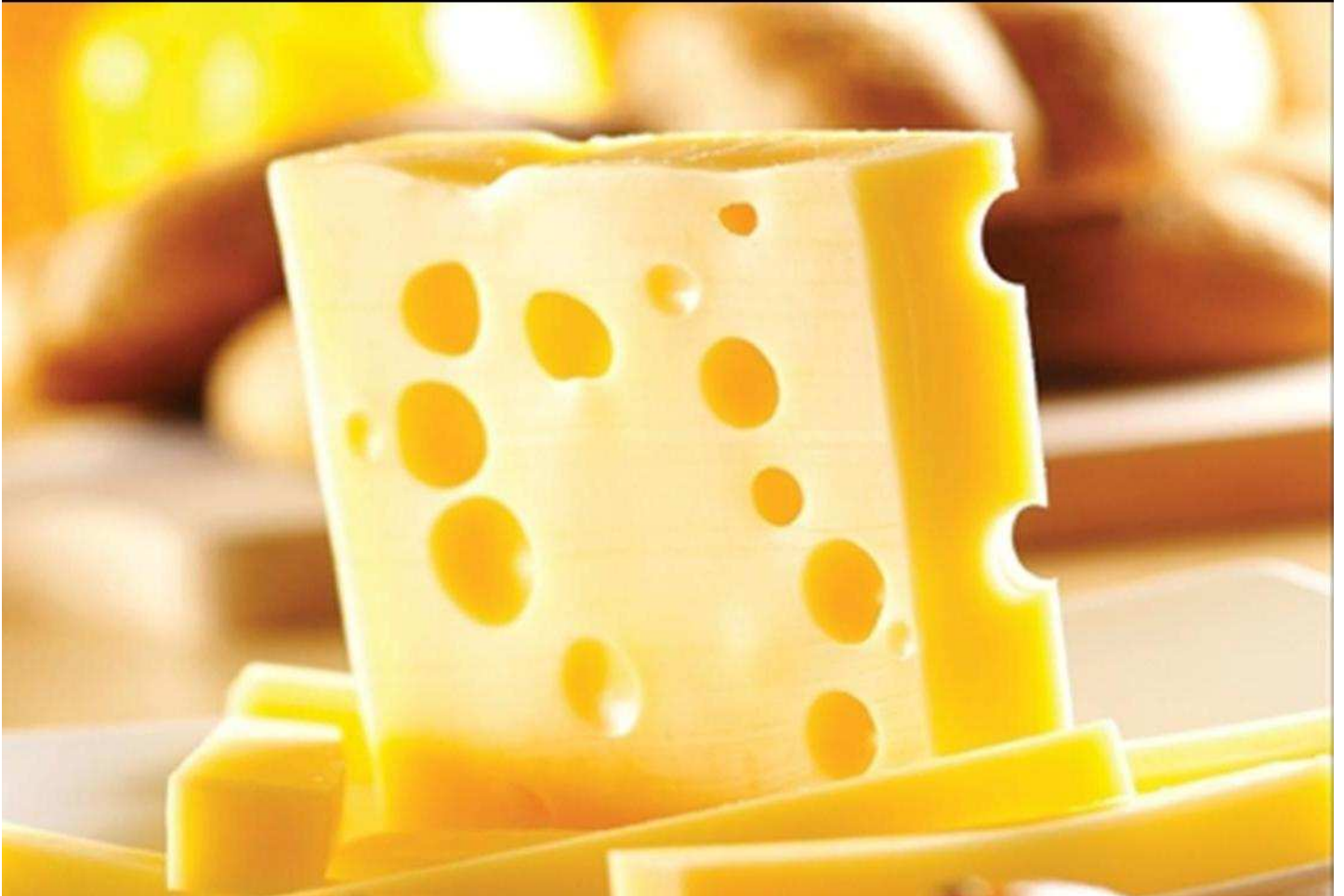




... A WAY TO DISTINGUISH YOUR RIPENED CHEESE

FLAVOUR WHEEL™ CONCEPT



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Marketing information

Life style and eating habits

Due to the influence of a multicultural and ageing society, people lead a more social life with an increased disposable income and more attention to 'quality time'. As a result, consumers are looking for more sophistication in flavour experiences and want to trigger their senses with indulgent and more flavour varieties. This is especially true for cheese. Whether cheese is positioned exclusive, healthy or traditional, consumers look for premium, high quality cheeses. Besides, consumers have shown more interest in authentic specialty cheeses, which are often regionally produced and made in a traditionally way. In figure 1 the trend towards more sophistication and variety in taste and texture is presented.

