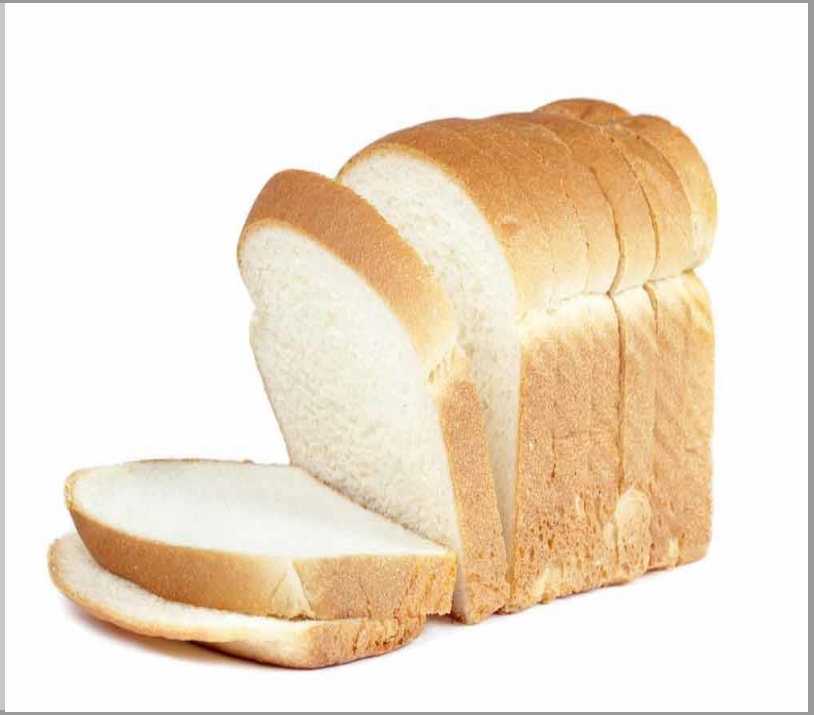
Flour Quality

Baking quality
Protein & starch analysis



Baking Quality.

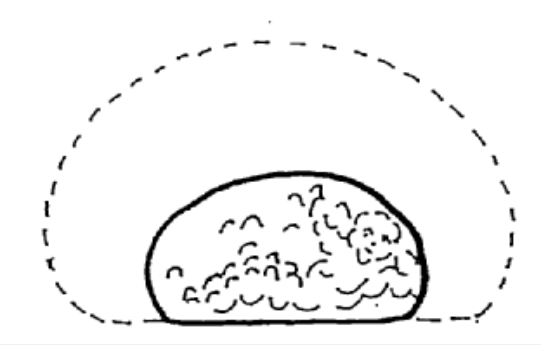
In order to obtain a good bread volume, the dough structure (gluten) should be able to hold back the carbon dioxide (CO_2) produced by the yeast during fermentation.

The best baking quality is obtained if :

- The quality of the dough structure and the carbon dioxide production are well balanced.
- Both factors reach their best properties at the same time.

Good gas production but poor gas retention

Gas production and gas retention well balanced



Poor gas production and good gas retention

Baking quality

Gas retention

- **Gluten quantity**
- **Gluten quality**
  - Enzymes

Gas production

- **Pre-existing sugar**
- **Starch decomposition**
  - Enzymes
  - Starch damage

Gluten quantity:
- Gluten washing
- Protein

Gluten quality :
- Farinograph
- Extensograph
- Alveograph
- Gluten index
- Sedimentation test (Zeleny)

Gas production :
- Falling Number
- Amylograph
- Damaged starch
- Maltose Test

Ultimate test in gas retention and gas production: → Baking test

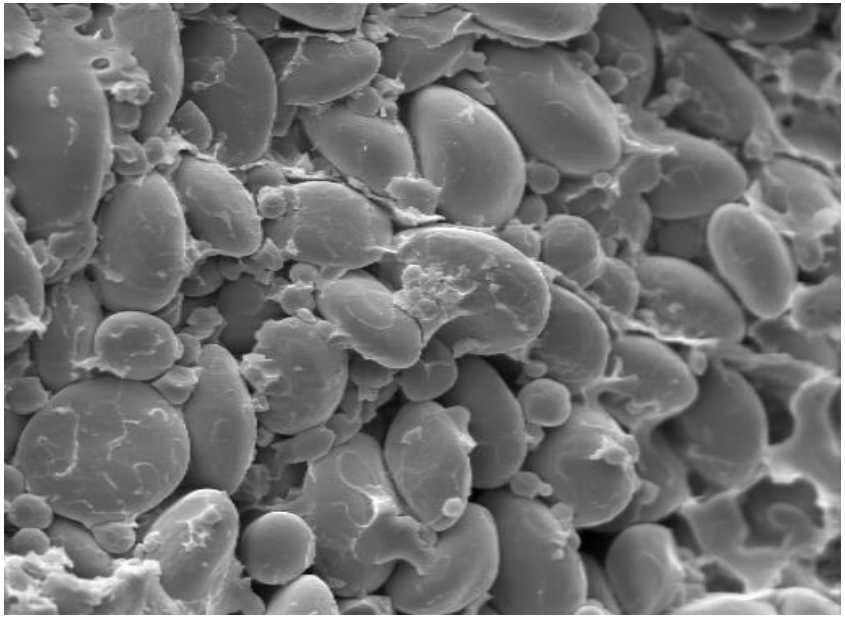
Production of gas.

