

2020 Oat Field Crop Trials Results

Minnesota Agricultural Experiment Station and the College of Food, Agricultural and Natural Resource Sciences

This past growing season was good for oat growth and resulted in higher yield averages for the state. Uniform replicated trials tested across Minnesota included Lamberton, Le Center, Rochester, Morris and Waseca in Southern Minnesota (south of I-94). Kimball has been discontinued as a Southern location and was replaced with Becker. In Northern Minnesota (north of I-94) trials were conducted in Crookston, Fergus Falls, Roseau and Stephen. In addition, entries

were evaluated for disease resistance to crown rust, barley yellow dwarf virus (BYDV), and smut in specific inoculated nurseries. Damage from wildlife caused yield trials near Morris to be abandoned, while extreme drought eliminated Becker.

The newest varieties available this year are Esker 2020 and Rushmore. Esker 2020 has improved crown rust resistance and maturity similar to Deon. Rushmore also has improved



Table 1. Origin and agronomic characteristics of oat varieties in Minnesota in multiple-year comparisons (2018-2020).

Entry	Origin	Year of Release	Legal Status	Seed Color	Days to Heading (days)	Plant Height (inches)	Straw Strength ⁵ (1-9)	Test Weight (lbs/bu)	Grain Protein ^{6,7} (%)	Grain Oil ^{6,7} (%)	Grain Beta-glucan ^{6,7} (%)
Antigo	WI	2017	Pending	Yellow	53.4	34.0	3.0	37.7	19.4	6.9	6.0
Badger	WI	2010	PVP(94)	Yellow	52.8	35.7	3.3	33.8	16.9	6.2	5.3
CS Camden ¹	Meridian Seeds	2013	PVP(94)	Yellow	59.2	36.4	3.0	32.7	—	—	—
Deon	MN	2014	PVP(94)	Yellow	56.9	35.7	3.3	35.1	16.1	6.6	5.5
Esker ²	WI	2006	PVP(94)	White	53.9	34.1	2.6	34.8	17.2	5.8	5.6
Esker 2020 ²	WI	2020	Pending	Yellow	55.1	34.3	3.0	33.5	16.8	5.6	6.1
Hayden	SD	2015	PVP(94)	White	57.0	36.8	4.1	36.1	15.1	7.2	5.7
MN Pearl	MN	2018	Pending	White	57.4	38.5	3.0	35.4	14.5	7.2	5.2
ND Heart ³	ND	2020	NA	White	56.7	37.1	3.4	35.0	—	—	—
Newburg	ND	2011	PVP(94)	White	58.1	38.5	4.6	34.0	15.8	6.7	6.7
Reins	IL	2016	PVP(94)	White	53.7	32.6	1.7	36.1	16.6	6.0	5.5
Rushmore ²	SD	2020	Pending	White	58.5	37.0	3.7	35.0	15.6	7.9	5.8
Rockford ²	ND	2008	PVP(94)	White	55.2	34.3	2.7	36.4	16.7	5.8	5.5
Saber	IL	2010	PVP(94)	Yellow	53.5	33.5	3.0	34.6	16.4	5.5	5.8
Saddle	SD	2018	Pending	White	52.9	34.0	1.6	36.0	16.6	6.1	5.2
Shelby 427	SD	2011	PVP(94)	White	54.1	36.0	3.7	36.3	15.9	6.9	5.2
Streaker ⁴	SD	2016	PVP(94)	Hullless	55.0	34.5	4.6	41.6	16.7	6.9	5.8
Sumo	SD	2017	Pending	White	52.3	34.4	2.7	36.5	18.2	5.6	5.3
Warrior ²	SD	2019	Pending	White	55.7	32.2	1.7	35.2	16.6	6.2	5.2

¹Line tested in 2018 and 2020; developed by Lantmannen Seed in Sweden.

²Line tested in 2019 and 2020.

³Line tested in 2020 only.

⁴Hullless oat.

⁵1-9 scale where 1 = most resistant and 9 = most susceptible.

⁶12% grain moisture.

⁷Trait measured in 2019 for three locations.

crown rust resistance, maturity later than Deon and has a white husk. Yield performance from single years should be viewed cautiously as environmental variability may significantly affect the yields in single locations or years. The results of the variety evaluations are summarized in Tables 1 to 5. Based on yield data from this year, MN-Pearl, Hayden and Rushmore are recommend for both northern and southern regions of Minnesota. In general, earlier maturing varieties perform better in Southern Minnesota so flowering can occur during cooler periods. In these locations, a variety maturing similar to Sumo or Saddle may be a good choice. In Northern locations varieties that mature later such as Hayden or Deon may be prudent.

