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Field Crops Research

Oat Variety and Fungicide Trials 2017

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In a Nutshell

- Small grain crops, like oats, are seeing renewed interest by farmers in Iowa. Iowa was once a nationwide leader in oats production, but many farm families have not grown them for a generation or two.
- 15 oat varieties were screened at two Iowa State University research farms and one commercial farm.

Key findings

- Top yield performers differed at each location.
- Antigo had the highest test weight at each location (≥38 lb/bu) but was also among the lowest yielding varieties. Reins scored a test weight of 38 lb/bu at Kanawha.
- Application of fungicide did not improve yield or test weight for the four varieties tested at Nashua.

Project Timline:
2015-17

Oat variety trials at Wayne Koehler's farm near Charles City. Photo courtesy of Wendy Johnson.

Background

Oats are a major spring-sown, small grain crop in Iowa. It 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 cover crop, and timely window for a mid-season animal manure application.

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. 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. Additionally, the concentration of Beta glucans in the grain, noteworthy for its positive effects on 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 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.

Table 1

State of origin, PVP and disease ratings for oat varieties included in 2017.

Variety	State of origin[a]	PVP[b]	Maturity	---Disease name and disease ratings[c] by variety---			
				Crown rust	Stem rust	BYDV[d]	Smut
Antigo	WI	PVP	Early	MR	S	MR	MR
BetaGene	WI	PVP	Mid-Late	MR	MR	R	R
Deon	MN	PVP	Late	MR	MS	MR	R
Goliath	SD	PVP	Late	MS	R	MR	MR
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
Leggett	AAFC	PVP	Early	MR	MR	S	R
Natty	SD	PVP	Medium	MR	MS	MR	R
Reins	IL	PVP	Early	MR	MR	R	R
Rockford	ND	PVP	Late	MS	MS	MR	MR
Saber	IL	PVP	Early	MS	S	R	MS
Shelby 427	SD	PVP	Medium	MS	MS	MR	MR
Souris	ND	PVP	Medium	S	MS	MS	MR
Sumo	SD	PVP	Early	R	R	MS	R

[a] Origin: AAFC-Agriculture and Agri-Food Canada; GM-General Mills; IL-University of Illinois, IN-Purdue University; MN-University of Minnesota; ND-North Dakota State University; SD-South Dakota State University; 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.

Methods

Variety trials (Experiment 1) were conducted at three locations in 2017—ISU Northern Research Farm in Kanawha; ISU Northeast Research Farm in Nashua; Wayne Koehler farm in Charles City. Additionally, a separate trial testing a fungicide application (Experiment 2) was conducted at the Nashua site that included four of the oat varieties. These trials build on the varieties screened previously at these locations in 2015 and 2016 (Gailans et al., 2015; Gailans et al., 2016). Information about each of the varieties included in the 2017 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 at Kanawha and Charles City; four times at Nashua. A seeding rate of 128 lb/ac and row spacing of 7.5 inches was used. Seeding depth was 1 in. No herbicides or insecticides were applied at any location. Fungicides were only applied to designated subplots in Experiment 2 at Nashua. Entries were screened for crown rust, barley yellow dwarf virus and septoria leaf blight at locations using a numeric scale (1=low, 9=high) by Bruce Roskens of Grain Millers, Inc. in late June at Nashua. Plots were harvested at Kanawha and Charles City with a Wintersteiger plot combine, cylinder speed at 1,450 RPM, concave set to 900 RPM and move sieves to high position; and at Nashua with a JD4420 combine with Weigh-Tronix load cells on weigh bin, cylinder speed at 1,200 RPM, slow down fan and concave set on 1.0. Upon harvest, grain samples were analyzed with a Seedburo scale to determine test weight.

Data were analyzed using JMP Pro 12 (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

2017 Growing Conditions

Mean monthly rainfall and growing degree day (GDD) accumulation for the period Apr. 1 – July 31, 2017, as well as the long-term averages, are provided for each location. Near-normal GDD were observed at all locations in 2017. July was particularly wet at Charles City and Nashua resulting in above-normal rainfall at those locations.

