

2-ROW MALTING BARLEY

2017 SEED GUIDE



Limagrain Cereal Seeds

A new standard for malting barley

Limagrain Cereal Seeds (LCS) is a U.S. based small grains breeding company with research stations located across the United States. As the lead-off partner in craft brewing supply chains, we understand how important it is for farmers, maltsters and brewers to begin with only the highest quality elite malting barley varieties.

The parent company of LCS, Group Limagrain, is an international agricultural cooperative with cereal breeding programs located in every area of the world where barley is widely grown. Through the exchange of elite Group Limagrain germplasm across six continents, LCS gives U.S. farmers, malting companies and brewers access to the best malting barley in the world. We are dedicated to developing 2-row barley varieties that exceed malt quality specifications and thrive in U.S. climates, soils and growing conditions.



Discover LCS 2-row malting barley

📍 LimagrainCerealSeeds.com/products/barley



Learn more about malting and brewing with LCS barley

📍 AcresToAles.com



Find your local LCS barley seed dealer

📍 AcresToAles.com/seed-dealers



Blake Cooper, Frank Curtis and Zach Gaines enjoy the fruits of their LCS labors at Horse & Dragon Brewing Company in Fort Collins, Colorado.

Blake on Barley: Without barley there would be no beer! Having developed wheat and barley for the U.S. for many years, it is amazing to see just how well barleys from our world-class Limagrain barley breeding programs in Europe have performed in our North American growing climate.

✉ blake.cooper@limagrain.com

Frank on Craft Beer: To me, craft beer is much more than a beverage—it's a way of life. The rise of the taproom as a meeting place, the absorbing tours, the menu pairing dinners and the outrageous experimental beers invented by talented brewers are all new and exciting phenomena made possible by the expansion of the craft beer movement. Craft beer is a magical portal to a culture that is engaging, inclusive and packed full with fun times.

✉ frank.curtis@limagrain.com

Zach on Collaboration: It's hard to comprehend how much growth has occurred in this industry in the past 20 years, and how many exceptional beers there are available to consumers today. We are living in a beer renaissance, created in part by the collaborative spirit of the craft industry. It's an environment that has been built by people who love what they do. It's not hard to want to be a part of something like that.

✉ zach.gaines@limagrain.com

Craft Barley

Answering the call

The explosion of craft beer into the North American brewing industry has created a new kind of demand on raw material producers and the supply chains in which they operate. Per barrel, craft brewers use more of everything—and the incredible spectrum of high quality beers they produce show this. Higher ABV content, pronounced flavor profiles and greater levels of mouthfeel are just a few ways these artisans use raw materials to meet the demand of a consumer base that is accustomed to being regularly blown away by amazing new styles of beer.

Until recently, the most basic raw material used in all North American brewing operations, barley, was essentially the same for all parties at the table. The American Malting Barley Association (AMBA), the Brewers Association (BA) and the newly formed North American Craft Maltsters Guild (CMG) are actively investing resources to help identify barley varieties that excel in all-malt styles of beer.

Key quality attributes that differentiate all-malt and adjunct styles of barley are continually being explored. For several years, AMBA has provided guidelines that give plant breeders like LCS detailed targets to shoot for when releasing new varieties. The Brewers Association has also published a similar analysis titled Malting Barley Characteristics for Craft Brewers. Both resources are available in their entirety online at these locations:

- 🌐 ambainc.org/content/63/guidelines
- 🌐 brewersassociation.org/attachments/0001/4752/Malting_Barley_Characteristics_For_Craft_Brewers.pdf

Greater levels
of mouthfeel

Pronounced
flavor profiles

Higher ABV
content %

Barley: All-Malt vs. Adjunct Style Beer

Key quality attributes defined

Total protein: The protein content desired for all-malt styles of beer is generally more than a point lower than for adjunct beers. Higher protein barley can reduce extract availability and create a need for increased conversion times. Levels of protein under 9.5% can negatively impact enzymatic activity and yeast health.

Free amino nitrogen (FAN): While FAN plays an important role in the creation of any style of beer as a nutrient supporting yeast health, excess levels remaining post fermentation can negatively impact the flavor stability of beer. FAN levels are positively correlated with total protein and enzymatic levels present in barley varieties.

Diastatic power (DP): A measurement for the horsepower of a barley's enzymatic engine, different styles of beer require different levels of DP. Barley used in adjunct-style beers is required to pull more than its own weight through conversion, requiring a more robust enzymatic package.

All-malt styles of beer, many of which are 100% malt grist brews, can benefit from lower DP barley varieties, due to a strong positive correlation between DP and protein content.

Beta-glucan (BG): A measure of how robust cell walls are in malting barley, beta-glucan content impacts both brewers and maltsters. High levels of BG extend modification times for malting companies by slowing the rate of seed hydration during steeping. Brewers can see negative impacts ranging from higher viscosity mashes to reductions in yield if BG content is too high. However, BG does play a role in increasing levels of mouthfeel in beer.

Glycosidic nitrile content (GN): GN content in barley is a critical factor for distilling operations. GN is a precursor to the creation of ethyl carbamate, a known animal carcinogen. As a strong historical partner to the Scotch whisky industry, the Limagrain UK breeding team has been developing barley varieties rated as Non-Producers of GN for more than a decade.

AMBA Malting Barley Breeding Guidelines Ideal Commercial Malt Criteria

	Six-Row	Adjunct 2-Row	All-Malt 2-Row	Distillers
Barley Factors				
Plump Kernels (on 6/64)	> 80%	> 90%	> 90%	> 70%
Thin Kernels (through 5/64)	< 3%	< 3%	< 3%	< 5%
Germination (4ml 72 hr. GE)	> 98%	> 98%	> 98%	> 98%
Protein	≤ 13.0%	≤ 13.0%	≤ 12.0%	11.5-14.0%
Skinned & Broken Kernels	< 5%	< 5%	< 5%	< 5%
Malt Factors				
Total Protein	≤ 12.8%	≤ 12.8%	≤ 11.8%	11.0-13.5%
On 7/64 Screen	> 60%	> 70%	> 75%	> 50%
Glycosidic Nitrile (ppm)	-	-	-	< 1.5
Measures of Malt Modification				
Beta-Glucan (ppm)	< 120	< 100	< 100	-
F/C Difference	< 1.2	< 1.2	< 1.2	-
Soluble/Total Protein	42-47%	40-47%	38-45%	> 48%
Turbidity (NTU)	< 10	< 10	< 10	-
Viscosity (Absolute cP)	< 1.50	< 1.50	< 1.50	-
Congress Wort				
Soluble Protein	5.2-5.7%	4.8-5.6%	< 5.3%	> 6.0%
Extract (FG db)	> 79.0%	> 81.0%	> 81.0%	> 79.0%
Color (°ASBC)	1.8-2.5	1.6-2.5	1.6-2.8	< 4.0
Free Amino Nitrogen	> 210	> 210	140-190	> 250
Malt Enzymes				
Diastatic Power (°ASBC)	> 150	> 120	110-150	> 200
Alpha Amylase (DU)	> 50	> 50	40-70	> 75

For complete AMBA guidelines, visit: ambainc.org/content/63/guidelines

Limagrain UK

Limagrain Nederland



Mark Glew
Senior Barley Breeder

Extract-forward spring barley

The Limagrain UK barley breeding program is the most successful barley breeding program in the United Kingdom. Based in Rothwell, Lincolnshire and led by Senior Barley Breeder Mark Glew, Limagrain UK has a long track record of producing 2-row barley varieties with superior agronomic and malting performance. The extract-forward breeding program focuses on developing varieties suited for all-malt styles of beer and spirits. Limagrain UK is particularly adept at breeding varieties that are non-producers of glycosidic nitrile (GN), including Concerto malting barley, the most widely grown variety in the UK over the past 5 years.



