

# 2017-2021 WINTER BARLEY VARIETY TRIAL TRENDS

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With support from: MSU Project GREEN, American Malting Barley Association, Michigan Craft Beverage Council

## Background

The craft beverage industry is increasingly becoming an important part of Michigan's economy; in fact, the craft beer value chain in 2016 was estimated to contribute over \$500 million to the Gross State Product (Miller et al., 2019). Currently, a goal in the sector is to provide local sources of malting barley to craft brewers and maltsters. Understanding winter barley varietal performance is important for Michigan producers, since varieties can differ widely in yield, disease resistance, phenology, and quality measurements.

MSU Extension, in collaboration with MSU AgBioResearch and the LTAR (Long-Term Agroecosystem Research) Project at W.K. Kellogg Biological Station, has conducted a Winter Barley Variety Trial since 2017 at Hickory Corners (Kalamazoo County) and Kawkawlin (Bay County). Over the course of five years, 85 varieties of winter barley have been tested for agronomic and malting quality data, and about 40 have been tested for at least two years. This long-term research is valuable because it is difficult to conduct multi-year, multi-location varietal studies and gather quality data. These data are crucial in helping producers, maltsters and brewers make decisions about varieties that produce optimal yields and quality in Michigan's climate.



**Above.** 2021 Winter Barley Variety Trial at KBS

**Below,** 2-row (left image) and 6-row (right image) winter barley



## Methods

In this analysis, we investigated which varieties are best performing (i.e., highest yield, highest quality metrics), how varieties differ in phenology (i.e., heading and maturity date), and which varieties are most susceptible to disease and extreme weather. We used quality data thresholds provided by the American Malting Barley Association to judge performance. To organize the data, we referenced tables from the MSU Wheat and Soybean Variety Trial publications to formulate methods for multi-year comparisons.

AMBA Quality Metrics	
RVA (>120)	Rapid Visco Analysis; degree of pre-harvest sprout damage
CP (<12.5%)	Crude Protein; impacts ability to produce malt extract
Plump (>90%)	Size and uniformity of kernel; ensures water is absorbed evenly when steeped
DON (<1 ppm)	Deoxynivalenol; indicates presence of Fusarium, a mycotoxin

# Background & Management: Hickory Corners

	2017	2018	2019	2020
<b>Planting date</b>	9/27/16	9/26/17 @ 120 lbs/A	10/16/18	10/10/19
<b>Fertility</b>	9/27/16 – 20 lbs N/acre, 100 lbs P/acre, 50 lbs K/acre 4/12/17 – 12 S/acre, 102.5 lbs N/acre (50 lbs AMS + 200 lbs urea/acre)	9/26/17 – 20 lbs N/acre, 65 lbs K/acre 4/5/18 – 12 S/acre, 102.5 lbs N/acre (50 lbs AMS + 200 lbs urea/acre)	10/16/2018 – 20 lbs N/acre, 45 lbs P/acre, 65 lbs K/acre, 6.3 lbs S/acre. 4/10/2019 100 lbs N/acre (urea)	10/8/2018 – 32 lbs N/acre, 52 lbs P/acre, 12 lbs S/acre. 3/27/2020 60 lbs K/acre, 100 lbs N/acre, 10 lbs S/acre.
<b>Fungicide</b>	5/26/17 – 8 oz./acre Prosaro®	5/29/18 – 8 oz/acre Prosaro®	5/31/2019 8.2 oz/A Prosaro	5/27/2020 13.7 oz/acre Miravis Ace
<b>Harvest</b>	6/30/17	7/2/18	7/17/19	6/30/20
<b>Growing season conditions</b>	Fall and winter were much warmer than usual, with temperatures becoming more normal into summer. Over-winter, the site received more rain than snow, however, spring and summer were a bit dryer than normal.	September was warm and very dry, but a switch to wet and cool conditions occurred mid-October, and cool conditions persisted through April delaying crop development. Temperatures turned warm in May with adequate rainfall until mid-June when conditions turned dry	An unusually cold wet spring delayed development. There was also some winter kill.	A cool and wet period in April and early May was followed by intermittent dry periods until harvest.
<b>Previous crop</b>	-	Soybeans	Soybeans	Soybeans
<b>Soil type</b>	-	Kalamazoo Sandy Loam	Kalamazoo Sandy Loam	Kalamazoo Sandy Loam



