

Durum: What is it?

Can you Bake Bread with this Grain?

Joel Abecassis¹ and Anaïs Bernabé²

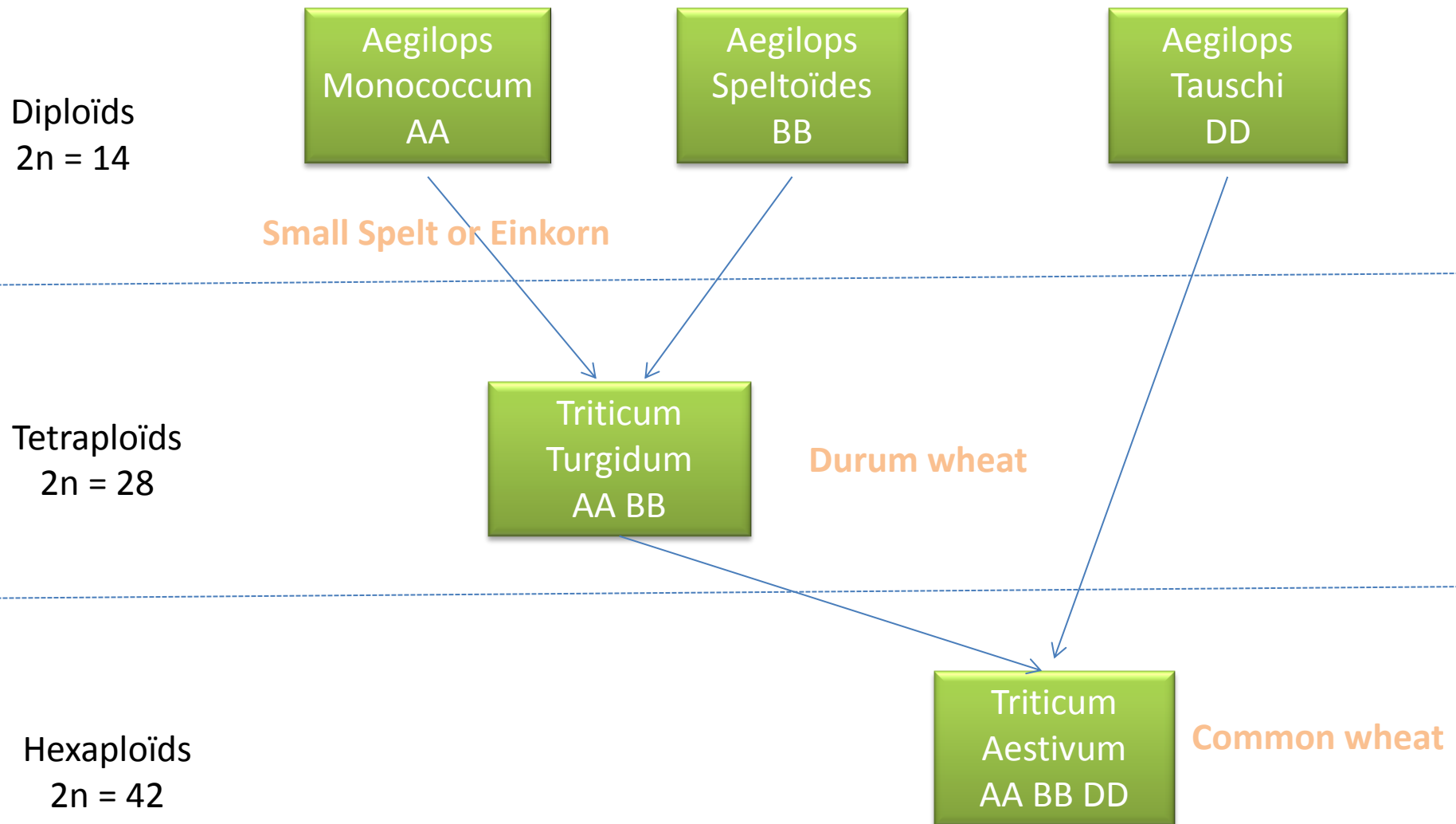
1. INRA UMR-IATE, Montpellier, France

2. Les Moulins Pyrénéens, France

Common Wheat vs Durum Wheat



Wheat Genealogy



Comparison between Grain Characteristics

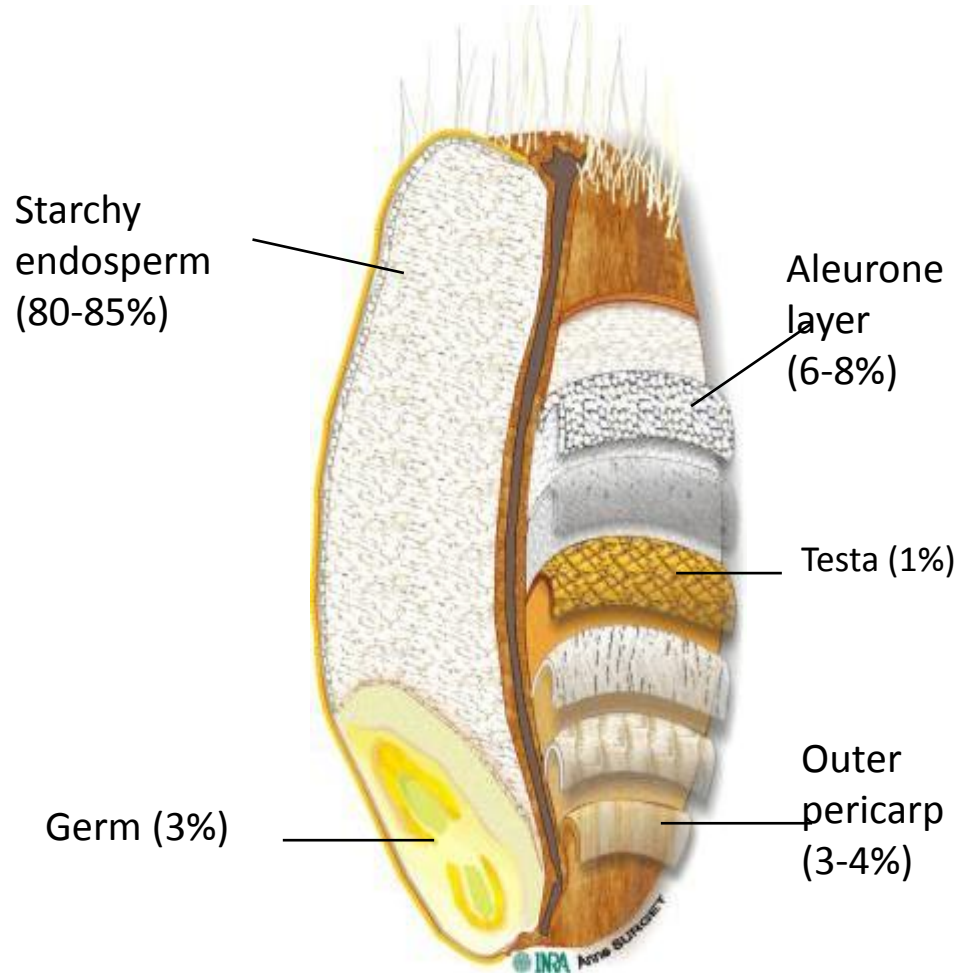
Common Wheat

- Grain shape: rounded
- Endosperm color : White
- Endosperm texture :
From very soft to hard
- A higher ratio HMW/LMW
glutenin subunit

Durum wheat

- Elongated
- Yellow amber
- Very hard and glassy
- Higher protein content
- Higher carotenoids content
- A lower agronomic yield
compensated (or not) by price

Wheat Grain Structure

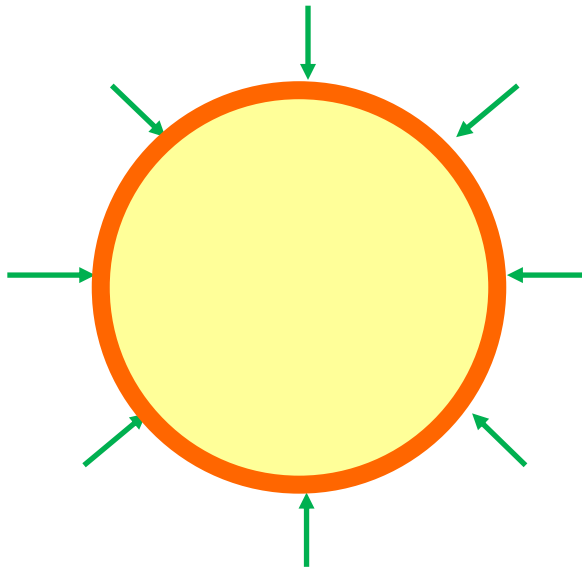


The wheat grain presents a very heterogeneous structure :

- Germ : the future plant
- Endosperm : nutritive substances
- Hulls : protection system