Kees Boot
Senior Barley Breeder

High yielding winter 2-row barley

The Limagrain Nederland barley breeding program focuses heavily on yield, extract and disease resistance, as well as developing earlier maturing varieties adapted for semi-maritime/continental climate zones. Based in the Rilland village in the Dutch province of Zeeland in the Netherlands, Limagrain Nederland has a trial network that extends throughout the Netherlands, Czech Republic, France and Denmark. Senior Breeder Kees Boot oversees the innovative, growing program as well as a second program in the Czech Republic.

Limagrain UK varieties adapted for the U.S. market

- Strong agronomic fit across a wide range of U.S. environments, from Washington to New York and as far south as New Mexico
- Market-leading resistance to cereal cyst nematodes
- Good tolerance to pre-harvest sprouting (PHS) in high moisture environments
- Low levels of DON compared to many varieties on the market
- Quality parameters in line with all-malt requirements of U.S. craft brewers

Limagrain Nederland varieties adapted for the U.S. market

- Strong fit along the Atlantic Coast, from North Carolina to New York and as far west as Wisconsin; varieties are also being evaluated in New Mexico, Kansas and Oklahoma
- Early enough to accommodate double-crop schemes in the Midwest and Eastern markets
- Disease resistance and tolerance to pre-harvest sprouting are major performance drivers
- Winter-hardiness levels above average in northern locations

2-ROW SPRING

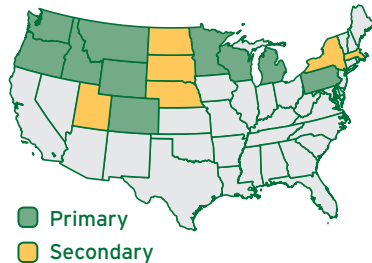
LCS Genie



The Genie Is in the Bottle

With a malting profile tailored for the craft industry and yield levels comparable with feed varieties, LCS Genie is a favorite of brewers, maltsters and farmers alike.

Areas of Adaptation



Malting & Brewing LCS Genie

Malting Specifications

Specification	2016 LCS ¹ Fort Collins, Colorado	2016 MSU ² Bozeman, Montana	2015 MSU ³ Combined Michigan	2013 AMBA ⁴ Idaho Falls, Idaho	2013 AMBA ⁴ Pullman, Washington
	Barley				
Plump (On 6/64) (%)	93.2	99.9	97.5	96.6	92.4
Moisture (%)	10.8	-	15.1	8.0	8.3
Total Protein (% d.b.)	10.9	-	11.0	11.0	11.6
Pre-Harvest Sprouting (RVA)	158	-	115	-	-
DON (ppm)	< 0.1	-	0.1	-	-
Malt					
Extract, Fine Grind (% d.b.)	81.8	79.6	83.2	82.7	80.4
Wort Color (Deg. Lov.)	1.57	2.00	2.55	3.40	1.60
Diastatic Power (Deg. L)	137	173	103	143	153
Alpha Amylase (D.U.)	54.7	50.1	59.6	60.0	61.4
Soluble Protein (% d.b.)	4.40	4.15	4.28	5.40	4.50
Total Protein (% d.b.)	10.9	13.2	10.7	11.6	11.9
Soluble/Total Protein (% d.b.)	40.4	32.4	42.8	46.9	38.0
Beta-Glucan (ppm)	66	67	36	48	51
Free Amino Nitrogen (FAN)	175	151	206	230	168

Malt House Analysis¹

Chitting (%)	Steep Out Moisture (%)	Malt Yield (%)	96-Hour Acrospire Count				
			0-1/4	>1/4-1/2	>1/2-3/4	>3/4-1	>1
95	46.8	90.5	0	0	5	90	5

¹ LCS data, obtained from Hartwick College:

hartwick.edu/about-us/centers-institutes/center-for-craft-food-and-beverage/

² Data obtained from Montana State University: plantsciences.montana.edu/crops/index.html

³ Data obtained from Michigan State University: msue.anr.msu.edu/topic/malting_barley/research

⁴ Data obtained from the American Malting Barley Association: ambainc.org/

By the Numbers

Dependable fine grind extract
81.5+% d.b.

Recommended
variety by the American Malting
Barley Association (AMBA)

Beta-glucan
content consistently
under 100 ppm

Growing LCS Genie

Yield & Protein Content

MEAN ▶		
3-Year WSU High Rainfall	LCS Genie 109.8 bu/ac yield Trial Avg. 101.9 bu/ac	108% of mean
	Associated protein content: 11.8%	
3-Year WSU Med. Rainfall	LCS Genie 80.8 bu/ac yield Trial Avg. 76.3 bu/ac	106% of mean
	Associated protein content: 12.6%	
3-Year WSU Low Rainfall	LCS Genie 63.3 bu/ac yield Trial Avg. 59.1 bu/ac	107% of mean
	Associated protein content: 13.8%	
2-Year OSU	LCS Genie 84.3 bu/ac yield Trial Avg. 80.3 bu/ac	105% of mean
	Associated protein content: 12.2%	
2016 UI North	LCS Genie 121.0 bu/ac yield Trial Avg. 111.7 bu/ac	108% of mean
	Associated protein content: N/A	
3-Year UI South	LCS Genie 131.7 bu/ac yield Trial Avg. 126.3 bu/ac	104% of mean
	Associated protein content: 11.5%	
2016 MSU (MT) Irrigated	LCS Genie 127.3 bu/ac yield Trial Avg. 112.0 bu/ac	114% of mean
	Associated protein content: 10.0%	
2016 MSU (MT) Dryland	LCS Genie 97.3 bu/ac yield Trial Avg. 86.6 bu/ac	112% of mean
	Associated protein content: 11.5%	
2016 UMN	LCS Genie 98.7 bu/ac yield Trial Avg. 94.4 bu/ac	105% of mean
	Associated protein content: N/A	
3-Year MSU (MI)	LCS Genie 74.1 bu/ac yield Trial Avg. 72.7 bu/ac	102% of mean
	Associated protein content: 11.0%	

Agronomic Features

University of Idaho South				Oregon State		
	TW (lb/bu)	Height (in)	Heading		TW (lb/bu)	Height (in)
LCS Genie	49.7	26.7	3.2	LCS Genie	50.4	25.3
CDC Copeland	49.1	34.3	0.5	Full Pint	53.5	25.2
AAC Synergy	48.5	32.7	-1.1	CDC Copeland	50.3	29.0
AC Metcalfe	50.0	33.7	-1.5	AAC Synergy	52.8	29.4
Moravian 69	46.0	27.0	3.2			