2021 Winter Barley Variety Trial at KBS.

# Background & Management: Kawkawlin

	2018	2019	2020
<b>Planting date</b>	10/3/17 @ 120 lbs/A	10/17/2018	10/26/19
<b>Fertility</b>	Fall of 2017- 150 lbs./ac of 10-10-30 was broadcast and then incorporated. Spring of 2018- 35 gals/ac of 28% N plus 9 lbs./ac S.	Fall – 10 lbs N/acre, 10 lbs P/acre, 30 lbs K/acre 4/25/2019 – 100 lbs N/acre (28%)	10/26/2019 – 15 lbs N/acre, 15 lbs P/acre, 45lbs K/acre. 5/16/2020 100 lbs N/acre (urea)
<b>Fungicide</b>	8.2 oz./acre of Prosaro® at heading.	5/18/2019 – 10 oz./acre Nexicor	None
<b>Harvest</b>	7/6/18	7/26/19	7/17/20
<b>Growing season conditions</b>	Similar to Hickory Corners, cooler than average temperatures persisted from planting through April. Subsequently, this site experienced drought conditions during grain fill. Crop height was short and lodging was not present at harvest.	An unusually cold wet spring delayed development. There was also some winter kill.	Late planting led to limited fall growth, including no fall emergence for a few varieties. A portion of the plot area was removed from analysis due to winter injury from ponding.
<b>Previous crop</b>	Dry beans	Dry beans	Dry beans
<b>Soil type</b>	Wixom Sandy Loam	Wixom Sandy Loam	Wixom Sandy Loam



Harvesting the 2021 Winter Barley Variety Trial in Kawkawlin.

# Grain Yield

Variety	HC 2-Yr Avg	KK 2-Yr Avg	HC 3-Yr Avg	KK 3-Yr Avg	HC 4-Yr Avg
08ARS509-1	106.95	90.20	-	-	-
08ARS632-5	98.20	81.35	-	-	-
13ARS537-13	97.50	79.50	-	-	-
13ARS537-19	71.00	79.75	-	-	-
AC13/028/53*	109.75	96.15	-	-	-
Charles	74.20	63.50	72.10	61.73	81.33
DH130910	80.10	83.00	85.80	77.73	102.85
DH140088	100.20	83.95	96.73	82.30	-
DH140963	109.00	85.05	-	-	-
Endeavor	75.70	64.30	79.83	61.00	88.63
Flavia	104.05	93.45	101.27	84.77	113.70
Hirondella*	102.20	91.30	98.00	76.90	112.50
KWS Scala	93.15	97.50	-	-	-
LCS Calypso	91.10	86.40	-	-	-
LCS Casanova	108.80	69.10	-	-	-
LCS Nenea	101.65	74.55	-	-	-
LCS Puffin	101.05	73.45	-	-	-
LCS Violetta	73.65	53.40	-	-	-
Lyberac	100.10	85.00	102.17	78.60	-
Nomini*	85.00	73.20	-	-	-
Rossignola*	116.05	89.45	-	-	-
Secretariat	89.55	81.30	-	-	-
Thoroughbred*	86.65	75.05	84.93	64.60	103.95
Wintmalt	85.90	73.70	82.83	65.83	94.13

Top 33% of varieties, by column

**Table 1.** Yield averages over 2-,3-, and 4- consecutive years, by site (HC: Hickory Corners, KK: Kaw-kawlin). “\*” indicates 6-row varieties



Winter barley at KBS.

# Malting Quality

Variety	Site Years AMBA Quality			
	RVA	CP	Plump	DON
Wintmalt	6/6	5/6	5/6	4/5
LCS Calypso	4/4	3/4	3/4	3/3
LCS Puffin	4/4	3/4	4/4	3/3
Flavia	3/6	6/6	6/6	4/5
Lyberac	3/3	3/3	4/5	2/3
Hirondella*	3/6	4/6	4/6	2/5
DH130910	4/4	2/4	4/6	2/3
LCS Violetta	3/4	2/4	3/4	2/3
KWS Scala	3/3	3/3	3/3	2/3
LCS Casanova	3/3	2/3	3/3	2/3
LCS Nenea	3/3	2/3	2/3	2/3
08ARS632-5	2/3	2/3	3/3	2/3
DH140963	3/3	3/3	3/3	1/3
Thoroughbred*	6/6	5/6	0/6	3/5
MW12_4007-001*	2/2	2/2	0/4	1/1
Charles	0/6	4/6	4/6	4/5
DH140088	1/3	2/3	4/5	2/3
Endeavor	1/6	5/6	2/6	4/5
Rossignola*	2/3	3/3	3/3	1/3
13ARS537-13	1/3	3/3	3/3	2/3
13ARS537-19	1/3	3/3	3/3	2/3
SU_Mateo	2/3	3/3	1/3	2/2
AC13/028/53*	0/2	2/2	2/2	0/2
Nomini*	3/3	2/3	0/3	1/3
Secretariat	3/3	2/3	1/3	1/3
08ARS509-1	1/3	3/3	1/3	2/3
VA11B-141LA	2/2	2/2	0/2	0/2
Amaze 10*	0/2	1/2	0/2	2/2

Achieves standard >67% of site years sampled
Achieves standard 33%-67% of site years sampled
Achieves standard <33% of site years sampled

