“...barley is to beer as grapes are to wine. You cannot make a good wine out of bad grapes and you can’t make a good beer out of bad barley. You can make a terrible beer out of good barley, that’s easy to do. But at least start right.”
– Bill Coors
Champlain’s Garden - 1610
Newfoundland -1617

Martha’s Vineyard - 1602
Jamestown -1611

Spanish Introduction - 1494
Land Races

Mixtures of many lines
Change when grown in new area

First pure varieties were from selections out of land races
Chevalier – 1824 selection

“hybrid” barley originating in the late 1800’s
August 10, 1788

“Should this letter get to your hands in time for the Sailing of Captn. Ellwood, and you can readily procure 25 bushls. of the best kind of Winter Barley I beg you to send it by him that I may try the success of it. The continual rains destroyed my Crop of spring Barley this year, but, if it had been otherwise, the Barley which you sent me the year before was so mixed with Oats (a circumstances I did not know till this Summer, as it was harvested while I was in Philadelphia) that it would no longer do to sow it. Could I be supplied with a quantity of that (spring Barley) which is really good from your City? Could I get it upon better terms from Rhode Island? and at what price (delivered here) might it be received from either place?”
September 16, 1788

“…If you have not already purchased the Winter Barley I would not wish you to do it, for I think it is very probable that I may be able to get the quantity which I shall want of the Brewer in Alexandria in exchange for Spring Barley, or if I should be disappointed there, that I can obtain it upon better terms and perhaps of a better quality upon James River than at Philadelphia, as you observe that the crops of it have generally failed, and none has yet been seen that is fit for seed.”
Transportation

- Barley produced locally
- Barge transportation
- Railroads opened new production areas
1959 WESTERN MALTING BARLEY VARIETIES

(California, Colorado, Idaho, Montana, Washington & Wyoming)
1974 WESTERN MALTING BARLEY VARIETIES

(California, Colorado, Idaho, Montana, Washington & Wyoming)
<table>
<thead>
<tr>
<th></th>
<th>US 2012 Census</th>
<th>Canada 2011 Census</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acres Planted</td>
<td>3,283,905</td>
<td>6,888,693</td>
</tr>
<tr>
<td>% Irrigated</td>
<td>25.9%</td>
<td>NA</td>
</tr>
<tr>
<td># of Farms</td>
<td>18,667</td>
<td>29,943</td>
</tr>
<tr>
<td>Acres/Farm</td>
<td>176</td>
<td>230</td>
</tr>
</tbody>
</table>
2012 Harvested Barley Acres By County

2012 USDA Census of Agriculture

Undisclosed*

Data not disclosed to avoid identifying an individual operation.
Typically means only a single barley farm in the county.
CANADIAN BARLEY GROWING AREA

ALBERTA

SASKATCHEWAN

MANITOBA
MEXICAN BARLEY GROWING AREAS

Source: A Comparison of North American Two-Row and Six-Row Malting Barley, Schwarz & Horsley
2012 Harvested Barley Acres By County

Northeast US

2012 USDA Census of Agriculture

- Undisclosed*
- 1-100
- 100-200
- 200-500
- 500-1,000
- 1,000-2,000
- 2,000-5,000
- 5,000-10,000
- 10,000-20,000
- 20,000-50,000
- > 50,000

*Data not disclosed to avoid identifying an individual operation. Typically means only a single barley farm in the county.
2012 Harvested Barley Acres By County

Midwest US

2012 USDA Census of Agriculture

*Data not disclosed to avoid identifying an individual operation. Typically means only a single barley farm in the county.
Harvested Barley Acres By County

USDA Census of Agriculture

1934

2012

Legend:
- Yellow: Undisclosed*
- Orange: 200-500
- Red: 100-200
- Pink: 1-100
- Brown: 500-1,000
- Green: 1,000-2,000
- Sky blue: 2,000-5,000
- Blue: 5,000-10,000
- Dark blue: 10,000-20,000
US Barley Acreage

Million Acres
Why Has Barley Acreage Declined?

