

# 2021 Oat and Barley Performance Tests

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The Wisconsin oat and barley performance trials are conducted each year to serve Wisconsin farmers. 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. Farmers can use this data to help choose the best varieties to plant, and breeders can use it to decide on whether to release a new variety or not, 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 farmers. 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 grain oat and barley varieties include grain yield, maturity, straw strength (or resistance to lodging), disease resistance, and grain quality (Tables 3-6). Oat farmers who are interested in selling their grain to the milling industry should also consider grain quality in the form of test weight, grain size and plumpness, groat percentage, and percentage of thins. Finally, some oat and barley varieties are evaluated for forage yield and quality (Tables 7 and 8). Barley

farmers may also consider whether a variety is acceptable by the malting industry.

## 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 purposes.

Tests were conducted at six locations during the 2021 growing season using conventional tillage practices. The goal was to have a stand of 1.3 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.

## 2021 Growing season

Wisconsin oat production in 2021 was estimated at 3.8 million bushels, the area planted with oat was 175,000 acres while the area harvested was 61,000 acres, which represents a reduction on area of 41% and 33% respectively compared to 2020 and 2019. During 2021, the total harvested area of oat has been reduced a 53% and 49 % on average in comparison to 2020 and 2019 respectively. Oat grain yield average was 62 bushels per acre, which represents almost no difference with the 63 bushels per acre harvested in average in 2020 (Table 2).

Wisconsin barley planted area in 2021 was 15,000 acres with an estimated harvest area of 7,000 acres. The planted area was reduced by 42% and 37% in comparison to 2020 and 2019 planted acres. The harvest area follows the same trend with a reduction of 46% and 12% in comparison to 2020 and 2019 (Table 2). Barley grain yield average was 53 bushels per acre, which represents an increase of 15% compared to 2020 and 2019.

The 2021 growing season was unusually variable in the Madison location. Average temperatures for April (47.2 °F), May (56.5 °F), June (70.6 °F) and July (69.2 °F) had

**Table 1.** Location and management practices of small grain variety trials in Wisconsin in 2021.

Location	County	Cooperators	Row Spacing	Previous Crop	Average N (lb per A)	Planting Date	Weed control	Harvest date	Number genotypes
Alma	Buffalo	C. Duley	7 inches	Soybean	50	5-Apr	2.4D	12-Jul	40
Antigo	Langlade	J. Schumitsch	6 inches	Potatoes	50	10-May	MCPA + Harmony E	12-Aug	40
Arlington	Columbia	M. Bertram	6 inches	Soybean	50	1-Apr	2.4D + Harmony E	27-Jul	60
Lancaster	Grant	D. Wiedenbeck	6 inches	Soybean	10.5	7-Apr	Harmony SG	2-Aug	40
Madison	Dane	J. Hedtcke	6 inches	Soybean	0	4-Apr	2.4D + Low Vol 4	25-Jul	60
Spooner	Washburn	P. Holman	7 inches	Soybean	15	5-May	2.4D + Buctril	25-Aug	40

**Table 2.** Historical areas, production, and yield of oat and barley in Wisconsin.

Year	Oat				Barley			
	Area planted (acres)	Area harvested (acres)	Total production (Million bu)	Grain yield (bu per A)	Area planted (acres)	Area harvested (acres)	Total production (million bu)	Grain yield (bu per A)
2021	175,000	61,000	3.80	62	15,000	7,000	0.37	53
2020	300,000	131,000	5.49	63	26,000	13,000	0.59	46
2019	265,000	120,000	6.48	54	24,000	8,000	0.37	46

-- Information not available. Source: USDA National Agricultural Statistics Service [www.nass.usda.gov](http://www.nass.usda.gov)

deviations of +4.6 °F, -1.6 °F, +2.6 °F and -1.8 °F from historical averages, but with days of extreme heat during April and May. The precipitations in April (1.5"), May (2.6"), June (4.5"), and July (0.7") had deviations of -0.5", -2.8", +0.4", and -2.6" from historical averages. Therefore, early season was dry, warmer, and with days of extremely hot temperatures which facilitated earlier planting dates in most locations but also created conditions for lower emergence and reduced tillering. in both barley and oats. Late season was mostly dry which delayed the expression of crown rust disease, but some heavy storms caused high levels of lodging.

