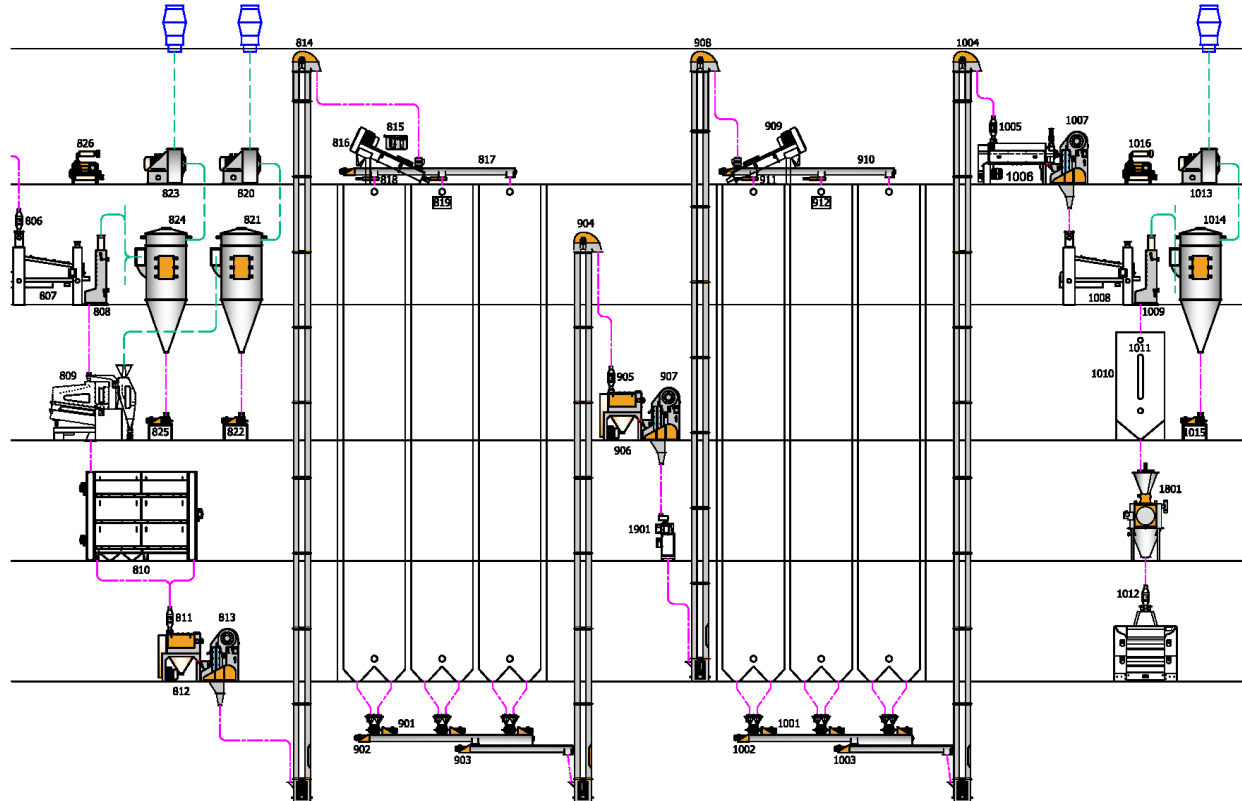


Impressions of Dampening Conditions on Milling Performance and Flour Quality

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WHEAT DAMPENING



• PERICARP/FRUIT COAT

Outer pericarp

Beard/Hairs of brush

Epidermis/Beeswing

Hypodermis

Inner pericarp

Cross cells/Mesocarp

Tube cells/Endocarp

• SEED COAT

Testa/Seed coat/Spermoderm

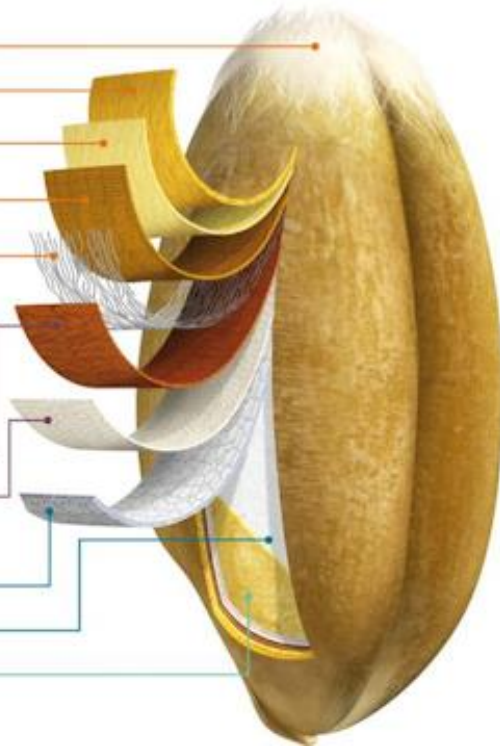
Hyaline layer/Nucellar layer

• ENDOSPERM

Aleurone cells/Aleurone layer

Starchy endosperm/Flour

• GERM/EMBRYO



Whole Grain Kernel

Endosperm

Germ

Bran

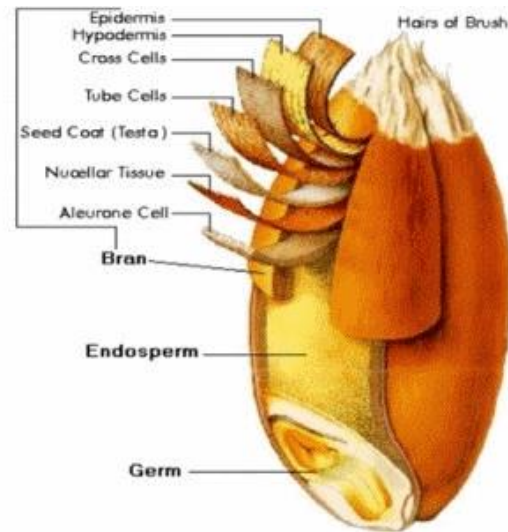


What factors are affect the wheat moisture absorption rate ?

- Dampening Temperature
- Dampening Amount and Time
- Initial Moisture of Wheat
- Kernel Size and Type
- Kernel Temperature

Water Penetration to the Wheat

The water which is given during dampening process, It is penetrated slowly from outside surface. Water exchange between shell layers takes a long time at normal temperature, whereas when the temperature increases, water absorption reach maximum level and in this case the wheat can receive up to %40 of its weight under normal conditions. When the temperature change is between 19°C and 32°C, the moisture transfer rate does not change, but as the temperature rises from 32°C to 52°C, a large increase in the transfer rate is observed



Factors Affecting Dampening Water

- The Bran Layer is very hard and Endosperm is very soft, indicating that grain water is above the optimum level. In this case, the cohesion between bran and endosperm increases and the bran-endosperm separation becomes difficult and sifting becomes difficult and flour extraction is reduced.
