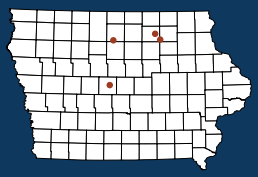
PRACTICAL FARMERS OF IOWA
COOPERATORS' PROGRAM Farmer-Led Research

RESEARCH REPORT

Oat Variety Trial 2018



2018

Staff Contact

Stefan Gailans - (515) 232-5661
stefan@practicalfarmers.org
Sarah Carlson - (515) 232-5661
sarah@practicalfarmers.org

In a Nutshell:

- Proper variety selection and timely management are necessary to raise a profitable oat crop.
- 16 oat varieties were screened at three Iowa State University research farms and one commercial farm.

Key Findings:

- Top yield performers differed at each location.
- None of the varieties screened scored a test weight greater than 36 lb/bu in 2018.

BACKGROUND

Careful management and proper choice of variety can make oats a profitable crop due to their low input requirements and favorable effects on succeeding crops in a rotation. Oats can be used for grain and straw production, as a companion crop to establish hay and pastures, or for early-season forage as hay or haylage. Because oats mature in late July to early August, it allows for cropping options for the remainder of the season including establishment of a perennial forage or summer cover crop, and timely window for a mid-season animal manure application. In 2018, 135,000 acres of oats were planted in Iowa according to the USDA-National Agricultural Statistics Service. The state average yield for the year was 63 bu/ac; the five-year average yield is 71 bu/ac.

Planting oats before April 15 is recommended for optimal yields in Iowa. This helps avoid exposure to warmer weather during grain fill. Test weight is the most commonly used indicator of grain quality. High test-weight varieties should be chosen by growers who intend to market oat grain to food-grade buyers. Additionally, the concentration of Beta glucans in the grain, noteworthy for its positive effects on human health, is considered by food processors. Fat concentration is also considered for storage purposes with low concentrations reducing the potential for grain rancidity and increasing shelf life.

Oat harvest at the ISU Northeast Research Farm in Nashua.

Cooperators

Matt Schnabel (ISU Northern Research Farm; ISU Ag Engineering and Agronomy Farm) – Kanawha, Boone

Ken Pecinovsky (ISU Northeast Research Farm) – Nashua

Wendy Johnson – Charles City

Collaborators

Brian Lang, ISU Extension and Outreach

Bruce Roskens, Grain Millers, Inc.

Funding

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Oat growth is regularly affected by rust and barley yellow dwarf virus. Variety resistance to these diseases should be considered. Another option is the use of a foliar fungicide applied at Feekes 9 growth stage, defined as flag leaf emerged with ligule visible.

METHODS

Variety trials were conducted at four locations in 2018: ISU Northern Research Farm in Kanawha; ISU Northeast Research Farm in Nashua; Wendy Johnson farm in Charles City; ISU Ag Engineering and Agronomy Farm in Boone. These trials build on the varieties screened previously at the Kanawha, Nashua and Charles City locations from 2015–2017 (Gailans et al., 2015; 2016; 2017). This was the first year the variety trial was conducted at the Boone location. Information about each of the varieties included in the 2018 trials can be found in **Table 1.**

At each location, oat varieties were seeded in small research plots (552.5 ft^2) and replicated three times. The previous crop was soybeans at each location. A seeding rate of 128 lb/ac and row spacing of 7.5 inches was used. Seeding depth was 1 in. No fungicides, herbicides or insecticides were applied at any location. Entries were screened for crown rust, barley yellow dwarf virus and septoria leaf blight at vvlocations using a numeric scale (1=low, 9=high) by Bruce Roskens of Grain

TABLE 1: State of origin, PVP and disease ratings for oat varieties screened in 2018.