Montana State						
	Irrigated			Dryland		
	TW (lb/bu)	Height (in)	Heading	TW (lb/bu)	Height (in)	Heading
LCS Genie	53.7	27.2	3.2	53.9	24.5	3.4
CDC Copeland	53.9	31.9	2.2	53.3	27.8	1.3
AC Metcalfe	54.0	32.6	-1.8	53.6	29.5	-1.1
AAC Synergy	52.5	31.7	0.2	53.0	28.7	-0.5

University of Minnesota			
	Lodging (1-9)	Height (in)	Heading (DOM*)
LCS Genie	2.5	30.6	4.8
ND Genesis	3.2	35.2	-0.9
AC Metcalfe	4.9	35.0	0.6
AAC Synergy	3.7	34.2	1.1

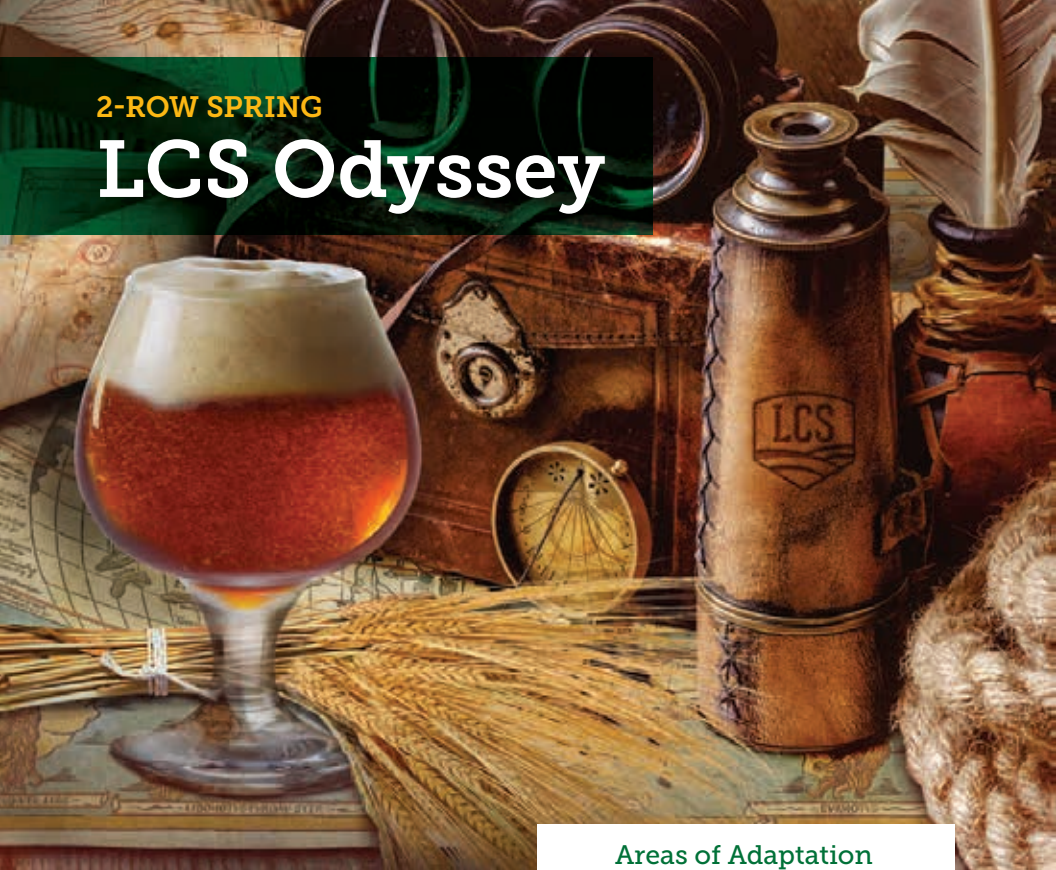
Michigan State				
	TW (lb/bu)	Height (in)	Heading (DOM*)	PHS (RVA)
LCS Genie	50.7	22.2	0.7	115.3
CDC Copeland	37.2	24.0	1.7	77.8
AC Metcalfe	50.3	25.6	-1.0	51.7
AAC Synergy	50.4	24.7	-1.7	36.7

Washington State				
		TW (lb/bu)	Height (in)	Heading (DOM*)
High Rainfall	LCS Genie	52.3	28.3	8.0
	CDC Copeland	51.4	38.0	8.4
Medium Rainfall	LCS Genie	53.1	26.3	2.5
	CDC Copeland	51.6	35.0	3.5
Low Rainfall	LCS Genie	53.3	25.5	1.0
	CDC Copeland	52.5	34.0	3.0

Data sets are available in their entirety at individual university websites. Links to these websites are listed on page 32 of this guide.
*Days off mean of trial

2-ROW SPRING

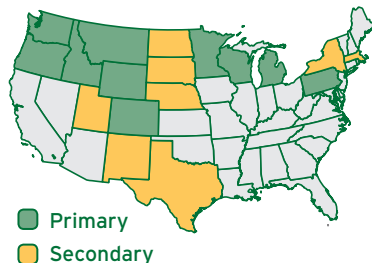
LCS Odyssey



An Adventure in Craft Barley

LCS Odyssey is a must-have variety for distillers, as it is the only malting barley variety available in the United States today rated as non-GN (zero glycosidic nitrile content).

Areas of Adaptation



Malting & Brewing LCS Odyssey



Malting Specifications

Specification	2016 LCS ¹	2016 MSU ²	2015 MSU ³	2013 AMBA ⁴	2013 AMBA ⁴	
	Fort Collins, Colorado	Bozeman, Montana	Combined Michigan	Idaho Falls, Idaho	Pullman, Washington	
Barley	Plump (On 6/64) (%)	97.0	99.9	97.8	97.9	94.5
	Moisture (%)	10.4	-	15.0	8.1	8.6
	Total Protein (% d.b.)	10.9	13.6	10.8	10.7	10.3
	Pre-Harvest Sprouting (RVA)	154	-	142	-	-
	DON (ppm)	< 0.1	-	0.0	-	-
Malt	Extract, Fine Grind (% d.b.)	82.4	79.0	83.2	82.9	81.2
	Wort Color (Deg. Lov.)	1.56	1.90	2.45	1.66	1.88
	Diastatic Power (Deg. L)	110	127	77	125	124
	Alpha Amylase (D.U.)	54.9	44.7	62.0	61.5	60.4
	Soluble Protein (% d.b.)	4.40	3.62	4.25	4.78	4.14
	Total Protein (% d.b.)	11.1	13.6	10.7	11.5	10.9
	Soluble/Total Protein (% d.b.)	39.6	27.5	42.6	41.8	37.8
	Beta-Glucan (ppm)	82	190	56	76	78
	Free Amino Nitrogen (FAN)	160	105	214	192	179

Malt House Analysis¹

Chitting (%)	Steep Out Moisture (%)	Malt Yield (%)	96-Hour Acrospire Count				
			0-1/4	>1/4-1/2	>1/2-3/4	>3/4-1	>1
95	45.4	91.3	0	30	35	35	0

¹ LCS data, obtained from Hartwick College:

hartwick.edu/about-us/centers-institutes/center-for-craft-food-and-beverage/

² Data obtained from Montana State University: plantsciences.montana.edu/crops/index.html

³ Data obtained from Michigan State University: msue.anr.msu.edu/topic/malting_barley/research

⁴ Data obtained from the American Malting Barley Association: ambainc.org/

By the Numbers

Non-producer of GN (glycosidic nitrile)

