Which methodology to study the effect of farming practices on the cheese sensory properties ?

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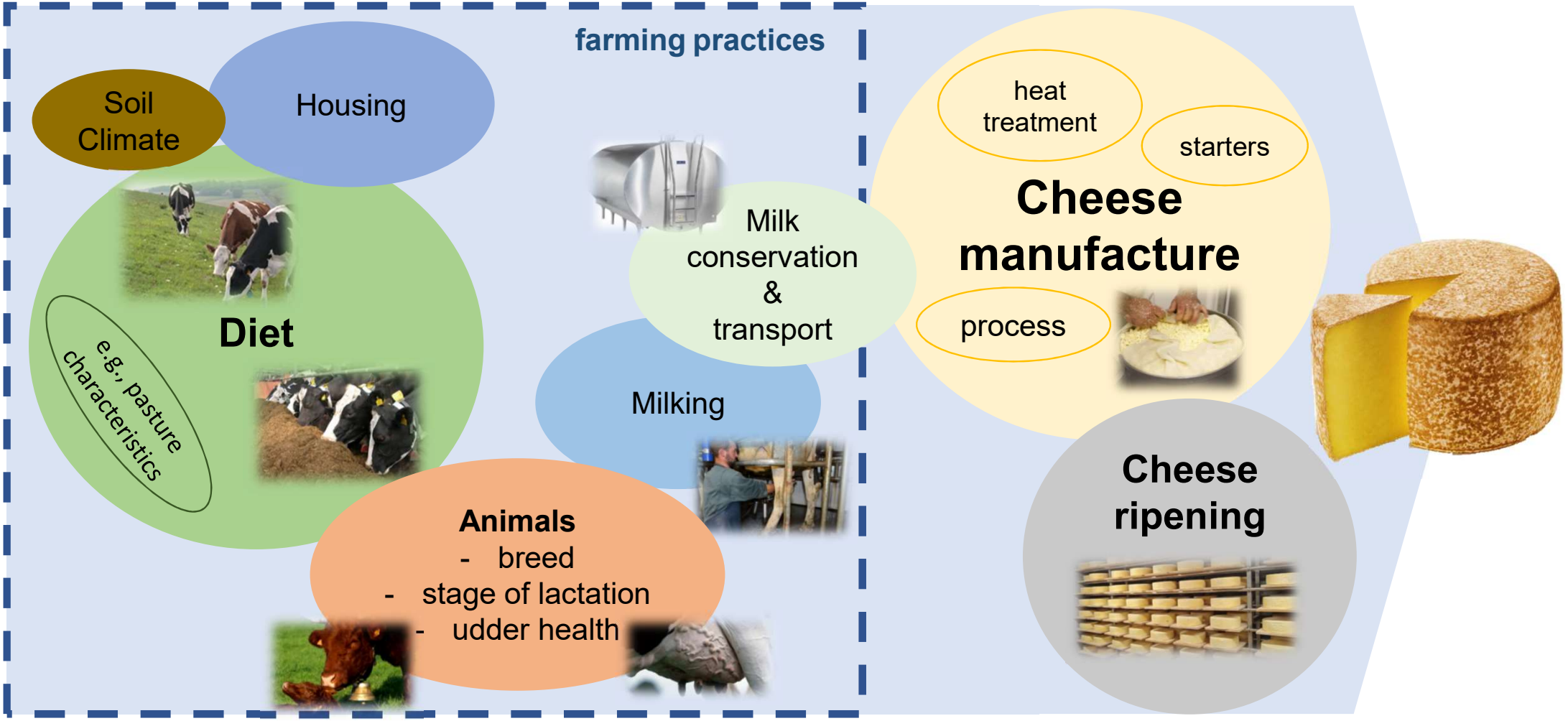
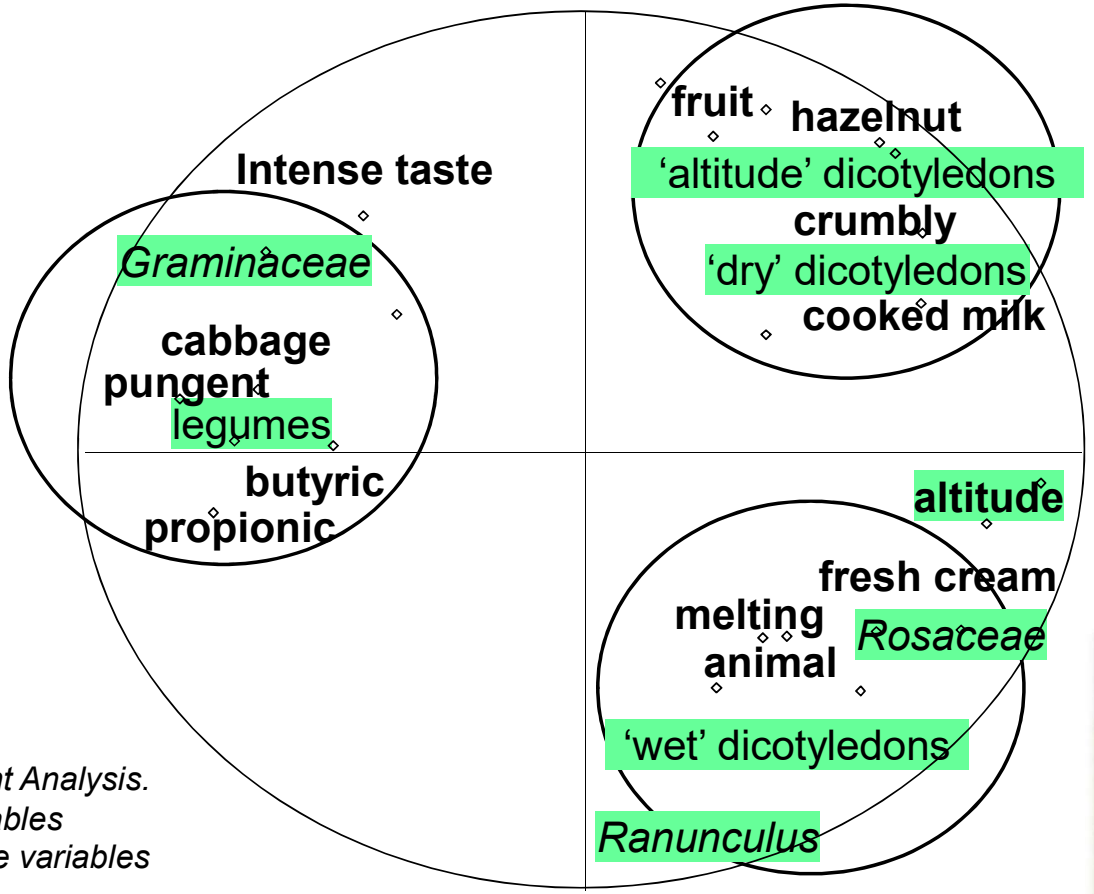
Linking farming practices to cheese sensory properties



