TERROIR TASTE IN ARTISAN CHEESE, MYTH OR REALITY?
CASE STUDY: COMTÉ

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LAY OF THE LAND

Europe

Massif du Jura

France

Production area

Switzerland

Switzerland

Europe

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www.comte.com

Comité interprofessionnel du Gruyère de Comté
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Le Comité interprofessionnel créé par décret n° 63-575 du 11 juin 1963. Le logo «Comité d’origine» est une marque de certification protégée du OGC.
Comté PDO chain:
Specific production area, milk producers, cooperatives and affineurs

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Milking and artisanal cheesemaking process

- Cows during milking
- Milk collection at 12°C – Transformation into Comté < 24 hours
- Artisanal Cheese making
- Setting on the green casein label
- COMTÉ: RAW MILK, HARD CHEESE, LONG AGING
- Affinage cellars
- Green cheeses at the Fruitière cellar

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Each Comté has a unique set of complex flavors:
Comté flavors differ depending on the place of origin

Massif du Jura

Fruitière de Tourmont

Fruitière de Largillay

Fruitière de Villers-sous-Chalamont

Fruitière de la Baroche

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Location of the different Fruitières on the Massif
Comté terroirs program

• 1990: program to characterize fruitières and describe flavors in Comté begins
  – Study of soil
  – Study of flora
  – Study of flavors (Jury terroir, Comté aromas wheel)

• 1996: a thesis showcases correlation between the flavors of Comté and the area of production based on data from 20 fruitières. Areas of production are characterized by soil and local flora => cru

• “Nouvelles du Comté” newsletter highlights the description of the terroir of a fruitière 4 times a year
The terroir jury

- 60 panelists trained since 1993
- An average of 14 panelists / tasting
- 7 sessions / year
- 250 tastings & more than 1000 different Comté explored

Comté milk producers

Chefs (cooking school)

Technicians & cheese-makers

Wine tasters & wine lovers

Food lovers & members of the Comté friends association

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Each Frutière has its own characteristics

La frutière de Tournmont/Saint-Lothan
une belle palette de... médailles

La palette aromatique des Comtés de Tournmont est à la hauteur du palmarès de la frutière depuis le début des années 2000.

La flore
Côté houpetant, les proches de la frutière qui s’étaient un peu écartées de la brousse, il y avait bel et bien de la floraison dorée, telle que l’oranger, l’ortie, le gaulthérie, le mûrier, le chêne, le saule, l’érable, etc. De nombreuses fleurs étaient en fleurs, scintillant à la lumière du soleil.

Les montagnes pouvaient aussi se métamorphoser avec la fleur odorante, le lichen, la constance jaune, le pissenlit, les fleurs des grès, le pissenlit commun, le cyprès agrippé au roc et renoncule. Les montagnes pouvaient aussi se métamorphoser avec la fleur odorante, le lichen, la constance jaune, le pissenlit, les fleurs des grès, le pissenlit commun, le cyprès agrippé au roc et renoncule.


Soils

People

Flavors

Vegetation
Each Fruitière has its own characteristics.
Each Fruitière has its own characteristics.
Each Frutière has its own characteristics

**Fruitière de Largillay**

- The village of Largillay overlooks the lake of Vouglans
- Natural region: low mountain
- The frutière brings together 17 farms and produces approx. 3.9 million liters of milk/year (1 029 600 gal).
Each Fruitière has a unique set of flavors

TOURMONT
Affinage: ETS ARNAUD
Fab. de 2000 à 2004

LA BAROCHE
Fabrications de 2006 à 2009
Affinage: Ets Arnaud

LARGILLAY
Fab de 2006 à 2012
Affinage: Ets ARNAUD ou PFCE

VILLERS SS CHALAMONT
de 1996 à 2002
Affinage Ets Arnaud

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Each Fruitière has a unique set of flavors

Main distinctive aromas / Fruitière:

<table>
<thead>
<tr>
<th>Tourmont</th>
<th>Largillay</th>
<th>Villers-sous-Chalamont</th>
<th>La Baroche</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acidified whey/</td>
<td>Milk caramel/</td>
<td>Cooked milk/ White</td>
<td>Hazelnut/ Walnut/</td>
</tr>
<tr>
<td>Lightened onion/</td>
<td>HazelNut/ Walnut</td>
<td>chocolate/ Yoghurt</td>
<td>Chestnut</td>
</tr>
<tr>
<td>Fried onion</td>
<td></td>
<td>Citrus fruit juice</td>
<td></td>
</tr>
<tr>
<td>Hazelnut /Citrus</td>
<td>Sometimes Roasted</td>
<td>Hazelnut/ Peanut</td>
<td>Ripened cream/</td>
</tr>
<tr>
<td>juice/ Sometimes</td>
<td>(bread/hazelnut) &amp;</td>
<td></td>
<td>Yoghurt/ Acidified</td>
</tr>
<tr>
<td>honey</td>
<td>Citrus fruit/</td>
<td></td>
<td>whey</td>
</tr>
<tr>
<td></td>
<td>Ripened cream/</td>
<td></td>
<td>Roasted peanut/</td>
</tr>
<tr>
<td></td>
<td>White chocolate</td>
<td></td>
<td>Intense cacao</td>
</tr>
<tr>
<td>Hint of animal :</td>
<td>Hint of animal :</td>
<td>Hint of egg yolk/ Hint of</td>
<td>Hint of</td>
</tr>
<tr>
<td>leather</td>
<td>leather/</td>
<td>steamed potato</td>
<td>mushrooms/humus/</td>
</tr>
<tr>
<td></td>
<td>Hint of cooked</td>
<td></td>
<td>Hint of egg yolk and</td>
</tr>
<tr>
<td></td>
<td>apricot</td>
<td></td>
<td>meat stock</td>
</tr>
</tbody>
</table>
Let's taste!
Why does each and every Comté have a different set of flavors?