Crown rust continues to be a major limiting factor to oat production in Minnesota that must be managed to achieve optimal yield. Buckthorn (*Rhamnus cathartica*), the alternate host of crown rust is widespread in Minnesota, allowing a persistent and particularly aggressive pathogen population. Rust in all yield trials

was managed through treatment with a propiconazole-based fungicide when the flag leaf was fully extended (Feekes 9) to evaluate the yield potential without disease infection. Crown rust and other disease resistance ratings are listed in Table 2. All disease scores were converted to a “1-9” scale. Where “1” is very resistant and “9” is very susceptible. Crown rust resistance was evaluated in the Buckthorn Nursery in St. Paul by the USDA-ARS using an exceptionally aggressive crown rust population. The most economical way of controlling crown rust is through resistant varieties; however, application of fungicide to a variety with rating of “4” or greater is prudent if crown rust is present in the lower canopy at Feekes 9. Deon and Warrior are the best varieties for crown rust resistance.

Other important diseases include BYDV and smut which were evaluated in inoculated nurseries at the University of Illinois and the University of Minnesota, respectively. Varieties susceptible to BYDV (rating > 3) should be selected with

caution particularly in the Southern Minnesota, where aphid disease transmitters are more common early in the season. A seed treatment and certified seed should be used to manage smut. Disease resistance may be a driving factor if pesticides are not economical or if the intended production system is organic.

The origin and agronomic characteristics of oat varieties tested are listed in Table 1. The U.S. Plant Variety Protection Act (PVP) status is also listed. PVP(94) notation indicates that seed of that variety may not be sold by a grower without the permission of the variety’s owner. If the PVP is pending, consider the variety as having PVP(94) protection. Maturity, height and test weight data are presented as statewide averages from 2018-2020 except where noted. Lodging data is also a statewide average from the same period, but only from locations where lodging was present. Maturity, height and lodging are important considerations for variety selection based on the intended location and expected end use of the crop.

For grain production, lodging and grain quality traits should be considered when choosing a variety (Table 1). For the human food market, oat varieties with high protein and low oil may be desirable. High test weight may carry equal consideration to yield if the crop is intended for food or feed market. Hull color may also need to be considered. Contact your local elevator or buyer to determine whether processors have preferred or (recommended) varieties for milling.

The regional yield performance evaluation in 2020 and 3-year averages are listed in Table 3. While Table 4 and 5 contain this year and 3-year averages for each location. To standardize the data across locations the yield is expressed as percent of the trial mean. MN-Pearl continues to

Table 2. Disease characteristics of oat varieties.

Entry	Crown Rust ¹ (1-9)	Loose Smut ² (1-9)	BYDV ³ (1-9)
Antigo	4	2	7
Badger	6	1	5
CS Camden	5	2	6
Deon	3	1	4
Esker	5	1	5
Esker 2020	4	1	6
Hayden	5	1	3
MN Pearl	5	1	6
ND Heart	5	—	6
Newburg	5	3	3
Reins	6	1	6
Rockford	6	2	3
Rushmore	4	1	4
Saber	5	4	6
Saddle	4	1	5
Shelby 427	5	1	6
Streaker	5	1	3
Sumo	4	1	7
Warrior	3	1	6

¹Tested in 2018, 2019 and 2020 with a mixed race population of crown rust; 1 = most resistant and 9 = most susceptible.

²Tested in 2018 and 2019; 1 = most resistant and 9 = most susceptible.

³Tested in 2015, 2016 and 2018; 1 = most resistant and 9 = most susceptible.

Table 3. Relative grain yield of oat varieties in Minnesota in single-year (2020) and multiple-year comparisons (2018-2020).

Entry	Northern Minnesota			Southern Minnesota			Statewide		
	2020	2 Yr	3 Yr	2020	2 Yr	3 Yr	2020	2 Yr	3 Yr
----- % of mean -----									
Antigo	87	90	92	94	101	102	91	96	97
Badger	88	94	95	94	93	95	91	94	95
CS Camden ¹	111	—	—	99	—	—	104	—	—
Deon	106	105	108	108	111	110	107	109	109
Esker ²	91	96	—	100	97	—	96	97	—
Esker 2020 ²	99	100	—	101	105	—	100	103	—
Hayden	115	111	113	108	104	103	111	107	108
MN Pearl	116	114	118	114	117	119	115	116	118
ND Heart ³	101	—	—	95	—	—	98	—	—
Newburg	107	106	104	99	98	98	103	101	101
Reins	102	99	101	99	100	102	100	100	101
Rockford ²	110	108	—	98	87	—	103	96	—
Rushmore ²	118	114	—	112	115	—	115	115	—
Saber	104	106	107	107	104	103	106	105	105
Saddle	97	99	101	96	104	105	96	102	103
Shelby 427	97	95	98	97	97	96	97	96	97
Streaker ⁴	80	83	83	76	71	70	78	76	76
Sumo	75	76	82	94	94	96	85	86	89
Warrior ²	108	103	—	102	102	—	105	102	—
Mean (Bu/Acre)	142	128	132	127	121	116	134	124	123
LSD (0.05)⁶	20.0	15.1	12.8	15.9	12.3	10.7	12.6	9.8	8.4
# of Environments	4	7	11	5	10	14	9	17	25

¹Data presented from 2020, see previous years' reports for additional data.