				Disease ratings[c]			
Variety	**Origin[a]**	**PVP[b]**	**Maturity**	**Crown rust**	**Stem rust**	**BYDV[d]**	**Smut**
Antigo	WI	PVP	Early	MR	S	MR	MR
BetaGene	WI	PVP	Mid-Late	MR	MR	R	R
CS Camden	SW	Pending	Late	MS	S	--	--
Deon	MN	PVP	Late	MR	MS	MR	R
Esker	WI	PVP	Mid-Late	MS	MS	--	--
Hayden	SD	PVP	Mid-Late	MS	MS	MR	R
Horsepower	SD	PVP	Medium	MS	MS	MS	MR
Jerry	ND	PVP	Medium	MS	MS	MS	MS
Natty	SD	PVP	Medium	MR	MS	MR	R
Pearl	MN	Pending	Mid-Late	MS	MR	--	--
Reins	IL	PVP	Early	MR	MR	R	R
Ron	WI	PVP	Mid-Late	MR	--	--	--
Saber	IL	PVP	Early	MS	S	R	MS
Saddle	SD	Pending	Early	MR	S	--	--
Shelby 427	SD	PVP	Medium	MS	MS	MR	MR
Sumo	SD	PVP	Early	MR	R	MS	R

[a] Origin: IL-University of Illinois, IN-Purdue University; MN-University of Minnesota; ND-North Dakota State University; SD-South Dakota State University; SW-Lantmannen Seeds, Sweden; WI-University of Wisconsin.

[b] PVP = Plant Variety Protection. The PVP Act provides a certificate to the developer of a variety granting exclusive rights for reproducing and marketing the seed.

[c] Disease Ratings: S = susceptible; MS = moderately susceptible; MR = moderately resistant; R = resistant.

[d] Disease: BYDV = Barley Yellow Dwarf Virus.

TABLE 2: Location-specific oat management details in 2018.

Location	Fertilizer	Tillage	Planting date	Harvest date
Kanawha	None	Soil finisher, Apr. 3	Apr. 30	Aug. 14
Charles City	None	Field cultivated, Apr. 28	Apr. 29	Aug. 15
Nashua	0-65-150 lb N-P-K/ac in Nov. 2017 16-16-70 lb N-P-K/ac on Mar. 22	Field cultivated, Apr. 24 & 25 Cultipacked, Apr. 30	Apr. 25	July 24
Boone	None	Field cultivated, Apr. 25	Apr. 25	Aug. 13

Millers, Inc. (St. Ansgar, Iowa) in late June at Nashua. Plots were harvested at Kanawha, Charles City and Boone with a Wintersteiger plot combine, cylinder speed at 1,450 RPM, concave set to 900 RPM and sieves moved to the high position; and at Nashua with a JD4420 combine with Weigh-Tronix load cells on weigh bin, cylinder speed at 1,200 RPM, fan speed set to low and concave set on position 1.0. Upon harvest, grain samples were analyzed with a Seedburo scale to determine test weight. Oat management information for each location is provided in **Table 2.**

Data were analyzed using JMP Pro 13 (SAS Institute Inc., Cary, NC). Statistical significance is determined at $P \leq 0.05$ level and means separations are reported using Tukey's least significant difference (LSD).

RESULTS AND DISCUSSION

2018 Growing Conditions

Mean monthly temperature and rainfall for the period Apr. 1 – Aug. 31, 2018, as well as the long-term averages, are provided for each location (**Figure A1**). April was cooler and drier than normal at all locations – these cool conditions precluded the target planting date of Apr. 15, which resulted in delayed planting at each location (**Table 2**). June and August saw over twice as much rainfall as the long-term average at all locations. Nashua received just over half the normal rainfall in July.

Oat Variety Trial

Entries were analyzed by location and are listed in order of 2018 yield performance (**Tables 3–5 and 7**). Reported yields are corrected for 14% moisture. A "percentage of test average" calculation for 2018 is included to aid in comparing among entries at each location. Yields were greatest at the Nashua site; the only site to receive fertilizer application (**Table 2**).

Yield performance varied across locations. Esker and Natty were top performers at Kanawha; Reins was the top performer at Charles City; Deon, Hayden and Ron were top performers at Nashua; and Ron and Deon were top performers at Boone.

No entries made a test weight of 38 lb/bu – the standard that many food companies require before dockage is applied. Reins was among the top test weight performers at all locations. Hayden and Antigo were among the top performers at two locations – Charles City and Nashua.