- Both Bran and Endosperm are hard and easily breakable, indicating that the grain water is low. In this case, the bran and endosperm are disintegrated together during milling and ability to separate is reduced. As Result, Flour extraction will be high. But, ash content and the color intensity will be high.
- The Bran Layer of wheat has elastic-strong structure whereas the endosperm is brittle, indicating that the grain water is at optimum level. In this kernel, epiderm-endosperm separation will be high, that is, ash content and the color intensity will be low.

Different Water Temperature Combinations

The use of heat during wheat dampening is mainly based on two main reasons. These are;

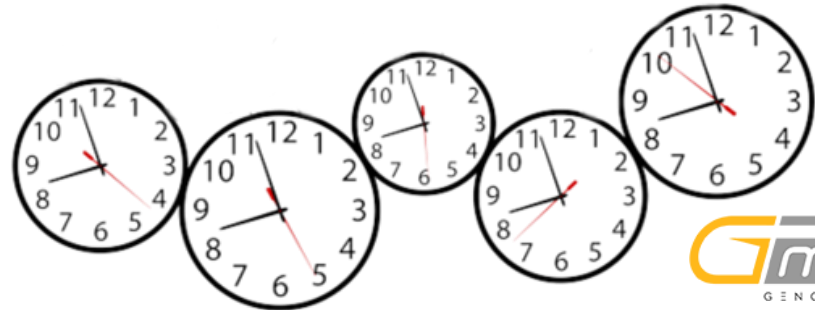
1. As the temperature increases, the water enters the grain and the spreading rate in the grain also increases, so the dampening process is accelerated
2. The processing of some weak wheat by heat has a significant effect on the rheological quality of flour.

Different Water Temperature Combinations

- During the dampening process, wet wheat is usually heated to temperatures below 55 ° C by steam application or radiators, then the wheat is kept and cooled until reaching grinding moisture. During this dampening process, the gluten properties are changing and the enzyme activity is weakening.
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Dampening Time

- Under normal conditions, water penetration takes 3-5 minutes, while water requires a 24-72 hour rest period in the grain.
- Hard wheat requires a longer rest period than soft ones, while on the other hand, as the temperature increases, the water gets into the grain and speeding up the spread.



