

2019 Oats Field Crop Trials Results

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

This past growing season was both wet and cool, which caused delayed oat growth. Uniform replicated trials tested across Minnesota included Lambertson, Le Center, Kimball, Rochester, Morris and Waseca in Southern Minnesota (south of I-94). 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. Dam-

age from multiple storm events caused yield trials near Fergus Falls to be abandoned. The results of the variety evaluations are summarized in Tables 1 to 5. The greatest challenges in oat production and performance evaluation continue to be lodging and crown rust. All yield performance trials were treated with a propiconazole based fungicide when the flag leaf was fully extended (Feekes 9) to evaluate the yield potential without disease infection.

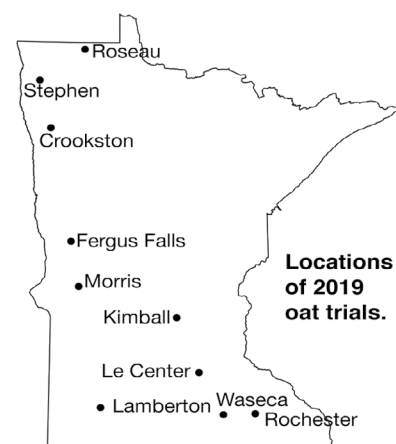


Table 1. Origin and agronomic characteristics of oat varieties in Minnesota in multiple-year comparisons (2017-2019).

Variety	Origin	Year of Release	PVP Status	Seed Color	Days to Heading (days)	Plant Height (inches)	Straw Strength ⁴ (1-9)	Test Weight (lbs/bu)	Grain Protein ^{5,6} (%)	Grain Oil ^{5,6} (%)
Antigo	WI	2017	Pending	Yellow	54.4	35.6	5.4	38.3	14.4	5.0
Badger	WI	2010	PVP(94)	Yellow	54.2	33.5	5.1	34.5	13.3	4.1
Deon	MN	2014	PVP(94)	Yellow	58.7	39.0	6	35.5	12.8	4.6
Esker ¹	WI	2006	PVP(94)	White	58.6	36.2	4.1	35.2	14.2	4.4
Esker 2020 ²	WI	2020	Pending	Yellow	57.4	35.1	4.6	33.3	—	—
Hayden	SD	2015	PVP(94)	White	59.2	39.4	7.9	36.8	12.8	5.3
Horsepower	SD	2012	PVP(94)	White	56.7	34.1	7.6	35.4	12.9	4.7
MN-Pearl	MN	2018	Pending	White	59.7	40.8	5.4	35.5	12.6	6.0
Newburg	ND	2011	PVP(94)	White	59.8	43.3	8.6	34.4	12.5	5.0
Reins	IL	2016	PVP(94)	White	55.1	32.0	2.6	37.1	14.2	4.1
Rockford ¹	ND	2008	PVP(94)	White	63.0	40.8	6.4	36.2	13.3	6.0
Saber	IL	2010	PVP(94)	Yellow	54.8	34.3	5.8	35.8	14.4	4.1
Saddle	SD	2018	Pending	White	54.1	35.3	2.5	35.9	14.4	4.1
Shelby 427	SD	2011	PVP(94)	White	56.1	38.4	6.7	37.2	13.5	5.2
Streaker ³	SD	2016	PVP(94)	Hulless	56.7	39.0	7.8	44.3	17.6	6.6
Sumo	SD	2017	Pending	White	53.6	36.3	4.3	36.6	15.0	3.8
Warrior ²	SD	2019	Pending	White	57.5	33.9	4.2	35.1	—	—

¹Line tested in 2017 and 2019.

²Line tested in 2019 only.

³Hulless oat.

⁴1 = resistant and 9 = susceptible.

⁵Whole grain NIRS.

⁶Trait measured in 2017 and 2018.

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 2017-2019 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. 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 Reins may be a good choice. In Northern locations varieties that mature later such as Hayden or Deon may be prudent.

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 taken into account. Contact your local elevator or buyer to determine whether processors have preferred (or recommended) varieties for milling.