**Table 2.** Frequencies of passing AMBA quality standards for RVA, CP, Plump, and DON. “\*” indicates 6-row varieties

# Phenology

Variety	Heading Date			Maturity Date	
	2021	2020	2019	2021	2020
Nomini*	15-May	21-May	21-May	28-Jun	25-Jun
Secretariat	16-May	21-May	26-May	29-Jun	28-Jun
Thoroughbred*	17-May	23-May	26-May	28-Jun	28-Jun
13ARS537-19	18-May	24-May	26-May	21-Jun	25-Jun
13ARS537-13	18-May	24-May	30-May	25-Jun	25-Jun
Visuel*	19-May	25-May	-	21-Jun	27-Jun
Thunder	19-May	25-May	-	23-Jun	25-Jun
KWS Faro*	20-May	23-May	-	25-Jun	28-Jun
Pixel*	20-May	25-May	-	28-Jun	28-Jun
Amaze 10*	20-May	-	27-May	28-Jun	-
VA16M-84	21-May	26-May	-	25-Jun	27-Jun
VA16M-81	21-May	25-May	-	28-Jun	28-Jun
Charles	23-May	24-May	1-Jun	21-Jun	25-Jun
Flavia	23-May	26-May	27-May	21-Jun	26-Jun
LCS Violetta	23-May	27-May	29-May	21-Jun	27-Jun
KWS Scala	23-May	27-May	1-Jun	23-Jun	26-Jun
OMU19	23-May	26-May	-	24-Jun	27-Jun
Hirondella*	24-May	27-May	31-May	24-Jun	28-Jun
Endeavor	25-May	27-May	3-Jun	26-Jun	27-Jun
Wintmalt	26-May	28-May	9-Jun	27-Jun	27-Jun
DH140963	26-May	27-May	31-May	28-Jun	26-Jun
KWS Somerset*	26-May	27-May	-	28-Jun	28-Jun
OMR19	27-May	27-May	-	26-Jun	26-Jun
LCS Calypso	29-May	25-May	27-May	23-Jun	25-Jun
DH141132	30-May	28-May	-	28-Jun	27-Jun
OMZ19	30-May	28-May	-	28-Jun	27-Jun
LCS Puffin	1-Jun	25-May	31-May	26-Jun	25-Jun

Earliest 1/3 <sup>rd</sup> heading/maturing, by year
Middle 1/3 <sup>rd</sup> heading/maturing, by year
Latest 1/3 <sup>rd</sup> heading/maturing, by year

**Table 3.** Average heading and maturity dates. Phenology data was only collected at Hickory Corners. "\*" indicates 6-row varieties

# Discussion

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## Grain Yield

- Yield averages vary by year and location due to external factors, including weather and management
- Flavia and Hirondezza had consistently high yields (and generally produce high quality grain), but are more susceptible to pre-harvest sprout
- Charles and Endeavor had consistently low yields as well as lower quality grain
- Higher yielding varieties do not necessarily relate to higher malting quality (ex: Rossignola, AC13/028/53)

## Malting Quality

- Varieties tend to achieve high quality scores in some metrics and low scores in others, across multiple years and locations. One example, Thoroughbred (a six-row variety), has high quality except in Plump
- CP is consistent among varieties and is more influenced by management and other factors than variety

*Varieties susceptible to pre-harvest sprout*

- Charles
- Endeavor
- Hirondezza



Pre-harvest sprout in winter barley

## Phenology

- There is no visible relationship between heading and maturity date
- 6-row varieties tend to have earlier heading dates and later maturity dates
- Most varieties trend in the same heading/maturity date range over multiple years
- Earlier maturing varieties (ex: LCS Calypso) allow more flexibility for double cropping systems
- Varieties with consistent heading date ranges (ex: Secretariat) allow for optimal fungicide applications to protect against Fusarium head blight

## Overall Recommendations

*Best performing (highest yield & malting quality)*

- Flavia
- Hirondezza
- Wintmalt
- Lyberac

*Worst performing (highest yield & malting quality)*

- Charles
- Endeavor

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## Literature Cited

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## Acknowledgments

Thank you to the following for your support: Karen Beaubien, James DeDecker, Josh Dykstra, Ryan Hamilton, Aaron MacLeod, Christian Kapp, Ashley McFarland, Dr. Luke Reese, Allison Smith, Kevin Smith & 2017-2020 Kellogg Farm interns

Funding for this research comes from:



## Learn more

For more information about small grains for brewing and distilling visit the [MSU Extension Malting Barley](#) website. Questions regarding the event can be directed to Brook Wilke ([wilkebro@msu.edu](mailto:wilkebro@msu.edu)) or Dean Baas ([baasdean@msu.edu](mailto:baasdean@msu.edu)).

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