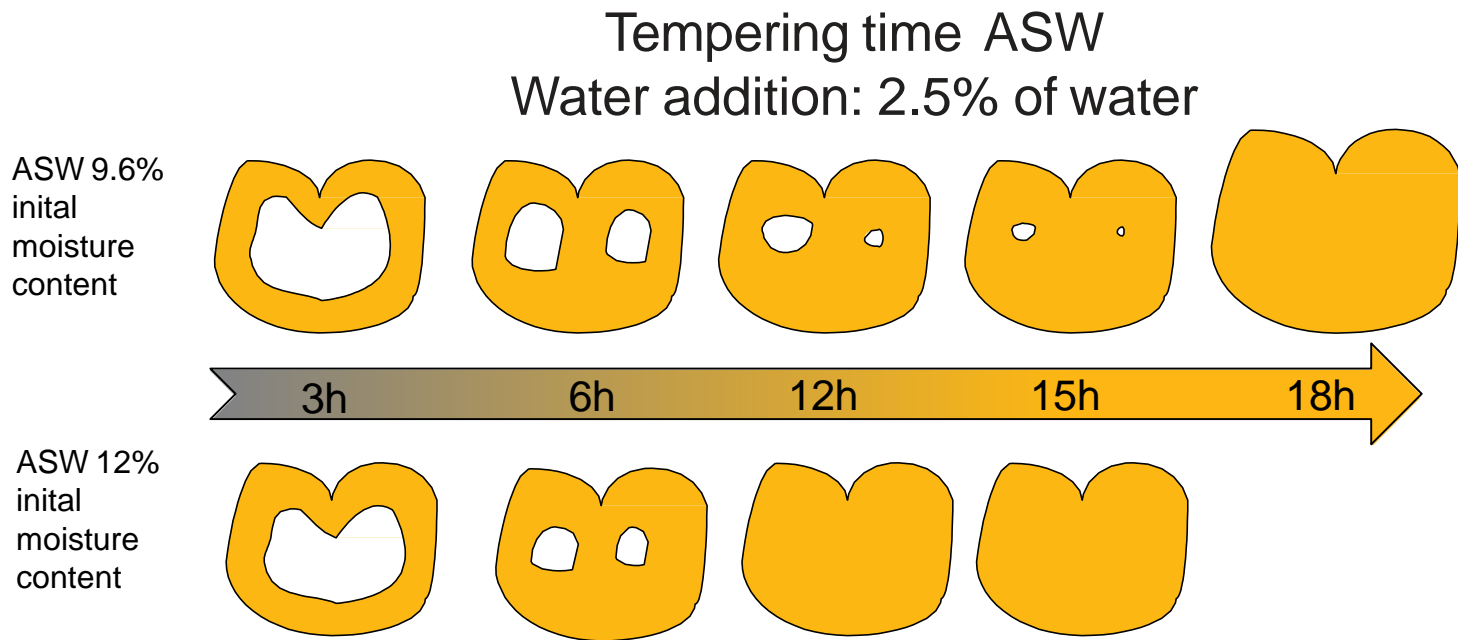
The Effects of Dampening Parameters

| <i>TIME</i> | | <i>TEMPERATURE</i> | |
|--|--------------|---|--|
| Advantage | Disadvantage | Advantage | Disadvantage |
| The amount of ash is reduced by increasing dampening time. | — | Shorter Dampening Time. Increased temperature reduces amount of ash. Protein and gluten are not affected by heat. | Flour extraction is reduced with increased dampening temperature |

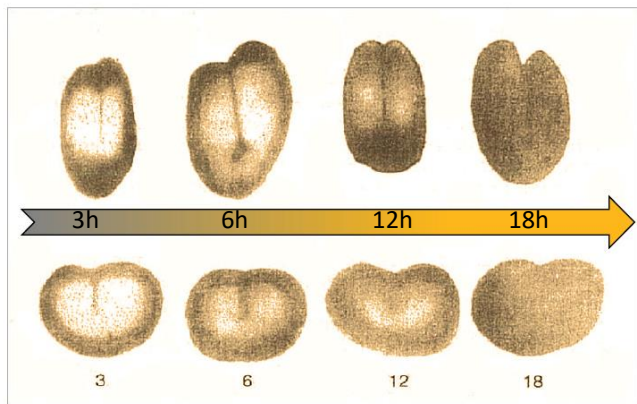
Moisture Content of Bran and Endosperm

| Dampening Time | From %13' to %14,5 dampened wheat | | From %17,7 to %14,5 dried wheat | |
|----------------|-----------------------------------|--------------------------------|---------------------------------|--------------------------------|
| | Bran Moisture Content (%) | Endosperm moisture content (%) | Bran Moisture Content (%) | Endosperm moisture content (%) |
| 1 Hour | 15,6 | 14,2 | 13,8 | 14,9 |
| 1 Day | 14,7 | 14,4 | 14,1 | 14,8 |
| 1 Week | 14,5 | 14,5 | 14,1 | 14,8 |
| 1 Month | 14,5 | 14,6 | 14,1 | 14,8 |

Influence of initial moisture content on conditioning time.