#1 choice for cereal cyst nematode resistance

Highest yielding variety in 2016 Montana State University trials

Growing LCS Odyssey

Yield & Protein Content

	MEAN ▶		
3-Year WSU High Rainfall	LCS Odyssey 107.0 bu/ac yield Trial Avg. 101.9 bu/ac		105% of mean
	Associated protein content: 11.8%		
3-Year WSU Med. Rainfall	LCS Odyssey 84.9 bu/ac yield Trial Avg. 76.3 bu/ac		111% of mean
	Associated protein content: 12.6%		
3-Year WSU Low Rainfall	LCS Odyssey 72.9 bu/ac yield Trial Avg. 59.1 bu/ac		123% of mean
	Associated protein content: 13.6%		
2-Year OSU	LCS Odyssey 88.9 bu/ac yield Trial Avg. 80.3 bu/ac		111% of mean
	Associated protein content: 12.5%		
2016 UI North	LCS Odyssey 126.8 bu/ac yield Trial Avg. 111.7 bu/ac		113% of mean
	Associated protein content: N/A		
2-Year UI South	LCS Odyssey 142.8 bu/ac yield Trial Avg. 128.7 bu/ac		111% of mean
	Associated protein content: 11.5%		
2016 MSU (MT) Irrigated	LCS Odyssey 130.4 bu/ac yield Trial Avg. 112.0 bu/ac		116% of mean
	Associated protein content: 10.0%		
2016 MSU (MT) Dryland	LCS Odyssey 101.7 bu/ac yield Trial Avg. 86.6 bu/ac		117% of mean
	Associated protein content: 11.7%		
2016 UMN	LCS Odyssey 108.6 bu/ac yield Trial Avg. 94.4 bu/ac		115% of mean
	Associated protein content: N/A		
3-Year MSU (MI)	LCS Odyssey 79.7 bu/ac yield Trial Avg. 72.7 bu/ac		110% of mean
	Associated protein content: 10.9%		

Agronomic Features

University of Idaho South				Oregon State		
	TW (lb/bu)	Height (in)	Heading		TW (lb/bu)	Height (in)
LCS Odyssey	48.4	28.7	3.2	LCS Odyssey	50.2	26.3
CDC Copeland	49.1	34.3	0.5	Full Pint	53.5	25.2
AAC Synergy	48.5	32.7	-1.1	CDC Copeland	50.3	29.0
AC Metcalfe	50.0	33.7	-1.5	AAC Synergy	52.8	29.4
Moravian 69	46.0	27.0	3.2			

Montana State						
	Irrigated			Dryland		
	TW (lb/bu)	Height (in)	Heading	TW (lb/bu)	Height (in)	Heading
LCS Odyssey	52.6	26.7	4.2	53.4	25.1	3.1
CDC Copeland	53.9	31.9	2.2	53.3	27.8	1.3
AC Metcalfe	54.0	32.6	-1.8	53.6	29.5	-1.1
AAC Synergy	52.5	31.7	0.2	53.0	28.7	-0.5

University of Minnesota			
	Lodging (1-9)	Height (in)	Heading (DOM*)
LCS Odyssey	3.4	29.0	2.6
ND Genesis	3.2	35.2	-0.9
AC Metcalfe	4.9	35.0	0.6
AAC Synergy	3.7	34.2	1.1

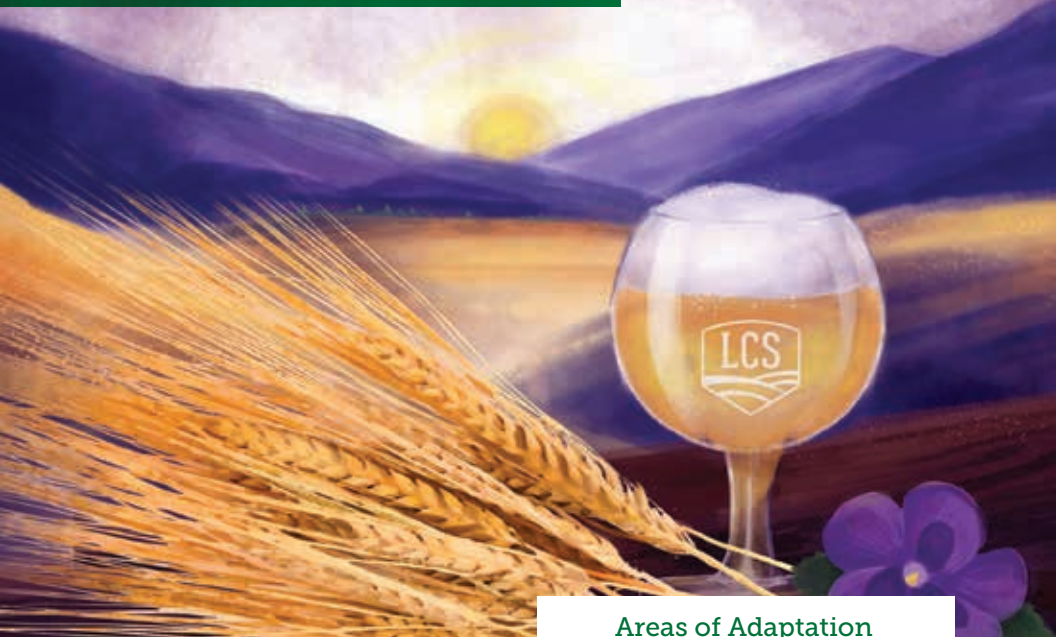
Michigan State				
	TW (lb/bu)	Height (in)	Heading (DOM*)	PHS (RVA)
LCS Odyssey	49.2	22.9	1.3	142.3
CDC Copeland	37.2	24.0	1.7	77.8
AC Metcalfe	50.3	25.6	-1.0	51.7
AAC Synergy	50.4	24.7	-1.7	36.7

Washington State				
		TW (lb/bu)	Height (in)	Heading (DOM*)
High Rainfall	LCS Odyssey	51.7	28.7	8.0
	CDC Copeland	51.4	38.0	8.4
Medium Rainfall	LCS Odyssey	52.7	27.0	1.0
	CDC Copeland	51.6	35.0	3.5
Low Rainfall	LCS Odyssey	53.1	26.5	1.0
	CDC Copeland	52.5	34.0	3.0

Data sets are available in their entirety at individual university websites. Links to these websites are listed on **page 32** of this guide. *Days off mean of trial

2-ROW WINTER

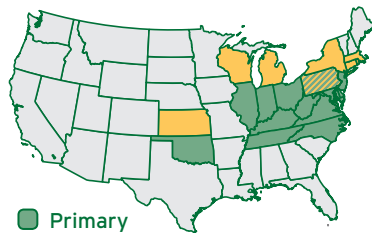
LCS Violetta



Bred for the Craft Spectrum

Excellent adaptation to the Eastern U.S., but grown as far west as Oklahoma. A combination of superior yield and a strong craft beer profile.