Static domestic malt use, limited barley & malt exports

Decline in use for feed = primary secondary use
- Competition from abundant supplies of corn and dried distillers grain (DDGs)

Static & limited food use – although has FDA Healthy Heart Claim
- USDA Barley Health Benefits Project – AMBA/NBIC lobbying

High risk crop – many chances for failure in making malting grade
- Good return as malting, low or no return as feed
- Risks: - Fusarium head blight (scab), other diseases, drought & heat stress, quality requirements

Competition with other crops – GROWERS HAVE OTHER OPTIONS
- Corn, soybeans, canola = large and growing markets
- Substantial investment by biotech seed companies, including GM variety development, in these crops and now wheat
US Barley Variety Types
Malting as a % of Total

- Other
- Two-Row
- Six-Row

Malting Percentage: 0.0% to 100.0%
US Barley Variety Types
Head Type as a % of Total Malt

Barley Development
Quality Barley

“The breeder’s avenue to quality is to produce barleys well adapted to the region – barleys that will mature well and will not lodge.”

“Scab is a serious disease in the Mississippi Valley. It is particularly bad on cornlands and heavy, poorly drained soils. It becomes more and more serious as barley growing is pushed southward into the hotter parts of the Corn Belt. In northern and western sections of the valley it decreases much as does the cultivation of corn itself. Its presence is ruinous to malting quality. It also makes the grain unsuited for feeding to hogs or horses, but it can be used for cattle and poultry.”

1936 USDA Yearbook of Agriculture
Table 2. Minimum, optimum, and maximum growth temperatures for the cereal crops.

<table>
<thead>
<tr>
<th>Crop</th>
<th>Minimum</th>
<th>Optimum</th>
<th>Maximum</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wheat</td>
<td>37-39</td>
<td>75-77</td>
<td>86-90</td>
</tr>
<tr>
<td>Barley</td>
<td>37-39</td>
<td>68-70</td>
<td>82-86</td>
</tr>
<tr>
<td>Rye</td>
<td>37-39</td>
<td>65-70</td>
<td>82-86</td>
</tr>
<tr>
<td>Triticale</td>
<td>37-39</td>
<td>68-70</td>
<td>82-86</td>
</tr>
<tr>
<td>Oat</td>
<td>37-39</td>
<td>68-70</td>
<td>82-86</td>
</tr>
<tr>
<td>Corn</td>
<td>48-50</td>
<td>84-88</td>
<td>105-110</td>
</tr>
<tr>
<td>Sorghum</td>
<td>55-60</td>
<td>86-90</td>
<td>105-110</td>
</tr>
<tr>
<td>Millet</td>
<td>55-60</td>
<td>86-90</td>
<td>105-110</td>
</tr>
</tbody>
</table>
# US Malting Barley Variety Development Programs

*(breeding, genetics, supporting and other research)*

<table>
<thead>
<tr>
<th>University/Institution</th>
<th>Sponsor(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Montana State University</td>
<td>AB-InBev</td>
</tr>
<tr>
<td>North Dakota State University</td>
<td>Malteurop</td>
</tr>
<tr>
<td>Oregon State University</td>
<td>MillerCoors</td>
</tr>
<tr>
<td>University of California – Davis</td>
<td>Limagrain</td>
</tr>
<tr>
<td>University of Minnesota</td>
<td></td>
</tr>
<tr>
<td>University of Nebraska</td>
<td></td>
</tr>
<tr>
<td>USDA-ARS, Aberdeen, ID</td>
<td></td>
</tr>
<tr>
<td>USDA-ARS, Raleigh, NC</td>
<td></td>
</tr>
<tr>
<td>Utah State University</td>
<td></td>
</tr>
<tr>
<td>Virginia Polytech &amp; State University</td>
<td></td>
</tr>
<tr>
<td>Washington State University</td>
<td></td>
</tr>
</tbody>
</table>

AMBA member

Funded by AMBA
Canadian Malting Barley Variety Development Programs

**Primary**
AAFC, Brandon, MB
University of Saskatchewan
Alberta Agriculture and Rural Development

**Secondary**
Sapporo Breweries Ltd.
Syngenta

US Varieties are entered into Canadian testing system for potential registration and production

*Brewing & Malting Barley Research Institute (BMBRI) – AMBA’s Canadian Counterpart*
## Crop Disappearance