Primary Processing of Cereals

Rice



Hull Removing

From outside to inside

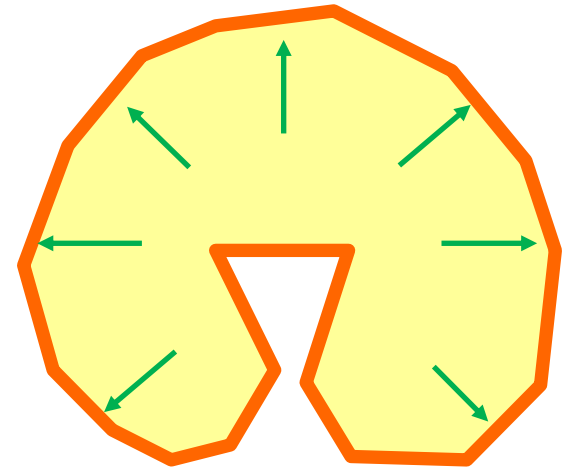
Name of the Process

Dehulling or Debraning

Necessary Conditions

Hardness and vitreousness
of the endosperm

Wheat



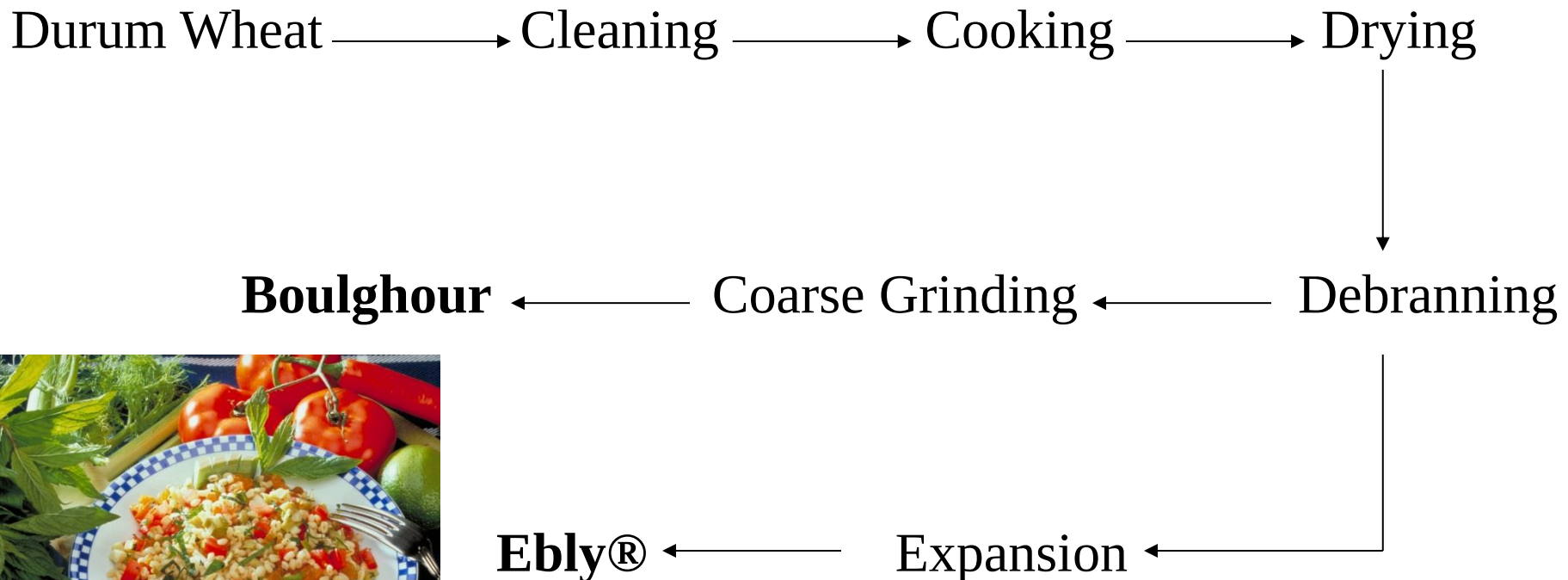
From inside to outside

Milling

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 ?



Processing Durum as Wheat

Primary Processing

Secondary Processing

COMMON WHEAT
(*Triticum aestivum*)



FLOUR
(0 - 200 μm)



BREAD
BISCUITS



DURUM WHEAT
(*Triticum durum*)



SEMOLINA
(200 - 500 μm)



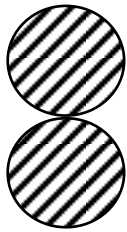
PASTA
COUSCOUS



Milling Process of Common Wheat

Breaking

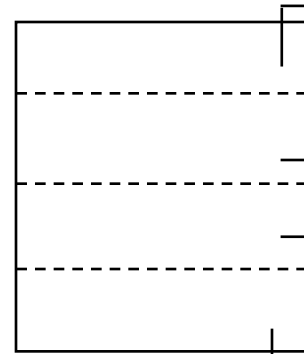
Wheat



Sieving

Bran (10%)