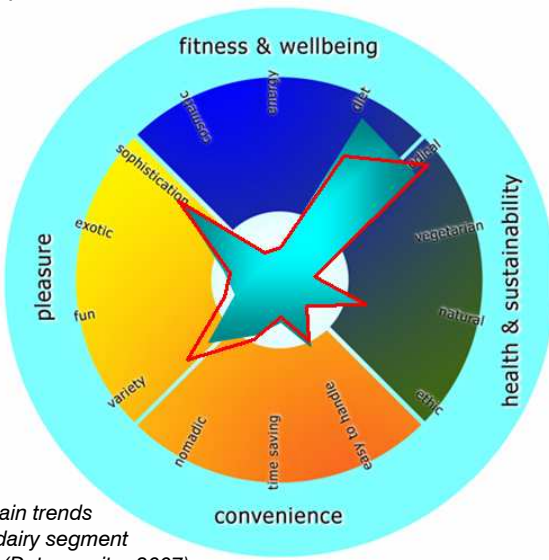


Figure 1. Main trends within the dairy segment worldwide (Data monitor 2007)

Target group

Flavour Wheel™ cultures are especially developed for the group of consumers who are looking for authentic, distinctive and high quality cheese. Some of them will take time to enjoy the tasteful cheese with a glass of wine. Others with busy life-styles look for convenient cheese variants like premium sliced or grated cheeses, as they do not want to compromise on product quality. Within these group of consumers elder people are becoming an important target group. As people's taste perception is enhancing as they grow older, high quality cheese with more pronounced flavours are becoming more appreciated by these group of consumers.

Proposition Flavour Wheel™ concept

As perception of taste, smell and colour is communicated via the senses, CSK has developed the Flavour Wheel™ concept. Within the Flavour Wheel™ concept prototypes with different flavour profiles are developed which are contributing to the desired flavour profiles of consumers. Not only taste differentiations in cheeses, like Gouda, Maasdam or Cheddar can be created, but also in surface-ripened cheeses. Flavour profiles like 'fruity sweet', 'thermophilic sweet', 'propionic sweet', 'creamy' or 'farmhouse' flavour can be developed to achieve a characteristic flavour in naturally coated, ripened cheese or new flavours in foil ripened cheese.

Technological information

Flavour development in cheese

Many biochemical processes take place during the ripening of cheese which are essential for flavour formation. Soluble proteins released from casein by the action of chymosin and plasmin are degraded by lactic acid bacteria (LAB). With a complex set of proteolytic, peptidolytic and other enzymes LAB are able to degrade the released proteins in several steps into various flavours. Besides protein degradation also fat and sugar metabolism contributes to the overall flavour. Therefore, the LAB cultures play a major role in the flavour formation of cheese (see table 2).

Compound	Especially found in
Fatty acids	Gruyère, Maasdam, Blue cheesses, Goat cheesses, Brie, Camembert, Parmesan, Farmhouse
Esters	Gruyère, Parmesan, Farmhouse
Aldehydes	Gruyère, Maasdam, Parmesan, Proosdij
Alcohols	Edam, Gruyère, Maasdam, Parmesan
Ketons	Blue cheesses, Edam, Gouda, Goud 20+, Gruyère, Parmesan, Proosdij
Sulphur compounds	Gouda, Cheddar, Surface-ripened, (All cheesses)

(thesis, Wim Engels, 1997)

Figure 2. Typical aromatic volatiles for different type of cheeses.

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Development of Flavour Wheel™ cultures

The Flavour Wheel™ cultures contain a large collection of lactic acid bacteria, which are screened for flavour generating capacity. Organoleptic properties and chemical composition of almost 200 strains grown in milk were determined. The LAB collection was classified on basis of organoleptic properties into following segments: 'thermophilic sweet', 'fruity sweet', 'propionic sweet', 'creamy' and 'farmhouse' flavour (see figure 3).

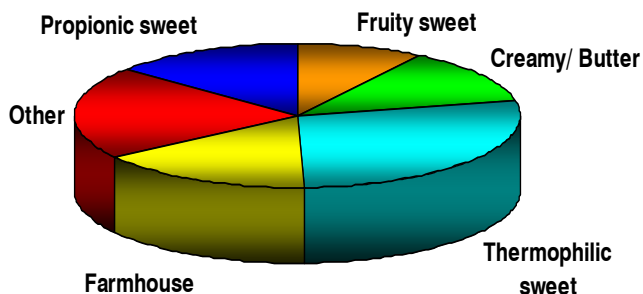


Figure 3. Presentation of the Flavour Wheel™ concept.

Adjunct cultures selected from the Flavour Wheel™ collection were tested besides the acidifying starter cultures in different types of cheese. After evaluation of the organoleptic properties in cheese, the adjunct cultures with the most specific and desired flavour profiles were selected to become part of the Flavour Wheel™ collection.

Flavour Wheel™ segment 'fruity sweet'

In this segment culture strains have been selected, which give a sweet and fruity flavour profile in cheese. The formation of esters and alcohols are mainly responsible for the formation of these sweet and fruity flavour notes. The use of specific yeast strains in combination with lactic acid bacteria typical beer- or wine sensations can be developed in cheese.