On-farm association between cheese sensory properties and pasture characteristics – the case of Abondance cheese



Highlands

Axis 1 & 2 of a Principal Component Analysis.
Pasture characteristics: active variables
***Cheese characteristics:** illustrative variables*

Bugaud et al., 2001
Martin et al., 2005

Experimental methods

To understand and quantify the effects of changes in farming practices on the sensory properties of cheese, we require experimental approaches controlling for:

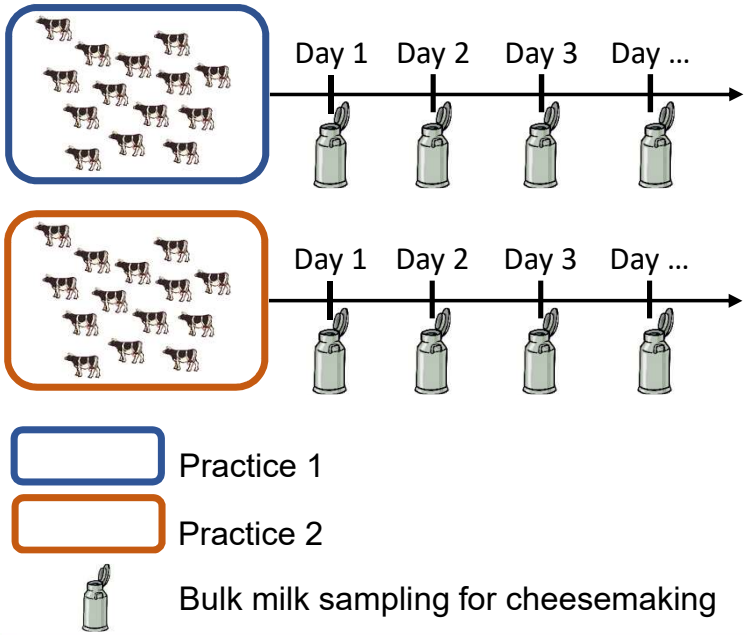
- **Environmental effects** → research facility
- **Cheese manufacture and ripening** → experimental dairy and cellar

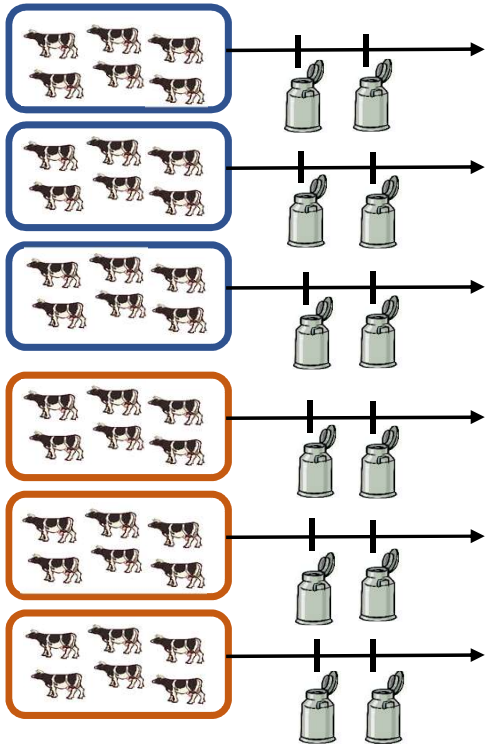
INRAE Marcenat

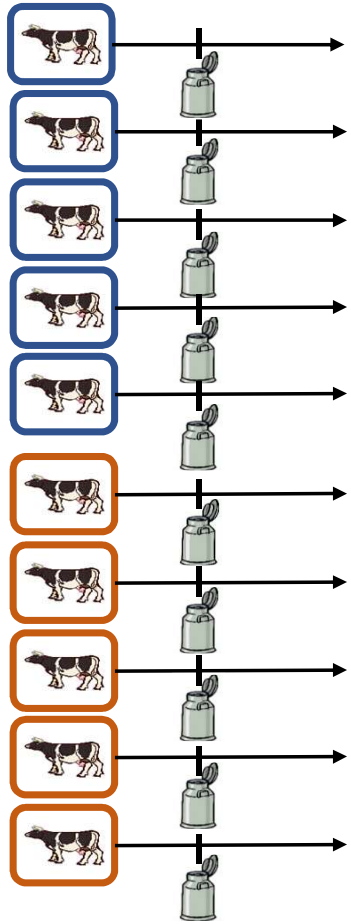
INRAE Aurillac

INRAE Aurillac

Which experimental approach ?







