Wheat Quality Requirements

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• Introduction to key quality parameters

• Quality in more detail
  – Why what we measure is important for quality and performance

• Summary
Quality testing for Recommended List

- Suitability of new varieties for end-use applications

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<th>Baking Performance Indicators</th>
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<td>• Dough rheology</td>
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<td>- Hagberg Falling Number</td>
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<td>- Starch damage</td>
<td>- Small scale, indicative</td>
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<td>baking</td>
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Baked product quality chain from field to milling

**Milling**
- Flour protein
- Starch damage
- Bran content
- Enzyme activity
- Yield
- Colour

**Dough preparation**
- Strength
- Elasticity
- Extensibility
- Enzyme activity
- Water absorption

**Baking**
- Volume
- Colour
- Firmness
- Crumb structure

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Baked product quality chain from field to milling

**Mill Intake**
- Endosperm texture
- Grain protein
- Enzyme activity
- Grain weight
- Grain moisture

**Flour Milling**
- Flour protein
- Starch damage
- Bran content
- Enzyme activity
- Milling yield
- Colour

**Dough Handling**
- Strength
- Elasticity
- Extensibility
- Enzyme activity
- Water absorption

**Finished Product**
- Volume
- Colour
- Firmness
- Crumb structure
Aim of the flour milling process is to maximise yield with desired quality

• Separation of endosperm from bran and germ

• Particle size reduction of endosperm to produce flour (whiter the better, without dark flecks)

• Creation of starch damage where appropriate to the product

Desired output is a consistent flour produced with an economic yield
Target is to achieve maximum yield of white flour from the process.

- Starchy endosperm: 84%
- Aleurone: 6%
- Embryonic axis: 1.5%
- Scutellum: 1.5%
- Outer pericarp: 4%
- Inner pericarp: 1%
- Seedcoat: 1%
- Nucellus: 1%
Grain fractions from milling process.

Flour

Aleurone

Outer pericarp ('Beeswing')

Pericarp & testa

All bran samples sieved to 125-180μm particle size
### Wheat/flour properties required for processing

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<th><strong>Bread</strong></th>
<th><strong>Biscuits</strong></th>
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<tr>
<td><strong>Endosperm texture</strong></td>
<td>Hard milling</td>
<td>Soft milling</td>
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<tr>
<td><strong>Protein content (wheat)</strong></td>
<td>High (13%db)</td>
<td>Low (11%db)</td>
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<td><strong>Protein/dough quality</strong></td>
<td>Elastic and extensible</td>
<td>Extensible</td>
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<tr>
<td><strong>Alpha-amylase activity</strong></td>
<td>Low (HFN&gt;250s)</td>
<td>Low (HFN&gt;180s)</td>
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<td><strong>Specific weight</strong></td>
<td>High (&gt;76kg/hl)</td>
<td>High (&gt;76kg/hl)</td>
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<td><strong>Bran levels</strong></td>
<td>Low (for white)</td>
<td>Low (for white)</td>
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<td><strong>Water absorption</strong></td>
<td>High (&gt;60%)</td>
<td>Low (&lt;55%)</td>
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• Impact of quality parameters on finished product
Impact of grain α-amylase on baking quality.

- Expressed as Hagberg Falling Number
- Required in bread dough to provide sugars for gas production
- Too high activity leads to excessive starch breakdown
  - sticky crumb and collapsed loaves
Impact of excess cereal $\alpha$-amylase on sliced bread quality.

Too much

Just right
Starch damage is important for baking performance.

- α-amylase only attacks damaged starch
- Damaged starch absorbs more water than intact starch granules
- There is an optimum level of starch damage for baking - Balances water addition with crumb structure

Water Absorption (%)

59.3
63.6
Proteins and the quality of wheat

- Wheat flour proteins are crucial in relation to breadmaking quality
- Both quantity and quality are important
- Gluten proteins give wheat products unique rheological and processing properties
Wheat dough: proteins are vital in forming and stabilising the foam structure of bread.
Effect of protein content and quality on dough rising

Increasing Protein Content and Quality
Effect of protein content on loaf volume and internal appearance

Low protein  High Protein
Summary

• Grain quality characteristics reflect processors needs
  - millers
  - bakers

• Consistency is the key
  – Millers’ and bakers’ processes need to operate reliably
  – majority of bread in the UK is plant-bakery produced 800g white sliced loaf
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