Wheat Quality Determination

Cairo, January 15, 2020

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Protein: Comparison of methods

- **GOST 10846-91** (on dry on moisture in fact)
- **ISO 20483** (on dry on moisture in fact)
- **GAFTA 4:2** (on dry on moisture in fact)
- **SENASA IRAM 15852** (on dry on moisture 13.5%)
- **AACC 46-12.01** (on dry on moisture 12%)

Kjeldahl method

- Common to most standards;
- Differences in calculation;
Gluten and Falling number

<table>
<thead>
<tr>
<th>Gluten content</th>
<th>Falling number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Manual method</td>
<td></td>
</tr>
<tr>
<td>Mechanical method</td>
<td></td>
</tr>
</tbody>
</table>

**Gluten content**

- Manual method
- Mechanical method

**Falling number**

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Falling number (Hagberg-Perten method)

**Falling Number, FN** – time in seconds required to activate the viscometric agitator and fall down from a predetermined height through the aqueous suspension.

Á-amylase activity is evaluated by the presence of the starch in the substrate sample. The definition is based on an aqueous suspension of flour ability to quickly turn into jelly in the boiling water bath and measuring the starch present in the sample dilution á-amylase.
Falling Number: Comparison of methods

<table>
<thead>
<tr>
<th>ANEC: AACC 56-81.03</th>
<th>ISO 3093:2009</th>
</tr>
</thead>
<tbody>
<tr>
<td>SENASA: IRAM 15862</td>
<td>DSTU (ISO 3093:2004)</td>
</tr>
<tr>
<td>Weight of Sample Corrected for Moisture Content on 14.0% moisture (moisture 60 min) ≠ Weight of Sample Corrected for Moisture Content on 15.0% moisture (moisture 120 min)</td>
<td></td>
</tr>
</tbody>
</table>

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Determination of Wet Gluten

It is made up of proteins **gliadin** and **glutenin**, which form the carcass in contact with water.
Factors affecting the quantity and quality of Protein and Wet Gluten

- Climate
- Soil
- Insect damage and disease
- Drying temperature
- Treatment fungicides, herbicides, insecticides
Gluten strength

Gluten determines many characteristics of wheat, flour and the dough. While gluten content and protein content are correlated, protein content may not be an indicative of protein quality.
Wet Gluten: Comparison of methods

+1.5-2.5%

- Manual methods > Mechanical methods
  - ISO 21415-1
  - GAFTA 25:1
  - AACC 38-10.01
  - ISO 21415-2
  - GAFTA 25:2
  - AACC 38-12.02

At this, the difference between these methods is as follows:
- as per ISO 21415-2 results are reported as is;
- as per AACC 38-12.02 results are recalculated and reported on 14% moisture basis;
- as per IRAM 15864 3rd results are recalculated and reported on 14% moisture basis;

In view of above, results of testing performed using ISO 21415-2 and AACC 38-12.02 (IRAM 15864) may be different.
Determination of rheological properties of flour Alveograph (W, P/L, G, I)
Deformation energy $W$

The average value of the maximum pressure

The standard curve

$P$  
$P_{200}$

4 cm

G ou L
Determination of Deformation Energy (W)  
(Alveograph Test by ISO 27971, AACC 54-30.02, ICC 121)

The Alveograph Test measures and records the force required to blow and break a bubble of dough.

a) The resistance of the dough to deformation, or its strength. It is expressed by the maximum pressure parameter, \( P \);

b) The extensibility or the possibility of inflating the dough to form a bubble; It is expressed by the parameters of extensibility, \( L \), or swelling, \( G \);

c) The elasticity of the dough during biaxial extension. It is expressed by the elasticity index, \( I_e \);

d) The work required to deform the dough bubble until it ruptures, which is proportional to the area of the alveogram (sum of the pressures throughout the deformation process). It is expressed by the parameter, \( W \).

The \( P/L \) ratio is a measurement of the balance between strength and extensibility.
As per info from HGCA (Home Grown Cereals Authority)

Suitable for bread flour – makes strong elastic dough and has excellent bread-making potential.
- high pressure (P)
- long time (L) to burst

Suitable for bread and baking flours – most varieties having bread-making potential.
- low P/L ratio important

Suitable for biscuit and blending flours – makes extensible dough, good for biscuits and blending with strong wheats.
- low pressure (P)
- long time (L)
- area under the curve (W) less critical

Suitable for animal feed only – makes tough, inelastic dough
- high pressure (P)
- short time (L) to burst

Alveograph P/L 0.5 - 0.9
W ≥200

Alveograph P/L 0.4 - 0.9
W 170 - 310

Alveograph P/L 0.2 - 0.4
W 70 - 100

Alveograph P/L 0.3 - 1.5
W 60 – 140

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Wheat Impurities Determination Methods Comparison
EN, ISO, ES, DSTU, USDA

Europe
- EN 15587:2018
- ISO 7970:2011

Egypt
- ES 1601-1/2010

Ukraine
- DSTU 3768:2019

USA
- USDA Chapter 13
Impurities determination

Visual check

Different standards prescribe different methodology of testing such as:

➢ use of different sieves
➢ different test portions for determining
➢ differences in the interpretation of damage in standards
➢ different reference samples that lead to different results
Wheat impurities determination
Equipment