Areas of Adaptation



■ Primary
■ Secondary



Malting & Brewing LCS Violetta

Malting Specifications

	Specification	2016 LCS ¹	2015 WMBT ²	2015 WMBT ²	2015 WMBT ²
		Fort Collins, Colorado	Glen Mills, Pennsylvania	Wooster, Ohio	Corvallis, Oregon
Barley	Plump (On 6/64) (%)	98.2	99.6	93.7	92.1
	Moisture (%)	13.0	-	-	-
	Total Protein (% d.b.)	11.3	-	-	12.0
	Pre-Harvest Sprouting (RVA)	166.0	-	-	-
	DON (ppm)	< 0.1	-	-	-
Malt	Extract, Fine Grind (% d.b.)	81.2	80.6	80.3	78.9
	Wort Color (Deg. Lov.)	1.68	2.14	2.41	2.26
	Diastatic Power (Deg. L)	154	106	179	252
	Alpha Amylase (D.U.)	48.4	41.9	69.0	64.2
	Soluble Protein (% d.b.)	4.40	3.70	5.40	5.41
	Total Protein (% d.b.)	10.8	9.1	13.0	12.8
	Soluble/Total	40.7	40.1	42.1	42.8
	Beta-Glucan (ppm)	114	45	207	142
Free Amino Nitrogen (FAN)	170	144	223	237	

Malt House Analysis¹

Chitting (%)	Steep Out Moisture (%)	Malt Yield (%)	96-Hour Acrospire Count				
			0-1/4	>1/4-1/2	>1/2-3/4	>3/4-1	>1
90	44.9	95.5	0	25	70	5	0

¹ LCS data, obtained from Hartwick College: hartwick.edu/about-us/centers-institutes/center-for-craft-food-and-beverage/
² Data obtained from Winter Malting Barley Trial (WMBT): triticeaetoolbox.org/barley/

By the Numbers

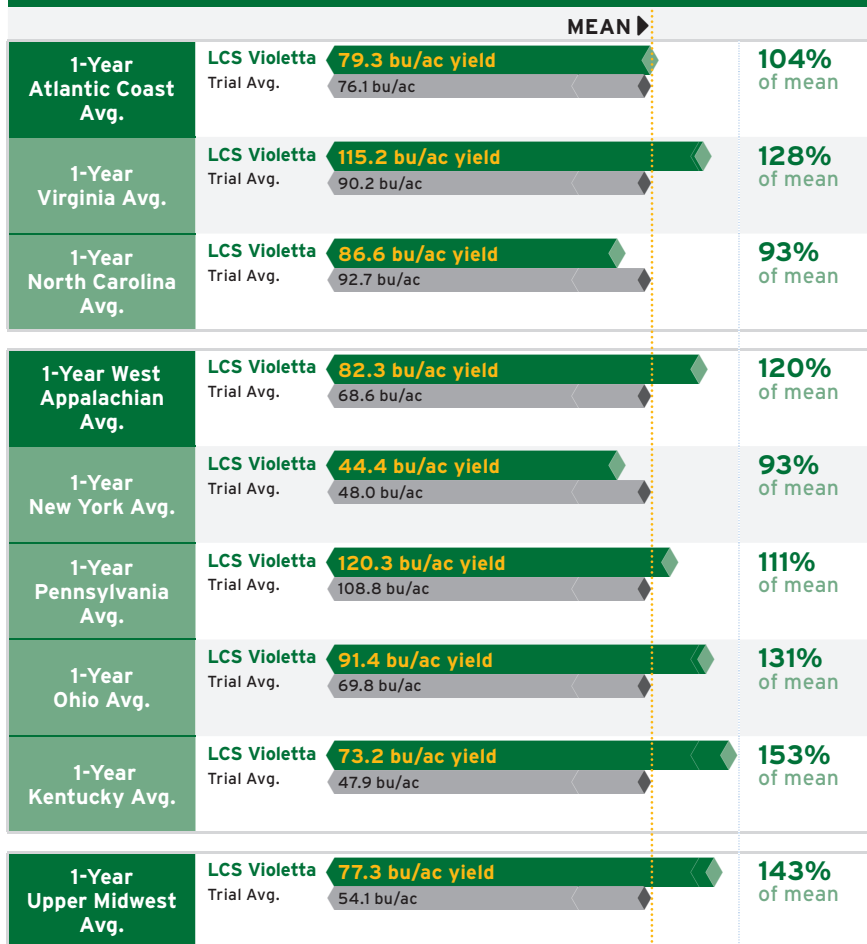
#1 choice for double cropping

Consistent
extract 80+% d.b. (FG)

Excellent
test weight

Growing LCS Violetta

Yield



Agronomic Features

WMBT Atlantic Coast ¹					
	TW (lb/bu)	Height (in)	Winter-Hardiness (DOM*)	Heading (RVA)	Lodging (0-9)
LCS Violetta	48.5	28.9	99.0	-1.8	3.1
LCS Calypso	47.0	33.8	99.3	1.0	2.9
Charles	42.3	24.2	93.3	-2.8	4.1
McGregor	42.4	33.3	99.0	1.0	2.6

WMBT West Appalachian ¹					
	TW (lb/bu)	Height (in)	Winter-Hardiness (DOM*)	Heading (RVA)	Lodging (0-9)
LCS Violetta	46.7	31.1	93.3	-2.3	3.3
LCS Calypso	45.6	32.3	92.2	0.7	5.5
Charles	36.8	27.7	90.0	-1.0	6.6
McGregor	46.3	33.0	96.7	-2.2	5.8

WMBT Upper Midwest ¹					
	TW (lb/bu)	Height (in)	Winter-Hardiness (DOM*)	Heading (RVA)	Lodging (0-9)
LCS Violetta	-	23.4	100.0	-4.7	-
LCS Calypso	-	24.0	89.9	-2.8	-
Charles	-	22.2	100.0	0.8	-
McGregor	-	23.8	98.9	-0.5	-

Virginia Tech 3-Year Agronomic Summary ²					
	TW (lb/bu)	Height (in)	Winter-Hardiness (DOM*)	Heading (RVA)	Lodging (0-9)
LCS Violetta	47.4	30.0	96.0	6.0	0.0
Thoroughbred	47.7	34.0	96.0	5.0	3.0
Atlantic	47.5	31.0	93.0	-2.0	3.0
Secretariat	48.1	31.0	92.0	-1.0	5.0

Virginia Tech Disease Summary ²					
	2-Year (2014, 2015)		3-Year (2014, 2015, 2016)		
	FHB Index (0-100)	DON ³ (ppm)	Leaf Rust (0-9)	Net Blotch (0-9)	Powd. Mildew (0-9)
LCS Violetta	25.8	14.4	1.0	2.0	0.0
Thoroughbred	30.9	21.5	3.0	4.0	4.0
Atlantic	34.4	18.7	4.0	3.0	0.0
Secretariat	31.8	17.5	4.0	2.0	0.0

