Soft Ripened White Mold Cheeses

The Science and the Art

Casein

Dairy Australia Webinar 2017

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H^+ $Ca_3(PO_4)_2$ H^+

PHOLIA FARM
Farmstead
Hand Made
Raw Milk Aged Goat Cheeses

Summary

- The three core cheesemaking technologies for bloomies
  - Lactic
  - Rennet
  - Stabilized
- Food Safety Reminder
- The key factors to remember during production
- Buffering review
- pH goal benchmarks
- Starter culture options
- Surface molds and yeasts
- The influence of rennet
- Moisture and pH at hooping/forming
- The role of salt
- Affinage

The Three White Mold Technologies

- Lactic
  - Examples: Most French soft ripened goat cheeses
  - Characteristics: Firm paste, thin rind with some softening around rind. Crumbly. Small format
- Make in Nutshell:
  - Little to no rennet
  - Long coagulation to low pH, about 4.4-4.6
  - Wet, acidic curd drained in bags or open meshed small forms
  - Bag drained curd is often reformed into wheels

The Three White Mold Technologies

- Rennet Traditional– softened paste
  - Traditional Camembert and Brie
  - Soft, runny paste when ripe
- Make in a Nutshell:
  - Quick rennet coagulation (relatively)
  - Little to no stirring
  - Large wet curds at hooping
  - pH at dehooping <5.0

The Three White Mold Technologies

- Rennet – stabilized paste
  - Exported and mass produced Camembert and Brie
  - Characteristics: Soft paste with long shelf stability.
  - Artisans can use stabilization techniques too!
- Make in a Nutshell:
  - Quick rennet coagulation
  - More stirring of curds and smaller curd size
  - Possible other stabilization techniques
    - Washing curd
    - Adding fat

Don’t forget these are “High Risk” Cheeses!

- Both pasteurized and raw versions are considered high risk.
- Post contamination potential
- High surface pH – sometimes 8.0!
- Keep in mind when designing production flow
- Address in food safety plans

The Keys to All Bloomies

- Buffering
  - Milk's natural buffering
  - How you manipulate it through pH developement
- Surface de-acidification – raising the pH
  - How you manipulate it with yeasts
  - How you manipulate it with molds
  - How salt manipulates the yeasts and molds
- Softening of the paste
  - How the surface flora change the interior
  - How the environment helps

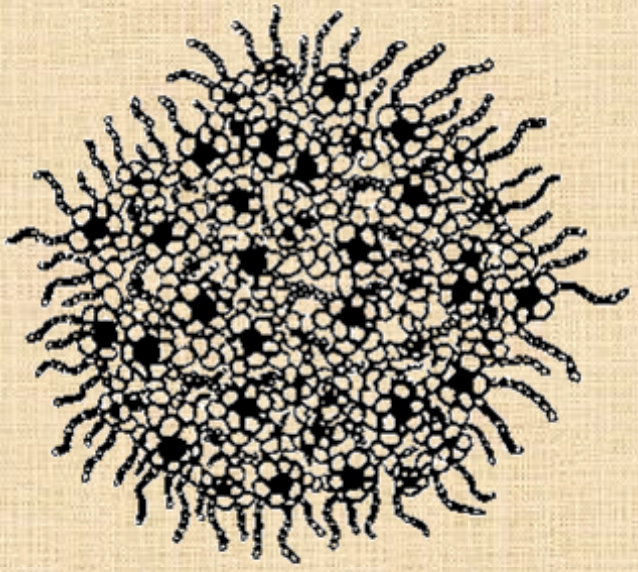
It’s all about Buffering

- Buffer Basics
  - Compounds that have the ability to resist changes in pH (free hydrogen ions)
  - Buffering Capacity of milk
    - The only reason we can make cheese
    - The better the milk’s buffering capacity the more time you have to make all cheeses

Milk's Powerful Buffering Ability

The Casein Micelle

- Caseins the major buffer in milk
- Calcium Phosphate as Colloidal Calcium Phosphate (CCP) – Insoluble
  - Pre-bound ionic calcium
  - Usually 2/3 of the total CP in milk
  - Exists in milk in greater quantity in milk than would be normal in another solution of the same pH
  - Combines with lactic acid to form calcium lactate



Comparison of Benchmarks

	Lactic	Traditional Rennet	Stabilized
pH at renneting	6.00 – 6.30	6.10-6.30	6.40-6.55
pH at unmolding	≤ 4.45	4.65-4.85	4.95-5.20
Ca/FFDM (**mineralization)**	<0.4%	0.8-1.7%	1.8-2.3%
Best Before	2-9 weeks	6-10 weeks	7-15 weeks

Starter Culture Choices

- Mesophiles
  - Produces more acid by hooping time
    - Less minerals in curd
    - Less buffering
  - Aroma
- Thermophiles – TA 50
  - Keeps the pH higher at hooping
    - More minerals in curd
    - More buffering
  - Exopolysaccharides
    - texture