Experiment 1: Oat variety trial

Entries were analyzed by location and listed in alphabetical order (**Tables 2, 3** and **4**). Reported yields are corrected for 14% moisture. Yields from previous years are also included. A "percentage of test average" calculation for 2017 is included to allow for comparison among entries at each location. Yields were again greatest at the Nashua site.

In terms of yield in 2017, Natty and Betagene were top performers at Kanawha; Saber and Reins were the top performers at Charles City; and Hayden and Deon were top performers at Nashua in terms of both yield and straw.

Antigo resulted in the greatest test weight at each site, but it was generally among the lowest yielding varieties at each site. Betagene had the lowest test weight at each site.

Reins plants were the shortest at each location.

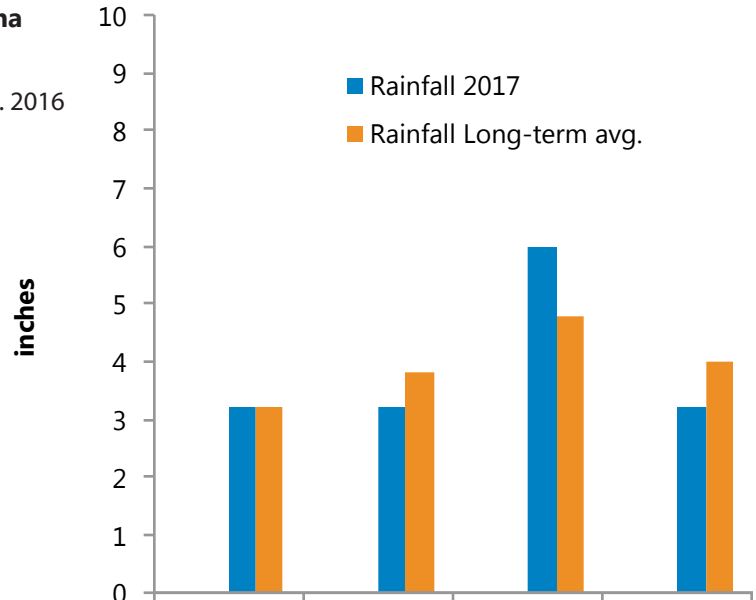
Experiment 2: Fungicide trial at Nashua

Oat yields, test weight, plant height, and crown rust and barley yellow dwarf virus disease ratings were not affected by the fungicide but were affected by variety (**Table 5**). Fungicide application had mostly no effect but did appear to increase straw yields, particularly for Shelby 427.

Oat variety trials at Wayne Koehler's farm near Charles City. Photo courtesy of Wendy Johnson.

Oat Variety Trial, ISU Northern Research Farm, Kanawha

Previous crop: Soybeans
Fertilizer: 27-127-227-34 lb N-P-K-S/ac in Nov. 2016
Tillage: Soil finisher on Apr. 9
Oat planting date: Apr. 12
Harvest date: Aug. 8
Replications: 3



	April	May	June	July
GDD (32 ˚F) 2017	505	797	1,139	1,256
GDD (32 ˚F) Long-term avg.	498	823	1,098	1,250

Table 2

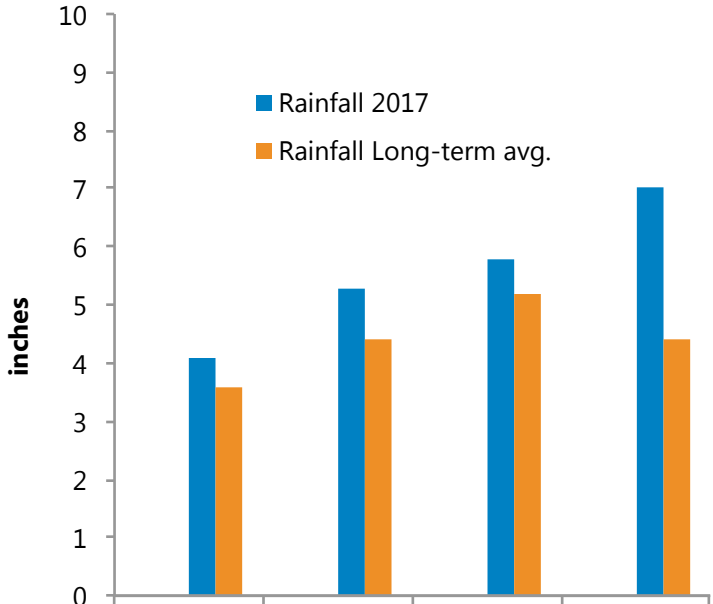
Oat variety trial at Kanawha in 2017.