¹ Data compiled from Winter Malting Barley Trial (WMBT) 2016 & 2015 crop years

Full data sets available: <https://triticeaetoolbox.org/barley/>

² Data compiled from VT Cooperative Extension 2016 Small Grains Report

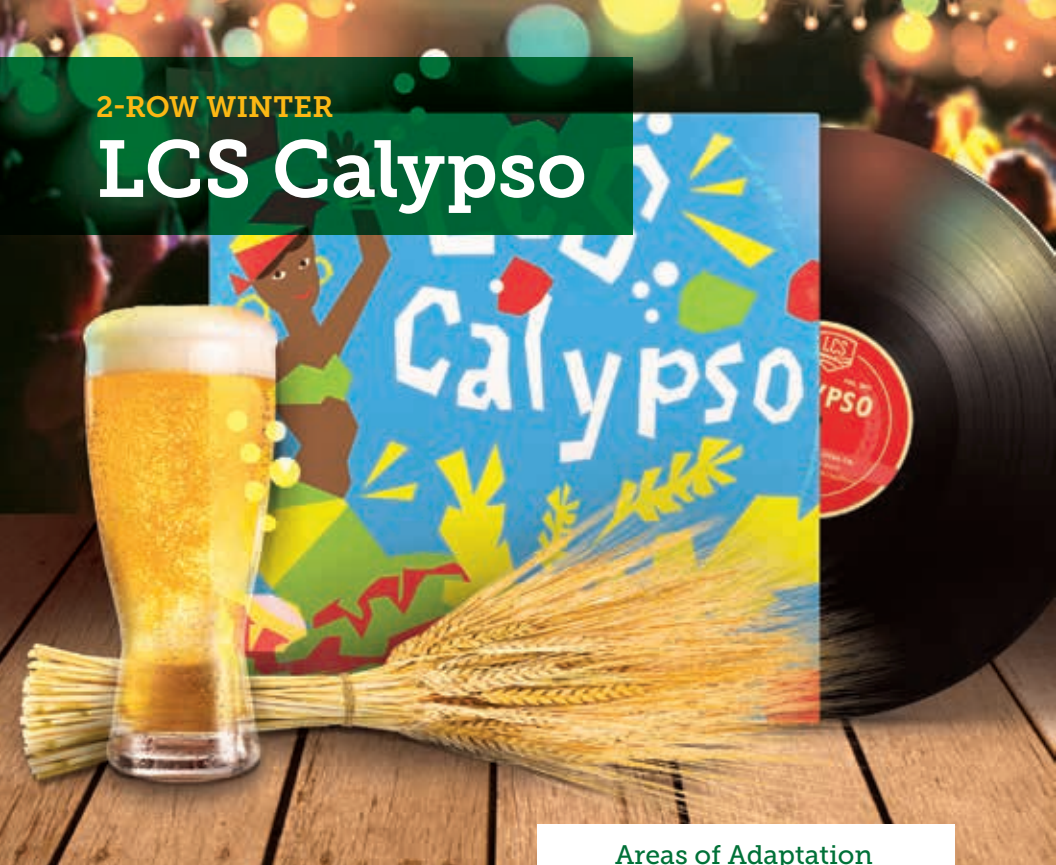
Full data sets available: pubs.ext.vt.edu/category/grains.html

³ DON and FHB scores obtained from inoculated nurseries to simulate heavy pressure

*Days off mean of trial

2-ROW WINTER

LCS Calypso

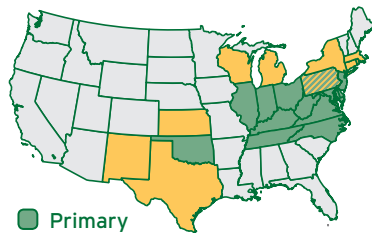


Malting & Brewing LCS Calypso

The Beginning of a Great Time

Promising across-the-board performance from a brand new variety to the U.S. market. Above average winter-hardiness and a strong disease resistance package.

Areas of Adaptation



■ Primary
■ Secondary

Malting Specifications

Specification	2016 LCS ¹ Fort Collins, Colorado	2015 WMBT ² Glen Mills, Pennsylvania	2015 WMBT ² Wooster, Ohio	2015 WMBT ² Corvallis, Oregon	2016 WMBT ² St. Paul, Minnesota
	Barley				
Plump (On 6/64) (%)	97.0	99.2	94.5	88.7	97.30
Moisture (%)	10.4	-	-	-	-
Total Protein (% d.b.)	13.1	-	-	11.6	14.10
Pre-Harvest Sprouting (RVA)	152.0	-	-	-	-
DON (ppm)	< 0.1	-	-	-	-
Malt					
Extract, Fine Grind (% d.b.)	80.5	81.8	81.5	79.4	80.7
Wort Color (Deg. Lov.)	1.85	-	2.28	2.38	1.40
Diastatic Power (Deg. L)	206	96	132	198	211
Alpha Amylase (D.U.)	52.3	35.2	50.4	54.4	50.1
Soluble Protein (% d.b.)	4.80	3.28	4.20	4.52	4.81
Total Protein (% d.b.)	12.8	8.3	11.5	12.3	13.5
Soluble/Total Protein (% d.b.)	37.5	40.3	37.7	38.6	35.5
Beta-Glucan (ppm)	38	25	171	93	148
Free Amino Nitrogen (FAN)	223	124	171	187	186

Malt House Analysis¹

Chitting (%)	Steep Out Moisture (%)	Malt Yield (%)	96-Hour Acrospire Count				
			0-1/4	>1/4-1/2	>1/2-3/4	>3/4-1	>1
95	45.3	91.4	0	0	5	70	25

¹ LCS data, obtained from Hartwick College: hartwick.edu/about-us/centers-institutes/center-for-craft-food-and-beverage/
² Data obtained from Winter Malting Barley Trial (WMBT): triticeaetoolbox.org/barley/

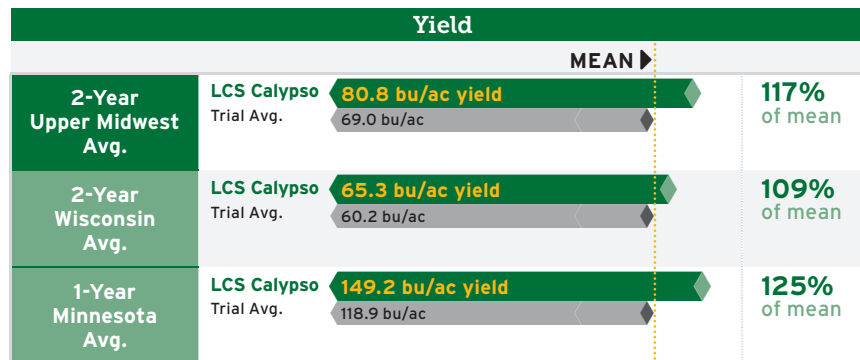
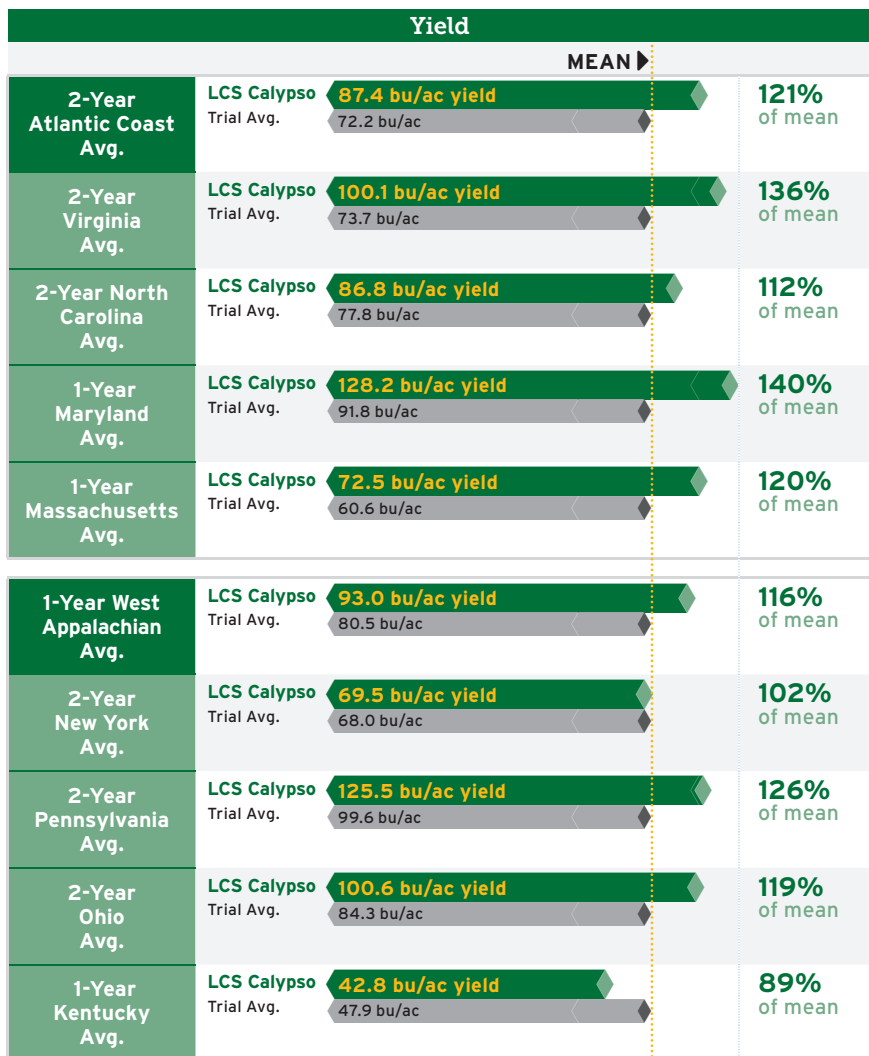
By the Numbers