Application examples

- **Gouda:** The adjunct cultures with fruity, alcoholic sweet flavour notes contribute to a more alcoholic 'BierKäse' type of flavour profile in Gouda cheese.
- **Cheddar:** In cheddar these fruity, alcoholic sweet flavour notes give especially matured cheddar a very balanced flavour profile

Flavour Wheel™ segment 'thermophilic sweet'

The flavour profile 'thermophilic sweet' is a collection of typical flavour notes, which can be described as sweet, burny, bouillon and creamy. These flavour notes are produced by thermophilic lactic acid bacteria. This flavour profile can also be described as a Parmesan type of flavour.

Application examples

- **Gouda:** Adjunct cultures from the thermophilic sweet flavour segment notes contribute to a flavour intensification and diversification in the direction of Parmesan, Proosdij or bouillon type of flavour profile.
- **Cheddar:** Also in cheddar these adjunct cultures contribute to an intensification and diversification of the flavour profile, which is very much appreciated in matured cheddar types. In combination with sulphuric flavour notes a more complex, balanced and sweet/farm-house cheese taste profile can be created.
- **Blue mould cheese:** The culture range within the thermophilic sweet range gives blue mould cheese a more full bodied taste and reduces the sharpness and bitterness of this cheese type.
- **Maasdam:** In Maasdam the thermophilic sweet adjunct cultures intensify the sweet flavour profile and keep the flavour profile more stable during shelf life. Besides, these cultures can mask taste deviations like sharpness and bitterness, which can be formed after longer ripening periods.



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Flavour Wheel™ segment 'farmhouse'

The taste profile of the farmhouse cheese type consists of a broad range of flavour notes. As farmhouse cheese is made in a traditional way with unpasteurised milk the taste profile is not uniform. From this broad palette of flavour notes we have selected thermophilic strains which contain different intensities of sulphuric, sharp, burny and sweet notes.

Application examples

- **Gouda:** When applied in Gouda cheese types a typical 'farmhouse' taste profile of natural ripened Gouda is developed. In rindless Gouda types the flavour gets much more character with a very strong flavour impact. In combination with thermophilic sweet notes a more balanced and mild flavour profile can be created.
- **Surface ripened smear cheese:** In traditional Tilsiter the farmhouse flavour segment with sulphuric flavour notes intensify the flavour profile of the smeared cultures, which results in a more complex and balanced flavour profile. In rindless Tilsiter types even a smeared like flavour profile can be developed without the addition of smear cultures.
- **Cheddar:** In cheddar these sulphuric farmhouse notes can give a real taste improvement of especially young cheddar. In matured cheddar an intensification of the flavour profile is perceived. In combination with thermophilic sweet notes a more balanced and mild flavour profile can be created.

Flavour Wheel™ segment 'propionic sweet'

The propioni cultures produce primarily propionic acid and carbon dioxide from lactate. Propionic acid gives a pure sweet nutty flavour to the cheese and the carbon dioxide is important for eye formation. These cultures are primarily applied in Maasdam and Emmental types of cheese.

Application examples

- **Maasdam:** When applied in Maasdam cheese types a typical propionic sweet and nutty taste is perceived. CSK has developed the original Maasdam flavour, which is described as a pure, intense sweet flavour with a nutty note.
- **Emmental:** In Emmental cheese types propioni cultures are selected which have more lipolytic activity. This results in a more spicy flavour note, which is appreciated besides the sweet and nutty flavour profile.

Flavour Wheel™ segment 'creamy / buttery'

The typical creamy or butter flavour is mainly formed by diacetyl production. The formation of diacetyl is a chemical conversion of pyruvate in the presence of oxygen. Especially when developing low-fat cheese specific cultures can improve the flavour profile towards a more creamy and full bodied taste. Besides, they will add some of the sensory notes which are missing in low-fat cheese.

Flavour Wheel™ culture range

CSK is constantly conducting cheese trials to extend the collection of the Flavour Wheel™ cultures to cover the market needs. In the table below the current defined segments are summarised with their main flavour description.

Flavour Wheel™ Segment	Culture range	Flavour description
Thermophilic sweet	L- range	Different sweet intensities in the direction of Proosdij or Parmesan flavour types
Fruity sweet	E- range	Different sweet intensities in the direction of alcoholic, yeasty and fruity flavour notes
Propionic sweet	P-range	Different sweet intensities in the direction of Maasdam and Emmental flavour types
Farmhouse	X - range	Farmhouse flavour with different intensities of sulphuric, sharp, burny, sweet and chocolate flavour notes
Creamy/Butter	C- range	Different intensities of creamy and buttery flavour notes

Table 1. Flavour description of the different segments within the Flavour Wheel™ collection

Consultancy

Our experts can provide you with further advice on the use of the Flavour Wheel™ cultures to develop the desired flavour profile of your cheese. In close collaboration they will give the optimal support to create new products or improve you existing product range. Cheese tastings based on Flavour Wheel™ prototypes can be supported by our consultancy and product management.

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