**2020 Growing season**

Wisconsin oat production in 2020 was estimated at 5.49

million bushels, the area planted with oat was 300,000 acres, and the area harvested was 131,000 acres, which was an increase of 13% and 9% respectively compared to 2019. During the last three years, the oat planted and harvested area have been increasing on average 18% and 11% respectively. Oat estimated grain yield was 63 bushels per acre, an increase of 17% in comparison to the production obtained in 2019 (Table 2).

Wisconsin barley planted area in 2020 was 26,000 acres and the estimated harvest area was 13,000 acres. The planted area had an increase of 8%, while the harvested area had an increase of 6% in comparison to 2019 (Table 2). Barley estimated yield was 46 bushels per acre in 2020 which was not different from the year 2019.

**Table 3.** Grain oat variety description.

Genotype	Origin	Release year	Kernel color	Maturity date <sup>a</sup>	Ht (in) <sup>b</sup>	Lodging (%) <sup>c</sup>	Test Wt (Lb/bu) <sup>d</sup>	Kernel protein	Crown rust <sup>e</sup>	Stem rust <sup>f</sup>	Septoria <sup>g</sup>	Smut <sup>h</sup>	BYDV <sup>g</sup>	Licensed/PVP <sup>h</sup>	Wis. Cert.
<b>Recommended</b>															
Antigo	WI	2017	yellow	22	32	15	46	high	MR	S	--	MR	MR	yes	yes
BetaGene™	WI	2014	yellow	25	33	5	42	--	MS	--	--	--	MR	yes	yes
Deon	MN	2013	yellow	29	37	15	43	med	R	--	R	R	R	yes	yes
Esker2020	WI	2020	yellow	23	35	10	42	med/high	R	MR	--	R	MR	yes	yes
MN-Pearl	MN	2019	white	29	35	10	42	med/high	MR	MR	--	MR	MR	yes	yes
Ron	WI	2014	yellow	27	36	20	42	med	S	--	R	R	MR	yes	yes
Rushmore	SD	2019	white	25	35	10	46	high	R	--	--	R	MR	yes	yes
WIX10305-4	WI	2022	yellow	27	27	5	38	high	R	--	--	--	R		
<b>Other varieties</b>															
Badger	WI	2010	yellow	22	79	21	42	med	S	R	MR	R	S	yes	yes
Esker	WI	2004	yellow	25	87	15	39	med	MR	MS	MR	R	R	yes	yes
Horsepower	SD	2012	yellow	25	85	33	38	med	S	R	MR	R	MR	yes	yes
Hayden	SD	2014	yellow	27	86	10	44	med/high	S	MS	--	R	MR	yes	yes
Shelby427	SD	2009	white	25	90	22	43	med/high	S	MS	MR	MR	MR	yes	yes
Ogle	IL	1981	yellow	26	86	23	38	low	S	S	S	S	R	yes	yes
Sumo	SD	2016	white	19	34	15	40	med/high	R	R	--	R	MR	yes	yes
Vista	WI	1999	yellow	28	89	10	39	low	MS	R	MS	R	MR	yes	yes
Warrior	SD	2018	white	25	26	5	38	high	R	--	--	R	MR	yes	yes

<sup>a</sup> Maturity (days after May 31st) as indicated in 15 Wisconsin tests conducted 2019-2021. <sup>b</sup> Height (inches) at maturity in 15 Wisconsin tests conducted 2019-2021. <sup>c</sup> Lodging in 15 Wisconsin tests conducted in 2019 and 2021, no expression on the 2020 season. <sup>d</sup> Test weight (lb per bu) in 15 Wisconsin tests conducted 2019-2021. <sup>e</sup> Crown rust disease resistance: R=Resistant, MR=Moderately Resistant, MS=Moderately Susceptible, S=Susceptible. Due to the high mutation rate of the pathogen, only 2019-2021 data were used for crown rust reports. <sup>f</sup> 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. <sup>g</sup> Barley yellow dwarf virus or red leaf disease resistance (BYDV): R=Resistant, MR=Moderately Resistant, MS=Moderately Susceptible, S=Susceptible. <sup>h</sup> PVP=Plant Variety Protection or licensed seed production. A "yes" indicates that these varieties cannot be grown and sold as seed without certification.

