Suitability of organic raw milk for cheesemaking according to seasons

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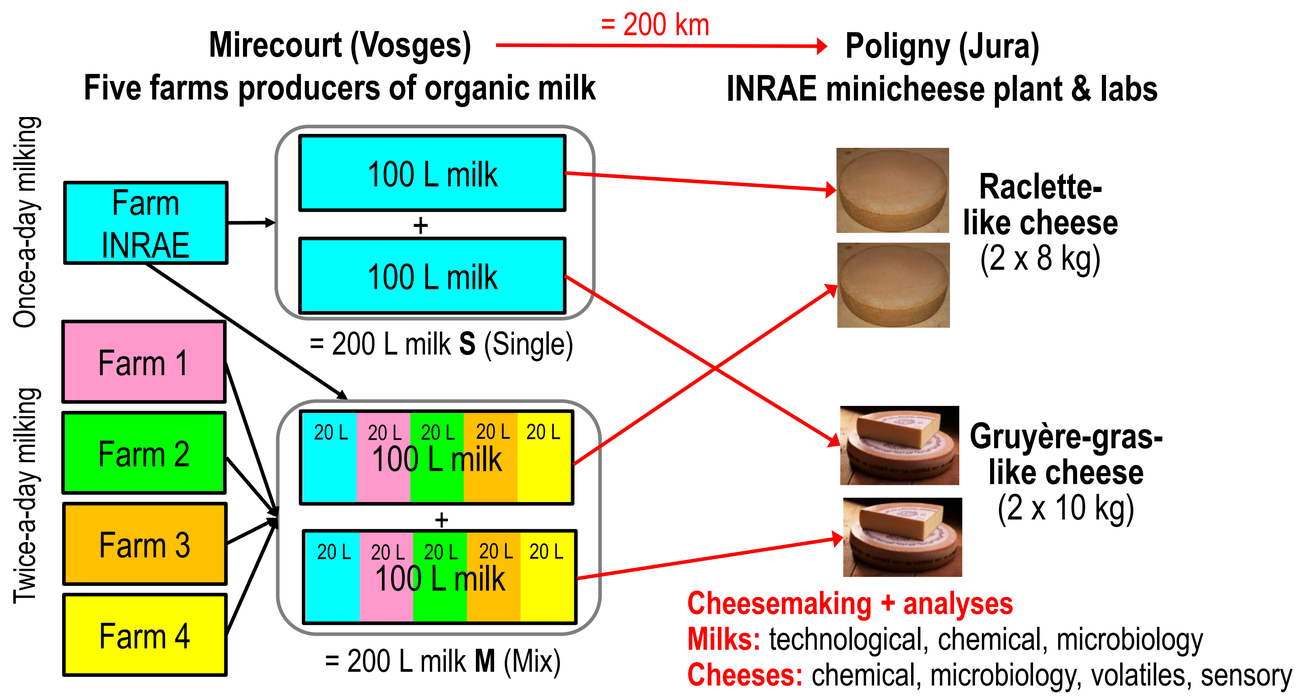
Introduction

Artisanal cheesemaking may be a good way to enhance added value on farms, particularly for dairy cattle organic farms. However, these systems, in particular grazing systems, are sensitive to weather conditions for forage production, a key factor in milk quality.

→ The aim of this work was to study

1. the variations of milk according to the production conditions, in particular climate hazards,
2. the consequences on cheesemaking properties (laboratory cheese yield and coagulation ability) and cheese quality.