Variety	Yield (bu/ac)				Yield (% of test avg.)	% Lodging	Test weight (lb/bu)	Plant height at harvest (in.)
	2017	*2016*	*2015*	*3-yr*	*2017*	*2017*	*2017*	*2017*
Antigo	58	--	--	58	87	78	40	33
Badger	--	77	141	109	--	--	--	--
Betagene	80	84	170	111	122	50	35	34
Deon	77	74	148	100	114	50	36	38
Excel	--	79	131	105	--	--	--	--
Goliath	63	66	107	79	95	93	37	44
Hayden	71	75	131	92	108	63	37	36
Horsepower	75	66	113	85	118	83	36	32
Jerry	45	64	105	71	70	87	36	38
Leggett	77	52	97	75	120	58	35	34
Natty	82	68	141	97	122	90	37	40
Reins	57	97	--	77	86	5	38	32
Rockford	57	56	89	67	86	68	38	37
Saber	78	99	133	103	118	62	36	33
Shelby 427	48	71	123	81	71	20	36	36
Souris	68	50	103	74	106	93	35	35
Sumo	54	--	--	54	78	43	38	35
LSD (0.05)*	28	30	36			43	2	5

*The least significant difference (LSD) was calculated at the $P \leq 0.05$ level for each variable.

Oat Variety Trial, Wayne Koehler Farm, Charles City

Previous crop: Soybeans
Fertilizer: None
Tillage: Soil finisher on Apr. 9
Oat planting date: Apr. 10
Harvest date: Aug. 11
Replications: 3



	April	May	June	July
GDD (32 ˚F) 2017	532	779	1,106	1,247
GDD (32 ˚F) Long-term avg.	498	823	1,098	1,250

Table 3

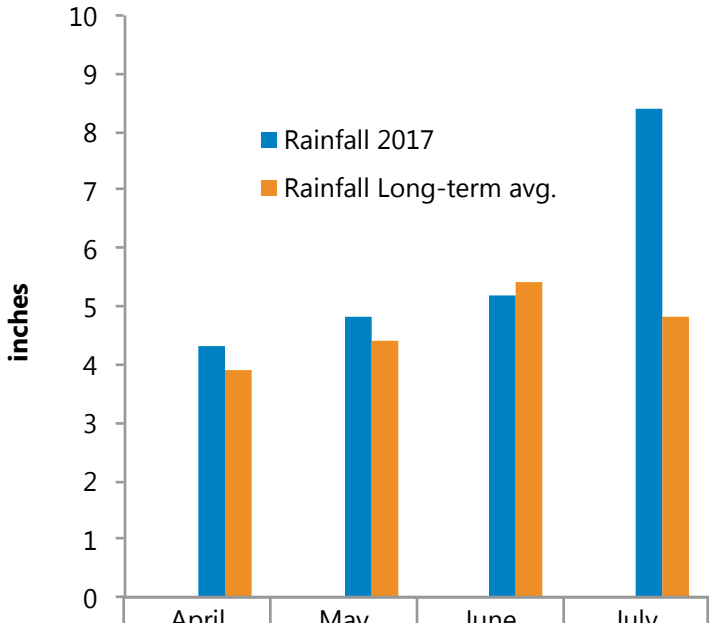
Oat variety trial at Charles City in 2017.