The 2020 growing season was characterized by a dry spring with lower precipitation and above average temperature. This created a larger variability in sowing dates among

locations and in general, later planting dates than average. The precipitations in April (1.44"), May (4.8"), June (4.33"), and July (5.6") had deviations of -0.77", -1.6",

+0.8", and +1.41" respectively in comparison to historical averages at Arlington WI. Lower precipitation combined with higher temperatures in April and May affected plant emergence and early development of the crop. The dryer weather in combination with several days of extreme high temperatures the last week of May were the most likely causes of reduced tillering in both barley and oat. There was also a lower infection rate of crown rust in oat.

The 2020 growing season was also an unusual year due to the COVID-19 pandemic. Due to heavy restrictions in travel for research activities, several testing locations could not be planted. Therefore, only five of the eight locations could be evaluated. Additionally, forage testing trials could not be planted due to the labor required.

### 2019 Growing season

Wisconsin oats production in 2019 was estimated at 6.48 million bushels, the area planted with oats was 265,000 acres, and the area harvested was 120,000 acres, which was an increase on area compared to 2018 (20%). Oat yield was

54 bushels per acre, which was 17% lower than production obtained in the last three years (Table 2).

Wisconsin barley planted area in 2019 was 24,000 acres and the estimated harvest area is 8,000 acres. The planted area was 50% less than 2018 and the estimated harvest area was 76% less than in 2018 (Table 2).

The 2019 growing season was characterized by a cold and wet spring with higher than average precipitation and lower than average temperature. Although average temperatures for April (46.6 °F), May (55.9 °F), June (66.6 °F) and July (75.2 °F) had small deviations of +0.3 °F, +1.4 °F, -0.4 °F and +3.9 °F respectively from historical values, lowest temperatures recorded during April were accompanied by snowfalls in several areas of the state which delayed or limited the start of emergence. This created a larger variability in sowing dates among locations and later planting dates than average. The precipitations in April (3.22"), May (6.17"), June (5.16"), and July (5.77") had deviations of -0.18", +2.62", +0.62", and +1.59" respectively in comparison to historical averages.

Source: USDA National Agricultural Statistics Service

**Table 4.** Grain yield (bushels per acre) performance of oat varieties in the 2021 growing season and average of three years (2019, 2020, and 2021).

Genotype	Grain yield (bu per A)													
	Antigo <sup>a</sup>		Arlington		Alma		Lancaster		Madison		Spooner		Overall <sup>b</sup>	
	2021	3-yr	2021	3-yr	2021	3-yr	2021	3-yr	2021	3-yr	2021	3-yr	2021	3-yr
Antigo	119	72	112	<b>109*</b>	125	<b>108*</b>	53	73	91	99	27	47	87	85
Badger	120	72	67	87	119	91	34	76	54	81	12	44	73	75
BetaGene™	124	76	140	<b>107*</b>	<b>158*</b>	<b>120*</b>	<b>68*</b>	<b>86*</b>	<b>132*</b>	<b>117*</b>	42	<b>57*</b>	<b>110*</b>	<b>94*</b>
Deon	<b>143*</b>	<b>101*</b>	131	<b>113*</b>	140	107	48	<b>78*</b>	<b>137*</b>	<b>123*</b>	22	<b>65*</b>	<b>104*</b>	<b>97*</b>
Esker	118	76	125	101	130	97	55	<b>86*</b>	100	98	34	55	94	85
Esker2020	138	<b>92*</b>	131	<b>112*</b>	140	<b>125*</b>	62	<b>91*</b>	104	111	37	<b>63*</b>	<b>100*</b>	<b>99*</b>
Hayden	134	<b>86*</b>	<b>151*</b>	98	114	92	55	<b>81*</b>	107	108	34	<b>57*</b>	<b>98*</b>	<b>88*</b>
Horsepower	--	72	97	61	95	63	52	70	104	97	--	55	79	69
MN-Pearl	<b>141*</b>	<b>99*</b>	125	<b>108*</b>	136	107	25	73	118	<b>118*</b>	44	<b>70*</b>	<b>99*</b>	<b>97*</b>
Ogle	95	57	115	75	128	96	--	75	<b>127*</b>	105	--	<b>58*</b>	90	79
Ron	120	<b>85*</b>	138	97	<b>154*</b>	106	<b>62*</b>	<b>81*</b>	111	105	<b>55*</b>	<b>68*</b>	<b>106*</b>	<b>91*</b>
Rushmore	134	<b>88*</b>	126	<b>103*</b>	<b>151*</b>	<b>119*</b>	42	76	124	<b>128*</b>	36	<b>63*</b>	<b>103*</b>	<b>98*</b>
Sumo	90	54	129	107	110	69	30	63	70	86	30	46	78	73
Vista	137	72	123	91	<b>157*</b>	<b>111*</b>	<b>69*</b>	<b>91*</b>	114	103	<b>51*</b>	<b>66*</b>	<b>108*</b>	<b>89*</b>
Warrior	--	--	127	97	--	--	--	--	102	109	--	--	95	<b>87*</b>
WIX10305-4	--	75	134	<b>130*</b>	<b>156*</b>	<b>113*</b>	--	75	91	96	<b>56*</b>	<b>60*</b>	<b>100*</b>	<b>89*</b>
Trial Mean	126.9	80.6	121.5	97.0	134.3	103.1	51.9	79.6	109.4	107.1	35.8	59.0	96.3	88.2
Trial S.E.	0.2	0.8	0.1	0.4	1.0	0.8	1.0	0.7	0.7	0.6	0.9	0.7	0.4	0.3
LSD	2.5	15.1	1.9	10.8	12.1	17.3	10.6	13.4	12.6	15.6	10.0	14.2	14.0	13.5

