2017 Wisconsin
Oats and Barley Performance Tests

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The Wisconsin oats and barley performance trials are conducted each year to serve Wisconsin growers. Trials include released varieties, experimental lines from Wisconsin and Midwestern states, and lines from private companies. The main objective of these trials is to obtain data on how varieties perform in different locations and years. Growers can use this data to help choose the best varieties to plant, and breeders to decide on whether or not to release a new variety and to select parents to make new crosses.

The best varieties for yield performance, disease resistance and quality are entered into the Wisconsin Certification Program. As new varieties are released to the public, older varieties with inferior qualities are removed from the recommended list and eventually dropped from the certified list as seed production declines. Additionally, good performing varieties from other states may be recommended and/or certified in Wisconsin.

Occasionally, varieties are certified without being recommended to Wisconsin growers. These varieties may include commercial varieties developed by private seed companies or varieties where there is a substantial market for Wisconsin-produced seed. Thus, in Wisconsin, recommendation and certification are different things. Recommended varieties are those with superior in-state production performance records, while certification provides assurance of seed purity and seed quality.

Variety Selection

Factors to consider when selecting oat and barley varieties include grain yield, maturity, straw strength (or resistance to lodging), disease resistance and grain quality. Barley growers should also consider whether a variety is acceptable for malting. Several varieties are also evaluated for forage yield and quality.

Variety Testing

Varieties in the trials are selected based on current demand, availability, and adaptation to Wisconsin's climate. Most of these varieties are commercially available. Several commercial and public varieties are regularly tested for comparison.

Tests were conducted at seven locations during the 2017 growing season using conventional tillage practices. The goal is to have a stand of 1.3 million plants per acre. Therefore, the seeding rate was 1.47 million plants per acre. Agronomic practices at all locations are listed in Table 1. All experiments were conducted in randomized complete block designs with four replications.

Growing conditions

2017 season. Wisconsin oats production was estimated at 6.1 million bushels, the area planted with oats was 180,000 acres, and the area harvested was 95,000 acres, which was lower than in 2016. Oats yield was 64 bushels per acre and was down 2 bushels from 2016 (Table 2).

Table 1. Location and management practices of small grain variety trials in Wisconsin in 2017.

Location	Cooperators	Row spacing	Previous crop	Average N (lb /A)	Planting date	Weed control	Harvest date	# Genotypes
Arlington	P. LeMahieu, M. Bertram	6 inches	soybean	0	9-Apr	2,4D + Harmony extra	29-Jul	42
Chilton	R. Kolbe	6 inches	sweet peas	0	25-Apr	Affinity	8-Aug	34
Lancaster	D. Wiedenbeck	7.5 inches	soybean	6	18-Apr	2,4D	25-Jul	34
Madison	J. Hedtcke	6 inches	soybean	0	8-Apr	2,4D + Harmony extra	25-Jul	42
Marshfield	J. Cavadini	6 inches	soybean	0	25-Apr	None	7-Aug	34
Spooner	P. Holman	7.3 inches	soybean	36	24-Apr	2,4D	16-Aug	34
Sturgeon Bay	M. Stasiak	6 inches	forage oats + peas	0	26-Apr	2,4D + Direct	7-Aug	34

Table 2. Characterization of the last growing seasons for oats and barley in Wisconsin.

	Oats				Barley			
	Area planted (acres)	Area harvested (acres)	Total (million bu)	Yield (bu/A)	Area planted (acres)	Area harvested (acres)	Total (M bushels)	Yield (bu/A)
2017	180,000	95,000	6.08	64	--	--	--	--
2016	210,000	100,000	6.60	66	--	--	--	--
2015	280,000	195,000	14.00	72	28,000	15,000	0.83	55
2014	255,000	140,000	8.68	62	26,000	16,000	0.75	47
2013	255,000	105,000	6.83	65	33,000	16,000	0.78	49

-- Information not available.
Source: USDA National Agricultural Statistics Service www.nass.usda.gov

2016 season. Wisconsin oats production was estimated at 6.6 million bushels, which was 53% less than the record high in 2015. The area planted with oats was 210,000 acres, and the area harvested was 100,000 acres. Oats yield was 66 bushels per acre, down 6 bushels from 2015.