Variety	Yield (bu/ac)			Yield (% of test avg.)	% Lodging	Test weight (lb/bu)	Plant height at harvest (in.)
	2017	*2016*	*2-yr*	*2017*	*2017*	*2017*	*2017*
Antigo	43	--	43	68	33	39	31
Badger	--	74	74	--	--	--	--
Betagene	61	70	66	98	10	33	32
Deon	68	99	84	106	8	35	36
Excel	--	70	70	--	--	--	--
Goliath	70	43	57	113	90	33	44
Hayden	71	55	63	113	45	36	34
Horsepower	67	56	61	108	93	35	29
Jerry	55	59	57	90	72	37	36
Leggett	59	55	57	95	42	34	34
Natty	58	78	68	90	38	36	37
Reins	75	90	82	121	5	37	26
Rockford	42	49	46	68	68	36	36
Saber	81	82	81	131	13	36	34
Shelby 427	66	63	64	106	38	36	36
Souris	66	41	54	107	57	34	31
Sumo	52	--	52	85	10	36	33
LSD (0.05)*	22	36			52	1	7

*The least significant difference (LSD) was calculated at the $P \leq 0.05$ level for each variable.

Oat Variety Trial, ISU Northern Research Farm, Nashua

Previous crop:	Soybeans
Fertilizer:	0-58-135 lb N-P-K/ac in Nov. 2016; 7-0-73 N-P-K/ac on Mar. 22
Tillage:	Field cultivate on Mar. 23 & Apr. 6; Cultipack on Apr. 8
Oat planting date:	Apr. 7
Harvest date:	July 31
Straw harvest date:	Aug. 1
Replications:	4



	April	May	June	July
GDD (32 ˚F) 2017	564	790	1,167	1,227
GDD (32 ˚F) Long-term avg.	498	823	1,098	1,250

Table 4

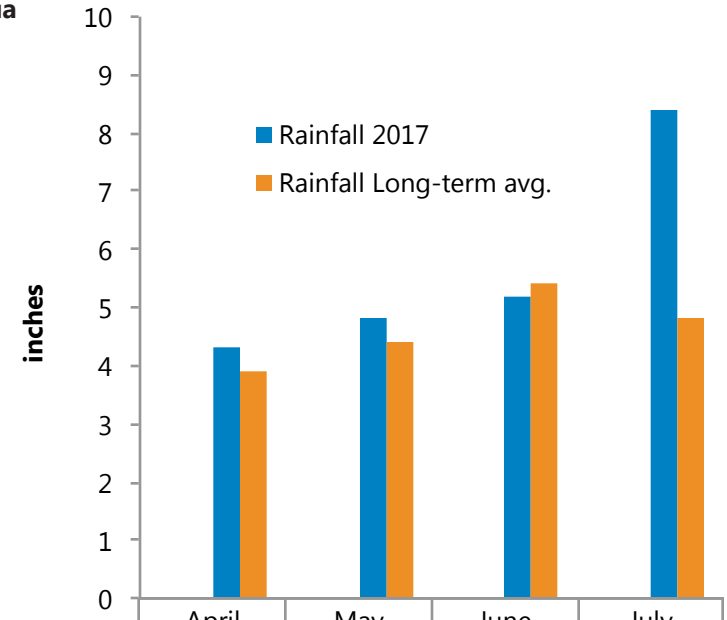
Oat variety trial at Nashua in 2017.

Variety	Yield (bu/ac)				Yield (% of test avg.)	Test weight (lb/bu)	Plant height at harvest (in.)	Straw (tons/ac)	Crown rust (1-9)*	% Heading on June 15
	2017	*2016*	*2015*	*3-yr*	*2017*	*2017*	*2017*	*2017*	*2017*	*2017*
Antigo	98	--	--	98	87	38	28	0.9	0.8	68
Badger	--	127	137	132	--	--	--	--	--	--
Betagene	116	136	145	132	102	33	30	1.0	0.5	30
Deon	127	140	140	136	112	35	32	1.4	0.0	2
Excel	--	131	146	139	--	--	--	--	--	--
Goliath	119	132	137	129	105	36	39	1.2	0.8	0
Hayden	129	132	152	138	114	36	32	1.3	0.0	10
Horsepower	120	116	132	123	106	35	26	0.9	0.4	18
Jerry	94	115	129	113	83	35	32	0.9	0.9	10
Leggett	117	127	141	128	104	34	31	1.2	0.8	5
Natty	120	129	139	129	106	35	35	1.1	0.8	70
Reins	110	116	--	113	97	36	25	0.9	0.5	65
Rockford	101	131	123	118	89	35	35	1.3	0.3	2
Saber	122	136	152	137	108	34	27	1.0	0.9	40
Shelby 427	102	115	137	118	91	36	32	1.1	0.9	55
Souris	116	121	128	122	103	33	30	1.0	2.3	10
Sumo	104	--	--	104	92	36	29	1.2	0.5	80
Tack	--	116	126	--	--	--	--	--	--	--
LSD (0.05)**	15	26	21			1	3	0.2	0.9	9