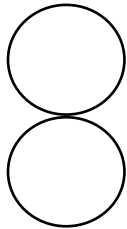
Semolina



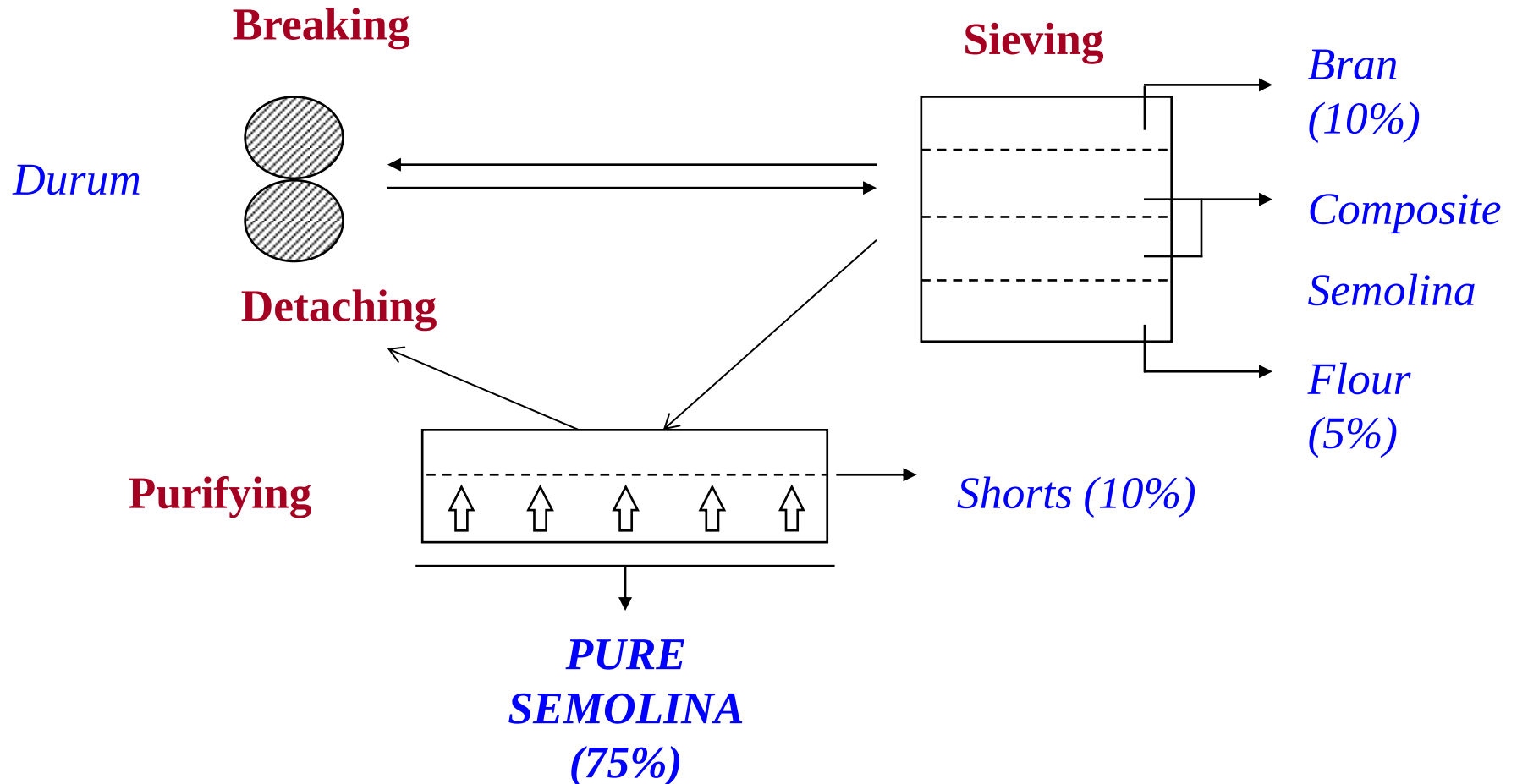
**F
L
O
U
R

7
8
%**

Reduction



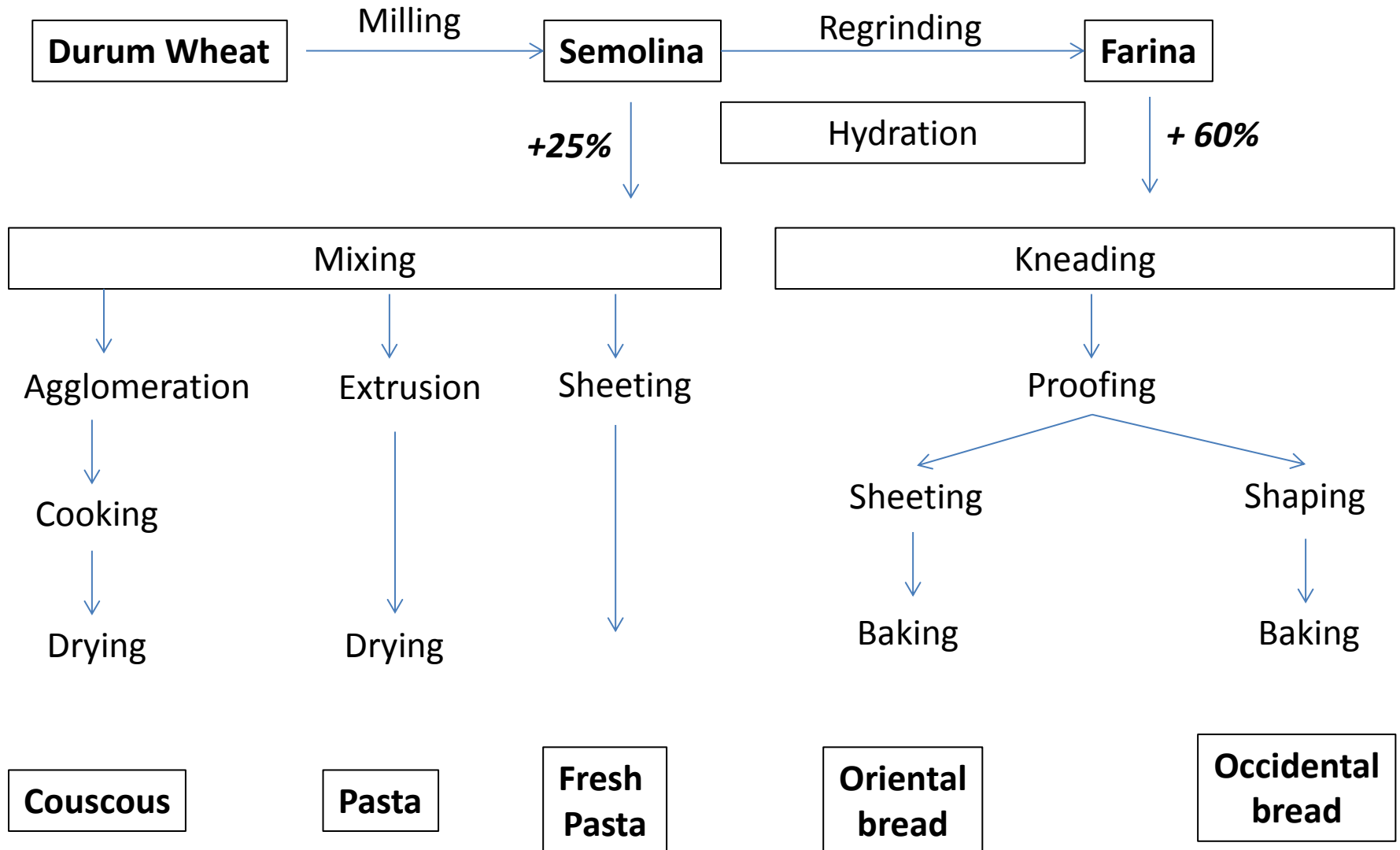
Milling Process of Durum Wheat



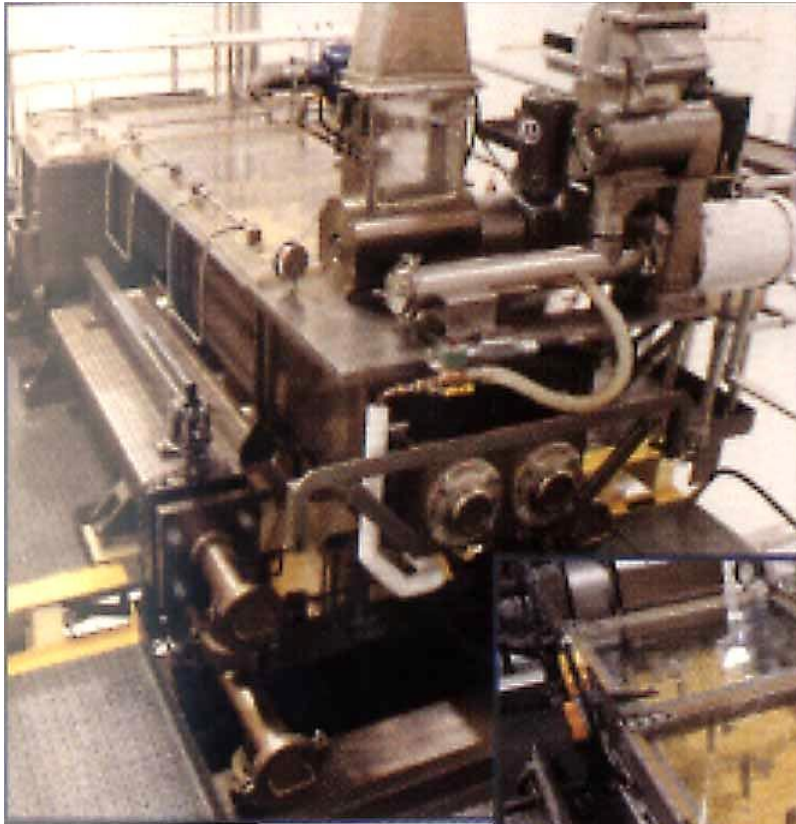
Durum Milling Process



Secondary Processing



