Barley Production and Research Trends in Canada

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Brewing and Malting Barley Research Institute (BMBRI)

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BMBRI

History and Role:

BMBRI has supported research and the development of world-class malting barley varieties in Canada since 1948.

• Set and support research and breeding targets

• Critically evaluate and communicate results
Malting Companies:
- MaltEurop Canada
- Prairie Malt
- Rahr Malting Canada

Brewing Companies:
- ABInBev
- MolsonCoors Canada
- Sleeman
- Sierra Nevada Brewing Co.
- Big Rock Brewery
- New Belgium Brewing Co.

Associate Members:
- Alberta Barley Commission (growers)
- FP Genetics (seed)
- SeCan (seed)
- Canterra Seeds (seed)
- Viterra (seed)
- Syngenta Seeds Canada (seed)
Canadian Malting Barley

Quality is in our nature
Presentation Overview:

• Canadian barley production trends and reasons

• Canadian variety trends and reasons

• Ongoing barley research efforts in Canada - Solutions
Canadian barley production trends and reasons

- Canadian variety trends and reasons
- Ongoing barley research efforts in Canada - Solutions
2010 - Record Wet - Spring
2010 - Record Wet - July
Some Reasons for Recent Canadian Barley Production Trends

• More crop alternatives/increased demand for other crops
  Recent Headline in The Western Procuer- “Canola Sector on track to meet goal ...15 million tonnes by 2015”

• New rotation practices: In the oilseed/pulses/cereals rotation barley now often comes out in 3rd place in some locations (after wheat and oats)

• Modern large scale farming (seeding, harvesting and storage of a range of grains)- some growers not prepared to invest in the specialty equipment and storage for malting barley (but some are prepared to do it under IP contracting)

• Some grains such as malting barley becoming specialty crops for both growers and grain elevator/selecting companies
Some Reasons for Recent Canadian Barley Production Trends (...2)

• Less demand for feed barley/more demand for other feed ingredient alternatives (DDGs, Corn, feed wheat, etc)– if barley not selected for malting the feed barley default is not very profitable

• 2.5 mln t. selectable malting barley is normal market need. Demand growth has not been as high as expected in some expanding international brewing markets (lower priced ingredients and recipes used by some brewing segments and beer styles)

• Disease challenges: e.g., FHB in the eastern Prairies. Barley in Manitoba now a minor crop

• Selection and storage risks for malting barley do not exist for other grains

• Weather challenges in recent years favor some other crops (some crops – Soya beans much better at surviving wet in 2010)
**Canadian Feed Barley Usage (million tonnes – Stats Can/AAFC)**

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<tbody>
<tr>
<td>Animal feed, waste and dockage</td>
<td>8.21</td>
<td>7.68</td>
<td>7.27</td>
<td>7.028</td>
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</tbody>
</table>
• Canadian barley production trends and reasons

• Canadian barley variety trends and reasons

• Ongoing barley research efforts in Canada - Solutions
CWB Variety Survey 2001-2010
Percentage of Prairie barley seeded area by type

- Feed (2&6 Row)
- Two-row (malt)
- Six-row (malt)
- Hulless (2&6 Row)
• Canadian barley production trends and reasons

• Canadian barley variety trends and reasons

• Ongoing barley research efforts in Canada – Potential Solutions
Potential Solutions?

• Invest in Research and Development for improved varieties and improved competitiveness of malting barley as an ingredient within the malting and brewing industry (already happening to some degree!)

• Raise the bar on agronomic performance for new varieties

• Have varieties that fit with modern grain farming practices (direct combining/long term storage)

• Develop malting and brewing traits in barley varieties that satisfy the future needs of diverse customers/beer styles, so that barley continues to be the preferred main ingredient in “beer” (vs. “enzyme beer”)

• Use of biotechnology in breeding (with/without GMO?)
Potential Solutions?.../2

• Don’t register varieties that are only equal to existing varieties in agronomic performance (unless there is an niche market demand/price premium for these varieties)

• **Get fast commercial acceptance** of some current higher yielding more agronomically competitive varieties *(immediate shot in the arm!)*

• Work with specialty growers in malting barley production locations

• Contract production of varieties, quality specs and management practices to customer needs

• If lower yielding niche-market varieties required, premium price/contract must be provided
Right combination of Grower Performance/Customer Demand