Reins plants were the shortest at each location. Ratings conducted at the Nashua location on June 28 indicated low disease pressure in 2018 (**Table 6**).

ISU NORTHERN RESEARCH FARM, KANAWHA

TABLE 3: Results for the 2018 Oat Variety Trial at Kanawha in north-central Iowa.

	Yield (bu/ac)					Yield (% of test avg.)	Test weight (lb/bu)	Plant height at harvest (in.)	% Lodging on Aug. 14
Variety	2018	2017	2016	2015	4-yr	2018	2018	2018	2018
Esker	70	--	--	--	--	125	29	35	95
Natty	70	82	68	141	90	125	32	38	92
Saber	68	78	99	133	95	121	31	34	95
Pearl	67	--	--	--	--	119	33	36	68
Ron	63	--	--	--	--	112	27	37	95
Saddle	62	--	--	--	--	110	30	35	18
Hayden	59	71	75	131	84	105	31	36	93
BetaGene	57	80	84	170	98	101	26	38	95
Deon	57	77	74	148	89	101	30	36	93
Horsepower	53	75	66	113	77	94	29	33	95
Shelby 427	53	48	71	123	74	94	33	37	95
Reins	51	57	97	--	68	91	33	31	92
Sumo	46	54	--	--	50	82	33	33	22
Antigo	45	58	--	--	52	80	31	35	95
CS Camden	44	--	--	--	--	78	25	35	95
Jerry	34	45	64	105	62	61	29	37	95
MEAN	56	66	72	123	--	--	30	35	83
CV*	22	22	23	19	--	--	9	7	31
LSD(0.05)**	23	28	30	36	--	--	4	5	18

* A coefficient of variation (CV) greater than 20 indicates higher experimental error.

** By response variable, if the difference between any two entries is greater than the least significant difference (LSD) the entries are considered statistically different with 95% confidence.

TABLE 4: Results for the 2018 Oat Variety Trial at Charles City in north-central Iowa.

Variety	Yield (bu/ac)				Yield (% of test avg.)	Test weight (lb/bu)	Plant height at harvest (in.)	% Lodging on Aug. 15
	2018	2017	2016	3-yr	2018	2018	2018	2018
Reins	78	75	90	81	140	35	26	18
Saddle	76	--	--	--	136	32	29	5
BetaGene	70	61	70	67	125	32	28	13
Pearl	66	--	--	--	118	34	32	42
Natty	62	58	78	66	111	33	32	20
Antigo	60	43	--	52	107	36	31	73
Esker	58	--	--	--	104	32	28	37
Saber	57	81	82	73	102	34	28	38
Sumo	55	52	--	54	98	34	30	15
Deon	54	68	99	74	97	33	31	18
CS Camden	51	--	--	--	91	32	29	10
Hayden	50	71	55	59	89	35	--	73
Shelby 427	50	66	63	60	89	35	32	63
Ron	42	--	--	--	75	34	29	7
Horsepower	35	67	56	53	63	33	26	75
Jerry	30	55	59	48	54	34	33	95
MEAN	56	63	65	--	--	34	30	38
CV*	32	23	29	--	--	4	9	92
LSD(0.05)**	42	22	36	--	--	2	6	69

* A coefficient of variation (CV) greater than 20 indicates higher experimental error.

** By response variable, if the difference between any two entries is greater than the least significant difference (LSD) the entries are considered statistically different with 95% confidence.

TABLE 5: Results for the 2018 Oat Variety Trial at Nashua in northeast Iowa.