Comparison of Cultures and Rennet Used

	Lactic	Traditional Rennet	Stabilized
Starter	Mesophilic	Mesophilic and Thermophilic	Thermophilic
Rennet (ml/100L, 26 gal)	4-12	16-25	25-40
Geotrichum	++	+	+
P. camemberti	+	++	+

Yeast's Role

- Deacidification
  - Vary in rate of surface deacidification
  - Vary on salt tolerance
- Gas Production Inside
  - Vary on whether gas is produced
  - Eyes inside are helpful for many traditional bloomy types
- Fat and Protein breakdown
  - Vary on ability to help soften the cheese
  - Vary on ability to produce other flavors

Comparison of Yeast Options

	Ferments on surface	Ferments inside plus gas	Neutralizing surface pH
KL- *Kluyveromyces lactis*	Yes	Yes	+
CUM – *Candida utilis mesophile*	Yes	Yes, glucose only	+++
DH – Debaryomyces hansenii	Yes	No	++

Geotrichum's Role

- Further de-acidification of rind
- Aroma
- Rind thickness

Comparison of Geotrichum Options

	Appearance	Growth Rate	Salt tolerance	Flavor	Lipolysis Proteolysis
Geo 15	Yeast like, cream	++	+	+	4x < PC
Geo 13	Intermediate	+	+	+	"
Geo 17	Mold like, white	++	+	+	"

Penicillium camemberti's Role

- Rind texture
  - Choice of PC influences texture
- Rind thickness
  - Each PC grows at a different thickness and height
- Rind aroma and paste flavor
  - Different aroma compounds produced
  - Different flavor compounds produced
- Paste texture
  - Draws lactate from paste to deacidify and allow for softening

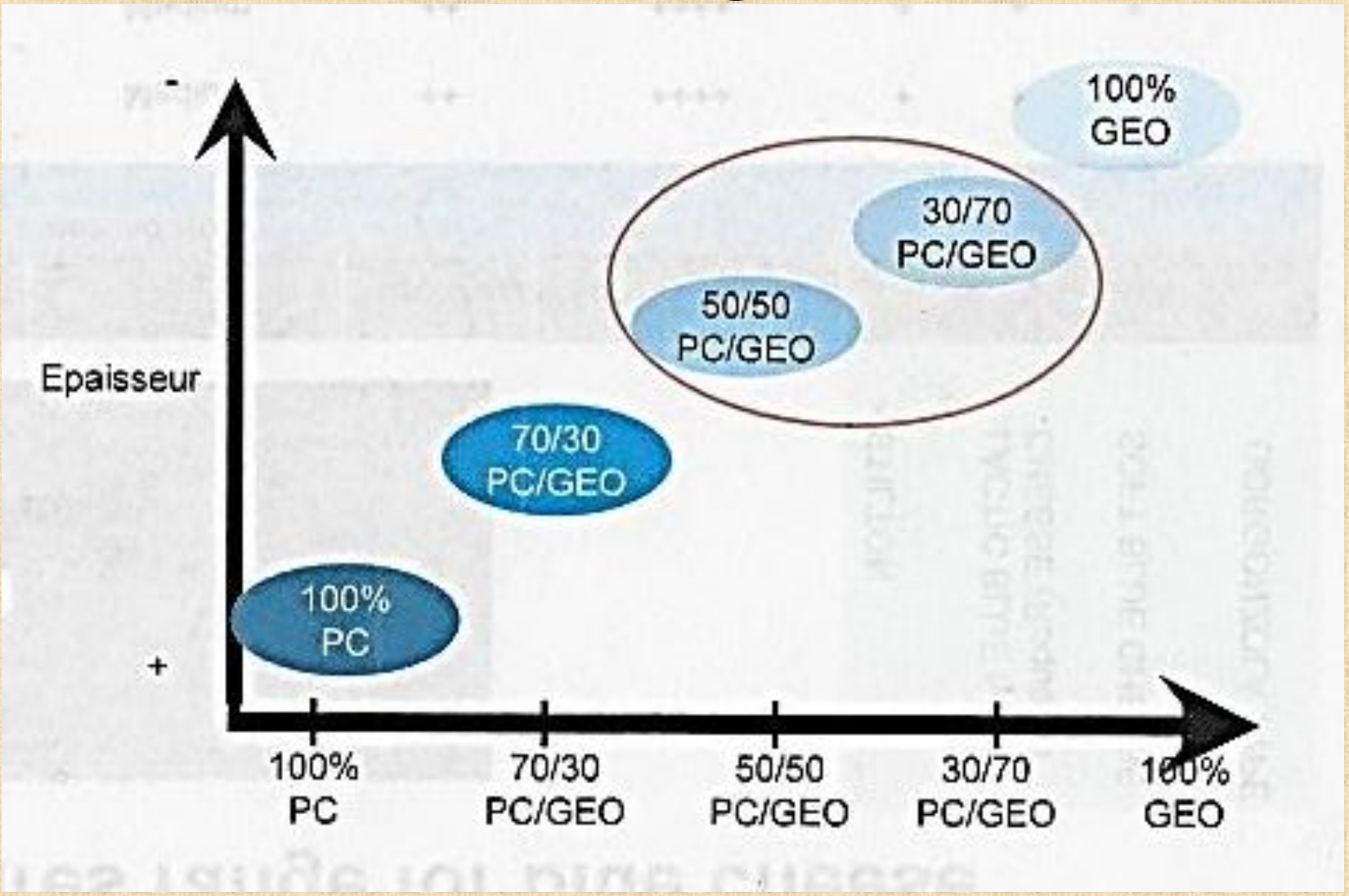
Comparison of PC (Choozit 10d)