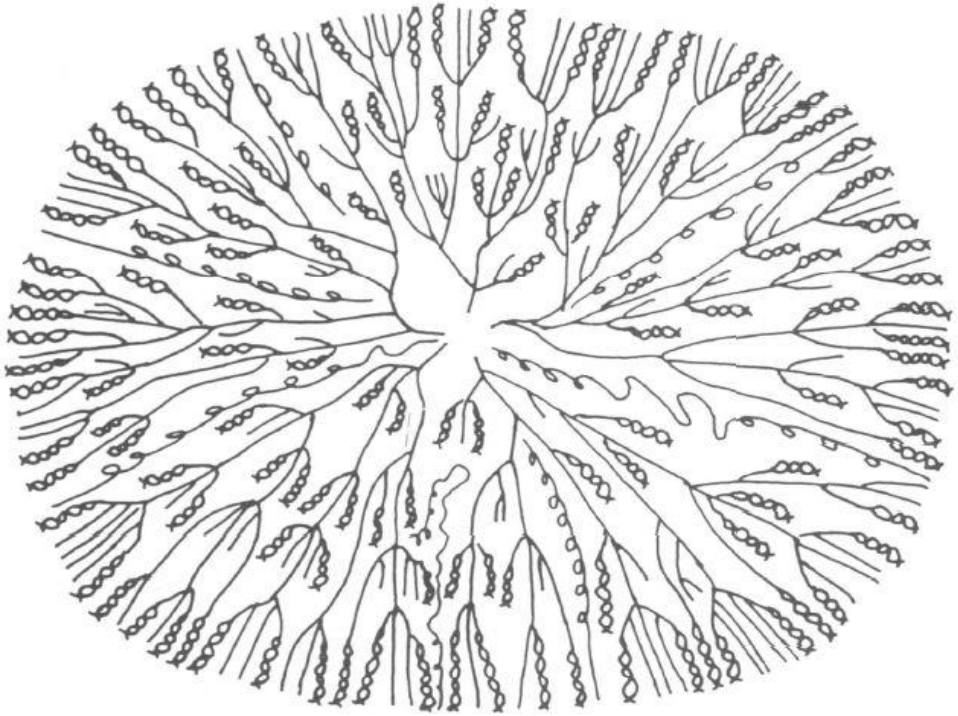
Gas production

Maltose test	Damaged starch	Falling number	Amylograph
Testing the maltose (sugar) content of the flour	Degree of damaged starch in the flour	Instant information on α-amylase activity	Testing the α-amylase activity during the baking process

Starch

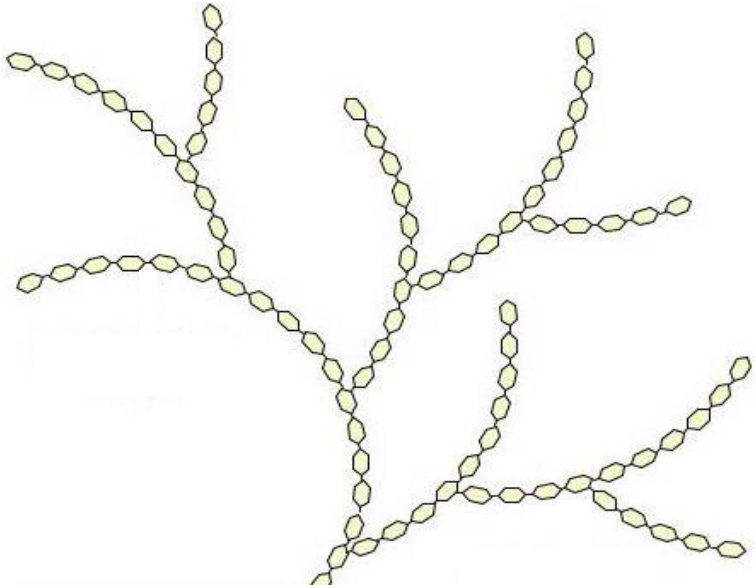
- Schematic structure of a starch kernel with amylopectin and amylose more or less equally distributed within the starch granule



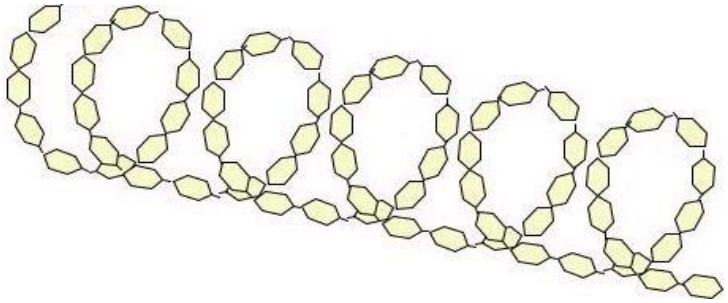


Starch

- Each starch granule consists of 2 different glucose chain formations. They are called amylopectin and amylose. The difference is mainly in the chemical structure where amylopectin has branched arms compared to amylose that is arranged in a twisted string formation.