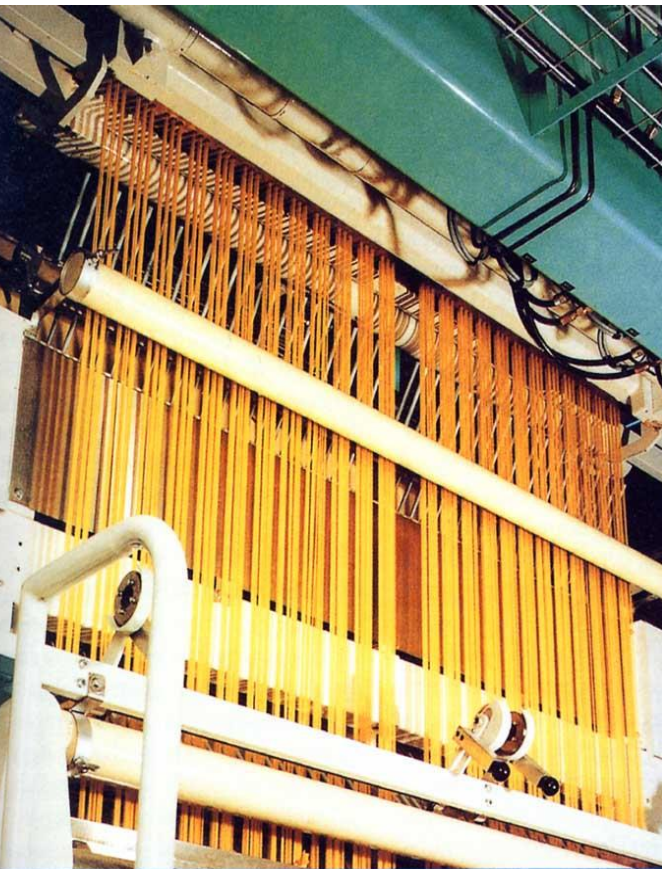
Pasta Processing



Hydration and Mixing



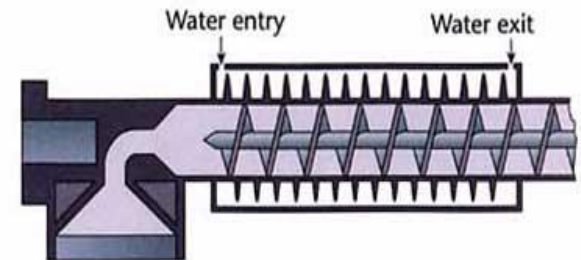
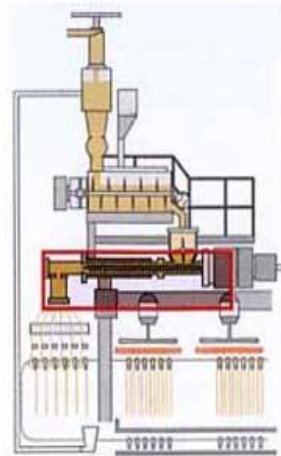
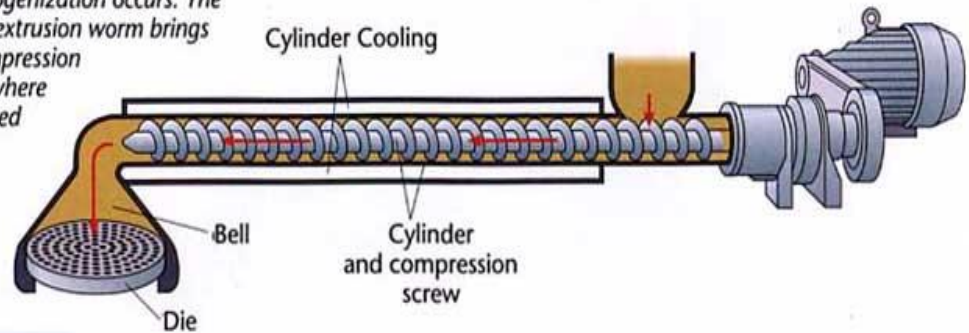
Pasta Processing: Extrusion



réfilage de la pâte par extrusion avant la mise en forme des s, une spécialité alsacienne.