<table>
<thead>
<tr>
<th>Stop!</th>
<th>Proceed</th>
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<tbody>
<tr>
<td>High Yield/Poor Demand</td>
<td><strong>High Yield/Good Demand</strong></td>
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<tr>
<td></td>
<td>- Better able to compete with other crops at reasonable price</td>
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<table>
<thead>
<tr>
<th>Stop!</th>
<th>Proceed with Caution</th>
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<tbody>
<tr>
<td>Lower Yield/Poor Demand</td>
<td><strong>Lower Yield/Good Demand</strong></td>
</tr>
<tr>
<td></td>
<td>- Contract production and higher grower price needed to compete with other crops</td>
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</table>
Major Canadian Barley Breeding and Research Centres

- FCDC Lacombe
- CDC Saskatoon
- AAFC Brandon
Some Other Canadian Public Research Bodies Doing Barley Work

- McGill University
- Dalhousie University
- CGC Grain Research Lab
- BMBRI
- CMBTC
- U of Guelph
- U of Manitoba
- AAFC (CRC)
- AAFC Lethbridge
- U of Alberta
- Dalhousie University
- McGill University
Malting Barley Breeding and Research Focus and Activities in Canada

Malting Barley Breeding *+ Related Research

University of Saskatchewan/ Crop Development Centre, Saskatoon
  • A. Beattie/B. Rossnagel - 2 Row Malting Barley
  • B. Harvey – 6 Row Malting Barley

Agriculture Canada, Brandon Research Centre, Brandon
  • B. Legge – 2 Row Malting Barley + Lead on FHB Research and Nursery
  • M. Therrien - 6 Row Malting Barley

Alberta Agriculture, Field Crop Development Centre, Lacombe
  • P. Juskiw – 2 Row Malting Barley

* Note some of these breeders and institutions are also involved in joint ventures with private breeders and in breeding other barley types (feed, food, hulless, etc.)
Malting Barley Breeding and Research Focus and Activities in Canada

Other Public Research Institutions/Researchers Working on Barley in Canada /1

Dalhousie University/A. Speers
Current Work: Malting Barley Fermentability (Collaboration with M.Edney/GRL and B. Rossnagel and A. Beattie/CDC and others)

McGill University/J. Singh
Current Work: Barley transgenic methods and use of transposons to identify trait specific sites within QTLs

CGC’s- Grain Research Laboratory/M. Edney and M. Izydorczyk + team
Current Work:
M. Izydorczyk: Basic Barley Research – malting and food/hulless barley basic research and functionality
M. Edney: Applied Barley Research and harvest quality and new breeder lines variety evaluation
Malting Barley Breeding and Research Focus and Activities in Canada

Other Public Research Institutions/Researchers Working on Barley in Canada .../2

BMBRI Winnipeg/M. Brophy + BMBRI Technical Committee
Current Work: Collaborative Testing of advanced breeder lines/funding research

CMBTC Winnipeg/R. McCaig and Y. Li + team

University of Saskatchewan/ G. Scoles, R. Chibbar and others
Current Work: Starch/protein/enzyme functionality, biotechnology/marker development to support breeding, other....)

Field Crop Development Centre Lacombe/J. Helm and Team (J. Nyachiro/J. Zantinge/ML Swift, ....)
Current Work: NIR uses for feed and malting quality, marker development for agronomic, disease and quality traits, improving nitrogen/water use efficiency, better disease resistance, other...
Malting Barley Breeding and Research Focus and Activities in Canada

Other Public Research Institutions Working on Barley in Canada ...

Alberta Research Council (Alberta Innovates)/ A. Anyia
Current Work: identification of breeder lines with improving nitrogen/water use efficiency

University of Alberta/T. Vananthan and F. Tamelli
Current Work: Food barley and nutrition studies

Agriculture Canada Research Centres in Winnipeg/Lacombe/Lethbridge/other)
J. O’ Donovan (AAFC Lacombe)
Current Work: - Western Canada GXE collaborative research project for malting barley varieties
K. Turkington (AAFC Lacombe)
Current Work: Barley Disease/Agronomy
N. Ames (AAFC Winnipeg)
Current Work: Hulless barley food uses and nutrition

Canadian International Grains Institute/L. Malcomson
Current Work: Hulless and regular barley use in mainstream milling and baking
Some Current Canadian Barley R&D Funding Sources

• Agriculture and AgriFood Canada (AAFC) – federal and federal/provincial programs

• Other Government of Canada – NSERC, other

• Provincial Agriculture Departments – federal/provincial and provincial programs

• Western Grains Research Foundation – CWB grower barley check-off/Endowment Fund