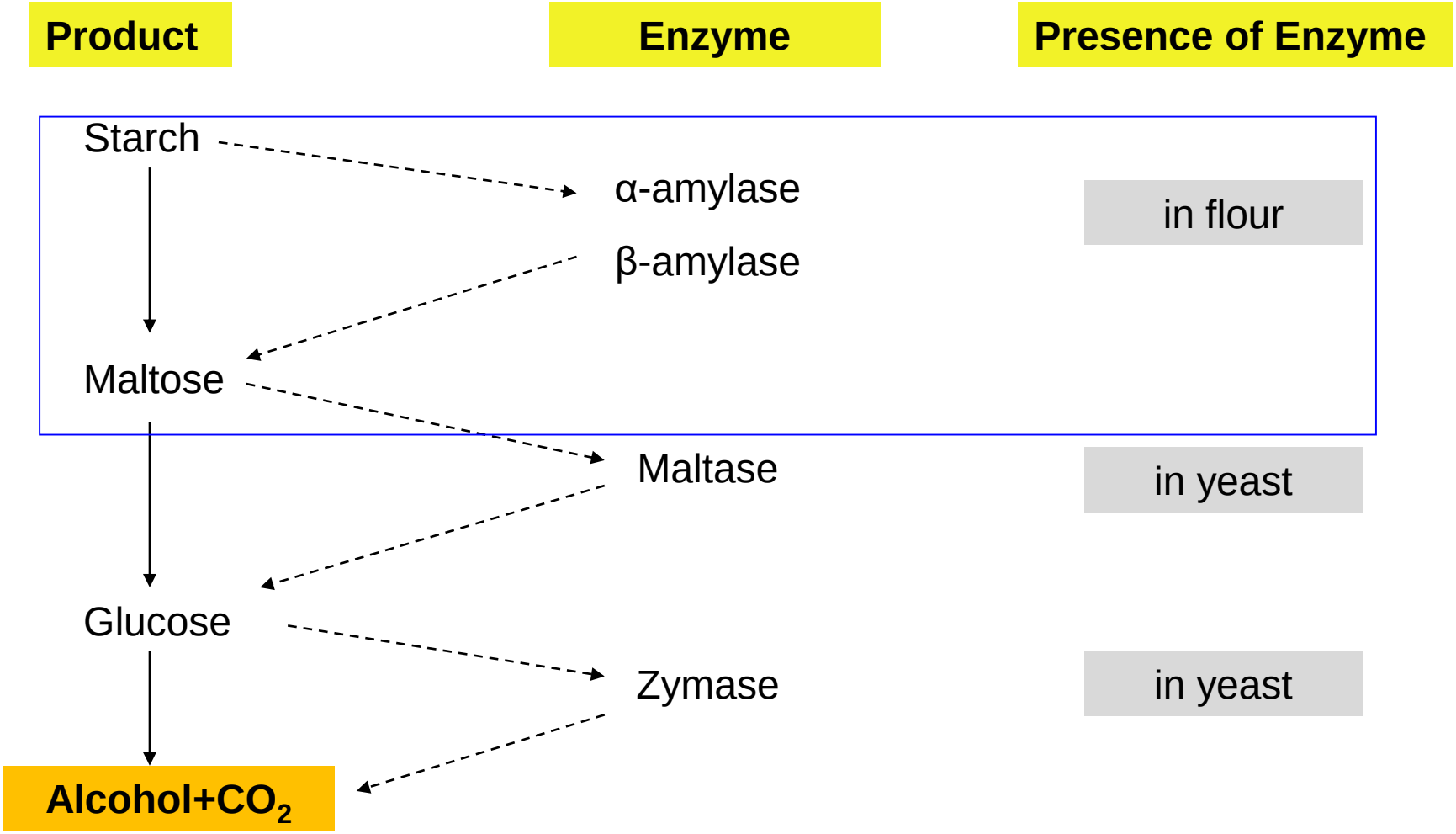
Amylopectin ca. 75%



Amylose

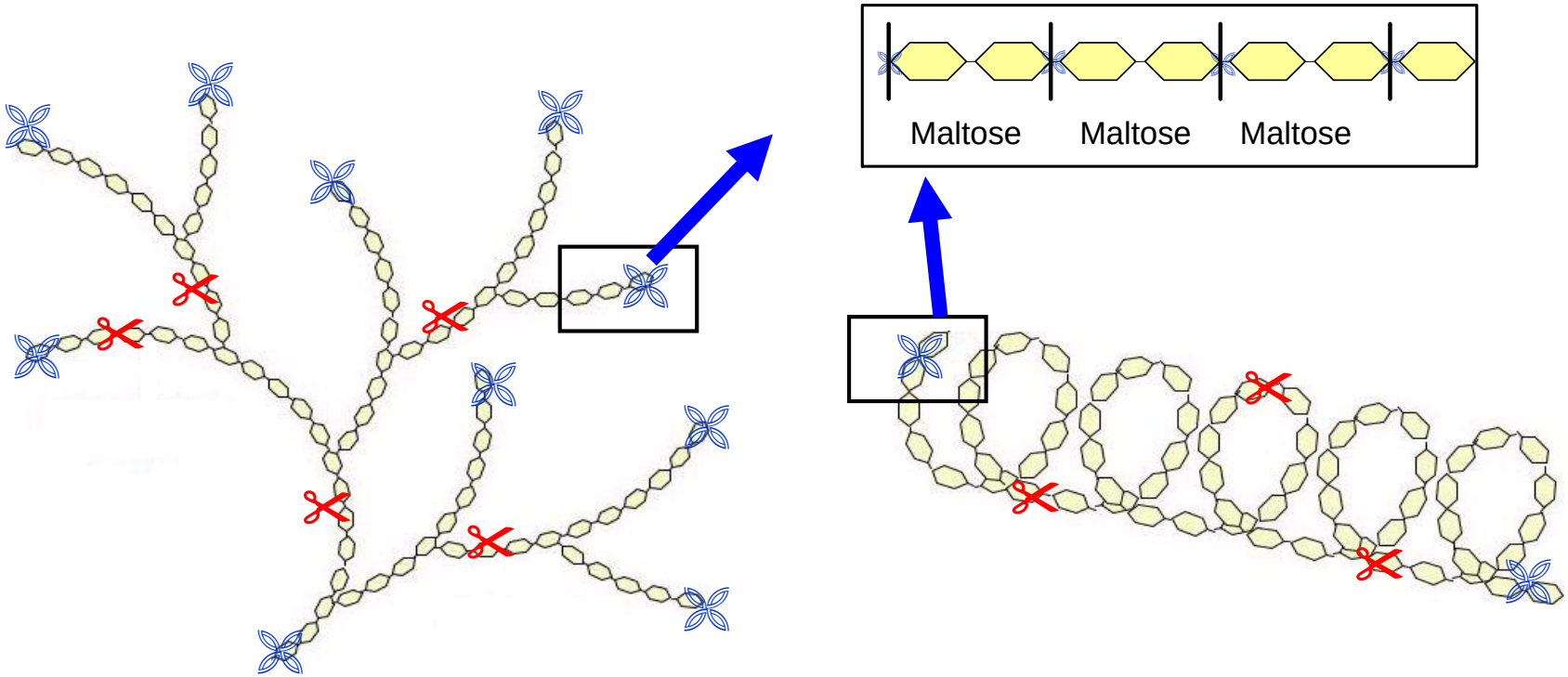
ca. 25%

Decomposition of starch.



Decomposition of starch.

- During the decomposition of starch the 2 enzymes (α-amylase and β-amylase) are cutting the glocuse chain as follows:
- ✂ = α-amylase (cutting big chunks)
- = β-amylase (cutting glucose into Maltose molecules)