CYLINDER AND EXTRUSION WORM

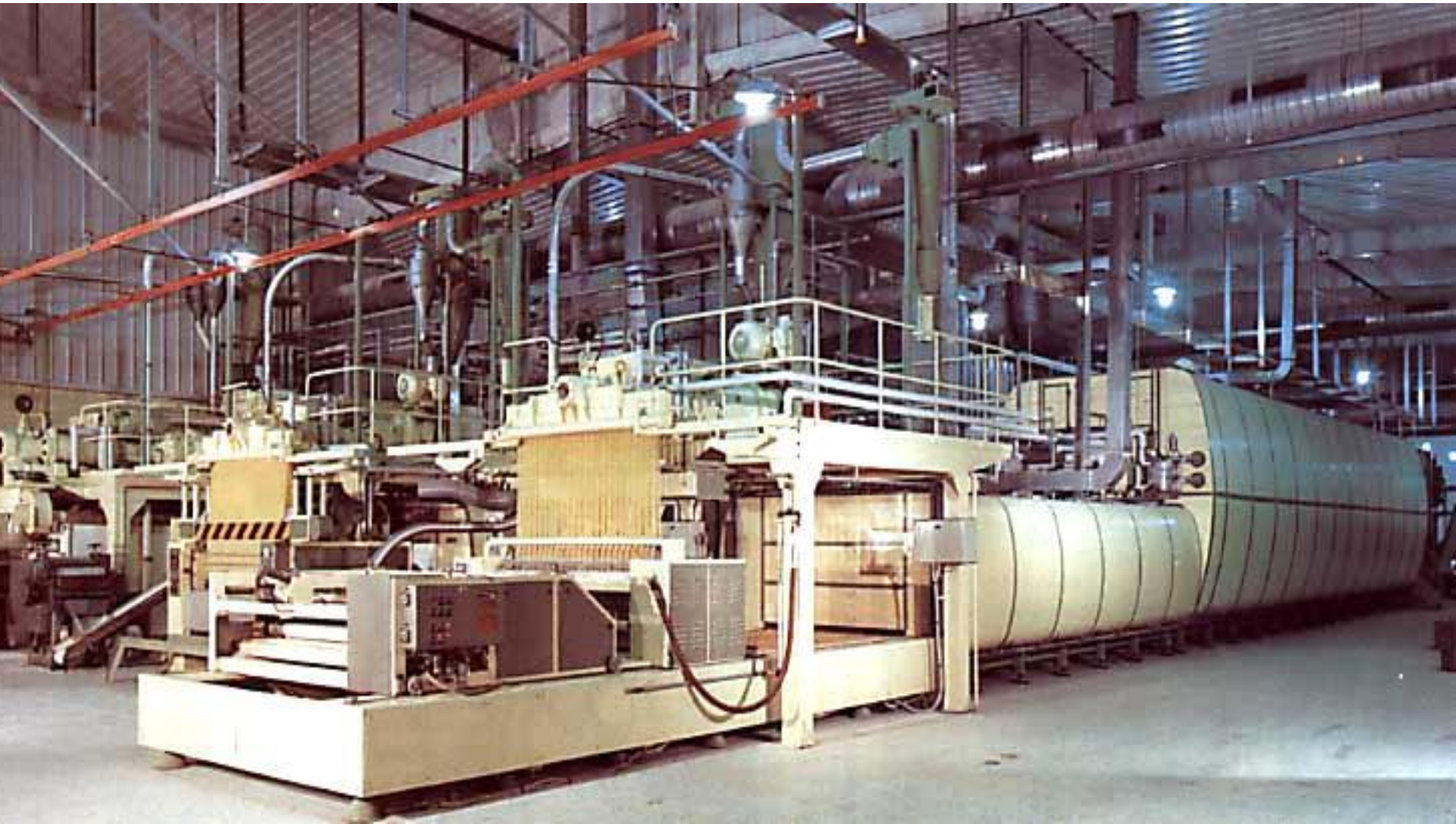
"Dough mixing" occurs in this part of the press; that is, complete homogenization occurs. The endless motion of the extrusion worm brings the mixture to the compression area of the machine, where it is uniformly distributed on the die.



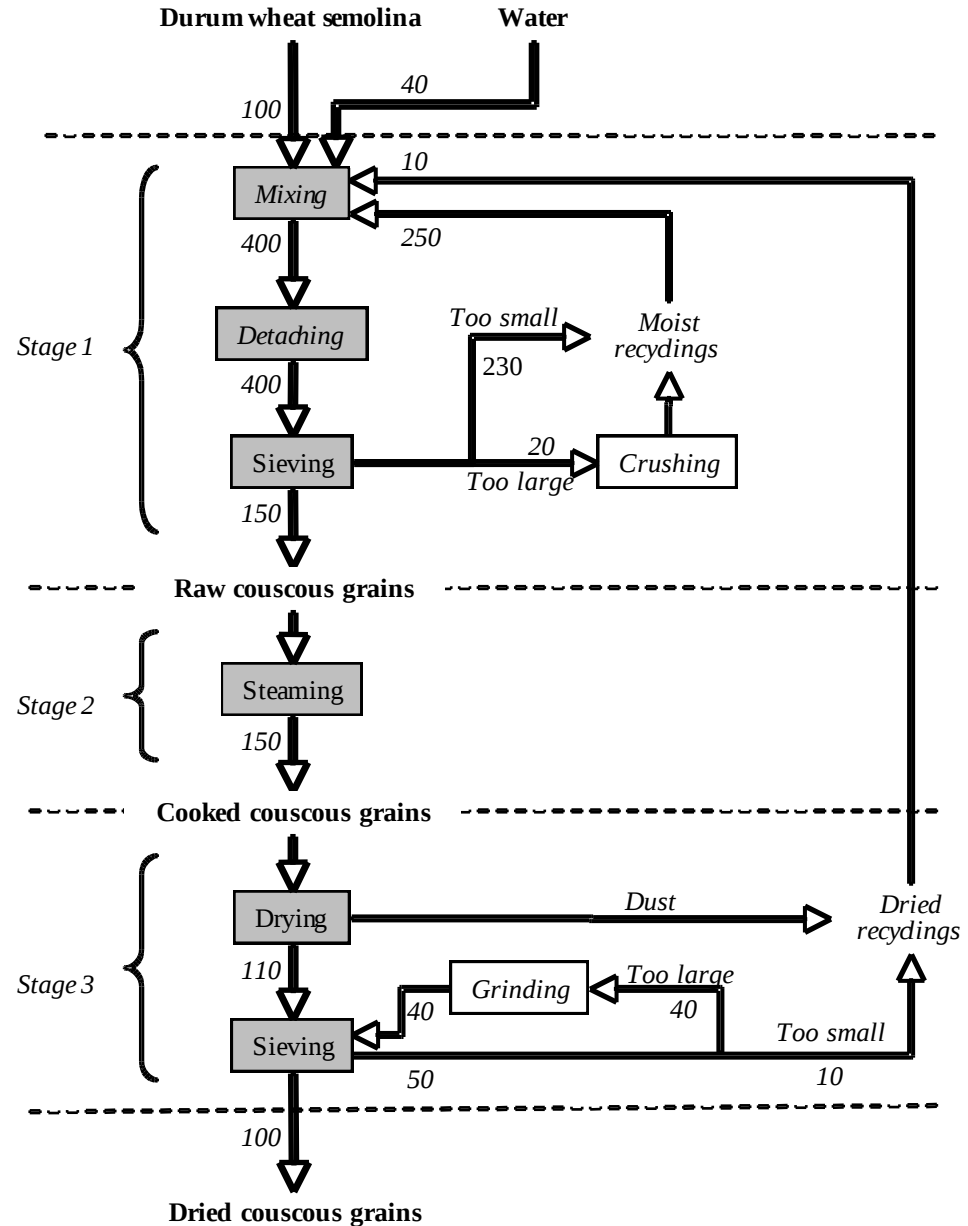
