Durum: What is it? Can you Bake Bread with this Grain?

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2. Les Moulins Pyrénéens, France

Trafoon Symposium, Wageningen, 12 May 2015
Common Wheat vs Durum Wheat
Wheat Genealogy

Diploïds
2n = 14

- Aegilops Monococcum
- Aegilops Speltoïdes
- Aegilops Tauschi

Small Spelt or Einkorn

Tetraploïds
2n = 28

- Triticum Turgidum

Durum wheat

Hexaploïds
2n = 42

- Triticum Aestivum

Common wheat
Comparison between Grain Characteristics

<table>
<thead>
<tr>
<th>Common Wheat</th>
<th>Durum wheat</th>
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</thead>
<tbody>
<tr>
<td>Grain shape: rounded</td>
<td>Elongated</td>
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<tr>
<td>Endosperm color: White</td>
<td>Yellow amber</td>
</tr>
<tr>
<td>Endosperm texture: From very soft to hard</td>
<td>Very hard and glassy</td>
</tr>
<tr>
<td>A higher ratio HMW/LMW glutenin subunit</td>
<td>Higher protein content</td>
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<tr>
<td></td>
<td>Higher carotenoïds content</td>
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<td>A lower agronomic yield compensated (or not) by price</td>
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</table>
The wheat grain presents a very heterogeneous structure:

- **Germ**: the future plant
- **Endosperm**: nutritive substances
- **Hulls**: protection system
Primary Processing of Cereals

**Rice**

- **Hull Removing**: From outside to inside
- **Name of the Process**: Dehulling or Debranling
- **Necessary Conditions**: Hardness and vitreousness of the endosperm

**Wheat**

- **Hull Removing**: From inside to outside
- **Name of the Process**: Milling
- **Necessary Conditions**: Plasticity and extensibility of the hulls
Processing Durum Wheat as Rice

Hard endosperm texture allows Durum wheat to be debranned

But how to reduce the cooking time?

Durum Wheat → Cleaning → Cooking → Drying

Boulghour ← Coarse Grinding ← Debranning

Ebly® ← Expansion ←
Processing Durum as Wheat

**Primary Processing**
- COMMON WHEAT
  \((Triticum aestivum)\)
- FLOUR
  \((0 - 200 \, \mu m)\)

**Secondary Processing**
- BREAD
- BISCUITS

**Primary Processing**
- DURUM WHEAT
  \((Triticum durum)\)
- SEMOLINA
  \((200 - 500 \, \mu m)\)

**Secondary Processing**
- PASTA
- COUSCOUS
Milling Process of Common Wheat

Breaking

Wheat

Reduction

Sieving

Bran (10%)

Semolina

Fine bran (8%)

Shorts (3%)

FLOUR

78%
Milling Process of Durum Wheat

- **Breaking**
  - Durum
  - Detaching

- **Purifying**
  - PURE SEMOLINA (75%)

- **Sieving**
  - Bran (10%)
  - Composite Semolina
  - Flour (5%)
  - Shorts (10%)
Durum Milling Process

Roller Mill

Plansifter

Handling & transport

Purifier
Secondary Processing

Durum Wheat → Milling → Semolina → Regrinding → Farina

Hydration

+25%

Mixing

Agglomeration → Extrusion → Sheeting

Cooking → Drying

Drying

Kneading

Sheeting → Proofing → Shaping

Baking

Baking

Couscous

Pasta

Fresh Pasta

Oriental bread

Occidental bread
Pasta Processing

Hydration and Mixing
Pasta Processing: Extrusion

“Dough mixing” occurs in this part of the press; that is, complete homogenization occurs. The endless motion of the extrusion worm brings the mixture to the compression area of the machine, where it is uniformly distributed on the die.

DETAIL OF THE WATER-COOLING SYSTEM IN THE COMPRESSION CYLINDER. This is very important because too much heat would compromise the quality of the pasta.
Pasta Processing: Drying
Couscous Processing

1. **Stage 1**
   - **Detaching**
     - Too small
     - Too large
   - **Sieving**
     - 20
     - 20
   - **Crushing**

2. **Stage 2**
   - **Steaming**

3. **Stage 3**
   - **Drying**
   - **Grinding**
   - **Sieving**

Materials:
- Durum wheat semolina
- Water
- Dried couscous grains
- Moist recyclings
- Raw couscous grains
- Cooked couscous grains
- Dried recyclings
- Dust

Tools:
- Sieving
- Steaming
- Drying
- Grinding
- Detaching
Durum Bakery Products

• A large diversity of bakery products around the Mediterranean basin from bread to pastry
• Hard endosperm texture implies to regrind semolina with a good control of starch damage
• Dough can be fermented or not
• Baking temperature 250-500°C
Italian Bread: Pane di Altamura

