Research & Production Trends in Mexico

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AMBA Barley Improvement Conference (BIC) & Barley Coordinated Agricultural Project (BCAP)

Combined Meeting

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Barley was introduced into Mexico during the sixteenth century by Spanish farmers. It has been growing at the High Valleys of the Central Highlands. The first crops were of Spanish varieties named “Crudo” or “Criollo” – brought over by settlers. These early varieties performed poorly due to the differences in the existing production conditions between Spain and Mexico.
• Barley grain production was boosted by the establishment of the first brewery in 1865

• However, it was not until almost a century later, in 1954, that a research program was established by the Ministry of Agriculture, along with the Rockefeller Foundation, in response to problems of low industrial quality and very low yields.

• Malting barley is an important crop in global and local markets, most notably for its role as a raw ingredient in brewing industries.
Barley in Mexico today

• In Mexico, barley is the fourth most important crop by surface; the first three are Maize, Wheat and Edible Beans

• As such, malting barley is the main source of income for more than 35,000 families

• Barley is also used as a food source for people, though to a lesser extent than its uses in brewing and as forage for livestock
Some Statistics

- Around 313,000 ha of barley are annually planted in Mexico, of which 230,000 ha belong to malting barley
- 70,000 ha grow in Fall-winter cycle (irrigated) with yields of 5.8 MT per ha
- 160,000 ha grow in Spring-summer cycle (rainfed lands) with yields of 2.0 MT per ha
Some Statistics

- **Total Malting Barley Production is roughly 650,000 MT**
- National average yield of 2.4 MT per hectare
- **When IASA was created in 1958, it reached an agreement with INIFAP for improving quality of Malting Barley**
- The main results of this agreement are summarized next:
INIFAP-IASA milestones

• In the 1960s five new varieties were developed:

• In the 1970s the Genetic Improvement Program for Barley developed seven new varieties:

• Another group of varieties were developed in the 1980s:
  – ‘Guanajuato’, ‘Cucapah 87’ and ‘Esperanza’

• In these years the trend was achieving output homogeneity in terms of malting quality
• In the late 1980s the release of ‘Esmeralda’ and ‘Esperanza’ varieties allowed production in both rainfed and irrigated systems

• Imports were reduced and local farmers were able to meet the demands of the local brewing industry

• At this time the trend was to improve at-field crop performance and tolerance to diseases
‘Adabella’ was commercially released in 2004. This variety is adapted to rainfed systems in the High Valleys of the Central Highlands, is tolerant to stripe rust and leaf rust.

It beats ‘Esmeralda’ and ‘Puebla’ in productivity and could replace ‘Esmeralda’ in some high-potential rainfed areas (more than 350 mm of rain).
Malting Barley Production in Mexico through IASA

Annual Average Line

Thousands MT

235.5 220.7 167.0 234.1 215.4 225.9 263.2 210.9 318.8 154.5 163.6

2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010

406.3 363.1 534.7 694.5 608.3 501.6 459.6 407.8 545.1 461.4 539.6*

Spring-Summer Cycle (rainfall lands)  Fall-Winter Cycle (irrigated)
Malting barley varieties currently used in Mexico (6-row)

• Fall-winter cycle (irrigated)
  – ‘Esperanza’ (over 20 years planted, public domain variety)
  – ‘Alina’ (planted in the last 5 years, breeder’s certificate: 2006/05/30)
  – ‘Armida’ (planted in the last 5 years, breeder’s certificate: 2006/05/30)

• Spring-summer cycle (rainfed systems)
  – ‘Esmeralda’ (over 20 years planted, public domain variety)
  – ‘Adabella’ (planted in the last 5 years, breeder’s certificate: 2006/11/30)
These five malting barley varieties were developed by the breeding program ran by INIFAP and financed by the Mexican Malting Industry.