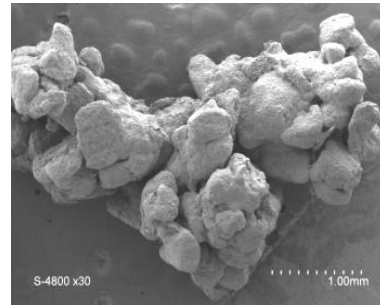
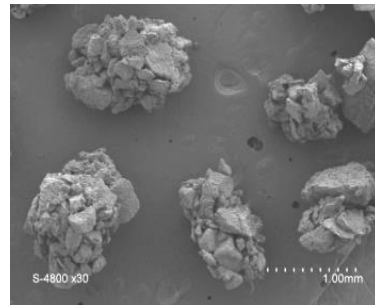
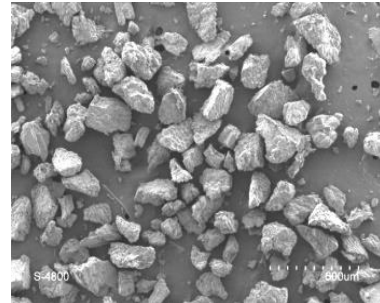
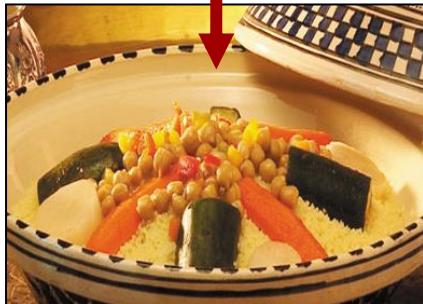
DETAIL OF THE WATER-COOLING SYSTEM IN THE COMPRESSION CYLINDER. This is very important because too much heat would compromise the quality of the pasta.



