ = 2018-19 Intrastate and 2017-19 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, 2018:

Variety	PPO ^{1/}	Kernel hardness	Flour			Mixograph			Baking		
			yield %	protein %	Ash %	tolerance (1-6)	mix time min	absorption %	mix time min	absorption %	volume cc
location-years	12	8	12	12	12	12	12	12	12	12	12
Decade	0.257	74.7	70.5	11.9	0.40	3.9	7.3	67.0	19.0	77.1	1052
Ray	0.136	81.6	72.3	11.8	0.42	3.8	9.4	65.6	20.4	76.3	1052
Yellowstone	0.215	79.6	70.5	11.7	0.41	3.8	7.5	65.5	13.7	76.0	1077
LSD (0.05)	0.032	2.7	0.6	ns	0.01	ns	1.7	1.1	3.9	ns	ns

^{1/} low is best for noodles