Crown rust and other disease resistance ratings are listed in Table 2. All

disease scores were converted to a "0-9" scale. Where "0" = very resistant and "9" = very susceptible. Crown rust continues to be a major limiting factor to oat production in Minnesota that must be managed to achieve optimal yield. Buckthorn, the alternate host of crown rust is widespread in Minnesota, allowing the pathogen population to be present annually and particularly aggressive. Crown rust resistance was evaluated in the Buckthorn Nursery in St. Paul by the USDA-ARS, and represents an exceptionally aggressive crown rust population. The most economical way of controlling crown rust is the use of a resistant variety. 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 continues to be one of the best varieties for crown rust resistance. In addition, the new variety Warrior also shows good resistance, however it has only been tested one year. Crown rust is a rapidly evolving disease; the rust ratings taken this year compared to last year's numbers are the same indicating that the pathogen has not overcome current genetics. 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 (>3) should be selected with caution particularly in the Southern Minnesota, where infected aphids are more common early in the season. A seed treatment and certified seed should be utilized to manage smut. Disease resistance may be a driving factor if pesticides are not economical or intended production is an organic system.

The regional yield performance evaluation in 2019 and 3-year averages are listed in Table 3. In addition, the statewide averages are listed. Table 4 and 5 contain the year and 3-year averages for each location. To standardize

Table 2. Disease characteristics of oat varieties.

Variety	Crown Rust ⁹ (0-9)	Loose Smut ¹⁰ (0-9)	BYDV ¹¹ (0-9)
Antigo ¹	4	4	8
Badger ²	8	0	5
Deon ²	3	0	4
Esker ³	6	2	6
Esker 2020 ⁴	3	0	7
Hayden ²	8	0	3
Horsepower ²	9	4	8
MN-Pearl ⁵	7	0	7
Newburg ⁵	7	7	4
Reins ⁶	9	1	8
Rockford ³	9	4	3
Saber ²	8	8	7
Saddle ¹	5	2	5
Shelby 427 ²	8	1	8
Streaker ⁷	7	0	3
Sumo ⁷	5	0	9
Warrior ⁸	2	1	—

¹Line tested in 2017, 2018, and 2019 for Crown Rust and Smut, Line tested in 2016 for BYDV.

²Line tested in 2017, 2018, and 2019 for Crown Rust and Smut; Line tested in 2015 for BYDV.

³Line tested in 2017 and 2019 for Crown Rust and Smut; Line tested in 2015 for BYDV.

⁴Line tested in 2019 for Crown Rust and Smut; Line tested in 2015 and 2016 for BYDV.

⁵Line tested in 2017, 2018, and 2019 for Crown Rust and Smut; Line tested in 2015 and 2016 for BYDV.

⁶Line tested in 2017, 2018, and 2019 for Crown Rust and Smut; Line tested in 2015 and 2018 for BYDV.

⁷Line tested in 2017, 2018, and 2019 for Crown Rust and Smut; Line tested in 2018 for BYDV.

⁸Line tested in 2019 for Crown Rust and Smut; Line not tested for BYDV.

⁹Tested in 2017, 2018, and 2019 with a mixed race population of crown rust, 0 = most resistant, 9 = most susceptible.

¹⁰Tested in 2017, 2018, and 2019; 0 = most resistant, 9 = most susceptible.

¹¹Tested in 2015, 2016, and 2018; 0 = most resistant, 9 = most susceptible.

the data across locations the yield is expressed as percent of the trial mean. MN-Pearl continues to be the top yielding line in statewide averages for 2019 and in multi-year comparisons. However, Deon and Horsepower surpassed MN-Pearl in yield in some locations.

The two newest varieties this year are Warrior and Esker 2020. Warrior has good crown rust resistance, maturity similar to Deon and high lodging resistance, whereas Esker 2020 has increase yield in the southern region and crown rust resistance. In general, yield performance from single years should be viewed cautiously as environmental variability may significantly affect the yields in single locations or years. From this year's trials MN-Pearl, Deon and Horsepower are recommend in northern Minnesota and MN-Pearl, Saddle, Antigo, Esker 2020 and Deon in southern Minnesota.

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 3. Relative grain yield of oat varieties in Minnesota in single-year (2019) and multiple-year comparisons (2017-2019).