	Whiteness	Growth Rate	Thickness	Proteolysis	Lipolysis	Other
ABL						
HP 6	+++	+++	++	+++	++	
Neige	++	+	++++	+++	+++	
PC VB	++	+	++++	++++	+++	
SAM 3	++	+	+++	++	++	Anti mucor

Rates of Dosing PC to Geo

		LACTIC SOFT CHEESE	MIXED SOFT CHEESE	STABILIZED SOFT CHEESE
Yeasts	CHOOZIT® DH	1 dose* for 1000L of milk		
	CHOOZIT® KL 71 - CUM	2 doses for 1000L of milk		
Geotrichum candidum	CHOOZIT® GEO 13 - 15 - 17	1-2 dose(s)** for 1000L of milk	2 doses* for 1000L of milk	
Penicillium camemberti	CHOOZIT® PC 02 - 12 - 22 - HP 6 - NEIGE - SAM 3 - VS - VB	2 to 5 doses*** for 1000L of milk		

Ratio of Dosing PC to Geo



How Rennet Affects Bloomies

- More rennet
  - More stirring
  - More loss of whey early
  - More minerals retained
- During aging
  - Small role in proteolysis
- The Type of Rennet

Resolubilization Review

- Several key pH/acid goals MUST be achieved if a soft texture is desired by the end of aging
  - High moisture at drainage means….
    - Loss of minerals during draining which means…
    - Loss of buffering capacity of curd
  - Low pH of 4.7-ish means…
    - Presence of lots of lactate (lactic acid) to feed yeasts first then white molds which means…
    - Consumption of lactic acid by white mold raises the pH by both acid consumption and ammonia production which means…
    - Casein returns to the point (above about 5.1) when it “likes” water again

Moisture at Hooping - Lactic

- Lactic
  - Tremendous loss of minerals before hooping
  - Low buffering capacity
  - Low pH
  - High lactate content
  - Crumbly texture

Moisture at Hooping – Rennet Trad.

- Rennet Traditional
  - Wet curd at hooping = loss of minerals during draining = loss of buffering capacity
  - Slightly higher pH = faster time to surface flora development
  - Texture can resolubilize

Moisture at Hooping – Stabilized

- Curd drier at hooping, higher pH
  - Higher buffering capacity
  - Sweeter curd
  - Faster rind growth
  - Firmer paste
  - Longer aging

The Role of Salt in Bloomies

- Drainage
  - Helps draw moisture from curd
- Rind Growth
  - Influences PC vs Geo
  - Limits other molds
- Flavor
- Preservation
- Goal Salt Amounts
  - 1.7 – 1.8% of weight of curd
  - Or brine 30 – 60 min.

Aging Needs

- Drying phase
  - Yeasts, Geo
  - 24-48 hours
  - 54-64 F
  - Room humidity about 80%
  - Small fan helpful

Aging Needs

- Aging phase I
  - 45-60F
  - 85 - 95 % RH
  - Turn daily
  - Lots of air exchange

Aging Needs

- Aging phase II
  - Wrap when mold growth is even and not too thick
  - Continue to age at 45-55F
  - Same humidity

Surface Invaders

- Historical perspective – is it contaminated or is it traditional?
- Sources of unwanted fungi:
  - Dairy farm
  - Make room
  - Aging room
- Petri-film yeast and mold plates to monitor milk
- Worker cleanliness
  - Hair
  - Street clothes
- Surface cleaning
- Air cleaning
  - Ozone
  - UV

Sources

J Food Prot. 2003 Dec;66(12):2355-8.

Use of ozone to reduce molds in a cheese ripening room.

Serra R[1], Abrunhosa L, Kozakiewicz Z, Venâncio A, Lima N.

Microorganisms 2017, 5(3), 42; doi:10.3390/microorganisms5030042

Review

Diversity and Control of Spoilage Fungi in Dairy Products: An Update

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