Material and methods



5 periods (seasons) = May (1), Early-July (2), Mid-July (3), November (4), February (5)
3 replicates at each period except (2) = climate hazard (heat-wave until 36°C), only once

Main results

Variance Analysis on milk characteristics

(interactions Season x Milk)

	1 x S	1 x M	2 x S	2 x M	3 x S	3 x M	4 x S	4 x M	5 x S	5 x M	P Season	P Milk	P SxM
Proteins g/L	36.3 b	35.6 bcd	34.5 cd	33.0 e	35.1 bcd	34.2 d	39.1 a	35.1 bcd	36.0 bc	35.0 bcd	***	***	***
Fat g/L	42.7 cde	38.6 f	45.0 b	41.9 e	44.0 bcd	41.4 e	51.6 a	42.2 de	44.5 bc	41.0 e	***	***	***
Ca g/L	1.20 b	1.17 b	1.21 b	1.19 b	1.16 b	1.17 b	1.30 a	1.21 b	1.22 b	1.19 b	***	*	NS
Yield/DM %	68.4 bcd	64.9 e	68.2 bcd	65.9 de	69.3 bc	66.3 cde	76.6 a	68.9 bcd	70.7 b	66.5 cde	***	***	**
R min	16.4 cd	15.3 d	20.2 a	15.4 d	17.8 bc	16.4 cd	18.9 ab	17.7 bc	16.2 cd	15.3 d	***	***	*
K20 min	21.3 cd	19.6 d	28.7 a	22.0 cd	25.1 b	22.7 c	23.5 bc	22.7 c	21.1 cd	19.6 d	***	***	**
K20/R	1.30 b	1.29 b	1.42 a	1.43 a	1.41 a	1.38 a	1.24 b	1.28 b	1.31 b	1.29 b	***	NS	NS
UFA %	34.2 b	34.9 b	36.2 ab	37.9 a	36.3 ab	38.6 a	38.4 a	37.9 a	31.0 c	30.9 c	***	NS	NS

Seasons: 1=May, 2=Early-July heat-wave, 3=Mid-July, 4=Nov, 5=Feb **Milks:** S=Single, M=Mix

Milks particularly rich in fat, especially once-a-day milked S milks
Protein, fat, Ca contents and yield impacted by Season and Milk (higher with S milk in November)
Technological quality affected mostly by Season then by Milk
→ coagulation time (R) and firming time (K20) impaired by heat-wave in S milk, firming speed (K20/R) impaired by summer conditions (2 & 3)
As expected, fatty acids more unsaturated (UFA) with grass-based feed (July and November)