Variety	Yield (bu/ac)					Yield (% of test avg.)	Test weight (lb/bu)	Plant height at harvest (in.)	Straw (tons/ac)	% Heading on June 18	% Lodging on July 24
	2018	2017	2016	2015	4-yr	2018	2018	2018	2018	2018	2018
Deon	109	127	140	140	129	121	33	39	1.6	7	1
Hayden	101	129	132	152	129	112	35	36	1.4	62	6
Ron	101	--	--	--	--	112	32	36	1.7	23	1
Natty	98	120	129	139	122	109	34	38	1.6	90	3
Pearl	97	--	--	--	--	108	34	36	1.2	8	1
CS Camden	96	--	--	--	--	107	30	34	1.1	13	6
BetaGene	91	116	136	145	122	101	31	36	1.2	77	7
Esker	90	--	--	--	--	100	31	36	1.2	77	1
Reins	90	110	116	--	105	100	34	27	0.9	95	3
Saddle	86	--	--	--	--	96	33	34	1.2	95	0
Sumo	86	104	--	--	95	96	34	33	1.5	95	1
Saber	85	122	136	152	124	94	33	33	1.2	95	1
Shelby 427	81	102	115	137	109	90	34	37	1.5	95	3
Jerry	80	94	115	129	105	89	32	38	1.2	50	52
Antigo	79	98	--	--	89	88	34	32	1.0	95	28
Horsepower	70	120	116	132	110	78	33	32	0.9	90	77
MEAN	90	113	126	137	--	--	33	35	1.3	67	12
CV*	12	10	9	8	--	--	4	9	22.7	54	205
LSD(0.05)**	17	15	26	21	--	--	2	4	0.5	45	40

* A coefficient of variation (CV) greater than 20 indicates higher experimental error.

** By response variable, if the difference between any two entries is greater than the least significant difference (LSD) the entries are considered statistically different with 95% confidence.

TABLE 6: Disease ratings for the 2018 Oat Variety Trial at Nashua in northeast Iowa.

Variety	Crown rust (1-9)*	Stem rust (1-9)*	BYDV (1-9)*	Septoria leaf blight (1-9)*
Antigo	0.3	0.0	1.7	2.0
BetaGene	0.0	0.0	1.0	1.3
CS Camden	1.3	0.0	1.7	1.0
Deon	0.0	0.0	1.0	1.0
Esker	1.0	0.0	1.0	1.3
Hayden	1.0	0.0	1.3	1.7
Horsepower	3.7	0.0	2.3	1.0
Jerry	2.0	0.0	1.7	2.7
Natty	1.3	0.0	1.0	1.0
Pearl	0.3	0.0	1.3	1.7
Reins	2.0	0.3	1.0	1.3
Ron	0.3	0.3	1.0	1.7
Saber	1.0	0.0	1.7	1.7
Saddle	0.0	0.0	1.0	1.3
Shelby 427	1.0	0.3	1.0	1.0
Sumo	0.3	0.3	1.0	1.0
MEAN	1.0	0.1	1.3	1.4
CV*	112	391	42	43
LSD(0.05)**	2.0	0.8	1.4	1.5

* Incidence of crown rust, stem rust, barley yellow dwarf virus (BYDV) and septoria leaf blight was assessed on a scale from 1 (low) to 9 (high) on June 28.

** A coefficient of variation (CV) greater than 20 indicates higher experimental error.

*** By response variable, if the difference between any two entries is greater than the least significant difference (LSD) the entries are considered statistically different with 95% confidence.

TABLE 7: Results for the 2018 Oat Variety Trial at Boone in central Iowa.

Variety	Yield (bu/ac)	Yield (% of test avg.)	Test weight (lb/bu)	Plant height at harvest (in.)	% Lodging on Aug. 13
Ron	80	134	31	36	33
Deon	79	132	32	38	22
Hayden	70	117	32	35	90
CS Camden	67	112	29	30	78
BetaGene	64	107	30	34	17
Pearl	63	106	32	35	70
Esker	61	102	31	34	22
Sumo	60	101	34	34	7
Reins	59	99	34	26	5
Saddle	59	99	32	33	5
Saber	57	96	32	32	13
Natty	53	89	33	35	93
Antigo	48	81	34	32	13
Horsepower	47	79	29	28	88
Shelby 427	46	77	32	36	42
Jerry	41	69	31	37	93
MEAN	60	--	32	33	43
CV*	21	--	5	10	85
LSD(0.05)**	21	--	2	4	38

* A coefficient of variation (CV) greater than 20 indicates higher experimental error.