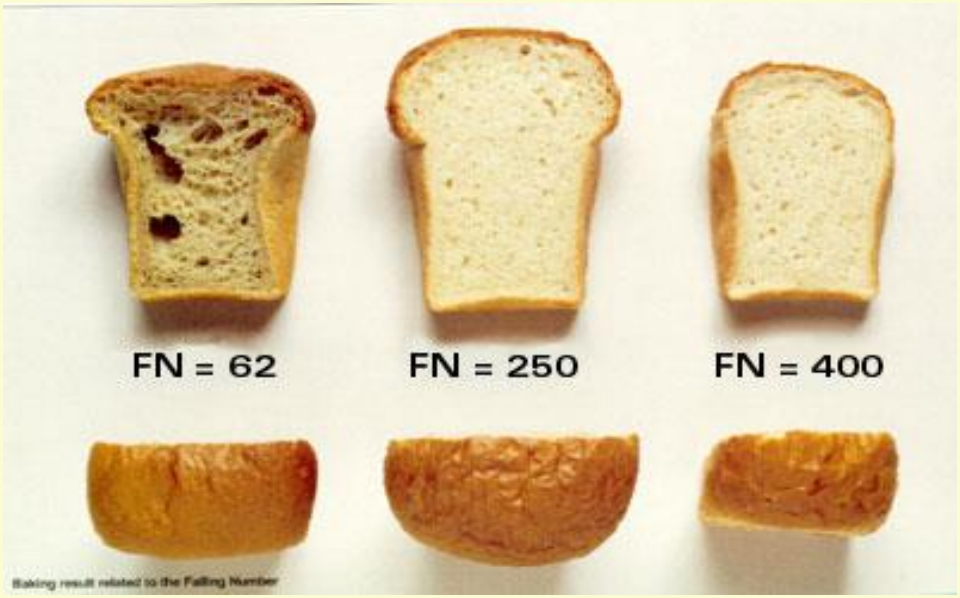
Falling number.

- Measuring the α-amylase activity in wheat or flour.

Falling number.

Indicator for α-amylase activity

- The falling number determines the activity of α-amylase.
- If the grain was subject to sprouting the amylases are very active and the falling number is very low (FN 62)
- Too high falling number (>350) means that the enzymes are not very active
- Neither too high, nor too low falling number is ideal for an ideal bread development.
- A certain amount of enzymes is needed to provide sufficient food for the yeast for cell division and to produce the sufficient amount of CO_2 for production of a light, fluffy bread.



Gluten Quality / Gas retention

Gluten index

Instant test on extensability of gluten

Sedimentation

Information about gluten quality and quantity

Farinograph

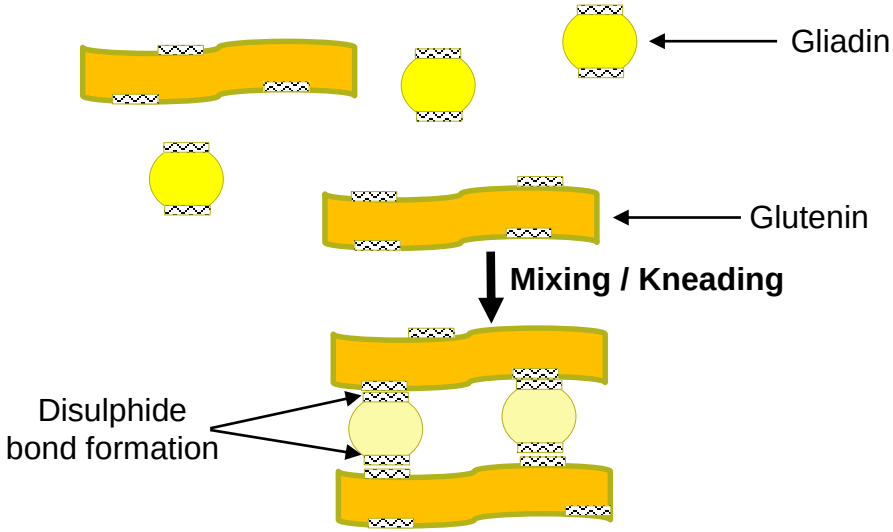
Testing the resistance against mechanical stress

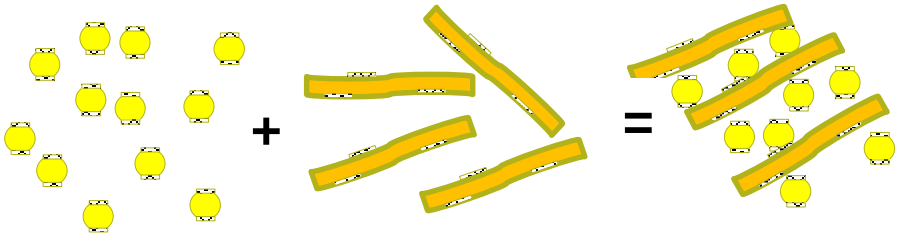
Extensograph

Information about any change of the gluten quality during the fermentation

Gluten / Protein.

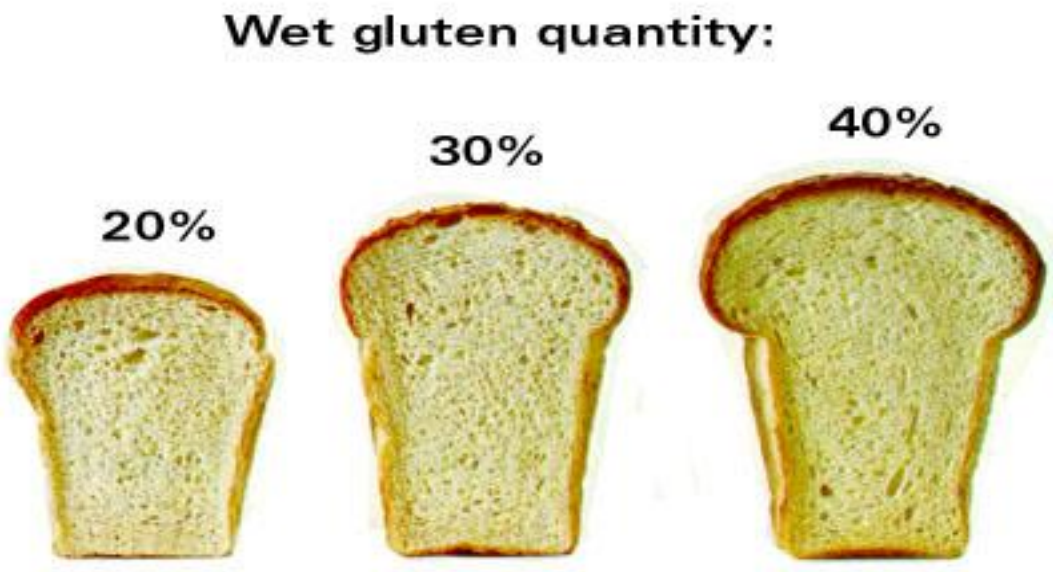
- Gluten is a complex protein formed of two protein structures, Gliadin and Glutenin (Gli+Glu).
- Due to the water and energy impact (kneading) Gli+Glu get connected to form the GLUTEN. The connection points are so called disulphide bridges.
- Yeasts consume sugar and produces carbon dioxide via fermentation.
  The CO_2 becomes trapped in this molecular mesh structure of gluten, causing bread to “rise.”
- Gluten is one kind of protein but not all protein is gluten → approx. 85% of the wheat protein consists of Gli + Glu.



