

A vertical strip of five cheese wheels, likely Casu Marzu, resting on a wooden tray. The cheese wheels are white with a dark, speckled rind. The tray is made of dark wood and has a metal mesh strip along the edge.

# Factors affecting yield of cheese

# **Cheese Yield Potential of Milk**

**Breed of cow**

**Variation  
between  
individual cows**

**Stage of  
lactation**

**Seasonal changes  
in climate and  
natural feed**

**Type of feed and  
level of feeding**

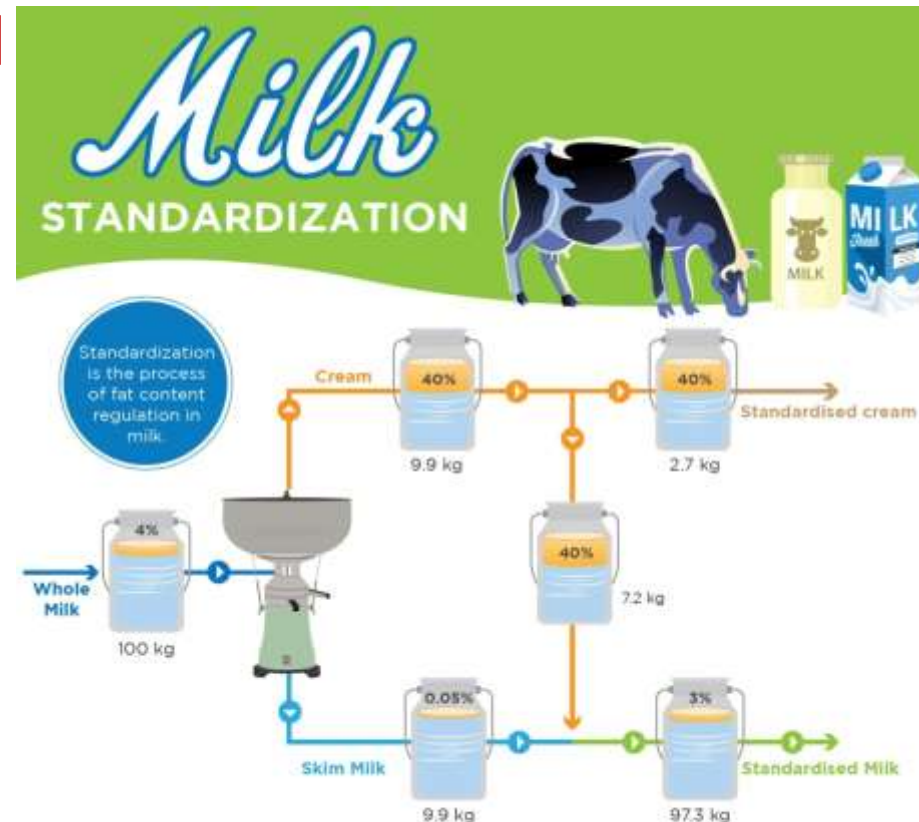
**Problems due to  
diseases (mastitis)**

**Milking procedures  
(time that elapses  
between milking and  
whether milked by  
hand/machines**

**Effect of genetic  
variants on milk  
composition**

## Processing conditions that affect cheese yield:

- ✓ Storage of milk
- ✓ Milk standardization
- ✓ Concentration of milk
- ✓ Growth media used for bulk starter preparation
- ✓ Type of starter culture used
- ✓ Heat treatment of milk
- ✓ Homogenization of milk
- ✓ Addition of  $\text{CaCl}_2$  to milk
- ✓ Type of coagulant used



- ✓ **Curd firmness**
- ✓ **Type of vat**
- ✓ **Curd handling system**
- ✓ **Cooking of curd**
- ✓ **Cheddaring of curd**
- ✓ **Washing of curd**
- ✓ **Proportion of salt added**
- ✓ **Pressure applied**
- ✓ **Loss of moisture during storage**



# Principal Factors Influencing Cheese Yield

## Milk Composition

- Important factor that affect cheese yield particularly casein and fat content.
- Cheese yield is linearly related with fat and casein content of milk.
- The greater contribution of casein is expected, as it forms the continuous paracasein sponge like network that occludes fat and serum phases. In contrast, fat on its own has little water holding capacity. Occluded moisture contributes directly to cheese yield and indirectly owing to the presence of dissolved solids, including whey proteins,  $\kappa$ -casein glycomacropeptide, lactate, and soluble milk salts.

- **Fat is occluded in pores of paracasein network of the cheese and prevents syneresis. The occluded fat globules physically limit aggregation of the surrounding paracasein network and therefore reduce the degree of matrix contraction and moisture expulsion. As fat content of curd is increased, it becomes more difficult to expel moisture and the moisture protein ratio increases.**
- **Some such factors are species and breed of animal, stage of lactation, seasonal variations, etc.**

## **Holding milk at low temperature**

- When it is not possible for the cheesemakers to start cheese making soon after milk reception, milk is stored in cold storages for some hours, depending on the manufacturing schedule.**
- This action of storing milk at refrigerated temperature results in some physicochemical changes in milk which include:**
  - Solubilization of casein and colloidal calcium phosphate which leads to increase in serum caseins, thereby increasing loss in whey.**
  - Growth of psychrotrophic bacteria which leads to release of enzymes like proteases and lipases.**
  - Increase in free fat levels owing to lipase action.**

- **Increased serum casein level can be reversed by pasteurization and thus, the effect of cold storage is nullified but the production of proteases cause protein breakdown into peptides.**
- **Some of these peptides are soluble in serum phase and do not coagulate during curd formation.**
- **They are lost in whey leading to decrease in cheese yield. Reduced casein level has an effect of curd shattering and weak coagulum, thereby increasing fat loss in whey.**
- **Dual effect of losing casein and fat in whey reduces the cheese yield considerably.**



# Heat treatment of milk

- Cheese milk can be given heat treatments (thermization, pasteurization etc).
- Heat treatment denatures whey proteins and results in their inclusion in gel and thereby, increase yield of cheese.
- Degree of whey protein denaturation determines extent of their recovery in cheese.
- Cold storage of milk leads to production of enzymes (proteases and lipases).
- Thermization prevents growth of psychrotrophs in milk, prevents casein solubilization and thus increases cheese yield.
- Pasteurization of milk (72 C for 15 s) denatures whey proteins to lower level and thus, cheese yield is slightly increased. Severe the heat treatment, more is resultant increase in cheese yield.

## **Addition of $\text{CaCl}_2$**

- **Addition of  $\text{CaCl}_2$  at rate of 0.02% in cheese milk is common practice. This results in strengthening the curd, making it less susceptible to shattering at the time of cutting and stirring.**
- **This reduces the chances of fat and protein loss in whey and thus increases cheese yield.**

## **Type of rennet**

- **Type of rennet used for coagulation affects cheese yield as it affects the extent of proteolysis.**
- **Rennet having more proteolytic activity solubilizes casein and increases its loss in whey.**
- **Proteolytic rennet reduces cheese yield significantly only when the pH of the whey at the time of drainage is below 6.0 as in the case of Blue cheese and Camembert cheese.**