

2016

WISCONSIN OATS AND BARLEY PERFORMANCE TESTS



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The Wisconsin oats and barley performance trials are conducted each year and 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 can use the data 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), and disease resistance. Barley growers should consider whether a variety is acceptable for malting. Several varieties are also evaluated for forage yield.

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 several locations using conventional tillage practices. All plots were planted at a seeding rate of 2.3-3.0 bushels 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

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 (Table 2).

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.

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 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 www.nass.usda.gov

Performance evaluation

Grain yield: Plots were harvested and threshed with a combine harvester in Madison and Arlington, 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 kg ha^{-1} and transformed to bu ac^{-1} . There are 32 pounds per bushel of oats and 48 per bushel of barley (Table 4).

Lodging: Lodging was measured in percent, where 0% is no lodging and 100% is severe lodging (Table 3).

Test weight: Test weight was measured with a Cox funnel using a 0.5 L measuring cup and weighting in grams. All analysis were conducted in g 0.5 L^{-1} and transformed to lb bu^{-1} following seed trade recommendations. Test weight is reported in pounds per bushel (Table 3 and 5).

Disease resistance: Disease resistance was evaluated as percentage of severity, where 0% is no disease presence and 100% is all plants affected. Disease severity is later transformed to disease resistance as follows: R = excellent resistance, IR = Intermediate resistance or very good, MR = moderate or good resistance, S = susceptible or poor resistance (Table 3).

Plant height: Plant height was measured from the base of the plant to the tip of the panicle at flowering time. All analysis were conducted in centimeters and transformed to inches. Plant height is reported in inches (Table 3).

Maturity: Maturity was evaluated by recording the date that 50% of the plants in a plot headed (Table 3).

Forage dry matter: Plots were hand harvested in Madison and Arlington at 5 centimeters (2 inches) above ground and dried. The weight of the plot was transformed to tons per hectare prior to analysis and transformed to tons per acre. Yield is reported in tons per acre (Table 6).

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, and BetaGene™ 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.



Additional information

Check the following annually updated publications for additional information on small grain production and seed availability.

Wisconsin Winter Wheat Performance Tests (A3868)

www.coolbean.info

Pest Management in Wisconsin Field Crops (A3646)

<https://learningstore.uwex.edu/>

The Wisconsin Certified Seed Directory

www.wcia.wisc.edu

For information on seed availability for public varieties:

Wisconsin Crop Improvement Association

554 Moore Hall, 1575 Linden Drive, Madison, WI 53706

(608) 262-1341

www.wcia.wisc.edu

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Table 1. Location and management practices of small grain variety trials in Wisconsin in 2016

Location	Cooperators	Soil type	Row spacing (inches)	Previous crop	Average nitrogen applied (lb ac ⁻¹)	Planting date	Harvest date
Arlington	P. LeMahieu	Silt loam	6.0	Soybean	0*	April 25	August 1
Lancaster	A.Crooks, B.Meyers	Silt loam	7.5	Soybean	6*	April 15	July 19
Madison	T.Wright, J.Hedtcke	Silt loam	6.0	Soybean	0*	April 26	July 28
Marshfield	J.Cavadini	Silt loam	6.0	Soybean	87	May 5	August 1, 2
Spooner	P.Holman	Sandy loam	7.3	Soybean	30*	April 22	August 3
Sturgeon Bay	M.Stasiak	Silt loam	12.0	Peas/Oats	83	May 10	August 2, 5

*Nitrogen credited from previous soybean.

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

	Oats				Barley			
	Area planted (acres)	Area harvested (acres)	Total production (M bushels)	Yield (bu ac ⁻¹)	Area planted (acres)	Area harvested (acres)	Total production (M bushels)	Yield (bu ac ⁻¹)
2016	210,000	100,000	6.60	66	NA	NA	NA	NA
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