- European bread awarded by « Protected designation of origin
- Recipe: Sponge-dough breadmaking process
  - Remilled semolina: 100
  - Sourdough: 20
  - Water: 60
  - Salt: 2
- Kneading: 20min
- Shaping via 3 molding phases each with intermediate proofing
- Average density (0.30) and very thick crust (> 3mm)
Homemade Bread in Maghreb

• Several names according to the location and recipe: Matlouh, Kesrah, Khobz-el-dar, etc
• Recipe
  – Semolina: 100
  – Yeast: 2 (dry)
  – Salt: 2
  – Water: 55-60
  – Fat: optionnal
• Kneading (by hand): 30-35 min
• Bulk fermentation: 40-70 min
• Shaping as flat bread thickness: 1 cm; diameter: 25cm
• Baking on a *tadjine* for 3 min on each side
• Final thickness: 3cm; density: 0.25; crust: not crunchy
Is it Possible to Bake Durum as a French Baguette?
Characteristics of French Bread

- Essentially four ingredients: flour, water, yeast, salt
- Small amounts of ascorbic acid and no shortening, sugar, dry milk, etc.
- Normally baked on the oven heart rather than in a pan
- The dough is cut with a blade before baking
- Density: 0.20-0.25
- Crunchy crust; crumb with irregular alveolos
Typical French Bread Formula
“Baguette”

• Ingredients %
  — Flour 100
  — Water 60
  — Yeast 2,5
  — Salt 2,0
  — Ascorbic acid 0,005

• Occasionally
  — Malt 0,3
  — Lecithin 0,3
A non-expected innovation is possible when people met!

**Producers**
Through its Coop Arterris

**Millers:**
Moulins Pyrénéens

**Bakers:**
Compagnons du Devoir et du Tour de France

**Scientists:**
INRA
## Research Steps

| Raw Materials | 130 durum varieties were analysed by INRA
<table>
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<tr>
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<th>A set of 5 Durum varieties</th>
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| Milling      | A new milling process able to transform directly Durum in Flour
|              | Granulometry <200µm |
| B breadmaking| A new formula and breadmaking process in collaboration with « Les compagnons du Devoir » |
| Market       | Studies on consumer expectations |
| Lancement    | June 2012: First Market test in Languedoc-Roussillon & Midi-Pyrénées |

A patented 100% Durum flour, now commercialised in France
# Flour Characteristics

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<th>Common Wheat Flour</th>
<th>Durum Wheat</th>
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<tbody>
<tr>
<td></td>
<td></td>
<td>Remilled Semolina</td>
</tr>
<tr>
<td>D50 (µm)</td>
<td>75</td>
<td>155</td>
</tr>
<tr>
<td>D90 (µm)</td>
<td>170</td>
<td>315</td>
</tr>
<tr>
<td>D10 (µm)</td>
<td>15</td>
<td>53</td>
</tr>
<tr>
<td>Ash (% db)</td>
<td>0.55</td>
<td>0.88</td>
</tr>
<tr>
<td>Starch Damage (AACC)</td>
<td>6.0</td>
<td>7.7</td>
</tr>
</tbody>
</table>
Standard Baking Test
Durum Flour for Breadmaking

*Durum Flour can be used alone or as an ingredient in a mix*

**Durum Flour easy to use:**
- No improvers
- Used alone: Flour, water, yeast, salt and ... blaker’s know-how!
- Used in a mix: A significant reduction of improvers

**Hydration:**
- Used alone, a very high hydration is necessary, about 95% with French traditional breadmaking
- Used in a mix, 20% of durum flour allow to increase hydration of 5%

**Shelf life:**
Longer according to a higher hydration rate

**Nutrition:**
More micronutrients and fibre

**Taste:**
Un subtle taste that allows to reduce salt

**Colour:**
A bright yellow colour specific from Durum varieties
... and for Other Uses

**Pizza Dough**
- Reducing kneading time
- Improving dough stability
- Yellow colour
- Improving dough impermeability to topping

**Pastry**
- 10% reduction of layering butter
- Improving rolling and sheeting
- High yellow colour allowing to reduce butter colorants and carotenes

**Biscuits**
Less retraction during baking

**Brioche**
- Yellow Crumb allowing to reduce butter colorants and egg yolk

**Durum Flour** a new raw material for bakers!
It gives free rein to the bakers imagination!
Conclusions

- Durum, an old cereal, symbol of the Mediterranean diet, is still with evolving uses.
- This evolution was mainly dependent from energy availability.
- Grain morphology determines primary processing whereas biochemical composition determines secondary processes.
- Surprisingly, even if genome D is lacking it doesn’t seem to limit breadmaking usage.
- Durum as other ancient grains can be a source for new products and innovation.
Thank you for attention

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