<table>
<thead>
<tr>
<th></th>
<th>US</th>
<th>Canada</th>
</tr>
</thead>
<tbody>
<tr>
<td>Exports</td>
<td>5.4%</td>
<td>15.8%</td>
</tr>
<tr>
<td>FSI</td>
<td>70.3%</td>
<td>13.8%</td>
</tr>
<tr>
<td>Feed</td>
<td>24.3%</td>
<td>70.3%</td>
</tr>
</tbody>
</table>
Movement of Barley and Malt in North America

Barley

Malt

Millions of Bushels
## MALTING BARLEY BREEDING GUIDELINES

### IDEAL COMMERCIAL MALT CRITERIA

*Based on a survey of AMBA's regular members.*

### General Comments
- Barley should mature rapidly, break dormancy quickly without pregermination and germinate uniformly.
- The hull should be thin, bright and adhere tightly during harvesting, cleaning and malting.
- Malted barley should exhibit a well-balanced, modification in a conventional malting schedule with four day germination.
- Malted barley must provide desired beer flavor.
- Distillers' Malt guidelines are designed to reflect how good varieties will performed when malted in the normal Brewers' cycles used for AMBA and CCRU variety trials.

### December, 2015

### AMBA Member Interest*
<table>
<thead>
<tr>
<th>AMBA Member Interest*</th>
<th>Six-Row</th>
<th>Adjunct Two-Row</th>
<th>All Malt Two-Row</th>
<th>Distillers'</th>
</tr>
</thead>
<tbody>
<tr>
<td>20%</td>
<td>55%</td>
<td>25%</td>
<td>20%</td>
<td></td>
</tr>
</tbody>
</table>

### Barley Factors

<table>
<thead>
<tr>
<th>Barley Factors</th>
<th>Six-Row</th>
<th>Adjunct Two-Row</th>
<th>All Malt Two-Row</th>
<th>Distillers'</th>
</tr>
</thead>
<tbody>
<tr>
<td>Plump Kernels (on 6/64)</td>
<td>&gt; 80%</td>
<td>&gt; 90%</td>
<td>&gt; 90%</td>
<td>&gt; 70%</td>
</tr>
<tr>
<td>Thin Kernels (thru 5/64)</td>
<td>&lt; 3%</td>
<td>&lt; 3%</td>
<td>&lt; 3%</td>
<td>&lt; 5%</td>
</tr>
<tr>
<td>Germination (4ml 72 hr. GE)</td>
<td>&gt; 98%</td>
<td>&gt; 98%</td>
<td>&gt; 98%</td>
<td>&gt; 98%</td>
</tr>
<tr>
<td>Protein</td>
<td>≤ 13.0%</td>
<td>≤ 13.0%</td>
<td>≤ 12.0%</td>
<td>11.5 -14.0%</td>
</tr>
<tr>
<td>Skinned &amp; Broken Kernels</td>
<td>&lt; 5%</td>
<td>&lt; 5%</td>
<td>&lt; 5%</td>
<td>&lt; 5%</td>
</tr>
</tbody>
</table>

### Malt Factors

<table>
<thead>
<tr>
<th>Malt Factors</th>
<th>Six-Row</th>
<th>Adjunct Two-Row</th>
<th>All Malt Two-Row</th>
<th>Distillers'</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Protein on 7/64 screen</td>
<td>≤ 12.8%</td>
<td>≤ 12.8%</td>
<td>≤ 11.8%</td>
<td>11.0 - 13.5%</td>
</tr>
<tr>
<td></td>
<td>&gt; 60%</td>
<td>&gt; 70%</td>
<td>&gt; 75%</td>
<td>&gt;50%</td>
</tr>
</tbody>
</table>
## Malt Enzymes

<table>
<thead>
<tr>
<th></th>
<th>Six-Row</th>
<th>Adjunct Two-Row</th>
<th>All Malt Two-Row</th>
<th>Distillers'</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diastatic Power (°ASBC)</td>
<td>&gt; 150</td>
<td>&gt; 120</td>
<td>110-150</td>
<td>&gt;200</td>
</tr>
<tr>
<td>Alpha Amylase (DU)</td>
<td>&gt; 50</td>
<td>&gt; 50</td>
<td>40-70</td>
<td>&gt;75</td>
</tr>
</tbody>
</table>

* Based on a survey of AMBA's regular members.

**General Comments**

Barley should mature rapidly, break dormancy quickly without pregermination and germinate uniformly.

The hull should be thin, bright and adhere tightly during harvesting, cleaning and malting.