Divider
Precision balance
Sieves
# Sieves for Wheat Impurities Analysis

<table>
<thead>
<tr>
<th></th>
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<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>3,55x20 mm</td>
<td>On the sieve: Organic Extraneous matter</td>
<td></td>
<td></td>
<td>On the sieve: Organic Extraneous matter</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3,5x20 mm</td>
<td>On the sieve: Extraneous matter</td>
<td></td>
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</tr>
<tr>
<td>1,0x20 mm</td>
<td>Pass via sieve: Inorganic</td>
<td>Pass via sieve: Extraneous matter</td>
<td>Pass via sieve: Extraneous matter</td>
<td>Pass via sieve: Extraneous matter</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1,7x20 mm</td>
<td>Pass via sieve: Shriveled grains</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Pass via sieve: Shriveled and Shrunken</td>
</tr>
<tr>
<td>2,0x20 mm</td>
<td>Pass via sieve: Shrivelled grains</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>1,63x9,53 mm</td>
<td>Pass via sieve: Broken+shriveled grains</td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Ø5/64”x Ø12/64 (1.98 mm )</td>
<td>Pass via sieve: Dockage</td>
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</tr>
<tr>
<td>0,064x3/8” (1.63 mm)</td>
<td>Pass via sieve: Shrunken and Broken</td>
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</tbody>
</table>

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Categories of Impurities: EN, ES, DSTU, ISO, USDA

**EN 15587:2018**
- Grain impurities (5)
- Miscellaneous impurities (7)
- Sprouted Grains (1)
- Broken Grains (1)

**ES 1601-1/2010**
- Damaged grains (5)
- Extraneous matter (6)
- Broken and Shrivelled (1)
- Other cereals (1)
- Harmful and toxic matter (4)

**DSTU 3768:2019**
- Grain impurities (7)
- Foreign matter (6)
- Bug-ridden grains (1)
- Bunted/Smutty grains (1)

**ISO 7970:2011**
- Damage wheat grains (5)
- Extraneous matter (2)
- Harmful and toxic matter (5)
- Other cereals (1)

**USDA Chapter 13**
- Damage kernels (10)
- Foreign matter (3)
- Shrunken and Broken (1)
- Harmful and toxic matter (4)
- Dockage (1)

Some Categories are Similar, but Not Equal
Wheat impurities analysis (simplified schemes)

**EN 15587:2008+A1:2013**

- **Laboratory sample**: ≈ 2 kg
- **Sieving** 3,5x20 mm
- **Test sample**: ≈ 250 g
- **Sieving** 1,0x20 mm
- **Test sample**: ≈ 60 g
- **Impurities by Categories**

**ES 1601/2010**

- **Laboratory sample**: ≈ 2 kg
- **Test sample**: ≈ 1000 g
- **Sieving** 3,55x20 mm
- **Test sample**: ≈ 250 g
- **Sieving** 1,63x9,53 mm
- **Test sample**: ≈ 60 g
- **Impurities by Categories**
## Impurities categories


<table>
<thead>
<tr>
<th>Impurities</th>
<th>60 g</th>
<th>60 g</th>
<th>60 g</th>
<th>60 g</th>
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</thead>
<tbody>
<tr>
<td><strong>Grain impurities</strong></td>
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<tr>
<td>Shrivelled grains</td>
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<td></td>
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<tr>
<td>Other cereals</td>
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<tr>
<td>Damaged by pests</td>
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<tr>
<td>Grains with discolored germ</td>
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<tr>
<td>Grains overheated during drying</td>
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</tr>
<tr>
<td><strong>Miscellaneous impurities</strong></td>
<td>60 g</td>
<td>60 g</td>
<td>60 g</td>
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<tr>
<td>Extraneous seeds</td>
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<tr>
<td>- Not noxious seeds</td>
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<tr>
<td>- Noxious seeds</td>
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<tr>
<td>Unsound grains</td>
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<tr>
<td>- Heat damaged grains</td>
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<tr>
<td>- Mouldy</td>
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<tr>
<td>- Diseased grains</td>
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<tr>
<td>- Fusaria-contaminated</td>
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<td></td>
</tr>
<tr>
<td>Extraneous matter</td>
<td>60 g</td>
<td>60 g</td>
<td>60 g</td>
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<tr>
<td>- Organic matter +3,55x20/250 g</td>
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<td></td>
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<tr>
<td>- Inorganic matter +1,0x20/250 g</td>
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<tr>
<td>Husks</td>
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<td>250 g</td>
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<tr>
<td>Ergot</td>
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<tr>
<td>Bunteded grains</td>
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<tr>
<td>Impurities of animal origin</td>
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<tr>
<td>Sprouted grains</td>
<td>60 g</td>
<td>60 g</td>
<td>60 g</td>
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<tr>
<td>Broken grains</td>
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## Impurities categories
### ES 1601-1/2010

<table>
<thead>
<tr>
<th>Impurities</th>
<th>60 g</th>
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<th>60 g</th>
<th>60 g</th>
<th>60 g</th>
</tr>
</thead>
<tbody>
<tr>
<td>Damaged grains</td>
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<td></td>
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<tr>
<td>Broken+shrivelled grains</td>
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<tr>
<td>Extraneous matter</td>
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<tr>
<td>Other cereals</td>
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<tr>
<td>Harmful/toxic seeds</td>
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</tbody>
</table>

### Impurities Details

- **Damaged grains**
  - Unsound grains
    - Mouldy grains (> 1/3)
    - Heat-damaged grains
    - Attacked by pests
    - Sprouted grains

- **Broken+shrivelled grains**

- **Extraneous matter**
  - Organic matter+3.55\times20/250 g
    - Foreign seeds
    - Weed seeds
    - Fragments of straw
    - Dead insects
    - Ambrosia
  - Inorganic matter+1.0\times20/250 g
    - Stone, sand

- **Other cereals**

- **Harmful/toxic seeds**
  - Harmful toxic seeds
  - Toxic seeds
  - Bunted grains
  - Ergot 1000 g

### Workshop
- Cairo 15 January 2020
Please contact us for any further questions:

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