Practical relevance and practicability

Statistical replication

Experimental setup

- INRAE Herbipôle research facility in Marcenat, 1100 m a.s.l.
- Two contrasted systems, on adjacent grasslands:
    - 12 cows each
    - 1 month on respective pasture plots (June 2019)
    - *ad libitum* pasture allowance + mineral blocks
    - no concentrate feed

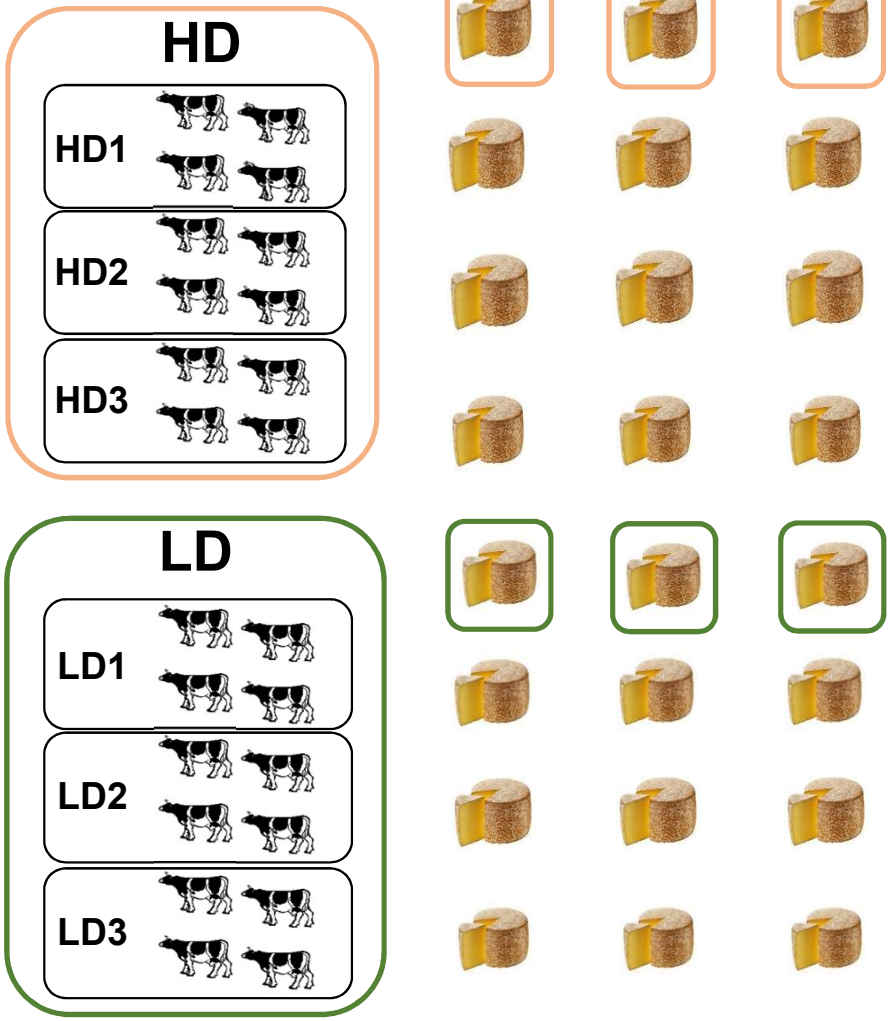
High biodiversity pasture (HD)

- permanent grassland
- 74 botanical species

Low biodiversity pasture (LD)

- old temporary grassland
- 31 botanical species

Experimental design



Subgroups

- 4 cows each
- balanced by:
  - breed
  - lactation stage
  - milk fat
  - milk protein

Cantal-type cheeses

- simultaneous processing/sampling
- ripened 9 weeks
- weight: 500 g

Cheese sensory evaluation

- 10 trained panelists
- 1 session / cheesemaking day
- sequential monadic presentation
- 25 sensory attributes graded on an unstructured scale:

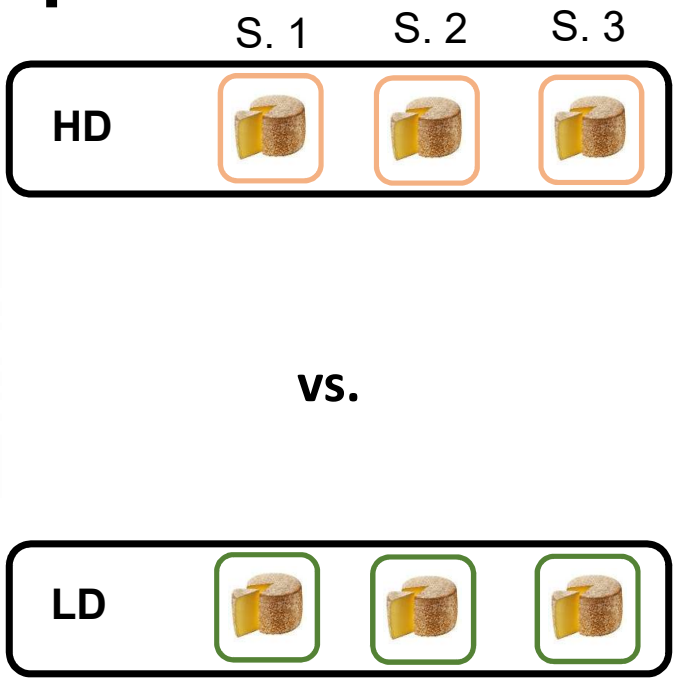
0 ——— 10

Appearance & texture	Odor	Flavor
Color of the curd Exudate Firmness by touch Firmness in the mouth Meltiness	Dry fruits/hazelnut Lactic Barny Rancid Silage	Acid/Bitter/Salty Herbal Dry fruits/hazelnut Spicy Barny Persistence

Sensory lab, VetAgroSup

- **Data analysis**: mixed linear models with mixed procedure in SAS

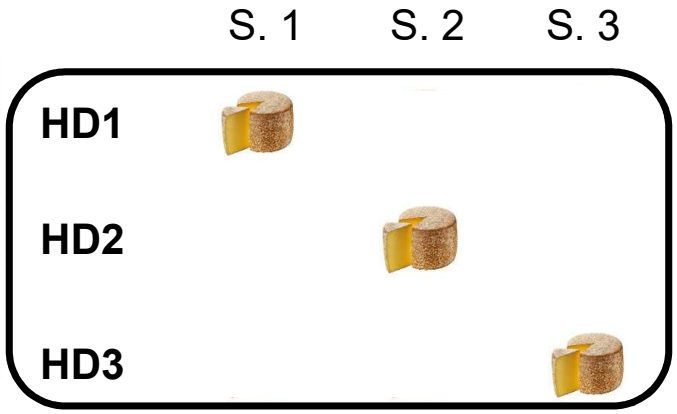
Results (1) – Repetition



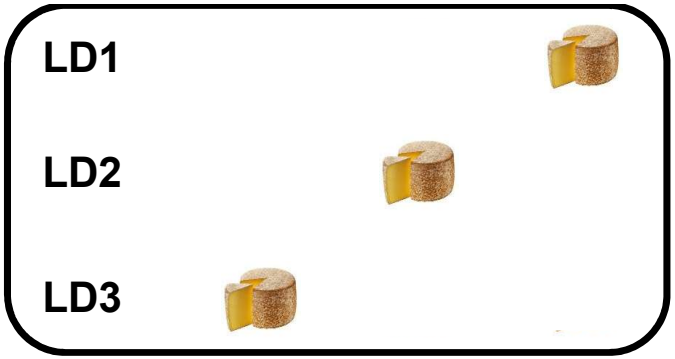
Model
Dependent variables: sensory attributes
Fixed effect: Pasture type
Random effect: Panelist
Repeated effect: Sampling

→ No significant effect of the pasture type on any sensory attribute.

Results (2) – Replication



vs.