Pasta Processing: Drying

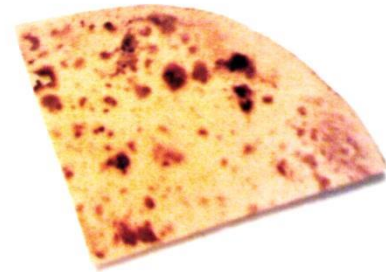


Couscous Processing



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



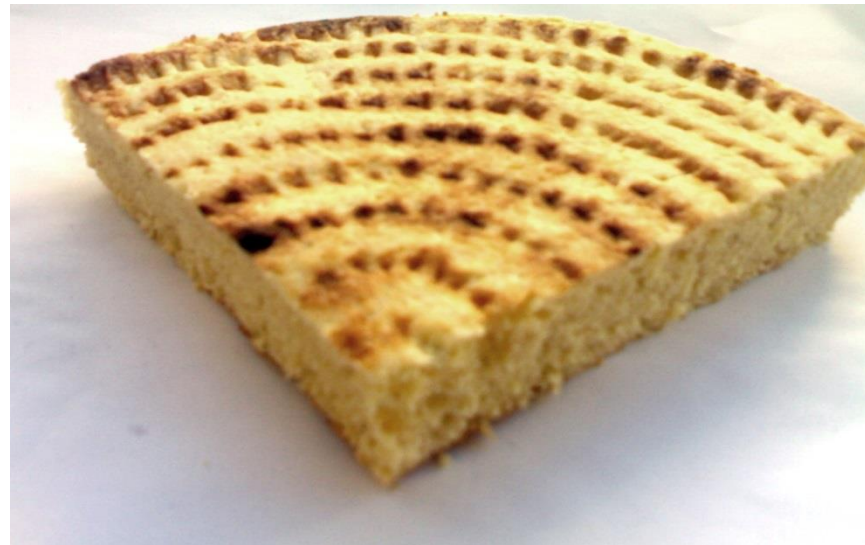
Italian Bread: Pane di Altamura

- 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 ?