Several factors can influence quality and the expression of aromas in Comté:

- Season,
- Microflora,
- Technological parameters,
- *Fruitière*,
- Type and duration of *affinage*, etc.

Let’s look at **microflora** and its influence on the transmission of flavors

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Microflora in milk plays a key role in the development of aromas

1. Microflora modifies/transforms components in cheese

- Water activity (Aw)
- Proteins
- Fat matter
- Minerals

Starter (Lactic acid bacteria), microflora in milk

= Microflora in cheese

Enzymes in microflora

Mechanisms:
- Proteolysis
- Lipolysis
- Fermentations

Precursors

Aromas

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2. What is microflora?

- **Microflora in raw milk** = indigenous micro-organisms in milk (bacteria, yeasts and moulds). Microflora contains multiple microbial communities that compete in cheese for nutrients.

- **Usual classification**

- **Main microbial groups**

- A desirable raw milk is a milk rich in microflora of interest for cheesemaking

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3. Role of microflora originating in raw milk

- Same microfiltered milk used as basis (almost no microflora): MF
- 3 microflora selected from 3 different fruitières (A, B, C)
- Preparation of 4 milk batches: MF, MF+A, MF+B, MF+C
- Fabrication of experimental cheeses using Comté technology

**Sensory characteristics**

- MF+C
  - Propionic
  - Aroma intensity
- MF+B
  - Pungent
  - Acid
  - Granular
- MF
  - Firm
- MF+A
  - Butter

Source: INRA-Poligny – 1997

Microfiltered milk MF (TF ≈ 2000 cfu/mL)

1. Without microflora: only basic butter flavor in the cheese

2. A different native milk microflora leads to a different array of tastes in the cheeses
Why do different Comté have different flavors?

1. Native microflora quickly becomes dominant in Comté

Microflora in raw milk plays a role in the development of cheese taste because it becomes dominant during ripening.

Un-hooping

Source: INRA-Poligny – 1999

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Why do different Comté have different flavors?

2. Microflora in the milk is specific to a place (a terroir)

4 species of mesophilic lactobacilli from raw milk are tracked from 4 farms of different terroirs; strain diversity is identified by genetic fingerprinting.

We observe strains diversity in farms from different terroirs - very few strains are common between terroirs => SPECIFICITY OF TERROIR

Source: CIGC - 2000

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3. Microflora is linked to the soil and the hay, meaning the farm environment and farming practices

Eric Beuvier (INRA Poligny): « recent research has shown that some mesophilic lactobacilli found in a farm’s raw milk came from the local hay from the farm and were also found on the cows’ teats».

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4. Interaction between the microflora and the cheese adds aromatic diversity and complexity

**ECOSYSTEM** « one microflora in one environment »

In each cheese, the biochemical environment differs involving specific behaviour of microflora and then a specific production of aromas.

Illustration with 3 maps representing 3 different biochemical environments inside cheese:

- **Fruitière 1**
- **Fruitière 2**
- **Fruitière 3**

→ In cheese, microflora works in different ways, depending on its diversity and the cheese environment → production of various aromas linked to the place!
A few relevant key points to improve the link and transmission between microflora and the taste of place

Actions - Attitudes - Care

- Cows and fodder
- Milking environment and farm practices
- Milk collection
- Artisanal cheese-making in small cooperatives
- Affinage
1. COWS AND FODDER

MINDSET: the farmer should think as a cheese producer in order to produce a milk rich in proteins and good native microflora

- Utmost attention to the quality of the hay and the pastures

- Basic diet of grass and hay produced on the farm

- Cows graze all day long in permanent pastures from spring to autumn

- The cows eat their farm’s hay in the winter

- The annual production of a farm is about 270,000 liters or 630 wheels (71,280 gal.)
2. MILKING ENVIRONMENT AND PRACTICES

MINDSET: Combining safety concerns with the preservation of microflora of interest for cheesemaking

- Milking twice a day and every day. No milking robot

- No sanitizing during milking:
  - no sanitizing of milking equipments
  - no sanitizing of udder before milking

- Application of safety procedures (HACCP): for example, washing milk machine with alkaline and acidic solutions and then rinsing
# 3. MILK COLLECTION

**MINDSET**: respect the milk’s microflora

- Milk is collected and stored at 12°C
- Milk is collected from farms within a 16 miles diameter
- Milk is collected every day
### 4. ARTISANAL CHEESEMAKING

#### MINDSET: respect the milk’s microflora - small volumes of milk and small batches of cheese

- 8 to 35 Comté milk producers per *Fruitière*

- Rennetting within 24 hours after the first milking; only 2 milkings are mixed

- Careful preparation of the whey starters and monitoring of the cooking temperature of the curd

- The cheesemaker adapts to the variations of the milk’s characteristics throughout the year (season, rainy period, changes in pastures, calving period,...)

- Respect of HACCP control points
### 5. AFFINAGE

**MINDSET : adapt to each cheese and its microflora (origin)**

- Ripening in cellars for a minimum of 4 months
- Aging continues until the aromas are developed (8 months on average)
- Careful monitoring of each wheel in order to achieve the best possible balance of aromas and texture
Conclusion

-Milk quality,
-Raw milk with dominant microflora of interest for cheesemaking, and
-Long aging,

are important requirements to produce cheeses with aromas that express a place, but are not sufficient!

A chain of specific actions and mindsets are necessary starting at the level of the farmer to allow the microbial ecosystems to work in cheese while technological parameters are controlled.
For more details or questions:
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