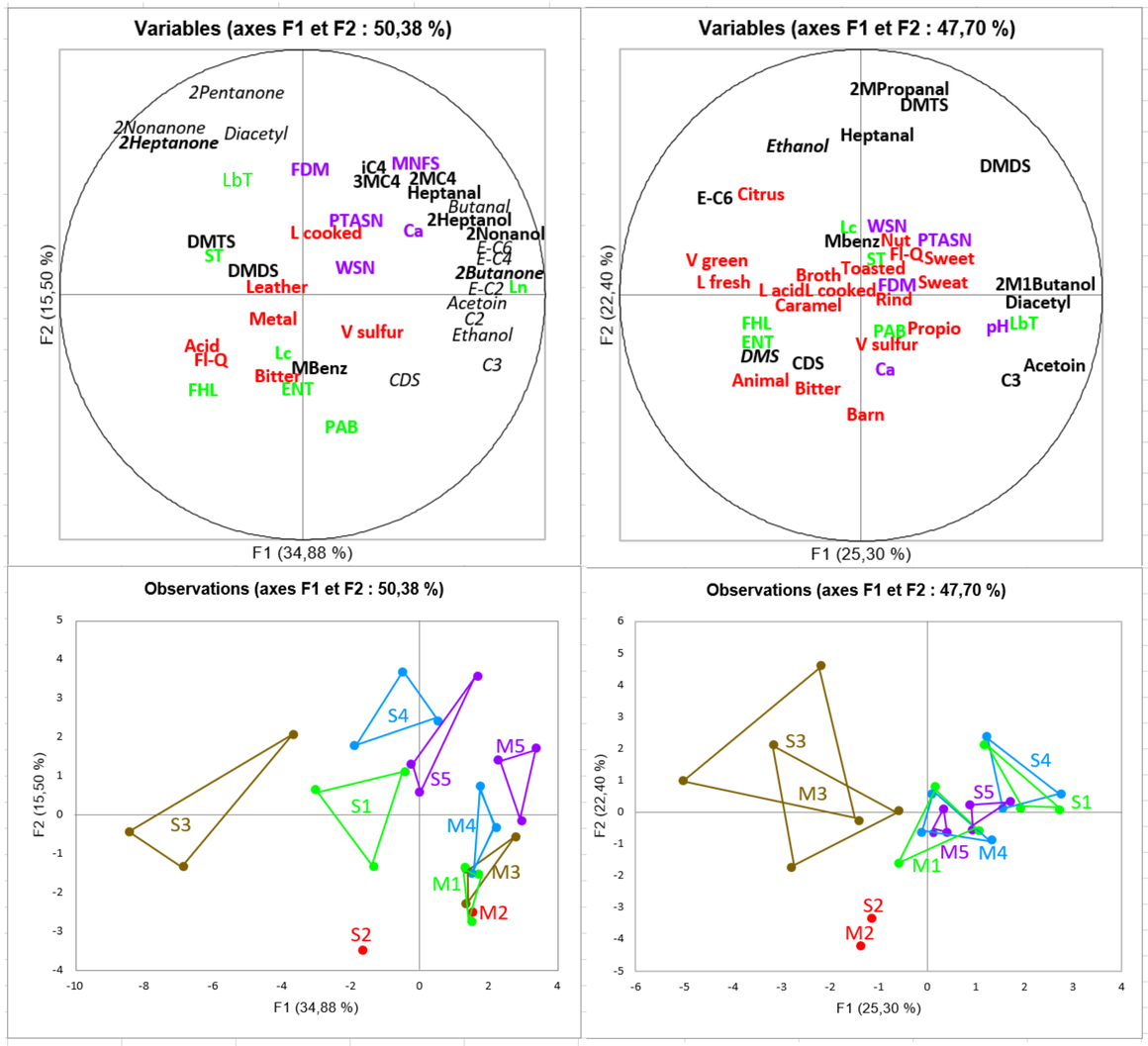
Volatile compounds of cheeses

Raclette: Milk more discriminant than season, seasons more different with S milk
With S milk, effect of Early- (climate hazard) and Mid-July: less volatile compounds
Gruyère-gras: Less volatile compounds affected by Season or Milk than in Raclette
Most effect = Season, similar composition according to Milks
As in Raclette, effect of Early- (climate hazard) and Mid-July
→ less volatiles, but for both Milks

Principal Components Analysis on cheese volatiles (in black)

Supplementary variables : microbial populations (in green), chemical variables (in violet), sensory descriptorss (in red)

Raclette-like **Gruyère-gras-like**



Variables: **Bold**: volatiles affected by season, *Italic*: volatiles affected by milk
-C2, C3, iC4, 2MC4, 3MC4: acetic, propionic, isobutyric, 2methylbutyric, 3methylbutyric acids
-E-C2, E-C4, E-C6: ethyl esters of acetic, butyric, hexanoic acids
-CDS, DMS, DMDS, DMTS: sulfur compounds (C: carbon, D: di, T: tri, M: methyl, S: sulfide), Mbenz: methylbenzene
-FDM: fat/dry matter, MNFS: moisture/non fat substance, WSN: water soluble N, PTASN: phosphotungstic acid soluble N
-LbT: thermophilic lactobacilli, ST: Streptococcus thermophilus, FHL: facultatively heterofermentative lactobacilli, PAB: propionic acid bacteria, Lc: lactococci, ENT: enterococci, Ln: leuconostocs
-Fl Q: flavour quality, L: lactic, V: vegetal
Observations: **S**: single milk, **M**: mix milk, **1-2-3-4-5**: seasons

Conclusions

Organic milks showed a high compositional and technological variability according to seasons.
Variability was higher with a single milk compared to a mix
→ the technical quality was more impaired by the heat-wave in single milk than in mix milk.
In the present conditions, Gruyère-gras technology was more robust than Raclette technology
→it showed less variations in volatile composition according to studied factors.
With Raclette, mix of milk showed more robustness than single milk
→ less variations in cheese volatile composition

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