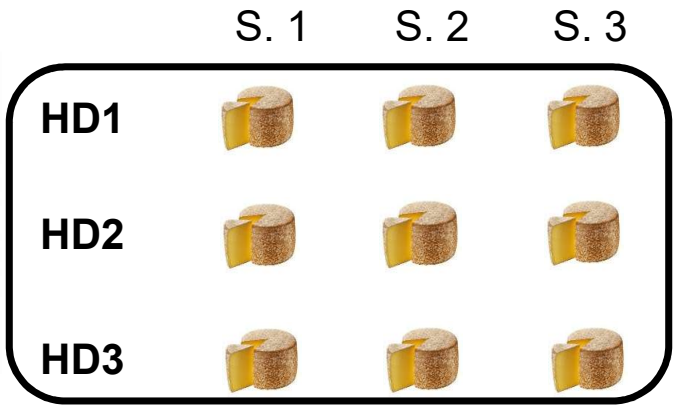
This and any other possible combination of 1 cheese per subgroup per pasture type…

Model

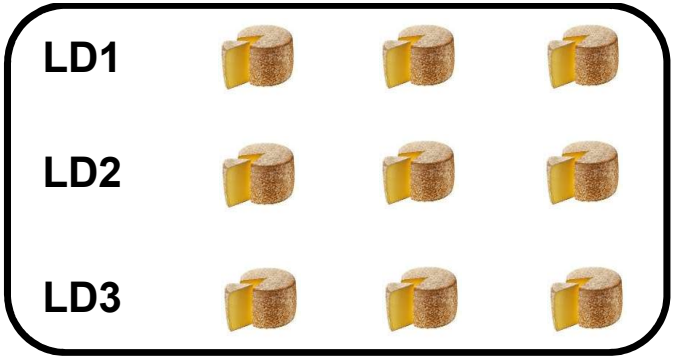
- Dependent variables: sensory attributes
- Fixed effect: Pasture type
- Random effect: Panelist

→ **No significant effect of pasture type on any sensory attribute.**

Results (3) – Replication and repetition



vs.



Model

- Dependent variables: sensory attributes
- Fixed effect: Pasture type
- Random effects: Subgroup, Panelist
- Repeated effect: Sampling

Significant effect of pasture type on:

Grade (0-10)	HD	LD	SEM
Firmness**	5.7	**6.4**	0.28
Dry fruits odor**	**3.2**	2.6	0.64
Dry fruits flavor**	**3.1**	2.5	0.61

$^{**}P < 0.01$

In line with on-farm observations!

Conclusions

- Which is the method of choice?
  - probably no “one fits it all” solution
  - depends on the variability induced by differing practices on the sensory attributes

- Further experiments with **more contrasting practices** required
  - e.g., comparing conserved *versus* fresh forages

- **Higher number of replicates**

  …within the limits of practicability in relation with:
  - infrastructure
  - experimental simultaneous cheesemaking
  - descriptive sensory analysis (e.g., number of trained panelists, sessions…)

Thank you for your attention !

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- Swiss Society of Animal Sciences (SSAS)

Other results in the frame of this TNA project:

Manzocchi E, Martin B, Bord C, Verdier-Metz I, De Marchi M, Bouchon M, Constant I, Giller K, Kreuzer M, Berard J, Musci M, Coppa M. 2021. Sensory characteristics and composition of milk and uncooked pressed cheeses from cows fed hay, silage or herbage on pasture and indoor. *Journal of Dairy Science* 104:5285-5302.

Manzocchi E, Ferlay A, Farizon Y, Enjalbert F, Bouchon M, Giller K, Kreuzer M, Berard J, Martin B, Coppa M. Herbage utilization method affects ruminal biohydrogenation of dietary fatty acids and milk fatty acid profile in Holstein and Montbéliarde cows. In preparation for *Animal*.

Further ongoing analyses on the transfer of the microbiota from soil to cheese…Stay tuned!

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