\*Varieties that are not significantly different (P<0.05) from the highest yielding variety in the trial are marked with a star (\*). These analyses refer to a Fisher's Least Significant Difference (LSD) test. 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. The trial mean average that includes the varieties in the table and some additional elite experimental lines is provided. It is not just the average of these varieties. -- Information not available

**Table 5.** Grain barley variety description.

Genotype	Origin	Year	Rows	Objective <sup>a</sup>	Test Wt <sup>b</sup>	Plant Height <sup>c</sup>	Maturity date <sup>d</sup>	Net Blotch <sup>e</sup>	Spot Blotch <sup>f</sup>	BYD V <sup>g</sup>	FHB <sup>h</sup>	Lodging (0-9) <sup>i</sup>
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AAC Synergy	CA	2012	2	Malting	46	28	29	MR	MS	MR	MR	0
AC Metcalfe	CA	1997	2	Malting	47	28	29	MS	S	MR	S	1
CDC Copeland	CA	1999	2	Malting	47	29	30	MS	S	MR	S	1
Conlon	ND	1996	2	Malting	48	27	23	S	S	MR	S	2
Kewaunee	WI	1994	6	Feed	47	31	21	MR	MS	MR	MR	1
LCS Genie	US	--	2	Malting	47	27	30	S	S	MR	S	0
ND Genesis	ND	2015	2	Malting	47	29	26	MS	MS	MR	MS	0
Pinnacle	ND	2008	2	Malting	47	30	25	S	MS	MR	S	0
Quest	MN	2010	6	Malting	46	28	22	MR	MS	MR	MR	2
Rasmusson	MN	2088	6	Malting	47.2	30.8	21	MR	MS	MR	MR	0

<sup>a</sup> Suggested use stated in release and commercial information. <sup>b</sup> Test weight (lb per bu) in 15 Wisconsin tests conducted 2019-2021. <sup>c</sup> Height (inches) at maturity in 15 Wisconsin tests conducted 2019-2021. <sup>d</sup> Maturity (month-day) as indicated in 15 Wisconsin tests conducted 2019-2021. <sup>e</sup> Net Blotch disease resistance: R=Resistant, MR=Moderately Resistant, MS=Moderately Susceptible, S=Susceptible. 2019-2021 data were used for Net Blotch reports. <sup>f</sup> Spot Blotch disease resistance: R=Resistant, MR=Moderately Resistant, MS=Moderately Susceptible, S=Susceptible. 2019-2021 data were used for Spot Blotch reports. <sup>g</sup> Barley yellow dwarf virus or red leaf disease resistance (BYDV): R=Resistant, MR=Moderately Resistant, MS=Moderately Susceptible, S=Susceptible. <sup>h</sup> FHB Fusarium head blight based on natural expression in 2 Wisconsin tests conducted in 2019-2021. <sup>i</sup> Lodging in 15 Wisconsin tests conducted in 2019 and 2021, no expression on the season 2020.

### Performance evaluation

**Grain yield.** Plots were harvested and threshed with a combine harvester in Madison, Arlington, Antigo, 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 12% moisture content. All the analysis was conducted in bushels per acre. There are 32 pounds per bushel of oat and 48 per bushel of barley (Tables 4 and 6).