*Incidence of crown rust was assessed on a scale from 1 (low) to 9 (high) on June 30.
** The least significant difference (LSD) was calculated at the P ≤ 0.05 level for each variable.

Oat Fungicide Trial, ISU Northeast Research Farm, Nashua

Previous crop:	Soybeans
Fertilizer:	0-58-135 lb N-P-K/ac in Nov. 2016; 7-0-73 N-P-K/ac on Mar. 22
Tillage:	Field cultivate on Mar. 23 & Apr. 6; Cultipack on Apr. 8
Oat planting date:	Apr. 7
Fungicide application:	4 oz/ac of Priaxor on June 12
Harvest date:	July 31
Straw harvest date:	Aug. 1



	April	May	June	July
GDD (32 ˚F) 2017	564	790	1,167	1,227
GDD (32 ˚F) Long-term avg.	498	823	1,098	1,250

Table 5

Fungicide trial involving four oat varieties at Nashua in 2017.

Variety	Yield (bu/ac)	Yield (% of test avg.)	Test weight (lb/bu)	Plant height (in.)	Straw (tons/ac)	Crown rust (1-9)*	BYDV (1-9)*	Septoria (1-9)*
	Fungicide							
Deon	121	104	34	33	1.5	0.0	4.0	1.5
Hayden	126	109	35	33	1.5	0.3	2.8	1.3
Horsepower	113	97	34	26	1.0	0.5	6.3	2.3
Shelby 427	111	96	35	32	1.9	0.0	2.0	1.5
	No fungicide							
Deon	117	101	34	32	1.4	0.0	3.8	0.5
Hayden	125	108	36	32	1.5	0.3	2.8	2.0
Horsepower	115	99	35	26	0.9	1.0	5.5	1.8
Shelby 427	100	86	35	31	1.2	0.0	2.8	1.5
LSD (0.05)*	25		2	3	0.5	1.1	2.6	2.0
Source of variation	*P*-value							
Variety (V)	0.0078		0.0001	0.0001	0.0001	0.0095	0.0001	0.1517
Fungicide (F)	0.3063		0.9294	0.4875	0.0074	0.4407	0.8739	0.5324
V x F	0.6673		0.1079	0.9666	0.0172	0.6113	0.5943	0.2200

*The least significant difference (LSD) was calculated at the $P \leq 0.05$ level for each variable.

Conclusions and Next Steps

Selling grain 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. Antigo made this requirement at each location but was also one of the lowest yielding varieties. Reins made this requirement at Kanawha only, but was close at the other two sites. None of the oat varieties at Charles City (**Table 3**) or Nashua (**Table 4**) achieved a test weight greater than 36 lb/bu. Application of fungicide to the four varieties involved in Experiment 2 at Nashua did not result in higher yields or test weights (**Table 5**).

Farmers interested in selling oats to food grade milling companies in the northern Cornbelt have some oat varieties to choose from which yield well and can reach close to desired milling specifications. Additionally farmers could use a grain vacuum to further clean oats to increase the test weight of the final product leaving the farm. Grain vacuuming is a common option to further add value to harvested grains behind the farm-gate.

Oat variety trials at Wayne Koehler's farm near Charles City. Photo courtesy of Wendy Johnson.

References

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