2015 season. Wisconsin oats production was estimated at 14 million bushels, which was 61% more than the record high in 2014. The area planted with oats was 280,000 acres, and the area harvested was 195,000 acres. Oats yield was 72 bushels per acre, up 10 bushels from 2014.

Wisconsin barley production was estimated at 0.83 million bushels, which was 11% more than in 2014. The area planted with barley was 28,000 acres, and the area harvested was 15,000 acres. Barley yield was 55 bushels per acre, up 17% from 2014.

There were no trials conducted during the 2015 season.

2014 season. Wisconsin oats production was estimated at 8.68 million bushels, which was 27% more than the 2013 year's record low. The area planted with oats was 255,000 acres, and the area harvested was 140,000 acres. Oats yield was 62 bushels per acre, down three bushels from 2013.

Wisconsin barley production was estimated at 0.75 million bushels, which was 4% less than in 2013. The area planted with barley was 26,000 acres, and the area harvested was 16,000 acres. Barley yield was 47 bushels per acre, down two bushels from 2013.

2013 season. Wisconsin oats production was estimated at 6.83 million bushels, which was record low since 1866 and 12% less than the 2012 year. The area planted with oats was 255,000 acres, and the area harvested was 105,000 acres. Oats yield was 65 bushels per acre, up five bushels from 2012.

Wisconsin barley production was estimated at 0.78 million bushels, which was 19% more than in 2012. The area planted with barley was 33,000 acres, and the area harvested was 16,000 acres. Barley yield was 49 bushels per acre, up five bushels from 2012. Source: USDA National Agricultural Statistics Service

Performance evaluation

Grain yield. Plots were harvested and threshed with a combine harvester in Madison, Arlington, Chilton and Sturgeon Bay; seed was dried and later cleaned. The other locations harvested bundles of plants that were dried and threshed. Yields are reported in bushels per acre at 8% moisture content. All the analysis were conducted in bushels per acre. There are 32 pounds per bushel of oats and 48 per bushel of barley (Table 4 and 5).

Test weight. Test weight was measured with a Cox funnel using a 0.5 liter (L) measuring cup and weighing in grams. All analysis were conducted in g 0.5 L^{-1} and transformed to pounds per bushel following seed trade recommendations. Test weight is reported in pounds per bushel (Table 3).

Maturity. Maturity was evaluated by recording the date that 50% of the plants in a plot headed. Maturity is reported by date using the three-year average of the 6-7 locations (Table 3).

Plant height. Plant height is measured from the base of the plant to the tip of the panicle after heading. All analysis were conducted in centimeters and transformed to inches. Plant height is reported in inches using the three-year average of the 6-7 locations (Table 3).

Disease resistance. Disease resistance was evaluated as a combination between incidence and severity, where 0 is no disease present and 9 is all plants affected up to the flag leaf (Table 3). Disease severity is later transformed to disease resistance as follows: R=excellent resistance, MR=moderate or good resistance, MS=moderate susceptible, and S = susceptible or poor resistance. Please note that the reporting method changed from previous reports to make them comparable to other states' reports. Please also note that an update of resistance status of all varieties is provided using combined data from Wisconsin and from other states.

Lodging. Lodging was measured in percent, where 0% is no lodging and 100% is severe lodging. It was then trans-

formed to weak=severe lodging, medium=intermediate lodging, low=low lodging. (Table 3).

Forage dry matter. An area of 2x3 ft was hand-harvested at 2 inches above ground and dried. The weight of the sample was transformed to tons per hectare prior to analysis. Yield is reported in tons per acre (Table 6). Madison and Arlington are the only locations used for forage trials.

Forage quality. Forage quality was evaluated at the Soil and Forage Lab from UW-Madison. Relative forage quality (RFQ), percent of crude protein (CP%), and total milk production in tons per acre is reported (Table 6).

Licensed varieties

The Wisconsin Agricultural Experimental Station and/or the UW-Madison Department of Agronomy has granted sole authority to the Wisconsin Crop Improvement Association to issue formal licenses for the production of certified seed of Kewaunee barley, Spooner rye; and Badger, Dane, ForagePlus, Gem, and Vista oats. The Wisconsin Alumni Research Foundation has granted sole authority to the Wisconsin Crop Improvement Association to issue formal licenses for the production of certified seed of Drumlin, Esker, Kame, Moraine, Ron, BetaGene™, Antigo and Laker oats.