**Test weight.** Test weight was measured with a Cox funnel using a 0.5 liter (L) measuring cup and weighting in grams. All data was transformed to pounds per bushel following seed trade recommendations and all analysis were

conducted in lb per bu. Test weight is reported in pounds per bushel (Tables 3 and 5).

**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 all locations (Table 3, 5, 7, and 8).

**Plant height.** Plant height is measured from the base of the plant to the tip of the panicle after heading in oat and to the tip of the spike without awns in barley. The analysis was conducted in centimeters and transformed to inches. Plant height is reported in inches using the three-year average of all locations (Table 3, 5, 7, and 8).

**Table 6.** Grain yield performance and heading date of barley varieties in the 2021 growing season at six locations in Wisconsin.

Genotype	Grain Yield (bu per A) <sup>a</sup>													
	Alma		Antigo		Arlington		Madison		Lancaster		Spooner		Overall <sup>b</sup>	
	2021	3-yr	2021	3-yr	2021	3-yr	2021	3-yr	2021	3-yr	2021	2021	2021	3-yr
AAC Synergy	46*	61	71	71	80*	80*	93	68*	55	47	23	35*	63*	54*
AC Metcalfe	23	43	53	53	64	64	80	59	44	41	12	23	49	39
CDC Copeland	16	37	55	55	72	72	83	56	50	34	15	19	50	36
Conlon	27	52	50	50	72	72	73	54	53	40	8	25	49	44
Kewaunee	22	45	77*	77*	81*	81*	83	69*	65*	48	26	37*	64*	60*
LCS Genie	27	42	53	53	53	53	80	52	44	27	15	21	48	31
ND Genesis	49*	73*	75	75	82*	82*	104	66*	62	48	37*	40*	71*	57*
Pinnacle	39	56	65	65	75	75	83	61*	42	46	22	30	59	48
Quest	47*	70*	80*	80*	85*	85*	88	67*	47	48	23	36	68*	59*
Rasmusson	38	69*	81*	81*	85*	85*	81	66*	76*	59*	30	40*	67*	59*
Trial mean <sup>c</sup>	33.3	54.7	65.9	65.9	74.8	74.8	84.6	61.7	53.8	43.6	21.2	30.6	58.6	48.6
Trial Standard error	0.8	0.9	0.5	0.7	1.3	0.8	1.3	0.8	2.1	0.7	0.9	0.7	1.2	0.3
LSD	5.0	7.0	5.2	4.5	8.0	6.9	7.7	7.3	12.4	7.0	5.3	6.6	7.3	6.1

<sup>a</sup> Varieties that are not significantly different ( $P < 0.05$ ) from the highest yielding variety in the trial are marked with a star (\*). These analyses refer to a Fisher's Least Significant Difference (LSD) test. <sup>b</sup> 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. <sup>c</sup> The trial mean average that includes the varieties in the table and some additional elite experimental lines is provided. It is not just the average of these varieties.

**Table 7.** Forage dry matter yield and quality of spring oat varieties harvested at Madison and Arlington, Wisconsin in 2021 and average of three years (2018, 2019, and 2021).

Genotype	Overall		Arlington								Madison							
			Dry Biomass (ton/A) <sup>a</sup>		Crude protein (%)		Relative forage quality		Milk (ton/A)		Dry Biomass (ton/A)		Crude protein (%)		Relative forage quality		Milk (ton/A)	
	Booting date	Heading date	2021	3-yr	2021	3-yr	2021	3-yr	2021	3-yr	2021	3-yr	2021	3-yr	2021	3-yr	2021	3-yr
ForagePlus	25	34	<b>1.6*</b>	<b>1.7*</b>	10.1	10.3	140	115	3137	2729	<b>2.4*</b>	1.6	10.0	10.3	134.7	144	3035	3145
George	21	30	<b>1.4*</b>	<b>1.7*</b>	10.3	10.8	157	119	3332	2814	1.6	<b>1.9*</b>	10.9	10.0	157.1	146	3322	3247
Goliath	19	28	0.9	1.4	11.4	11.6	182	138	3596	3014	1.0	1.6	<b>12.9*</b>	11.1	<b>192.0*</b>	160	<b>3693*</b>	3063
Laker	21	32	1.1	1.4	11.9	<b>12.7*</b>	164	122	3385	2801	1.2	1.1	11.7	<b>14.3*</b>	177.8	<b>180*</b>	3458	2934
Vista	18	26	1.1	<b>1.5*</b>	12.2	11.7	159	125	3339	2834	1.2	1.6	10.2	10.9	139.8	146	3107	<b>3306*</b>
Trial mean <sup>b</sup>	21	30	1.1	1.5	11.6	11.4	167	129	3411	2903	1.4	1.1	11.6	10.3	167	145	3412	2969
Trial S.E.	1.2	1	<0.1	<0.1	<0.1	<0.1	1.7	0.6	17.1	7.2	<0.1	<0.1	<0.1	<0.1	1.7	0.51	17.1	13.3
LSD	--	--	0.2	0.2	0.9	0.6	19.6	12.0	193.8	140.1	0.3	0.2	0.9	0.6	19.6	7.5	193.8	211.6