Variety	North		South		State	
	2019	3 Yr	2019	3 Yr	2019	3 Yr
Antigo	94	92	108	107	103	101
Badger	100	100	96	100	97	100
Deon	107	109	107	108	107	108
Esker ¹	107	102	97	99	100	99
Esker 2020 ²	101	—	112	—	109	—
Hayden	106	111	104	102	105	106
Horsepower	111	109	100	95	104	102
MN-Pearl	112	113	123	123	119	119
Newburg	101	101	96	97	98	98
Reins	95	98	105	107	102	103
Rockford ¹	107	103	74	79	85	88
Saber	107	104	102	106	104	105
Saddle	103	104	113	116	110	111
Shelby 427	89	96	101	95	97	96
Streaker ³	88	79	68	69	74	73
Sumo	76	79	89	93	84	87
Warrior ²	93	—	106	—	102	—
Mean (Bu/Acre)	111	138	115	103	114	116
LSD (0.1)	18	11	16	10	13	8

¹Line tested in 2017 and 2019.

²Line tested in 2019 only.

³Hulless oat.

Table 4. Relative grain yield of oat varieties in Northern Minnesota locations in single-year (2019) and multiple-year comparisons (2017-2019).

Variety	Crookston		Roseau		Stephen		Northern Minnesota	
	2019	3 Yr	2019	3 Yr	2019	3 Yr	2019	3 Yr
Antigo	98	95	101	92	82	89	94	92
Badger	97	101	99	100	107	99	100	100
Deon	98	97	113	114	116	112	107	109
Esker ¹	115	122	100	89	100	99	107	102
Esker 2020 ²	112	—	100	—	86	—	101	—
Hayden	110	115	94	108	112	110	106	111
Horsepower	115	112	109	113	108	104	111	109
MN-Pearl	113	106	113	121	112	110	112	113
Newburg	94	96	99	97	111	109	101	101
Reins	88	94	97	99	104	102	95	98
Rockford ¹	107	112	103	98	110	102	107	103
Saber	115	108	96	104	106	102	107	104
Saddle	105	101	101	104	104	107	103	104
Shelby 427	101	100	86	95	74	94	89	96
Streaker ³	81	84	103	75	86	79	88	79
Sumo	55	67	99	86	86	82	76	79
Warrior ²	97	—	88	—	93	—	93	—
Mean (Bu/Acre)	148	117	87	150	98	146	111	138
LSD (0.1)	33	16	15	22	15	19	18	11

¹Line tested in 2017 and 2019.

²Line tested in 2019 only.

³Hulless oat.

Table 5. Relative grain yield of oat varieties in Southern Minnesota locations in single-year (2019) and multiple-year comparisons (2017-2019).

Variety	Kimball		Lamberton		Le Center		Morris ⁴		Rochester ⁴		Waseca		Southern Minnesota	
	2019	3 Yr	2019	3 Yr	2019	3 Yr	2019	3 Yr	2019	3 Yr	2019	3 Yr	2019	3 Yr
Antigo	110	115	106	100	100	102	93	93	117	129	129	119	108	107
Badger	95	104	76	88	95	107	100	101	93	92	113	106	96	100
Deon	72	80	156	136	102	111	100	104	104	96	144	115	107	108
Esker ¹	99	94	80	97	83	64	98	98	122	129	98	134	97	99
Esker 2020 ²	107	—	107	—	119	—	106	—	116	—	115	—	112	—
Hayden	104	97	97	109	105	104	109	109	111	90	84	91	104	102
Horsepower	125	109	60	87	103	99	107	110	94	83	75	71	100	95
MN-Pearl	121	119	150	129	127	131	118	106	109	119	137	136	123	123
Newburg	88	86	113	108	100	107	106	105	88	79	79	77	96	97
Reins	117	124	74	82	103	112	84	90	129	129	114	118	105	107
Rockford ¹	66	65	80	94	78	67	90	98	85	67	43	74	74	79
Saber	104	106	78	100	109	116	103	110	112	100	86	94	102	106
Saddle	107	117	108	105	119	121	108	108	108	135	127	122	113	116
Shelby 427	111	106	92	92	107	100	105	103	107	89	80	82	101	95
Streaker ³	86	79	74	78	57	54	70	78	54	50	62	67	68	69
Sumo	76	91	115	94	95	86	81	88	81	111	95	96	89	93
Warrior ²	110	—	135	—	99	—	121	—	70	—	118	—	106	—
Mean (Bu/Acre)	148	95	77	113	155	133	129	127	113	86	71	70	115	103
LSD (0.1)	45	25	15	17	24	18	23	16	23	34	13	12	16	10

¹Line tested in 2017 and 2019.²Line tested in 2019 only.³Hulless oat.⁴Location evaluated in 2017 and 2019.