• Alberta Barley Commission – grower barley check-off

• Brewing and Malting Barley Research Institute – project specific research grants

• University Funding – core funding

• Other (various private industry company/organization grants and contributions) e.g., CWB, grain companies, malting companies, brewers, etc.)
Some Recent Innovations from Canadian Barley Breeding and Research

- Better/higher yielding 2R and 6R varieties that perform well in Canada and USA (AAFC/CDC/FCDC)

- Hulless barley varieties with improved malting quality (but lower yielding than regular hulled varieties) (AAFC/CDC)

- Low phytate barley types (AAFC/CDC)

- Varieties with better pre-harvest sprouting tolerance

- Varieties with lower protein

- Hulless barleys with various starch types with potential food, functionality and diet applications

- Backcrossing for special attributes in malting varieties (low LOX, better resistance to FHB, low phytate, etc)
Some Recent BMBRI Funded (with matching grants from others) Research and Breeding-related Projects

2010 - 2011

- Use of transposons to Target Malting Quality Traits (McGill)
- Characterization and quantification of aribinoxylans in Canadian malting barley (GRL Winnipeg)
- Characterization of barley lines with increased A-type starch granules (CDC, U of S)
- GXE barley agronomy study, study of impact on malting quality and other factors (AAFC/CGC/Others)
Some Recent BMBRI Funded (with matching from others) Research and Breeding-related Projects

2009 - 2010

• Improved fermentability assay (Dalhousie)
• Use of transposons to Target Malting Quality Traits (McGill)
• Effects of water use efficiency on nitrogen use efficiency and protein content of barley (ARC, Alberta)
• Effect of reduced phytate content on malting and brewing quality (AAFC, Brandon)
• Study of induced resistance to FHB in barley using detached leaf assay (AAF, Lacombe)
• Identifying single nucleotide polymorphisms in Canadian 2R malting (barley – and associations with limit dextrinase activity (U of S, Saskatoon)
Some Key Organizations Providing Advice and Direction on Malting Barley Research and Breeding Priorities

• Western Grains Research Foundation’s (WGRF) in Manitoba and Saskatchewan. Its Barley Advisory Committee has various stakeholder members (grower organizations, BMBRI, CWB, CMBTC, breeders, CCG GRL, etc)

• BMBRI

• Prairie Recommending Committee for Oats and Barley (at the level of requests for registration support)

• Barley Development Council

• Alberta Barley Commission (Alberta + other provinces)

• Others....(CWB, private breeders, end use customers, ...)
Desirable Quality Traits in Malting Barley

for BMBRI Member Companies

A BREWING AND MALTING BARLEY RESEARCH INSTITUTE Publication

303 – 161 Portage Avenue East
Winnipeg, Manitoba, CANADA R3B 2L6
www.bmbri.ca

QUALITY FACTORS IN MALTING BARLEY

A BREWING AND MALTING BARLEY RESEARCH INSTITUTE Publication

303 – 161 Portage Avenue East
Winnipeg, Manitoba, CANADA R3B 2L6
www.bmbri.ca
## BMBRI’s List of Desirable Quality Traits for Development in Malting Barley

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<thead>
<tr>
<th>Characteristic</th>
<th>In Breeding</th>
<th>For Research</th>
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<tbody>
<tr>
<td>Aribinozylan Measurement</td>
<td></td>
<td>+</td>
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<tr>
<td>Balanced Modification</td>
<td>+</td>
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<tr>
<td>Consistent Barley Quality Across Regions</td>
<td>+</td>
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<tr>
<td>DMS/DMS Precursors</td>
<td></td>
<td>+</td>
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<tr>
<td>Enzyme Activities *</td>
<td>+</td>
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<tr>
<td>Extract</td>
<td>+</td>
<td>+</td>
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<tr>
<td>Fermentability</td>
<td></td>
<td>+</td>
</tr>
<tr>
<td>FHB Resistance</td>
<td>+</td>
<td></td>
</tr>
<tr>
<td>Hull Adherence</td>
<td>+</td>
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<tr>
<td>Long Term Germination</td>
<td>+</td>
<td></td>
</tr>
<tr>
<td>Pre Harvest Sprout Tolerance</td>
<td></td>
<td>+</td>
</tr>
<tr>
<td>Protein*</td>
<td>+</td>
<td></td>
</tr>
<tr>
<td>Varietal Identification</td>
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<td>+</td>
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</table>
BMBRI’s List of Desirable Quality Traits for Development in Malting Barley

**Protein-Enzyme Quality Profiles:**

- **Moderate protein (11-12.5%)/Moderate enzymes (125–150 DP, >53 alpha amylase)**
  
  - e.g. AC Metcalfe (+ recent newer varieties such as CDC Meredith, Merit 57, Major, Cervesa, others?)