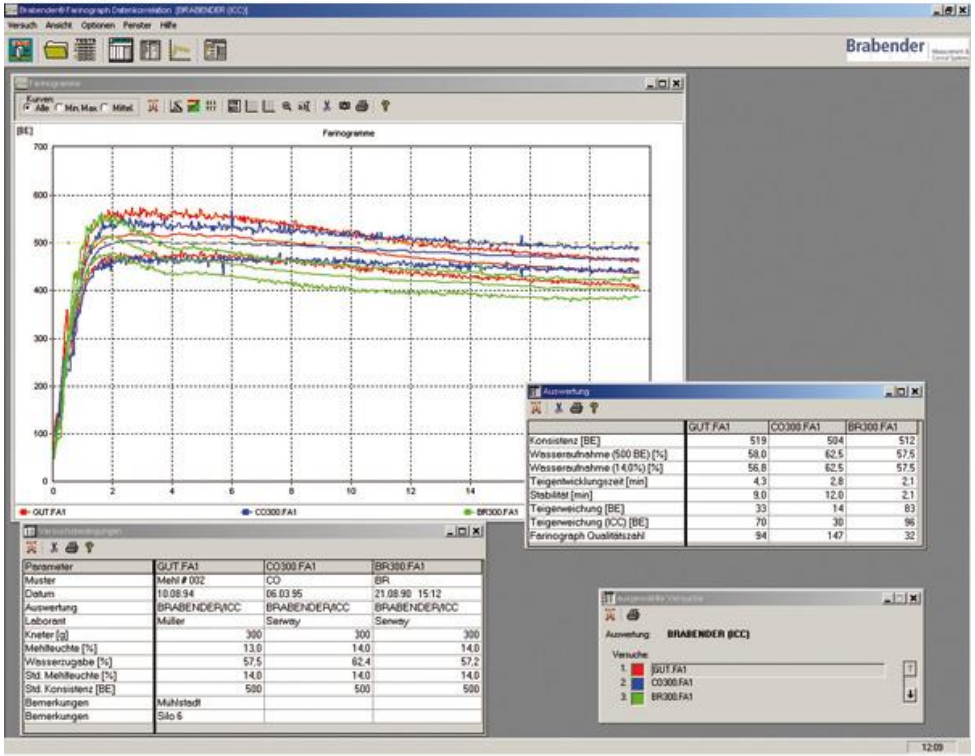


Gluten in bread.

- The amount of gluten contained in the bread has a significant influence on the baking volume of the bread



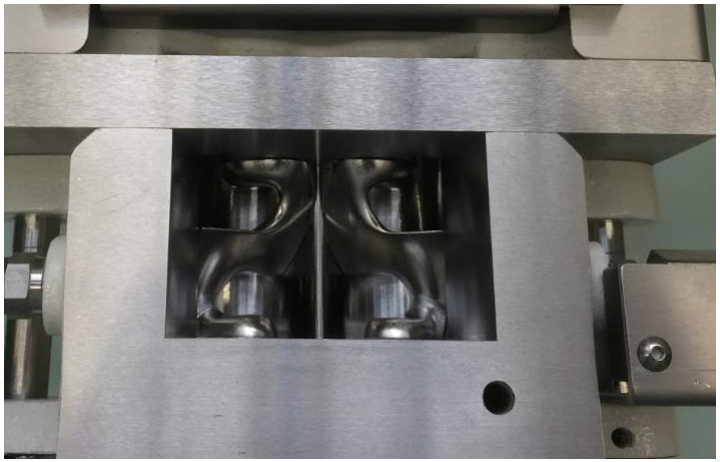
Gluten Analysis: FARINOGRAPH.



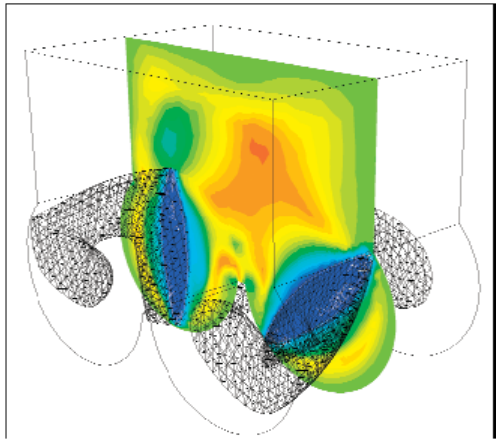
	GUT.FA1	CO300.FA1	BR300.FA1
Konsistenz [BE]	519	504	512
Wasseraufnahme (500 BE) [%]	58,0	62,5	57,5
Wasseraufnahme (14,0%) [%]	56,8	62,5	57,5
Teigentwicklungszeit [min]	4,3	2,8	2,1
Stabilität [min]	9,0	12,0	2,1
Teigerweichung [BE]	33	14	83
Teigerweichung (ICC) [BE]	70	30	96
Farinograph Qualitätszahl	94	147	32

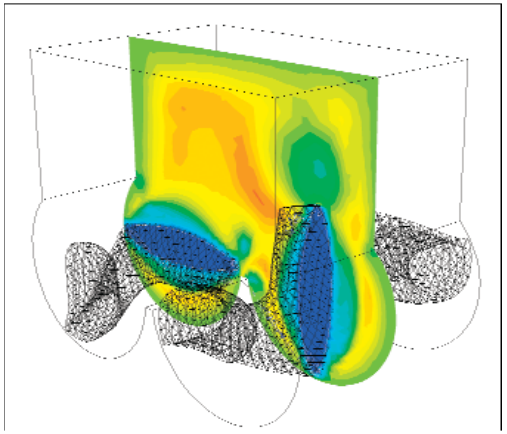
Parameter	GUT.FA1	CO300.FA1	BR300.FA1
Muster	Mehl # 002	CO	BR
Datum	10.08.94	06.03.95	21.08.90 15:12
Auswertung	BRABENDER/ICC	BRABENDER/ICC	BRABENDER/ICC
Laborant	Müller	Serway	Serway
Kneter [g]	300	300	300
Mehlfeuchte [%]	13,0	14,0	14,0
Wasserzugabe [%]	57,5	62,4	57,2
Std. Mehlfeuchte [%]	14,0	14,0	14,0
Std. Konsistenz [BE]	500	500	500
Bemerkungen	Mühlstadt		
Bemerkungen	Silo 6		

Farinograph: Kneading unit.