These grants of sole authority are intended to reinforce Plant Variety Protection (PVP) regulations and to generate research and development funds for the Wisconsin cereals breeding program. These varieties are PVP protected and a license is required for seed production. Each bag of seed will have a special red and white PVP/Licensed Variety tag attached or preprinted on the bag.

Testing agencies

The cereal breeding variety tests were conducted by the Department of Agronomy, College of Agricultural and Life Sciences, University of Wisconsin-Madison in cooperation with the Wisconsin Crop Improvement Association.

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Table 3. Grain oats variety description.

Variety	Origin	Release year	Kernel color	Maturity date[a]	Ht[b] (in.)	Lodging (%)[c]	Test Wt[d] (lb/bu)	Kernel protein	Crown rust[e]	Stem rust[f]	Septoria[f]	Smut[f]	BYDV[g]	Licensed/ PVP[h]	Wis. cert.
Recommended															
Antigo	WI	2017	yellow	18-Jun	37	med	42.2	med/high	MR	S	--	MR	MR	inP	inP
Badger	WI	2010	yellow	18-Jun	33	med	36.6	med	MS	R	MR	R	R	yes	yes
BetaGene™	WI	2014	yellow	22-Jun	36	med	34.9	--	MR	--	--	--	MR	yes	yes
Deon	MN	2013	yellow	26-Jun	40	med	36.4	med	MR	--	R	R	R	yes	no
Esker	WI	2004	yellow	20-Jun	37	med	34.5	med	MS	MS	MR	R	R	yes	yes
Hayden	SD	2014	white	23-Jun	40	weak	36.2	--	MS	MR	--	R	MR	yes	--
Horsepower	SD	2012	yellow	21-Jun	34	weak	36.2	med	MS	R	MR	R	MR	yes	no
Ron	WI	2014	yellow	24-Jun	38	med	37.0	med	MR	--	R	R	MR	yes	yes
Shelby427	SD	2009	white	20-Jun	40	weak	38.7[i]	med/high	MS	MS	MR	MR	MR	yes	yes
Other varieties															
Dane	WI	1990	yellow	6-17	35	weak	36.4	med	MS	MR	S	R	S	yes	yes
Vista	WI	1999	yellow	24-Jun	40	weak	35.7	low	MS	R	MS	R	MR	yes	yes
Ogle	IL	1981	yellow	21-Jun	37	med	35.7	low	MS	S	S	S	R	no	yes

[a] Maturity (month-day) as indicated in 19 Wisconsin tests conducted 2014-2017.
[b] Height (inches) at maturity in 19 Wisconsin tests conducted 2014-2017.
[c] Lodging in 19 Wisconsin tests conducted 2014-2017. Lodging: weak=severe lodging, medium=intermediate lodging, low=low lodging.
[d] Test weight (lb/bu) in Arlington Wisconsin tests conducted 2014-2017.
[e] Crown rust disease resistance: R=Resistant, MR=Moderately Resistant, MS=Moderately Susceptible, S=Susceptible. Please note that the labels have changed from previous year evaluations. Additionally, please note that none of the varieties were labeled as fully resistant. Due to the high mutation rate of the pathogen, only 2017 data were used for crown rust reports.
[f] Because disease expression varies from year to year, and cannot be scored every single year, historical data was used to assign disease resistance to stem rust, septoria, and smut.
[g] Barley yellow dwarf virus or red leaf disease resistance (BYDV): R=Resistant, MR=Moderately Resistant, MS=Moderately Susceptible, S=Susceptible. Please note that the labels have changed from previous year evaluations. Additionally, please note that none of the varieties were labeled as fully resistant.
[h] PVP=Plant Variety Protection or licensed seed production. A "yes" indicates that these varieties can't be grown and sold as seed without certification. inP= PVP application in process.
[i] 2017 data only.
-- Information not available.

Table 4. Grain yield performance of oat varieties in the 2017 Wisconsin growing season and for the average of the last three trial seasons (2014, 2016 and 2017).