²Line was tested in 2019 and 2020 only.

³Line was tested in 2020 only.

⁴Hulless oat.

be the top yielding line in statewide averages for 2020 and in multi-year comparisons. However, Rushmore and Hayden surpassed MN-Pearl in yield in some locations this year.

Authors and Researchers

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Oat

Planting Rate and Date

Bushel Weight, Pounds.....	32
Seeds/Pound.....	16,200
Planting Rate, Pounds/Acre.....	80
Planting Rate, Seeds/Sq. Ft.....	28
Planting Date.....	Early Spring

Table 4. Relative grain yield of oat varieties in Northern Minnesota locations in single-year (2020) and multiple-year comparisons (2018-2020).

Entry	Crookston		Fergus Falls ⁵		Roseau		Stephen	
	2020	3 Yr	2020	3 Yr	2020	3 Yr	2020	3 Yr
	----- % of mean -----							
Antigo	100	102	89	96	65	88	85	85
Badger	93	102	86	84	90	98	82	91
CS Camden ¹	116	—	110	—	99	—	113	—
Deon	105	100	90	100	116	114	113	115
Esker ²	102	—	86	—	86	—	85	—
Esker 2020 ²	107	—	83	—	105	—	101	—
Hayden	119	121	111	115	123	109	106	108
MN Pearl	111	110	120	126	112	120	116	118
ND Heart ³	96	—	102	—	98	—	107	—
Newburg	99	101	122	122	84	91	113	106
Reins	98	96	101	92	106	104	101	108
Rockford ²	96	—	129	—	115	—	100	—
Rushmore ²	113	—	115	—	117	—	125	—
Saber	112	114	90	100	106	105	106	105
Saddle	89	99	93	91	100	106	105	105
Shelby 427	98	102	95	95	99	98	94	95
Streaker ⁴	75	84	101	101	72	75	68	75
Sumo	75	69	61	76	84	92	81	90
Warrior ²	97	—	116	—	121	—	99	—
Mean (Bu/Acre)	165	132	146	143	101	118	155	138
LSD (0.05)⁶	26.9	18.6	37.8	33.0	34.8	24.6	25.9	20.2

¹Data presented from 2020, see previous years' reports for additional data.

²Line was tested in 2019 and 2020 only.

³Line was tested in 2020 only.

⁴Hulless oat.

⁵Location was tested in 2018 and 2020.

⁶A large LSD suggests large variability from year to year for the specific location.

Table 5. Relative grain yield of oat varieties in Southern Minnesota locations in single-year (2020) and multiple-year comparisons (2018-2020).

Entry	Kimball ³	Lamberton		Le Center		Rochester ⁶		St. Paul ⁷	Waseca	
	3 Yr	2020	3 Yr	2020	3 Yr	2020	2 Yr	2020	2020	3 Yr
	----- % of mean -----									
Antigo	108	106	106	99	97	101	107	85	82	100
Badger	100	99	90	99	98	99	94	73	103	104
CS Camden ¹	—	92	—	100	—	92	—	101	108	—
Deon	94	113	129	104	105	109	110	111	108	114
Esker ²	—	105	—	96	—	97	105	102	103	—
Esker 2020 ²	—	112	—	97	—	94	103	102	104	—
Hayden	92	87	99	113	108	113	107	120	109	97
MN Pearl	98	116	133	101	117	109	110	130	119	131
ND Heart ³	—	106	—	98	—	91	—	92	88	—
Newburg	97	94	105	102	101	96	94	102	104	87
Reins	117	105	86	91	97	95	107	103	107	111
Rockford ²	—	87	—	108	—	100	90	89	104	—
Rushmore ²	—	120	—	118	—	113	113	100	110	—
Saber	101	84	89	118	112	117	115	113	100	93
Saddle	117	95	99	100	108	102	103	98	82	103
Shelby 427	98	74	87	107	102	100	98	105	97	89
Streaker ⁴	75	66	70	83	66	72	67	79	79	73
Sumo	104	113	106	81	89	103	94	81	96	97
Warrior ²	—	125	—	83	—	96	82	115	96	—
Mean (Bu/Acre)	128	118	105	133	146	137	126	126	121	79
LSD (0.05)⁸	36.1	19.7	20.1	28.8	20.9	23.6	26.8	11.7	15.7	20.3

¹Data presented from 2020, see previous years' reports for additional data.

²Line was tested in 2019 and 2020 only.

³Line was tested in 2020 only.

⁴Hulless oat.

⁵Location was tested in 2018 and 2019.

⁶Location was tested in 2019 and 2020.

⁷Location was tested in 2020 only.

⁸A large LSD suggests large variability from year to year for the specific location.