90 bu/ac. 2-year average yield across Atlantic locations

Lower levels
of beta-glucan

Good
winter-hardiness

Growing LCS Calypso



Agronomic Features					
WMBT Atlantic Coast					
	TW (lb/bu)	Height (in)	Winter-Hardiness (DOM*)	Heading (RVA)	Lodging (0-9)
LCS Calypso	43.8	31.7	97.0	2.6	0.7
Charles	39.3	24.5	96.3	-3.8	3.9
Thoroughbred	46.3	31.8	97.5	-4.0	1.6
Wintmalt	43.9	28.4	96.7	5.3	0.6
WMBT West Appalachian					
	TW (lb/bu)	Height (in)	Winter-Hardiness (DOM*)	Heading (RVA)	Lodging (0-9)
LCS Calypso	50.4	35.3	100.0	0.6	1.4
Charles	44.4	26.9	99.4	-2.0	3.4
Thoroughbred	51.7	38.3	100.0	-4.2	1.4
Wintmalt	49.3	31.6	99.4	3.8	0.5
WMBT Upper Midwest					
	TW (lb/bu)	Height (in)	Winter-Hardiness (DOM*)	Heading (RVA)	Lodging (0-9)
LCS Calypso	-	34.3	76.6	0.3	2.0
Charles	-	30.4	73.6	0.6	5.0
Thoroughbred	-	32.5	97.2	-1.9	4.0
Wintmalt	-	32.6	86.3	2.8	2.0
WMBT Atlantic Coast Disease					
	FHB Index (0-100)	Net Blotch (0-9)	Powd. Mildew (0-9)		
LCS Calypso	2.7	2.6	0.0		
Charles	4.2	4.0	0.0		
Thoroughbred	0.9	5.4	3.6		
Wintmalt	4.9	2.8	1.0		

Data compiled from Winter Malting Barley Trial (WMBT) 2016 & 2015 crop years
 Full data sets available: <https://triticeaetoolbox.org/barley/>
 *Days off mean of trial

Acres to Ales



The power of local

Have you ever enjoyed a truly local pint of craft beer? There are supply chains in the United States today producing beer crafted from barley that has traveled as few as five miles from the acreage where it was harvested to the taps where it is being served.

The collaborative spirit driving this movement to use more and more locally sourced ingredients is a phenomenon worth celebrating – and is the reason we created the Acres to Ales project. The farmers, maltsters and brewers who cooperate locally are introducing a new kind of quality to the marketplace, and we are excited so many of them are choosing to use LCS varieties in their operations.

It's our hope that Acres to Ales will help you learn more about who these artisans are and where you can find their products!



In the summer of 2015, the first ever Acres to Ales Tap Takeover took place at the Mayor of Old Town tap house in Fort Collins, Colorado. 250 guests, including local farmers, maltsters, brewers and craft industry representatives, enjoyed 14 locally crafted beers made from LCS Genie barley.

The benefits of regional sourcing

Before a load of malt ever makes its way into a mash tun, that commodity changes hands four different times over the course of three years – from the seed producer to the farmer to the maltster, and finally to the brewer. In local supply chains, these four entities have the opportunity to work together closely to manage quality and customize flavor on a truly batch scale. It also goes without saying that these artisan groups keep dollars in the states and communities where they work while delivering ingredients with regional terroir.

Quality assurance

All farmers who produce seed of LCS barley varieties use the certified seed model. This means a huge emphasis on purity and quality is at the forefront of every Acres to Ales supply chain. Acres to Ales malting companies also support the use of certified barley in their contracts. So you can count on high germination rates and seed stock free of other varieties, other crops and noxious weeds – only the best goes in Acres to Ales beer.