Malted barley should exhibit a well-balanced, modification in a conventional malting schedule with four day germination.

Malted barley must provide desired beer flavor.

Distillers' Malt guidelines are designed to reflect how good varieties will performed when malted in the normal Brewers' cycles used for AMBA and CCRU variety trials.

**December, 2015**
2016 AMBA Recommended Malting Barley Varieties

Two-Rows

- AAC Synergy (2015)
- ABI Voyager (2014)
- AC Metcalfe (2005)
- CDC Copeland (2007)
- CDC Meredith (2013)
- Charles* (2009)
- Conlon (2000)
- Conrad (2007)
- Endeavor* (2015)
- Expedition (2013)
- Harrington (1989)
- Hockett (2010)
- Merit (2000)
- Merit 57 (2010)
- Moravian 37 (2010)
- Moravian 69 (2010)
- ND Genesis (2016)
- Pinnacle (2011)
- Scarlett (2008)
- Wintmalt* (2013)

Six-Rows

- Celebration (2011)
- Innovation (2014)
- Lacey (2000)
- Legacy (2001)
- Quest (2011)
- Stellar-ND (2006)
- Thoroughbred* (2015)

Variety name & year first recommended

*Winter
2015 MIDWEST CONTRACTED BARLEY VARIETIES

(Minnesota, North Dakota, South Dakota & Wisconsin)

- Lacey: 20.7%
- Pinnacle: 7.2%
- CDC Meredith: 4.3%
- Quest: 1.9%
- CDC Copeland: 1.9%
- Innovation: 1.5%
- Tradition: 59.5%
2015 WESTERN CONTRACTED BARLEY VARIETIES

(Colorado, Idaho, Montana, Washington & Wyoming)

- AC Metcalfe: 23.2%
- ABI Voyager: 11.5%
- CDC Copeland: 5.6%
- Hockett: 15.3%
- Other: 5.9%
- Moravian 69: 12.6%
- Conrad: 11.0%
- Moravian 115: 7.8%
- Merit 57: 7.0%
# 2015/2016 Recommended Varieties in Canada

## Two-Row Varieties

<table>
<thead>
<tr>
<th>VARIETY</th>
<th>MARKET COMMENTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>CDC Copeland₁</td>
<td>Established Demand</td>
</tr>
<tr>
<td>AC Metcalfe₁</td>
<td>Established Demand</td>
</tr>
<tr>
<td>CDC Meredith₁</td>
<td>Limited, Increasing Demand</td>
</tr>
<tr>
<td>Bentley₂</td>
<td>Limited, Stable Demand</td>
</tr>
<tr>
<td>CDC Kindersley₁</td>
<td>Undergoing Commercial Market Development</td>
</tr>
<tr>
<td>Cerveza₆</td>
<td>Undergoing Commercial Market Development</td>
</tr>
<tr>
<td>AAC Synergy₅</td>
<td>Undergoing Commercial Market Development</td>
</tr>
</tbody>
</table>

### Additional Two-Row Varieties:

<table>
<thead>
<tr>
<th>VARIETY</th>
<th>MARKET COMMENTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Newdale₄</td>
<td>Limited, Stable Demand</td>
</tr>
<tr>
<td>CDC PolarStar₂</td>
<td>Limited, Stable Demand</td>
</tr>
<tr>
<td>Merit 57₂</td>
<td>Undergoing Commercial Market Development</td>
</tr>
</tbody>
</table>

*These two-row varieties are primarily handled by one company. For interest in growing Newdale, please contact Canada Malting Company. CDC PolarStar is produced in a closed loop, identity preserved program. For interest in growing CDC PolarStar, please contact Prairie Malt-Cargill. For interest in growing Merit 57, please contact BARI-Canada.

Note: CDC Landis is not yet grown for commercial use. Production is limited to quantities required for pre-market development testing.

