Wheat Production and Quality research in Norway

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Cereal Production in Norway – key numbers

Area of agricultural land: 1 mill ha
64% grassland
31% cereals and oilseed rape
Agriculture contributes to 2.3 % of employment
0.5 % of BNP
Norwegian wheat production

- Norwegian wheat production ~ 460,000 ton
- Closed marked – all wheat passing food grade will be used
- From 100% import to
  ~70% Norwegian wheat in bread flour
- Challenge:
  - variable quality from year to year
  - variable quality between batches within year
Share of Norwegian wheat in the domestic consumption of wheat flour

From almost solely use of imported wheat to a large part Norwegian!
Main quality challenges in wheat

- Pre-harvest sprouting
- Gluten quality
- Physical grain quality
  - Schrivelled grains and low test weight

- Fungal diseases
  - Fusarium species, mycotoxins
  - Others: Mildew, septoria-species
Quality requirements for bread wheat

- more than 9.7% protein
- falling number > 200
- high test weight, well-developed grains, low amount of shrunken kernels, high flour yield
- no mould accepted
- < 2% of other cereal species
# Wheat - classes

<table>
<thead>
<tr>
<th>Strong protein quality class 1</th>
<th>Strong protein quality class 2</th>
<th>Strong protein quality class 3</th>
<th>Strong protein quality class 4</th>
<th>Weak protein quality</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bastian (SW)</td>
<td>Bjarne (SW)</td>
<td>Zebra (SW)</td>
<td>Bjørke (WW)</td>
<td>Mjølner (WW)</td>
</tr>
<tr>
<td>Berserk (SW)</td>
<td>Demonstrant (SW)</td>
<td>Magnifik (WW)</td>
<td>Finans (WW)</td>
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<td>Olvin (WW)</td>
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</tbody>
</table>

**Intention:** Stable flour of desired qualities

- SW= Spring wheat
- WW=Winter wheat
Research on wheat quality in Norway

- Gluten quality genes – improvements of baking quality in cultivars
  - Composition of gluten proteins
    - High-molecular weight glutenin subunits
    - Low-molecular-weight glutenin subunits
- Gluten structure and analysis
  - Rheological analyses (large and small deformation rheology)
  - Polymerisation and size distribution
- Environmental effects on gluten quality
  - Fertilisation (N and S)
  - Effects of variation in weather parameters during grain filling
- Endosperm hardness – mutation in the puroindolins expressing hard and soft wheat
Gluten quality of Norwegian cultivars introduces in the period 1900 - 2000.

(Færgestad unpublished)
Relation dough rheology – baking quality

- Kieffer dough and gluten extensibility rig
  - Extensibility (Ext)
    - Expansion
  - Resistance to extension (Rmax)
    - Keep shape
    - Hinder rupture of gas cell membrane

(Aamodt 2004)
Effect of protein quality

- Wheat flour with HMW-GS 5+10 higher %UPP

- Hearth bread baked from flour with HMW-GS 5+10 larger area, volume and form ratio

(Aamodt 2004)
Load extension meters

Kieffer-rig

Maximum resistance to extension = Rmax
Extensibility = Ext
Initial slope = Ei (Kieffer-rig)

(Tronsmo et al 2003)