Kneading



Shaping



Cutting



Baking

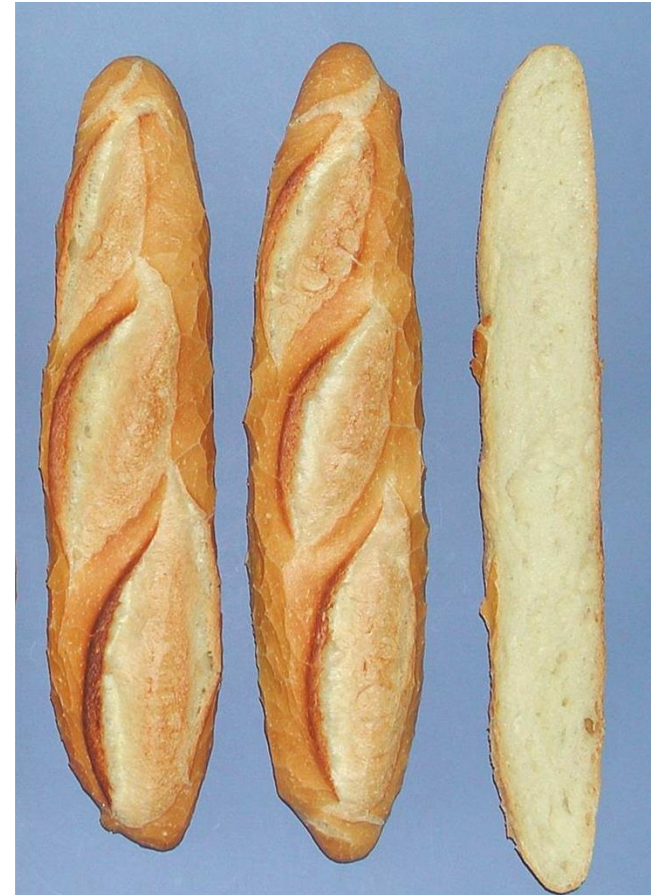
Characteristics of French Bread

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

Typical French Bread Formula

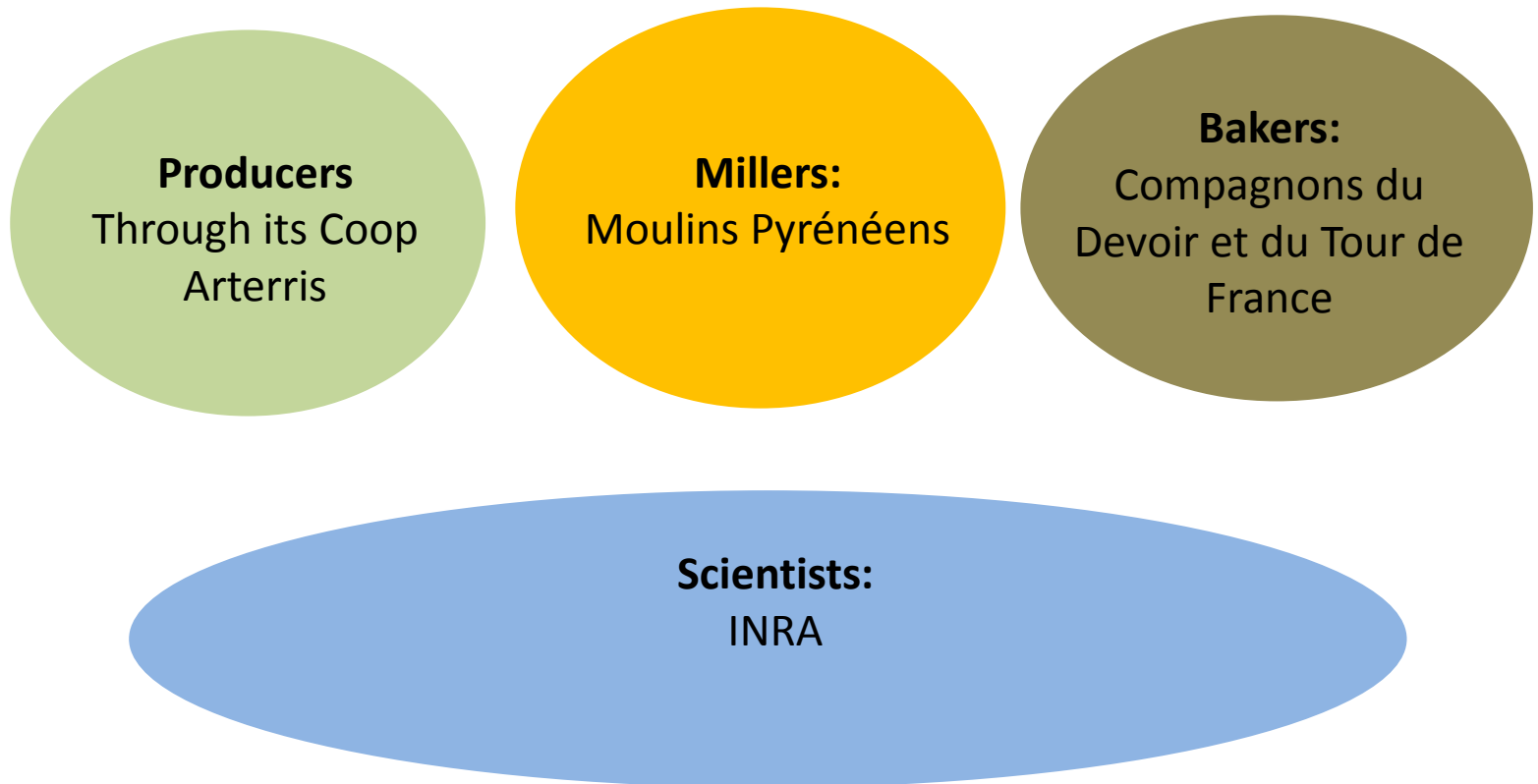
“Baguette”

- Ingredients %
 - Flour 100
 - Water 60
 - Yeast 2,5
 - Salt 2,0
 - Ascorbic acid 0,005
- Occasionally
 - Malt 0,3
 - Lecithin 0,3



A Story of Innovation

A non-expected innovation is possible when people met !



Research Steps

Raw Materials

130 durum varieties were analysed by INRA

→ **A set of 5 Durum varieties** ←



Milling

A new milling process able to transform directly Durum in Flour

→ **Granulometry <200µm** ←



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

Characteritics	Common Wheat Flour	Durum Wheat	
		Remilled Semolina	Durum Flour
D50 (μm)	75	155	100
D90 (μm)	170	315	200
D10 (μm)	15	53	28
Ash (% db)	0.55	0.88	1.03
Starch Damage (AACC)	6.0	7.7	10.4

Standard Baking Test



Common
Wheat

Durum
Flour

Remilled
Semolina

Gruau D

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

. Colour:

A bright yellow colour specific from Durum varieties

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 hydratation rate

Taste:

Un subtle taste that allows to reduce salt

Nutrition:

More micronutrients and fibre

... and for Other Uses

Pizza Dough

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

Biscuits

Less retraction during baking

Pastry

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

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



joel.abecassis@supagro.inra.fr