These varieties meet the minimum requirements of the malting industry.
Three growing regions

**BAJÍO REGION**
- **States**
  - Mainly Guanajuato
  - Querétaro, Jalisco, Michoacán
- **Conditions**
  - Fall-winter cycle
  - Irrigated (dry season)
- **Varieties**
  - ‘Esperanza’, ‘Alina’ and ‘Armida’

**CENTRO-NORTE REGION**
- **States**
  - Mainly Zacatecas
  - S. L. Potosí, Durango, Guanajuato
- **Conditions**
  - Spring-summer cycle
  - Non irrigated (rainy season) (lower rainfall than Altiplano)
- **Varieties**
  - ‘Esperanza’

**ALTIPLANO REGION**
- **States**
  - Hidalgo, Tlaxcala, Puebla, Mexico
  - Parts of Oaxaca
- **Conditions**
  - Spring-summer cycle
  - Non irrigated (rainy season)
- **Varieties**
  - ‘Esmeralda’ (more than 90% of the area)
  - ‘Adabella’
We are actually running two separated programs with the collaboration of two institutions in order to get the varieties needed by the industry:

- **INIFAP**, since 1958
- **ICARDA**, since Nov’2009
Desired Ideotypes for Rainfed Varieties (Spring-Summer Cycle)

- Plant height: 100 cm
- High straw strength (resistant to lodging)
- **Adaptation to the different areas** (different rainfall levels)
- **Vegetative cycle: 90-100 days** (up to physiological maturity)
- High yield potential
- Resistance to peeling
- **Drought tolerance**
- Malting quality (7 parameters)
- Tolerance to diseases and pests...
Expected tolerance to diseases and pests such as:

- *Puccinia striiformis* f. sp. hordei (Stripe/Yellow Rust)
- *Bipolaris sorokiniana* (Spot Blotch)
- *Dreschlera teres* (Net Blotch)
- *Rynchosporium secalis* (Scald)
- *Ustilago nuda* (Loose Smut)
- *Ustilago hordei* (Covered Smut)
- *Diuraphis noxia* (Russian Wheat Aphid)
Desired Ideotypes for Irrigated Varieties (Fall-Winter Cycle)

- **Plant height:** 80-90 cm
- **High straw strength** (resistant to lodging)
- **Vegetative cycle:** 105-115 days (up to physiological maturity)
- **High yield potential**
- **Resistance to peeling**
- **Malting quality** (7 parameters)
- **Tolerance to diseases...**
Tolerance to diseases following:

- *Puccinia striiformis* f. sp. *hordei* (Stripe Yellow Rust)
- *Erisiphe graminis* (Powdery Mildew)
- *Puccinia hordei* (Leaf Rust)
- *Helminthosporium* spp. (Leaf Spot)
- *Rynchosporium secalis* (Scald)
- *Ustilago nuda* (Nuda Loose Smut)
- *Ustilago hordei* (Covered Smut)
7 parameters that must be achieved for evaluating advanced lines

<table>
<thead>
<tr>
<th>Parameter</th>
<th>6-row advanced lines</th>
<th>2-row advances lines</th>
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<tbody>
<tr>
<td>Protein Content (%) (DM basis)</td>
<td>10 – 13.5</td>
<td>10 – 13</td>
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<tr>
<td>Wort - Soluble Protein (%) (DM basis)</td>
<td>4.0 – 6.1</td>
<td>3.9 – 5.9</td>
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<td>Extract – Fine Grind (%) (DM basis)</td>
<td>&gt;76.5</td>
<td>&gt;78.5</td>
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<td>Diastatic Power, ° Lintner (DM basis)</td>
<td>&gt;140</td>
<td>&gt;110</td>
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<td>α- Amylase, U/g (DM basis)</td>
<td>&gt;40</td>
<td>&gt;40</td>
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<tr>
<td>Wort Viscosity, cps</td>
<td>&lt;1.54</td>
<td>&lt;1.56</td>
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<tr>
<td>Wort Filtration Time, min.</td>
<td>&lt;60</td>
<td>&lt;60</td>
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Mexican Standard
NMX-FF-043-SCFI-2003

- Humidity (%): 11.5 - 13.5
- Germination (%): ≥ 85
- Plumpness - minimum for malt use (%): 85
- Damaged kernels (%): maximum 10
- Skinned and broken kernels - maximum (%): 5
- Impurities – maximum (%): 2
- Mixtures (%): maximum 10
- Hectolitric Weight (kg/hl): Six-row: 56; Two-row: 58
What are IASA main targets and challenges in the years to come?

- Higher resistance to drought (climate change)
- Better use of inputs
- Release 2-Row varieties for rainfed areas
- Reducing production costs
- Higher yield to compete against alternative crops
- Overcome the earlier varieties in malting quality performance
- Keeping food safety
- Development of organic inputs
Thank you!

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