- **Moderate protein (11-12.5%)/High enzymes (>150 DP, >53 alpha amylase)**
  
  - e.g. CDC Kendall, Legacy (+ recent new varieties such as CDC PolarStar, Celebration, CDC Mayfair, others?)

- **Moderate protein (11-12.5%)/Lower enzymes (<125 DP, <53 alpha amylase)**
  
  - e.g. CDC Copeland (+recent newer varieties such as CDC Meredith/Bentley, others?)

- **Low protein (<11%)/low enzymes (<125 DP, <53 alpha amylase)**
  
  - e.g. *Bentley?*
## Some Newer Malting Barley Varieties Registered in Canada

### Two-Row Varieties
- CDC Kindersley (TR 07114) - 2010
- Cervesa TR 0694 - 2010
- CDC Polarstar (TR 06918) - 2010
- Merit 16 (TR 05910) - 2009
- Merit 57 (TR 05911) - 2009
- Major (TR 06297) - 2009
- Bentley (TR 05669) – 2008
- CDC Meredith (TR 05104) - 2008
- CDC Reserve (TR 05912) – 2008

### Six-Row Varieties
- SR 424 – Recommended in 2010
- SR 425 – Recommended in 2010
- SR 420 – Recommended in 2009
- Celebration (BT 980) - 2009
- Stellar-ND (BT 984) - 2009
- CDC Kamsack (SR 410) - 2008
- CDC Mayfair (SR 412) – 2008
- CDC Clyde (BT 490) – 2004
Bentley, CDC Landis, Major, Merit 57, Norman, Cerveza, and CDC Reserve are not yet being grown for the commercial market. Production is limited to quantities required for testing and market development. CDC Meredith reached capacity for plant scale testing in 2010.

**CDC Polarstar is available only through a closed loop Identity Preserved program offered by Prairie Malt Limited/Sapporo Breweries and their agents.**
Recommended Malting Barley Varieties 2011-12

Recommended Six-Row Barley Varieties

<table>
<thead>
<tr>
<th>VARIETY</th>
<th>DOMESTIC</th>
<th>EXPORT</th>
<th>MARKET DEMAND</th>
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<tbody>
<tr>
<td>Legacy\textsubscript{1,2,3}</td>
<td>Established</td>
<td>Established</td>
<td>Declining Demand</td>
</tr>
<tr>
<td>Tradition\textsubscript{1,2,3}</td>
<td>Established</td>
<td>Established</td>
<td>Declining Demand</td>
</tr>
<tr>
<td>Stellar-ND\textsubscript{5}</td>
<td>Limited</td>
<td>Limited</td>
<td>Increasing Demand</td>
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Celebration, CDC Clyde, CDC Kamsack, and CDC Mayfair are not yet being grown for the commercial market. Production is limited to quantities required for testing and market development. Please talk to local malting company selector in regards to demand for CDC Battleford, Lacey and Robust.
Malting barley now being a specialty crop, perhaps 7 million tonnes of barley production in Western Canada can be viable for the future with:

- Increased selection rates of malting barley from available production (with normal weather!)
- Specialty growers operating in value chain IP production contracts that include malting companies and end users are developing
- Quicker adoption of better more productive 2R and 6R varieties (than AC Metcalfe and Legacy for example) - a number of these are close to commercial approval
Conclusions- Areas for Optimism:

Canada’s team of world-class barley breeding and research institutions and scientists:

• They will and can respond to the needs of the industry if correct and clear signals are provided to them

• But continued funding and succession planning in the barley breeding and research scientific pool is very important
Conclusions – Key priorities

• Continue to invest in Research and Development to achieve productivity gains to make malting barley competitive with other crops for growers and with other ingredients for brewers

• Achieve faster transfer and commercial adoption of innovations, including higher yielding varieties and better production practices

• Keep barley as the key raw material in “beer” across all market segments. Promote brewing and beers that use quality malting barley (as other industries do, e.g., oilseeds products – the “Canola” brand)
Acknowledgements:

- BMBRI Members
- Agriculture and AgriFood Canada (AAFC) – AgriMarketing Program
- Canadian Breeders and Researchers; CWB; CMBTC; CGC Grain Research Laboratory
Canadian Malting Barley

Back to the Future!