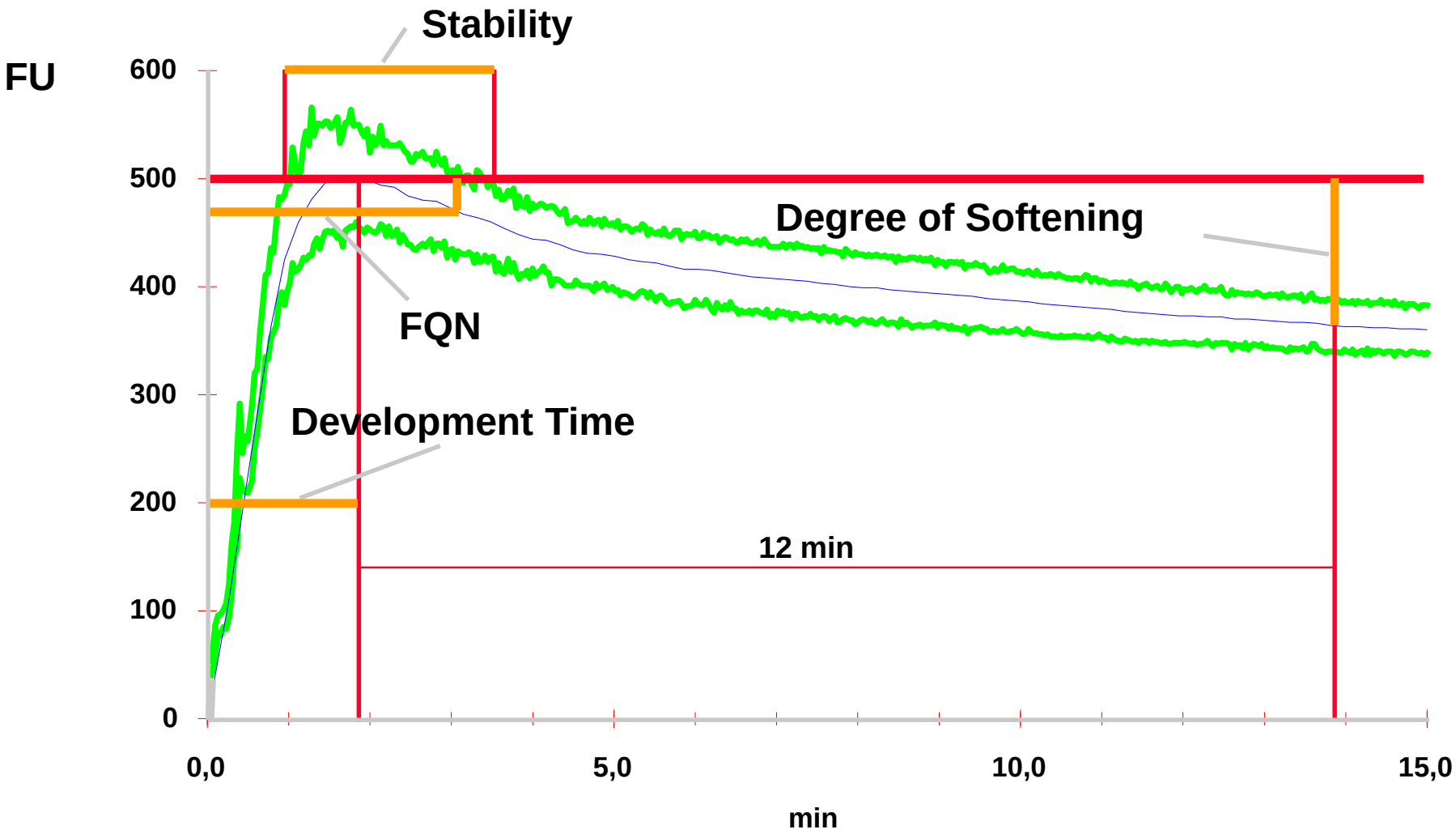


Measurement of the dough resistance to kneading by specified kneaders.

