Oats: a minor grain with major potential

Fred Gates
Outline

• Oats are a minor crop
  – Why are we here?
• The potential of oats
  – What are the benefits?
• Achieving the potential
  – How to add value to oats?
Oats a minor crop
Cereal production worldwide

Production (million tonnes)

- Maize
- Rice, paddy
- Wheat
- Barley
- Millet
- Oats
Oat production

M = Million, k = Thousand
Oat production (top five)

M = Million, k = Thousand
THE POTENTIAL OF OATS
Benefits of oats

- Oats are a valuable break crop in cereal rotations reducing disease and weed problems, require less fertiliser than wheat, perform well in marginal areas
- High value animal feed
- Scientifically proven health benefits
- Well accepted by consumers
EFSA Approved Health Claims: Oat Beta-Glucan and Dietary Fibre

Article 13, Beta-Glucan
  Maintenance of normal Blood Cholesterol Levels

Article 13, Beta-Glucan
  Blood Glucose peak Reduction

Article 13, Oat Grain Fibre
  Increase of Faecal Bulk

Article 14, Oat Beta-Glucan
  Reduction of Blood Cholesterol and Risk of development of Coronary Heart Disease
Potential health benefits of oats

- Reduce asthma risk in children
- Boost nutrition profile of gluten-free diets
- Increase appetite-control hormones
- Oat beta-glucans improve immune system defences
- Improve insulin sensitivity

Compiled by Whole Grains Council (USA) based on scientific publications
Gluten free

• Oats are generally considered suitable for most people with coeliac disease
• Cross-contamination can be a problem
ADDING VALUE TO OATS
Supply and demand

- Oat supply
  - A minor crop
- Oat processing
  - Flakes
  - Breakfast cereals
  - Biscuits
- Marketing
  - Health claims
- Consumer demand
  - Oats are seen as good
Oat mill processing

Variety selection
Agronomy
Grain drying
Storage

Intake testing
Cleaning
Dehulling
Kilning

Groat storage
Steel Cutting
Steaming
Flaking & Drying

Packing
Distribution
Storage
End use
Main issues with oats

- A minor grain
  - Supply fluctuates
  - Quality attributes are not standardised
- Hulls
  - Naked oat varieties are available
  - Losses during dehulling
- Rancidity
  - High levels of fat and lipolytic enzymes
  - Stabilisation
## Quality of milling oats

<table>
<thead>
<tr>
<th>Factor</th>
<th>Requirement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Test weight, min.</td>
<td>51 kg/hl</td>
</tr>
<tr>
<td>Sound cultivated oats, min.</td>
<td>97%</td>
</tr>
<tr>
<td>Moisture, max.</td>
<td>13%</td>
</tr>
<tr>
<td>Foreign material, max.</td>
<td>3%</td>
</tr>
<tr>
<td>Wheat and barley, max.</td>
<td>2%</td>
</tr>
<tr>
<td>Heat-damages, max.</td>
<td>0.1%</td>
</tr>
<tr>
<td>Ergot</td>
<td>Nil</td>
</tr>
<tr>
<td>Pesticides/chemicals</td>
<td>None detected</td>
</tr>
<tr>
<td>Pests</td>
<td>No live infestation</td>
</tr>
<tr>
<td>Thins (through 2 mm slotted screen), max.</td>
<td>5%</td>
</tr>
<tr>
<td>Free fatty acid, max.</td>
<td>8%</td>
</tr>
</tbody>
</table>

*Giradet and Webster (2011)*
Breakage during impact dehulling

- Size of the grain
- Moisture content
- Sprouting
- Speed of dehuller
- Impact ring
Kilning

- Inactivates lipolytic enzymes
- Changes flavour and colour
- Reduces microbial levels
- Reduces vitamins
  - Vitamin B₁ losses averaged 30% (Ganssmann & Vorwerck)
Rancidity

• Hydrolytic rancidity
  – Heat treatment to inactivate lipase
  – Validating enzyme inactivation

• Oxidative rancidity
  – Enzymatic and non-enzymatic processes
  – Polar lipids are susceptible to non-enzymatic oxidation after heat treatment
Stabilisation

• Enzyme inactivation temperature is dependent on moisture content

• Industrially kilning times are typically 90 – 120 min
  – Uneven temperature and moisture distribution in the kiln
Pasteurisation system for dry ingredients

Tubular spirals around a central support cylinder

Tube heated by Joule effect due to the IHS (Impedence Heating System) principle

Unidirectional vibrations cause movement of the particles
Milling

• Flaking
  – Either whole groats or steel-cut oats
  – Steaming for about 30 minutes to raise moisture to about 15%
  – Roll gap and oat size used to control flake thickness

• Oat flour and oat bran

• Fractionation
Quality attributes of oat flakes

- Residues and contaminants
- Appearance
- Size
- Thickness
- Specific weight
- Breakage
- Texture
- Water absorption
- Pasting
- Composition
CONSUMER PRODUCTS
Traditional oat products

- Oat porridge
- Biscuits
- Flapjacks
- Muesli
- Baby food
Innovative products

- Convenient porridge
- 100% oat bread
- Dairy substitutes
- Meat substitutes
Oat Ingredients

- Colloidal oat flour
- Oat bran concentrates
  - Beta-glucan health claims
- Beta-glucan extracts
- Oat protein
  - Vegetable protein from non-GMO source
- Oat oil
  - Polar lipids and emulsification
- Oat starch
General requirements for food ingredients

- Safe
- Acceptable to consumers
- Process specific technical requirements
- Consistency is a key requirement for industry
Quality attributes of oat ingredients

- Water absorption in a process
- Viscosity and texture
- Boil over
- Expansion during extrusion
- Stability over shelf life
  - Oxidation, phase separation
What next?
THANK YOU!