Table 3. Oat variety description

Variety	Origin	Year of release	Kernel color	Maturity (date) ^a	Ht (in) ^b	Lodging %	Test Wt (lb bu ⁻¹)	Kernel protein	Crown rust	Stem rust	Septoria	Smut	BYDV ^c	Licensed /PVP ^f	Wis. cert. ^g
Recommended															
Badger	WI	2010	yellow	6-23	33	med	35.9	med	R	R	IR	R	R	yes	yes
BetaGene™	WI	2014	NA	6-28	36	med	34.7	NA	R	NA	NA	NA	R	yes	yes
Deon	MN	2013	yellow	7-1	40	med	37.4	med	R	-	R	R	R	yes	no
Drumlin	WI	2003	yellow	6-30	37	med	36.1	med	R	IR	IR	R	R	yes	yes
Esker	WI	2004	yellow	6-26	37	med	35.4	med	R	IR	IR	R	R	yes	yes
Excel	IN	2006	white	6-26	36	med	36.4	med	R	S	IR	R	R	yes	QA
Horsepower	SD	2012	yellow	6-26	34	weak	37.9	med	R	R	IR	R	R	yes	no
Newburg	ND	2011	white	6-30	42	weak	36.9	med	R	R	IR	R	R	yes	no
Ron	WI	2014	yellow	6-29	37	med	37.4	med	R	-	R	R	R	yes	yes
Rockford	ND	2008	white	7-1	39	med	37.7	med	R	R	IR	MR	R	yes	yes
Shelby427	SD	2009	white	6-25	39	med	38.8	med/high	R	MR	IR	MR	R	yes	yes
Vista	WI	1999	yellow	6-29	39	weak	35.7	low	R	R	MR	R	IR	yes	yes
Other varieties															
Dane	WI	1990	yellow	6-22	35	weak	35.2	med	IR	IR	S	R	S	yes	yes
Kame	WI	2005	yellow	6-24	35	weak	33.9	med	R	IR	MR	R	IR	yes	yes
Ogle	IL	1981	yellow	6-26	37	weak	35.2	low	IR	S	S	S	R	no	yes

^a Maturity (month-day) as indicated in 17 Wisconsin tests conducted 2013-2016^b Height (inches) at maturity in 17 Wisconsin tests conducted 2013-2016^c Test weight (pounds per bushel) in 17 Wisconsin tests conducted 2013-2016^d Disease resistance: R= excellent resistance, IR=Intermediate resistance or very good, MR=moderate or good resistance, S=susceptible or poor resistance^e BYVD=Barley yellow dwarf virus or red leaf disease^f PVP=Plant Variety Protection or licensed seed production. A "yes" indicates that these varieties can't be grown and sold as seed without certification^g QA=Quality Assurance

NA=Information not available



Table 4. Grain yield performance (bushels per acre) of oat varieties in Wisconsin

Variety	Arlington ^a	Lancaster	Madison	Marshfield	Spooner	Sturgeon Bay	Mean 2016 ^b	Mean 2013-2016 ^c
Early Season								
Badger	168	130	115	81	39	65	100	95
Dane	154	107	81	65	42	63	85	87
Kame	160	130	99	73	36	84	97	94
Natty	161	130	117	90	68	71	106	109
X10055-8	173	127	119	73	45	56	99	117
Midseason								
Esker	179	142	111	132	62	86	<u>119</u>	109
Excel	171	136	<u>133</u>	119	50	78	114	106
Horsepower	179	140	129	102	52	<u>90</u>	115	116
Ogle	167	123	104	95	69	75	106	104
Ron	178	132	117	74	46	73	103	109
Shelby427	189	137	117	82	58	67	108	104
Mid-Late Season								
BetaGene	160	136	92	95	53	64	100	108
Hayden	<u>216</u>	144	125	98	72	61	119	<u>123</u>
Late Season								
Deon	160	142	101	97	<u>77</u>	61	106	117
Drumlin	181	118	101	114	40	55	102	100
Newburg	173	151	114	108	55	45	107	113
Rockford	136	149	87	100	27	51	92	102
Vista	147	121	90	60	38	64	87	99
X10097-2	155	119	130	79	44	63	98	98
Mean	171	134	110	94	52	69	105	107
Average S.E.^d	11	13	8	15	5	8	4	4
Heritability^e	0.60	0.00	0.69	0.28	0.84	0.60	NA	NA

^aVarieties that are not significantly different from the highest yielding variety in the trial (underlined) are in bold

^b Mean of six trials in Wisconsin in 2016

^c Mean of 18 trials in Wisconsin from 2013-2016

^d Average S.E. indicates the average standard error of mean differences

^e Heritability indicates how much of the differences among genotypes is genetic in relation to the genetic and environmental variance

