

MSU/MAES Hollow-Stemmed Winter Wheat Varieties

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Description of selected varieties developed by MSU/MAES Winter Wheat Breeding Program:

Flathead - a hard red winter wheat developed by the Montana Agricultural Experiment Station and available to certified seed growers in fall 2019. Flathead is derived from a composite of 2 crosses involving Yellowstone and a Washing State University line, PI 640431, that carries 2 stripe rust seedling resistance genes. Flathead is an early maturing (especially for a Montana line), hollow-stemmed, medium height wheat with white chaff (Table 2). Flathead has average yield, above average test weight, and average protein, with average winter survival. Flathead out-yields other early maturing varieties, such as Brawl CI Plus (Table 1). Flathead has excellent resistance to stripe rust and is moderately resistant to both stem rust and dwarf bunt. Flathead has medium PPO and above average milling and baking characteristics (Table 3). 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 has been issued (Certificate# 202000202).

FourOsix - a hard red winter wheat developed by the Montana Agricultural Experiment Station and available to seed growers in fall 2018. FourOsix is a medium maturing, short to medium statured wheat, with average winter-hardiness. FourOsix is a high yielding variety with above average test weight and average protein. FourOsix (50% Yellowstone, in pedigree) is similar in grain yield of Yellowstone, but with significantly earlier heading, shorter plant height, and significantly higher test weight and protein. FourOsix is resistant to stripe rust and this resistance is either similar or significantly higher than that of Yellowstone. FourOsix is moderately susceptible to stem rust. FourOsix has excellent milling and baking qualities, comparable to Decade and parental cultivar, Yellowstone. PVP, Title V has been issued (Certificate# 201900053).

Northern is a hard red winter wheat developed by the Montana Agricultural Experiment Station and released to growers in 2015. Northern was named to commemorate the 100th anniversary of the Northern Agricultural Research Center (NARC) in Havre, Montana. Northern is a medium-late maturing, medium-short statured wheat, with white chaff. Northern has average yield (similar to Yellowstone and Colter), average test weight, and average protein. Northern is resistant to both stem and stripe rust. Northern has above average milling and average baking properties (Table 3.) Northern is a low PPO cultivar with favorable Asian noodle color stability and noodle score. PVP, Title V has been issued (Certificate# 201600092).

SY Clearstone 2CL – a 2-gene CLEARFIELD hard red winter wheat developed by Montana Agricultural Experiment Station in 2012 and licensed exclusively to Syngenta Seeds. SY Clearstone wheat 2CL is very similar to Yellowstone. It is a medium maturing, medium tall, white chaffed wheat with average winter hardiness. It is a high yielding wheat with average test weight and protein. SY Clearstone 2CL is resistant to stripe rust and has moderate resistance to stem rust, the latter an improvement over Yellowstone. SY Clearstone 2CL is a medium PPO variety with average mill and above average bake properties. PVP, Title V has been issued (Certificate# 201300357). Additionally, the CLEARFIELD genes are patented.

Yellowstone – hard red winter wheat developed by the Montana Agricultural Experiment Station and released to seed growers in 2005. Yellowstone is a very high yielding winter hardy variety with medium test weight, maturity, height, and grain protein. Yellowstone has excellent baking and good Asian noodle quality. It is moderately resistant to TCK smut and resistant to stripe rust, but susceptible to stem rust. Yellowstone has been the leading winter wheat variety planted in Montana since 2012. PVP, Title V has been issued (Certificate #200600284).

Table 1. Yield of Hollow-Stemmed Winter Wheat varieties, 2018-2021^{1/}

Variety	Shaded entries, in all tables, are MSU/MAES developed varieties							All Locations
	Districts							
	1	2	3	4	5	5	6- Sidney & Williston	
location-years	Kalispell	Bozeman	Huntley ^{2/}	Moccasin ^{3/}	Conrad ^{4/}	Havre ^{5/}	Williston	
	5	4	22	16	11	16	8	82
Keldin	136.4	116.5	84.7	59.0	67.2	51.4	54.9	72.6
Northern	129.5	115.3	77.2	60.5	69.3	51.2	57.7	71.0
Yellowstone	131.9	109.5	73.3	56.6	66.6	49.9	56.1	68.2
FourOsix	128.9	107.2	74.8	58.4	65.7	48.6	52.2	67.9
SY Clearstone 2CL	132.6	110.0	73.8	58.2	65.0	48.8	51.7	67.9
Flathead	134.6	104.0	74.5	54.0	62.6	47.7	48.9	66.3
Brawl CL Plus	112.0	96.3	72.8	53.6	62.7	47.2	40.2	63.1
LSD (0.05)	10.1	10.8	4.5	4.2	ns	ns	6.5	2.1

bold = indicates highest value within a column

ns = non-significant

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

1/ = 2018-2021 Intrastate and 2018-2021 Off Station tests

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

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

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

5/ includes data from Ft. Benton, Loma, Turner

Table 2. Agronomic characteristics of Hollow-Stemmed Varieties, 2018-2021^{1/}

Variety	Test	Winter	Heading date		Plant	Lodging	Protein	Saw fly	Stripe	Coleoptile
	weight lb/bu	survival %	Julian	Calendar	height in	%	%	cutting %	rust %	length in
location-years	81	7	31		77	6	80	22	2	1
Brawl CL Plus	61.8	55	158.0	7-Jun	27.9	12	13.6	28	70	2.8
Flathead	61.0	69	159.8	9-Jun	28.8	13	13.0	40	3	2.6
FourOsix	60.4	60	163.6	13-Jun	28.6	9	13.0	48	6	2.8
Keldin	60.9	52	164.5	14-Jun	29.1	11	12.8	43	41	2.8
Northern	60.5	66	166.0	15-Jun	29.4	17	13.2	38	8	2.6
SY Clearstone 2CL	59.8	67	165.1	14-Jun	31.6	29	13.0	50	16	2.9
Yellowstone	59.8	70	165.4	14-Jun	30.7	20	12.9	48	-	2.7
LSD (0.05)	0.2	12	0.5		0.5	13	0.2	6	18	0.2

1/ = 2018-2021 Intrastate and 2018-2021 Off Station tests

ns = non-significant

bold = indicates highest value within a column

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Table 3. Mill and bake characteristics of Hollow-stemmed Varieties, 2018-2020

Variety	PPO ^{1/}	Kernel	Flour			Mixograph			Baking		
		hardness	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
Brawl CL Plus	0.254	68.8	71.1	12.3	0.39	2.6	4.1	65.9	7.7	76.0	1050
Flathead	0.231	71.7	72.9	12.2	0.41	3.8	8.6	67.3	18.1	77.9	1058
FourOsix	0.233	73.1	71.8	12.3	0.41	2.8	5.2	66.5	11.3	76.4	1111
Keldin	0.274	65.8	70.4	12.0	0.43	2.9	4.6	64.8	8.6	75.1	1024
Northern	0.108	80.7	71.3	12.2	0.45	3.0	3.4	64.0	5.3	73.7	1082
SY Clearstone 2CL	0.246	75.1	69.6	11.8	0.41	3.4	5.4	64.7	8.9	74.6	1065
Yellowstone	0.226	76.0	70.3	12.1	0.42	3.5	7.4	67.0	13.9	77.3	1075
LSD (0.05)	0.022	3.0	1.1	ns	0.01	0.6	0.9	1.6	1.9	1.6	33

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/ polyphenol oxidase, low is best for noodles