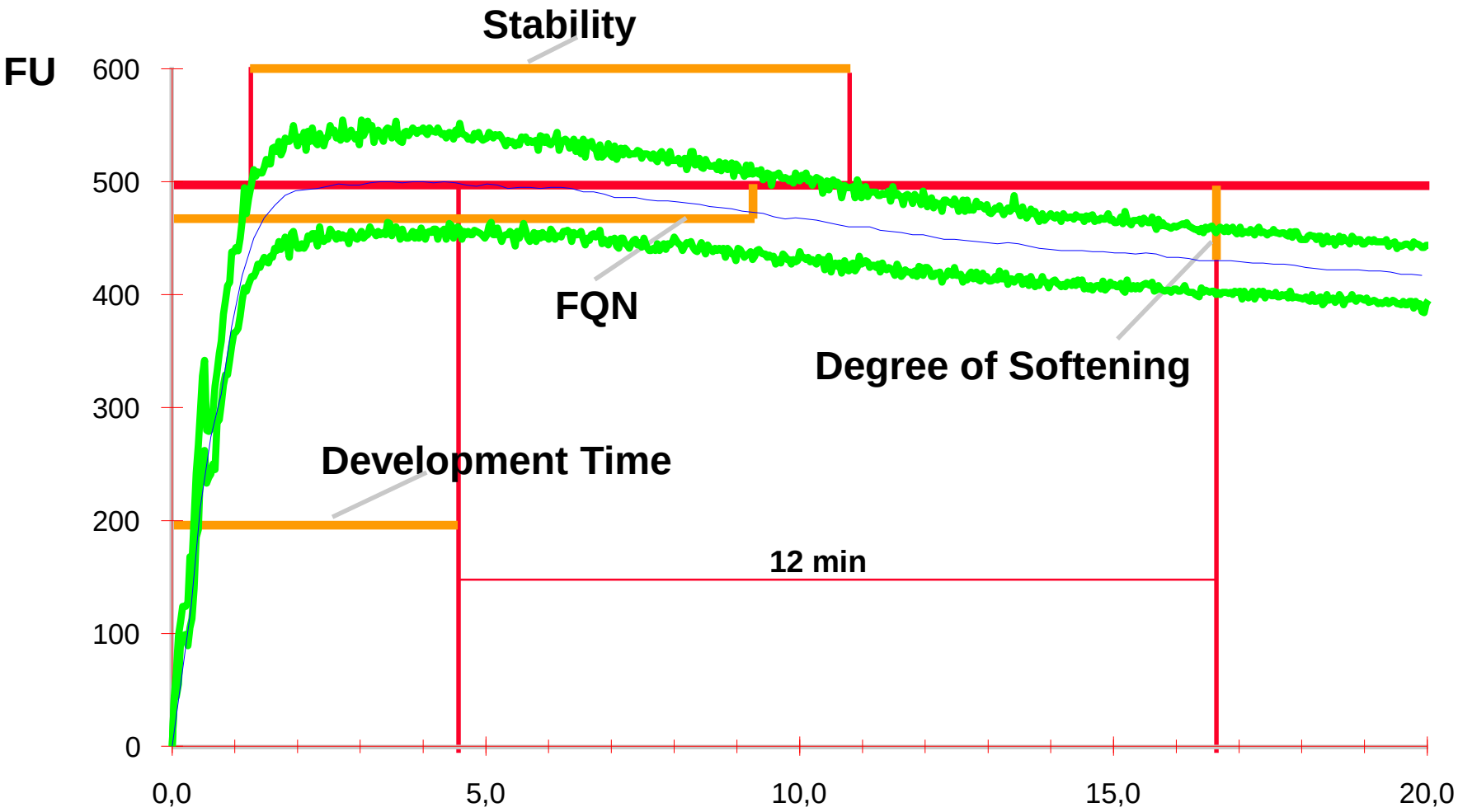




FARINOGRAPH Evaluation.
Weak Flour



FARINOGRAPH Evaluation.
Strong Flour



EXTENSOGRAPH.

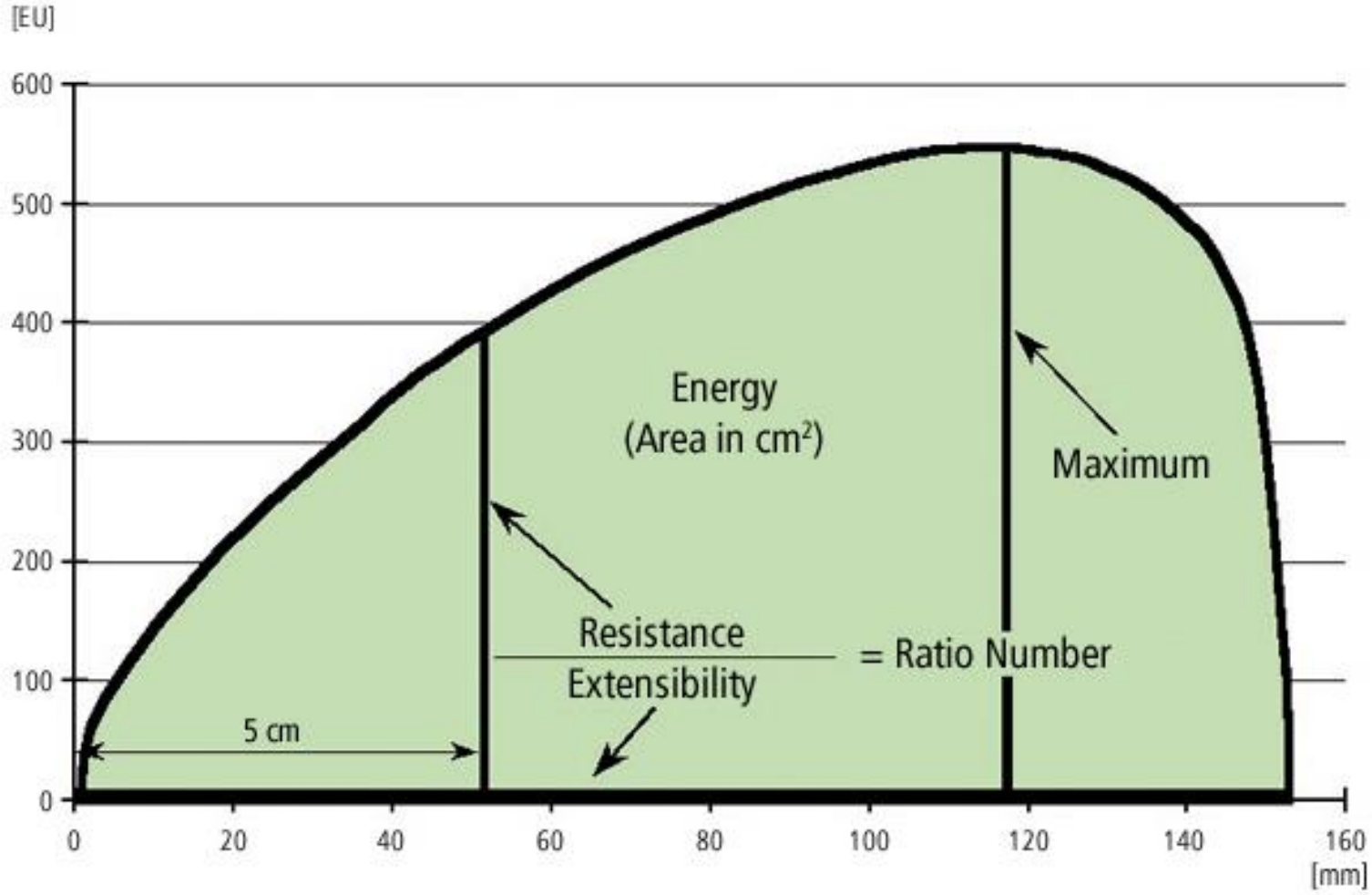
Gives information on:

- Wheat quality
- Stretching behaviour
  - Extensibility
  - Resistance to extension
- Effect of additives e.g.
  - Ascorbic acid
  - Enzymes
  - Emulsifiers