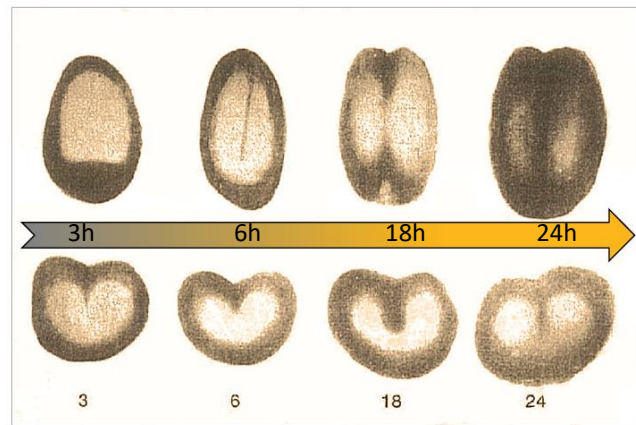


Influence of grain hardness on Conditioning time.



Soft Wheat

Water penetration



Hard Wheat

Water penetration

Providing Optimum Grain Water

- Providing Optimum Grain Water by Drying
- Providing Optimum Grain Water by Dampening
 - Optimization by Washing
 - Optimization by Blending
 - Optimization by Water Options (Hot,Warm,Cold)

Dampening Methods

- Cold Dampening
- Warm Dampening
- Hot Dampening
- Steam Dampening

| Process | WHEAT TYPES | | |
|-------------------|-------------|----------|-------|
| | Hard-Dry | Soft-Dry | Wet |
| Steam Process(°C) | 38/42 | 55/65 | 40/45 |
| Dampening (°C) | 40 | 40 | 60 |
| Cooling(°C) | 40-25 | 40-25 | 60-25 |

Flour Extraction

According to researches; temperature application increases breaking flour and bran yield. The temperature softens the grain and endosperm of the wheat and thus improves the yield of breaking flour. Increase of the bran extraction, also reduces flour extraction so the extraction decreases partially in temperature application.

| Temp. | Time(h) | Ext. (%) |
|-------|---------|----------|
| 25°C | 12 | 69,1a |
| | 24 | 67,9a |
| | 36 | 68,2a |
| | 48 | 68,3a |
| 45°C | 12 | 67,5a |
| | 24 | 67,4a |
| | 36 | 67,5a |
| | 48 | 67,5a |

Chemical Properties of Flour

| Temp. | Time Hour | Moisture % | Ash % | FN sn | Protein % | Wet Gluten % | Gluten Index | Sed. cc | Uz. Sed. cc |
|-------|--------------|---------------|----------|----------|--------------|--------------------|-----------------|---------|-------------------|
| 25°C | 12 | 14,75a | 0,85a | 425a | 11,84a | 32,0a | 76,3a | 21,3a | 32,0a |
| | 24 | 14,98a | 0,78b | 450a | 11,70a | 31,9a | 76,0a | 25,8a | 33,5a |
| | 36 | 15,05a | 0,78b | 456a | 11,69a | 31,6a | 75,8a | 24,5a | 33,0a |
| | 48 | 14,98a | 0,75b | 512a | 11,62a | 31,7a | 75,0a | 21,8a | 31,3a |
| 45°C | 12 | 15,00a | 0,77a | 472a | 11,59a | 31,0a | 74,5a | 23,3a | 31,8a |
| | 24 | 14,80a | 0,75b | 465a | 11,56a | 31,1a | 75,8a | 23,5a | 33,0a |
| | 36 | 15,23a | 0,72b | 475a | 11,58a | 30,5a | 78,0a | 26,5a | 33,5a |
| | 48 | 14,93a | 0,70b | 478a | 11,56a | 30,7a | 76,0a | 25,0a | 33,0a |

Influence of Dampening Conditions on Cost

As it is known, in the installations where the dampening period is high, the volume of the silos to be used with dampening purpose is high and accordingly number of the mechanization units needs to increase. Briefly ; investment, labor and maintenance costs are also rising. Due to reduced time taken by hot dampening process, a reduction in costs may occur.



THANKS FOR YOUR TIME ...