## Six-Row Varieties

<table>
<thead>
<tr>
<th>VARIETY</th>
<th>MARKET COMMENTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Legacy₃,₄</td>
<td>Limited Demand</td>
</tr>
<tr>
<td>Tradition₄</td>
<td>Limited Demand</td>
</tr>
<tr>
<td>Celebration₂</td>
<td>Limited Demand</td>
</tr>
</tbody>
</table>

**Demand for six-row malting barley has been declining. Please talk to your local malting company selector in regard to demand for six-row varieties in your area.**
CANADIAN SIX-ROW MALTING BARLEY VARIETIES

2014 & 2015
(ALBERTA, SASKATCHEWAN & MANITOBA)
# US Barley Production

<table>
<thead>
<tr>
<th></th>
<th>Seeded</th>
<th>Yield</th>
<th>Production</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(000s acres)</td>
<td>(bu/acre)</td>
<td>(000s bushels)</td>
</tr>
<tr>
<td>Minnesota</td>
<td>75</td>
<td>100</td>
<td>52.0</td>
</tr>
<tr>
<td>North Dakota</td>
<td>620</td>
<td>900</td>
<td>67.0</td>
</tr>
<tr>
<td>South Dakota</td>
<td>28</td>
<td>40</td>
<td>52.0</td>
</tr>
<tr>
<td>Three States</td>
<td>723</td>
<td>1,040</td>
<td>65.1</td>
</tr>
<tr>
<td>California</td>
<td>80</td>
<td>70</td>
<td>73.0</td>
</tr>
<tr>
<td>Colorado</td>
<td>57</td>
<td>65</td>
<td>124.0</td>
</tr>
<tr>
<td>Idaho</td>
<td>560</td>
<td>610</td>
<td>94.0</td>
</tr>
<tr>
<td>Montana</td>
<td>920</td>
<td>1,010</td>
<td>58.0</td>
</tr>
<tr>
<td>Oregon</td>
<td>40</td>
<td>65</td>
<td>50.0</td>
</tr>
<tr>
<td>Washington</td>
<td>115</td>
<td>115</td>
<td>60.0</td>
</tr>
<tr>
<td>Wyoming</td>
<td>80</td>
<td>85</td>
<td>107.0</td>
</tr>
<tr>
<td>Seven States</td>
<td>1,852</td>
<td>2,020</td>
<td>74.3</td>
</tr>
<tr>
<td>Other</td>
<td>400</td>
<td>353</td>
<td>77.7</td>
</tr>
<tr>
<td>Total U.S.</td>
<td>2,975</td>
<td>3,413</td>
<td>72.4</td>
</tr>
</tbody>
</table>
## Canadian Barley Production

<table>
<thead>
<tr>
<th>Region</th>
<th>Seeded 2014</th>
<th>Seeded 2015</th>
<th>Yield 2014 (bu/acre)</th>
<th>Yield 2015 (bu/acre)</th>
<th>Production 2013 (000s bushels)</th>
<th>Production 2014 (000s bushels)</th>
<th>Production 2015 (000s bushels)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alberta</td>
<td>3,200</td>
<td>3,400</td>
<td>67.3</td>
<td>60.6</td>
<td>254,700</td>
<td>189,750</td>
<td>170,600</td>
</tr>
<tr>
<td>Saskatchewan</td>
<td>2,000</td>
<td>2,400</td>
<td>54.2</td>
<td>54.2</td>
<td>156,700</td>
<td>99,800</td>
<td>120,100</td>
</tr>
<tr>
<td>Manitoba</td>
<td>300</td>
<td>350</td>
<td>61.5</td>
<td>70.8</td>
<td>32,400</td>
<td>16,300</td>
<td>23,360</td>
</tr>
<tr>
<td>Other</td>
<td>380</td>
<td>361</td>
<td>59.8</td>
<td>62.9</td>
<td>26,388</td>
<td>21,123</td>
<td>21,466</td>
</tr>
<tr>
<td>Canada</td>
<td>5,880</td>
<td>6,511</td>
<td>61.9</td>
<td>58.8</td>
<td>470,188</td>
<td>326,973</td>
<td>335,526</td>
</tr>
</tbody>
</table>
2015 Season

- Much Improved over 2014
- Started very dry in western US and western Canadian Prairies
- Just in time June rains saved many farms from devastating drought
- Widespread rain in early September compromised the quality of much of the crop in Canada (60% harvested at the time)
- Good size crop in US with average to good quality
- Lower yields in Canada with marginal to average quality
Good Beer Requires Quality Barley

“...barley is to beer as grapes are to wine. You cannot make a good wine out of bad grapes and you can’t make a good beer out of bad barley. You can make a terrible beer out of good barley, that’s easy to do. But at least start right.”

– Bill Coors
THANK YOU