	Grain yield (bu/A) [a]															
	Arlington		Chilton[b]		Lancaster		Madison		Marshfield[c]		Spooner		Sturgeon Bay[d]		Overall[e]	
Variety	2017	3- Year	2017[f]	3 -Year	2017	3 -Year	2017	3- Year	2017[f]	3- Year[f]	2017	3- Year	2017[f]	3- Year[f]	2017[f]	3 -Year
Antigo	167*	162	160	--	80*	90*	160*	141*	50	81	81*	74*	44	56	106	106*
Badger	157*	150	182	--	98*	108*	129	118	45	79	78*	56	72	59*	104	109*
BetaGene™	179*	155	169	--	105*	124*	156*	126*	52	95	109*	83*	64	74*	116	119*
Dane	137	139	159	--	70	84	96	86	33	58	70*	57	63	58	85	89
Deon	169*	156	175	--	76*	109*	124	109	56	109	100*	84*	68	81*	105	109*
Esker	190*	165*	191	--	92*	109*	133*	125*	48	86	88*	78*	69	78*	107	116*
Hayden	162*	184*	189	--	86*	109*	136*	130*	49	101	103*	86*	67	76*	122	114*
Horsepower	124	156	176	--	96*	117*	109	116	33	79	90*	72*	47	78*	94	96*
Ogle	145*	147	150	--	84*	107*	123	111	56	78	89*	76*	56	78*	97	100*
Ron	160*	165*	138	--	85*	110*	144*	127*	53	88	95*	77*	65	75*	99	105*
Shelby427	143*	162	156	--	82*	106*	136*	123*	40	75	62*	60*	58	64*	92	96*
Vista	124	133	148	--	81*	104*	94	89	38	71	59	64*	58	77	82	86
Trial mean[g]	**159**	**156**	**173**	**--**	**92**	**108**	**131**	**121**	**44**	**88**	**85**	**70**	**59**	**73**	**106**	**104**
Trial standard error	**9.6**	**8.5**	**6.3**	**--**	**6.8**	**9.3**	**8.3**	**8.5**	**7.7**	**13.2**	**8.5**	**7.8**	**5.6**	**8.2**	**13.9**	**9.7**

[a] Varieties that are not significantly different (P<0.05) from the highest yielding variety in the trial are marked with an asterisk (*). These analysis refer to a Tukey's Honest Significant Difference test.

[b] There were no trials in Chilton during the 2014 or 2016 growing season. The yield average of 2017 are higher than historical yield averages for that location.

[c] The Marshfield location had a particularly rough year with all the rain during the growing season and therefore 2017 yield averages are lower than historical yields for that location.

[d] The Sturgeon Bay location had lower yields in 2017 than historical yield averages.

[e] The overall performance is provided for completeness; however we advise caution in selecting varieties by the overall yield for Wisconsin because of the large genotype by environment interaction present. The three-year average for a nearby location is probably a better predictor of the performance of a variety in a particular area.

[f] Although significant differences among the varieties were found in the trial (P<0.05), no variety was significantly different from the highest yielding variety in this particular trial. That means all of these varieties received an asterisk.

[g] This is the trial's average that includes some experimental lines. It is not just the average of these varieties.

-- Information not available.

Table 5. Grain yield performance and maturity of barley varieties in the 2017 Wisconsin growing season at six locations[a].

		Grain yield (bu/A) [b]						
Variety	**Maturity date**	**Arlington[b]**	**Chilton**	**Lancaster**	**Madison**	**Spooner**	**Sturgeon Bay**	**2017**
Kewaunee	20-Jun	93.7	109.1*	15.5	98.7*	54.3	33.0	67.5
Pinnacle	25-Jun	90.8	90.8	32.7*	73.0	59.7	25.5	61.7
Quest	24-Jun	100.2	110.0*	11.6	96.9*	52.9	31.8	67.3
Rasmusson	22-Jun	96.4	100.4	35.7*	105.9*	77.0	32.8	74.9
Trial mean[c]	--	**95.3**	**102.6**	**23.9**	**93.6**	**61.0**	**30.8**	**67.9**
Trial standard error	--	**6.74**	**1.52**	**1.93**	**2.84**	**5.73**	**2.27**	**1.78**

[a]The Marshfield location had a particularly rough year with all the rain during the growing season and therefore 2017 yield is not reported.
[b] Varieties that are not significantly different (P<0.05) from the highest yielding variety in the trial are marked with an asterisk (*). These analysis refer to a Tukey's Honest Significant Difference test.
[c] This is the trial's average that includes some experimental lines. It is not just the average of these varieties.
-- Information not available.