Learn more about Acres to Ales and connect with local supply chains

 AcresToAles.com

Become an Acres to Ales Seed Dealer or Malting Company

 zach.gaines@limagrain.com

 970.498.2204

Acres to Ales Seed Dealers

Colorado

Marc Arnusch Farms Inc.
Keenesburg, CO
📍 arnuschfarms.com
☎ 303.732.4074

Rio Grande Commodities
Monte Vista, CO
☎ 719.852.4088

Idaho

CHS Primeland
Lewiston, ID
📍 chsprimeland.com
☎ 208.731.5397

Ririe Grain and Feed Coop
Ririe, ID
☎ 208.538.6712

Illinois

Kitchen Seed
Arthur, IL
📍 kitchenseed.com
☎ 217.273.6402

Kentucky

Walnut Grove Farms
Adairville, KY
📍 walnutgrovefarms.com
☎ 270.726.7768

Michigan

Schmidt Farms of Auburn
Auburn, MI
📍 schmidtfarmsofauburn.com
☎ 989.529.8829

Minnesota

Friederichs Seed Farm
Foxhome, MN
📍 friederichsseed.com
☎ 218.585.4621

Montana

Northern Seed, LLC
Butte, MT
📍 northernseedllc.com
☎ 406.782.4670

New York

Fico Farms
Rochester, NY
☎ 585.770.4702

North Carolina

White Hat Seed Farm
Hertford, NC
☎ 252.264.2427

Oklahoma

Conrady Farms
Wakita, OK
☎ 316.648.1982

Pennsylvania

SEEDWAY
📍 seedway.com
☎ 717.367.1075

Virginia

Hundley Seed Co.
Champlain, VA
☎ 804.443.8206

Virginia Identity
Preserved Grains
Richmond, VA
☎ 804.840.1751

Wisconsin

Biddick Inc.
Livingston, WI
📍 biddick.net
☎ 608.943.6363

Acres to Ales Malting Companies

Colorado



Fort Collins, CO
 troubadourmaltings.com
 773.704.4407



Loveland, CO
 rootshootmalting.com
 970.227.0475



Monte Vista, CO
 proximitymalt.com
 414.755.8388

Delaware



Laurel, DE
 proximitymalt.com
 414.755.8388

Idaho



Idaho Falls, ID
 mountainmalt.com
 208.346.7805

Kansas

Amber Waves Malting
 Garden Plains, KS
 316.619.2363

Maryland



Cooksville, MD
 dcmalthouse.com
 443.739.4509

Michigan



Byron Center, MI
 pilotmalthouse.com
 616.209.8388



Traverse City, MI
 greatlakemalting.com
 231.714.4551



Saline, MI
 maconcreekmalt.com
 906.869.0372

New York



Rochester, NY
 pioneermalting.com
 585.770.4702

North Carolina



Durham, NC
 epiphanymalt.com
 919.886.7306



Asheville, NC
 828.670.0092

Oklahoma



Ames, OK
 fortysixgrain.com
 580.227.0990

Washington



MAINSTEM MALT

Walla Walla, WA
 mainstemmalt.com
 509.520.6826



Spokane Valley, WA
 palousepint.com
 509.230.1223



Industry Resources

North American Craft Maltsters Guild (CMG)

The guild fosters the growth of the craft malt industry through education advocacy, and honest relationships intended to produce local malt of the highest quality.

The drive behind craft malt comes from the desire to have local-to-regional agriculture supply local-to-regional brewers/distillers, and to do so in a transparent fashion. It is a natural extension of the local foods movement, and in many ways an evolution of the craft beer and distilled spirits movement itself.

- craftmalting.com
- [@CraftMalting](https://twitter.com/CraftMalting)
- facebook.com/CraftMalting

Hartwick College Center for Craft Food and Beverage (CCFB)

CCFB is a resource for testing, business development and education that supports small and mid-sized breweries, malhousers, farms and other craft food and beverage producers.

CCFB offers laboratory testing services for beer and brewing raw materials such as barley, malt and hops. The organization provides technical assistance, business planning services, professional development and education.

- hartwick.edu/about-us/centers-institutes/center-for-craft-food-and-beverage/

American Malting Barley Association (AMBA)

AMBA encourages and supports production of an adequate supply of high quality malting barley for the malting and brewing industry.

AMBA's vision is to be the leader in the improvement, development and understanding of malting barley in the United States.

- ambainc.org

Brewers Association

The Brewers Association promotes and protects American craft brewers, their beers and the community of brewing enthusiasts.

A 501(c)(6) not-for-profit trade association of brewers, for brewers and by brewers, the association includes more than 3,700 U.S. brewery members and 46,000 members of the American Homebrewers Association, in addition to members of the allied trade, beer wholesalers, retailers, individuals, other associate members and Brewers Association staff.

- BrewersAssociation.org
- [@BrewersAssoc](https://twitter.com/BrewersAssoc)
- facebook.com/BrewersAssoc

Association of Official Seed Certifying Agencies (AOSCA)

AOSCA promotes and facilitates the movement of seed or plant products in local, national and international markets through the coordinated efforts of official seed certification agencies.

AOSCA is dedicated to assisting clients in the production, identification, distribution and promotion of certified classes of seed and other crop propagation materials. Established in 1919 as the International Crop Improvement Association, AOSCA's membership includes seed certifying agencies across the U.S. and global membership, including Canada, Argentina, Brazil, Chile, Australia, New Zealand and South Africa.

- aosca.org



University Resources

University resources

Every region in the U.S. where malting barley is produced has a university program standing firmly behind it, supporting the farmers and malting companies who operate there. The information generated each year by these programs are an invaluable resource to emerging craft beer supply chains.

If you haven't met the barley research team in your production area, we highly suggest you do. To obtain the most accurate technical data possible for this guide, ratings and scores are comprised of all available LCS and public research data. The results presented in this guide may not be an indicator of results you may obtain in your individual location, as local growing conditions, including soil type and weather, will vary from year to year.

Agronomic performance, disease scores, yield performance and other technical data from universities are available in their entirety at the following locations:

University of Idaho

2016 Southern Idaho Small Grains Report

uidaho.edu/extension/cereals/scseidaho/sgr

Montana State University

2016 Barley Variety Performance Evaluations and Recommendations

plantsciences.montana.edu/crops

Washington State University

2016 Spring Barley Performance Data by Precipitation Zone

smallgrains.wsu.edu/variety/2016-data

Oregon State University

2016 Elite Yield Trial Data

cropandsoil.oregonstate.edu/content/2016-oregon-elite-yield-trial-data

North Dakota State University

2016 Variety Trial Data

www.ag.ndsu.edu/varietytrials

University of Minnesota

Winter Malting Barley Trial

maes.umn.edu/publications/field-crop-trials/2016

Michigan State University

2016 Malting Barley Variety Trials

msue.anr.msu.edu/topic/malting_barley/research

Cornell University

Keys to Producing Malting Barley in New York

plbrgen.cals.cornell.edu/research-extension/small-grains/cultivar-testing

Virginia Tech

Virginia Cooperative Extension—Small Grains in 2016

pubs.ext.vt.edu/CSES/CSES-167/CSES-167.html

Ohio State University

Practical Considerations for Growing Malting—Quality Barley in Ohio

stockingerlab.osu.edu/malting-barley-resources

Winter Malting Barley Trial (WMBT)

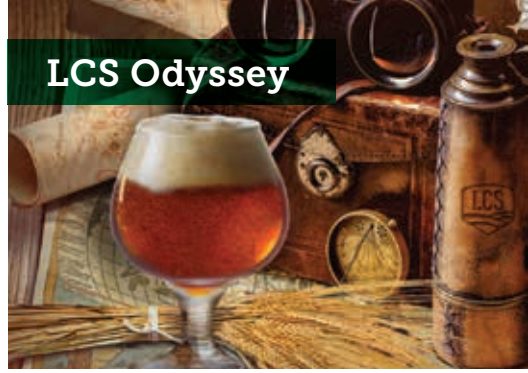
Collaborative 2-Year Data

triticeaetoolbox.org/barley/

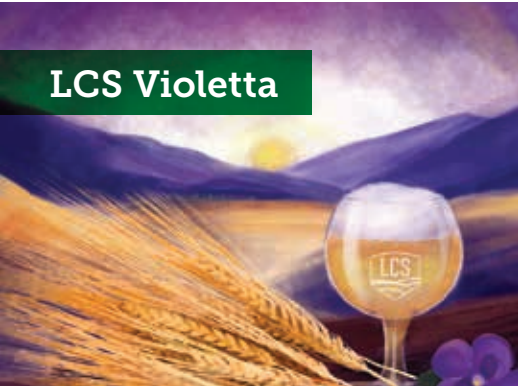
LCS Genie



LCS Odyssey



LCS Violetta



LCS Calypso



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LimagrainCerealSeeds.com

✉ lcs-info@limagrain.com

☎ 970.498.2200

Limagrain 