** By response variable, if the difference between any two entries is greater than the least significant difference (LSD) the entries are considered statistically different with 95% confidence.

CONCLUSIONS

Selling oats into a specialty market (i.e., for human consumption) takes an increased level of management and care for the final product. Oat millers typically require a test weight of 38 lb/bu before dockage is applied. None of the varieties screened met this requirement at any location in 2018. Delayed planting (late April) due to colder than average temperatures in April at each location could be to blame for the poor test weight performance. Reins, Antigo and Sumo have met the test weight requirement in previous years (Gailans et al., 2016; 2017). Farmers could consider using a grain vacuum to clean harvested oats – a common recommendation to increase the test weight of, and thus add value to, the final product leaving the farm.

APPENDIX–WEATHER CONDITIONS

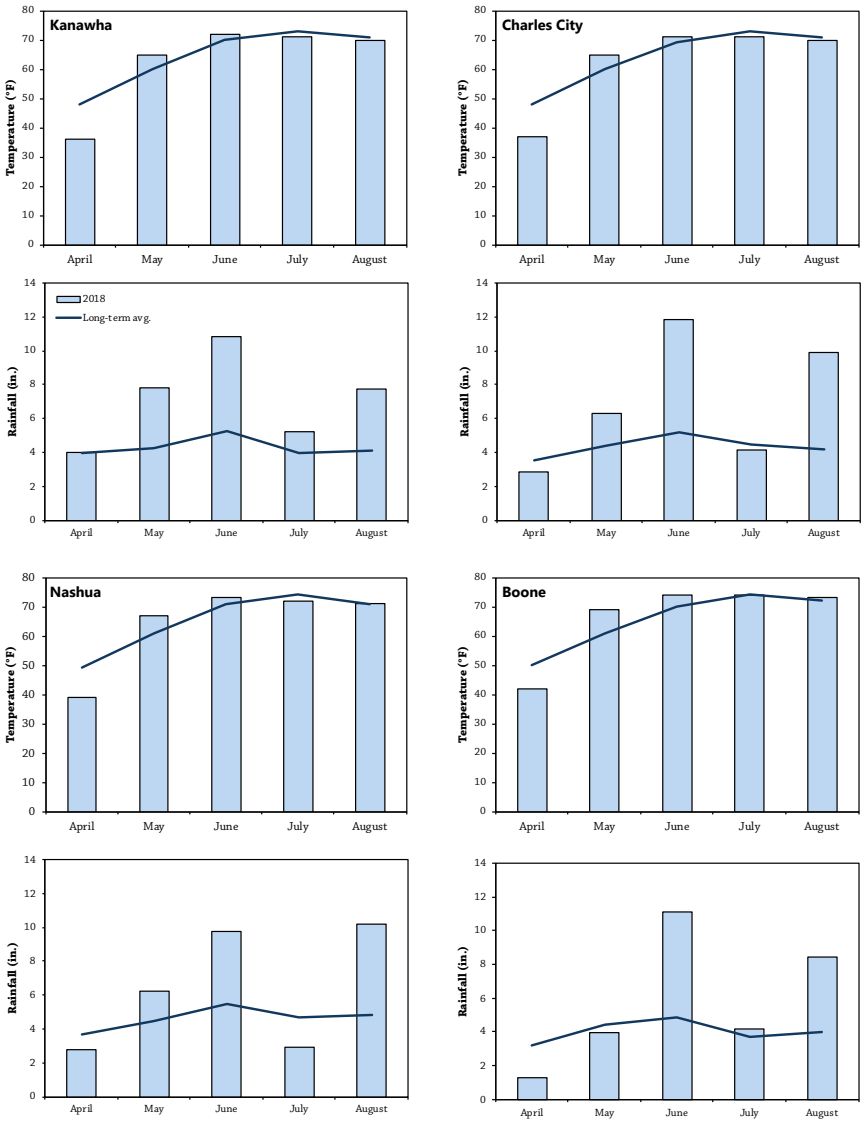

FIGURE A1. Mean monthly temperature and rainfall for 2018 and the long-term averages at each location (Iowa Environmental Mesonet, 2019).

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