Table 6. Forage dry matter yield and quality of spring oat and barley forage varieties harvested at different times at two locations in 2017.

		Arlington							Madison						
Variety	**Targeted harvest [a]**	**Booting date**	**Heading date**	**Harvest date**	**Dry biomass (ton /A)[b]**	**Relative forage quality**	**Crude protein (%)**	**Milk (ton/A)**	**Booting date**	**Heading date**	**Harvest date**	**Dry biomass (ton /A)**	**Relative forage quality**	**Crude protein (%)**	**Milk (ton/A)**
Barley: Hays	B	12-Jun	19-Jun	12-Jun	1.9	129.2	11.1*	2.6	12-Jun	19-Jun	12-Jun	1.7	114.7	9.9	2.0
Barley: Kewaunee	B	9-Jun	14-Jun	9-Jun	1.7	155.3 *	12.5*	2.5	8-Jun	12-Jun	8-Jun	1.1	135.3	11.4	1.5
Barley: Westford	B	12-Jun	18-Jun	12-Jun	1.7	141.7	11.8*	2.5	12-Jun	17-Jun	12-Jun	1.7	137.6	11.2	2.3
Oats: ForagePlus	B	19-Jun	30-Jun	19-Jun	2.8	128.2	11.1*	3.7	19-Jun	30-Jun	19-Jun	2.1	121.0	10.7	2.7
	B+2			21-Jun	3.2	129.4	10.8	4.2*			21-Jun	2.6*	96.1	10.2	2.7
	H			30-Jun	4.1*	99.2	9.0	4.5*			30-Jun	3.2*	130.9	11.0	4.1*
	H+3			3-Jul	4.6*	97.1	9.0	4.9*			3-Jul	2.9*	119.4	9.8	3.6*
Oats: Goliath	B	14-Jun	22-Jun	14-Jun	2.1	140.3	11.1*	3.0	12-Jun	22-Jun	12-Jun	1.7	134.4	11.5	2.3
Oats: Laker	B	16-Jun	26-Jun	16-Jun	2.1	136.7	11.8*	2.9	16-Jun	29-Jun	16-Jun	1.3	123.7	10.9	1.7
	B+2			19-Jun	2.6	118.5	10.9*	3.3			19-Jun	2.1	120.0	10.8	2.5
	H			26-Jun	3.8*	100.5	9.5	4.2*			30-Jun	2.6*	130.5	11.3	3.4*
	H+4			30-Jun	4.4*	92.0	9.3	4.4*			3-Jul	3.1*	144.0	12.1	4.4*
Oats: Vista	B	12-Jun	21-Jun	12-Jun	2.0	127.0	11.1*	2.6	12-Jun	19-Jun	12-Jun	1.7	157.6	11.7	2.5
Trial mean	--	**15 -Jun**	**24-Jun**	**18-Jun**	**2.57**	**129.0**	**10.95**	**3.2**	**15-Jun**	**24-Jun**	**18-Jun**	**1.9**	**128.9**	**11.0**	**2.5**
Trial standard error	--	--	--	--	**0.17**	**4.43**	**0.307**	**0.20**	--	--	--	**0.15**	**12.53**	**0.68**	**0.28**

[a] **Targeted Harvest:** Target developmental stage at harvest; B=booting, B+2= two days after booting, H=heading, H+4= four days after heading. The Arlington trials were planted on April9th, while the Madison trials were planted on April 10th. 5 x10 ft plots were used for plot evaluations, while forage harvest area was 2 x 3 ft.
[b]Varieties that are not significantly different (P<0.05) from the highest performing variety in the trial are marked with an asterisk (*). These analysis refer to a Tukey's Honest Significant Difference test.
-- Information not available.