NA=Information not available



Table 5. Test weight performance (pounds per bushel) of oat varieties in Wisconsin

Variety	Arlington ^a	Lancaster	Madison	Marshfield	Sturgeon Bay	Mean 2016 ^b
Early season						
Badger	37.5	37.6	38.1	32.5	33.8	35.9
Dane	37.0	34.8	36.5	32.2	31.5	34.4
Kame	35.1	34.3	35.3	29.5	30.8	33.0
Natty	40.6	38.7	40.4	37.6	33.4	38.1
WI10055-8	35.7	35.7	35.8	31.2	29.3	33.5
Midseason						
Esker	35.4	34.3	34.9	30.2	30.0	32.9
Excel	38.3	38.8	39.0	34.9	31.7	36.5
Horsepower	38.8	39.2	38.7	32.6	33.7	36.6
Ogle	35.8	37.3	35.7	33.5	30.4	34.5
Ron	37.5	38.9	38.5	34.6	35.0	36.9
Shelby427	39.1	38.4	40.7	37.5	35.0	38.1
Mid-late season						
BetaGene	35.5	37.0	34.2	33.0	34.0	34.7
Hayden	38.6	40.5	39.6	35.5	<u>36.2</u>	38.1
Late season						
Deon	36.9	38.6	36.9	35.3	32.4	36.0
Drumlin	36.5	36.3	35.6	33.6	33.0	35.0
Newburg	36.7	36.9	37.0	33.1	32.2	35.2
Rockford	38.8	40.6	37.3	33.9	34.6	37.0
Vista	36.1	36.9	37.5	32.7	33.0	35.2
WI10097-2	<u>42.1</u>	<u>42.2</u>	<u>41.8</u>	<u>39.3</u>	35.1	<u>40.1</u>
Mean	37.5	37.7	37.5	33.8	32.9	35.9
Average S.E.^c	3.9	4.0	4.1	4.3	4.2	3.8

^aVarieties that are not significantly different from the variety with the highest test weight in the trial (underlined) are in bold

^b Mean of six trials in Wisconsin in 2016

^c Average S.E. indicates the average standard error of mean differences

NA=Information not available



Table 6. Forage dry matter yield of spring oat and barley varieties harvested at different developmental stages in 2016

Treatment	Harvest ^a	Harvest date	Madison				Harvest date	Arlington			
			Dry biomass ^b (ton ac ⁻¹)	Relative forage quality	Crude protein (%)	Milk (ton ac ⁻¹)		Dry biomass (ton ac ⁻¹)	Relative forage quality	Crude protein (%)	Milk (ton ac ⁻¹)
ForagePlusA	B	19-Jun	3.0	159.3	14.3	4.6	27-Jun	3.9	128.8	12.20	5.1
ForagePlusD	B+2	23-Jun	3.2	142.5	14.6	4.3	29-Jun	4.2	134.6	12.34	5.6
ForagePlusF	H	29-Jun	4.1	129.7	11.8	5.1	2-Jul	5.5	144.4	12.37	7.7
ForagePlusG	H+5	3-Jul	5.3	104.7	10.2	5.8	5-Jul	5.7	119.6	11.57	7.0
Goliath	B	15-Jun	2.2	176.5	17.2	3.2	21-Jun	2.8	150.3	13.48	3.9
Hays	B	15-Jun	1.9	161.6	16.4	3.1	20-Jun	2.8	157.6	13.64	4.1
Kewaunee	B	15-Jun	1.9	NA	NA	NA	20-Jun	3.0	129.1	13.01	3.8
Vista	B	15-Jun	2.6	165.8	15.0	4.2	20-Jun	3.2	128.8	13.16	4.2
Westford	B	20-Jun	2.8	152.3	14.4	3.9	21-Jun	2.8	149.1	14.58	4.0
Mean	--	--	3.3	142	13	4.4	--	4.2	132	12	5.3
Average S.E.^c	--	5	0.4	11	1	0.5	2	0.2	9	1	0.3

^aHarvest: developmental stage at harvest; B=booting, B+2= two days after booting, H=heading, H+5= five days after heading.

^bVarieties that are not significantly different from the variety with the highest test weight in the trial (underlined) are in bold

^c Average S.E. indicates the average standard error of mean differences.

NA=Information not available