<sup>a</sup> Varieties that are not significantly different (P<0.05) from the highest performing variety in the trial are marked with a star (\*). These analyses refer to a Fisher's Least Significant Difference (LSD) test. <sup>b</sup> The trial mean average that includes the varieties in the table and some additional elite experimental lines is provided. It is not just the average of these varieties. -- Information not available. Forage evaluations were not performed during the year 2020 due to COVID-19 restrictions.

**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. Disease resistance in all varieties is eventually overcome by the pathogen variability, and therefore, only the most recent years are used for the report (Tables 3 and 5).

**Lodging.** Lodging was measured in percent, where 0% is no lodging and 100% is severe lodging. It was then transformed to weak=severe lodging, medium=intermediate lodging, low=low lodging (Table 3, 5 7, and 8).

**Forage dry matter.** An area of 3x3.28 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 (Tables 7 and 8). 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 (Tables 7 and 8).

#### 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 oat. 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, Esker2020, Kame, Moraine, Ron, BetaGene™, Antigo, Laker, and George oat.

**Table 8.** Forage dry matter yield and quality of spring barley varieties harvested at Madison, Wisconsin in 2021 and an average for three years (2018, 2019, and 2021).

Genotype	Overall		Arlington								Madison							
			Dry Biomass (ton/A) <sup>a</sup>		Crude protein (%)		Relative forage quality		Milk (lb./A)		Dry Biomass (ton/A)		Crude protein (%)		Relative forage quality		Milk (lb./A)	
	Booting date	Heading date	2021	3-yr	2021	3-yr	2021	3-yr	2021	3-yr	2021	3-yr	2021	3-yr	2021	3-yr	2021	3-yr
Kewaunee	12	19	<b>0.7*</b>	<b>1.0*</b>	13.0	11.9	225	<b>162*</b>	<b>3918*</b>	<b>3285*</b>	1.0	0.6	<b>14.3*</b>	11.1	<b>188*</b>	<b>176*</b>	<b>3622*</b>	<b>3399</b>
Hays	16	27	<b>0.7*</b>	<b>1.1*</b>	<b>14.9*</b>	<b>13.0*</b>	<b>240*</b>	<b>171*</b>	<b>4027*</b>	<b>3396*</b>	<b>2.1*</b>	<b>1.3*</b>	11.1	<b>12.3*</b>	146	<b>175*</b>	3160	3057
Redrock	15	26	<b>0.8*</b>	--	11.8	--	217	--	<b>3990*</b>	--	1.2	--	11.1	--	175	--	<b>3508*</b>	--
Trial Mean	21	30	1.1	1.0	11.6	11.0	167	129	3412	2903	1.4	1.1	11.6	10.3	167	145	3411	2969
Trial S. E.	1.2	1.0	<0.1	<0.1	<0.1	<0.1	1.7	0.6	17.1	7.2	<0.1	<0.1	<0.1	<0.1	1.7	0.5	17.1	13.3
LSD	--	--	0.2	0.2	0.9	0.6	19.6	12.0	194	140	0.3	0.2	0.9	0.6	19.6	7.5	194	212

<sup>a</sup> Varieties that are not significantly different (P<0.05) from the highest performing variety in the trial are marked with a star (\*). These analyses refer to a Fisher's Least Significant Difference (LSD) test. <sup>b</sup> The trial mean average that includes the varieties in the table and some additional elite experimental lines is provided. It is not just the average of these varieties. -- Information not available. Forage evaluations were not performed during year 2020 due covid restrictions.

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 cereals 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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2021 Wisconsin Oats & Barley Performance Tests (A3874)