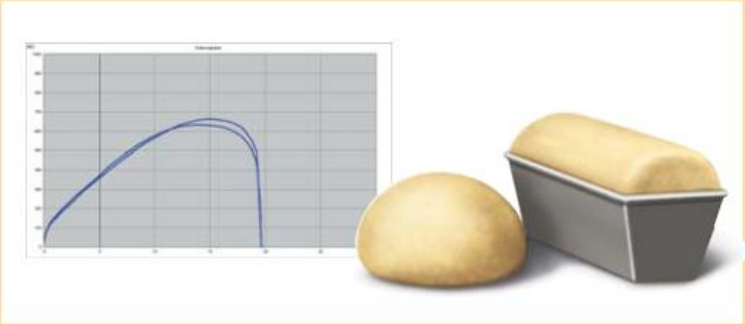
EXTENSOGRAPH
Dough Homogenizer – Sample Molding

EXTENSOGRAPH.
Stretching of the dough

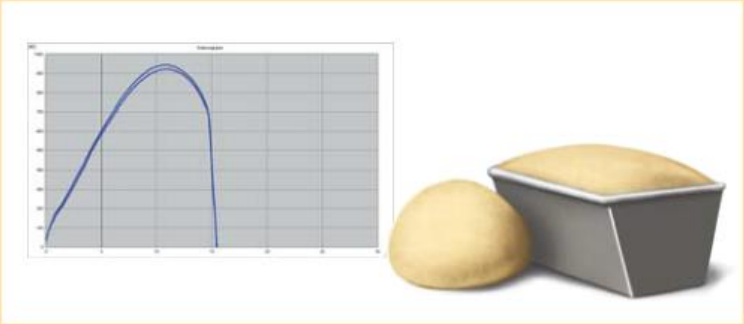
EXTENSOGRAPH Evaluation.



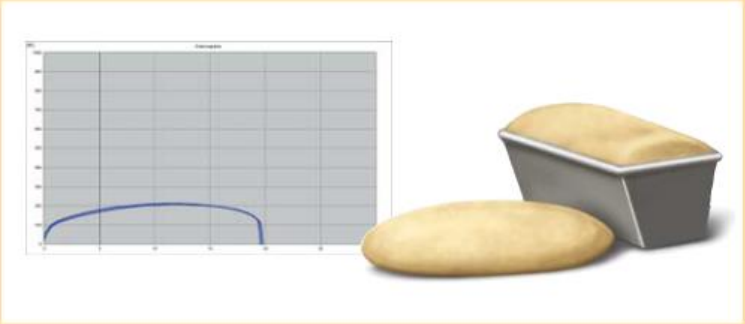
EXTENSOGRAPH Evaluation.



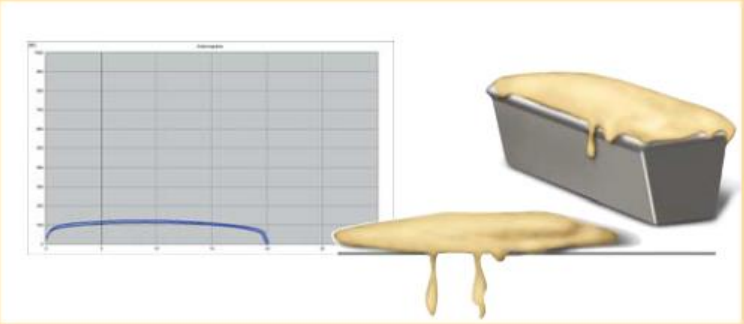
- Strong flour
- Extensible, elastic dough
- Suited for long fermentation processes, large proving tolerance
- Light, voluminous baking products with a good volume



- Rigid, tough dough structure
- Poor extensibility
- Dough hardly rises during proving
- Results in small pieces of dough with poor spring

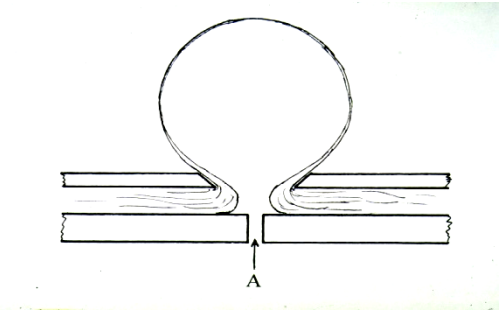


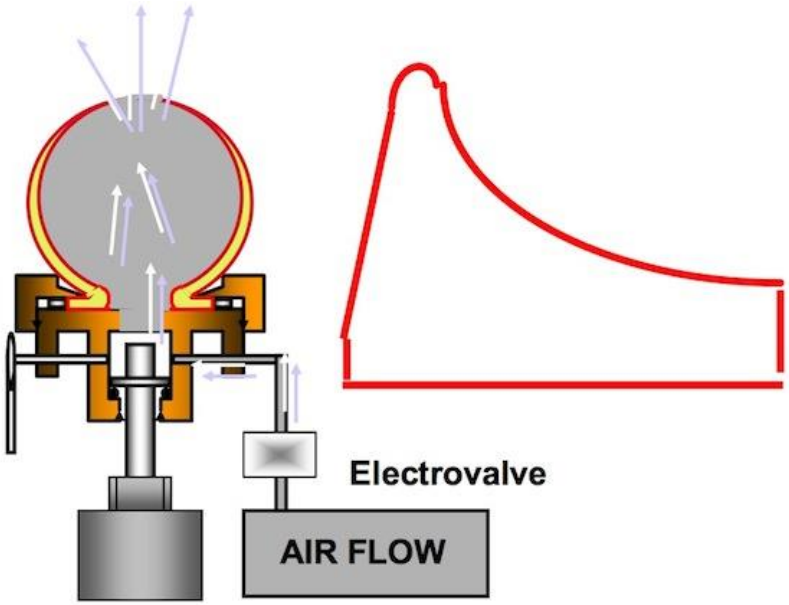
- Flour producing a wet, plastic dough
- Soft dough
- Narrow fermentation tolerance, dough tends to spread
- Small baking volume



- Flour not suitable for normal baking products

Flour Quality Tests.
Physical Dough Tests - Alveograph





Flour Quality Tests.
Physical Dough Tests - Alveogram