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Bacterial and botanical diversity of pastures affects raw milk Cantal-type cheese sensory properties

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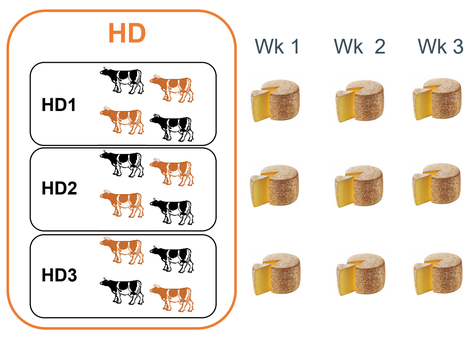
Introduction

- Botanical diversity of pastures is associated with sensory characteristics of raw milk cheese (Martin *et al.*, 2005)
- Bacterial species diversity in the phyllosphere in association with pasture botanical diversity may also drive the development of raw milk cheese sensory quality (Frétin *et al.*, 2018)
- **Hypothesis:** the pasture botanical diversity shapes the bacterial communities along a continuum from plant aerial surface to raw milk and finally to raw milk cheese

Materials & Methods

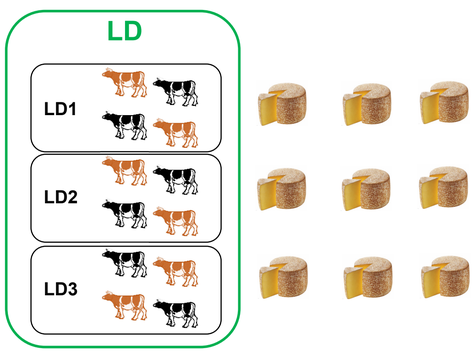
- **Experimental design** (with real treatment replication)

Highly biodiverse pasture (HD)
Permanent grassland
74 botanical species
Shannon diversity index ***H'* 312**



Subgroups
- 4 cows each (2 Montbéliarde, 2 Holstein)
- Balanced by:
  - Lactation stage
  - Milk fat and protein content

Less biodiverse pasture (LD)
Ancient temporary grassland
31 botanical species
Shannon diversity index ***H'* 219**



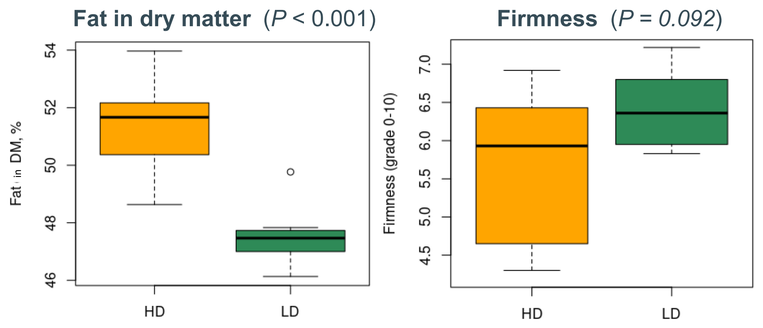
Cheese model
- Cantal-type
- Morning milking
- Simultaneous cheesemaking of subgroups
- 9 weeks of ripening
- weight: ~500 g
- 7 cheeses/subgroup/week

- **Laboratory analyses**
  - Wet chemistry and rheology (uniaxial compression)
  - Cheese sensory analysis
    - 10 trained panelists
    - 1 session / day of cheesemaking
    - Monadic sequential sample presentation
    - 25 sensory attributes graded on unstructured scale (0 to 10)

  - 16S rDNA metabarcoding of bacterial communities

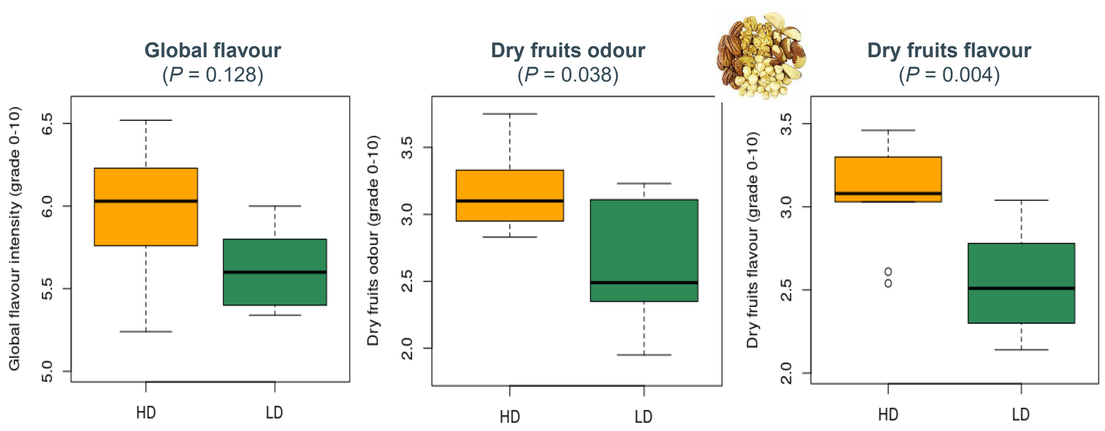
Results

- **Texture of HD and LD cheeses**



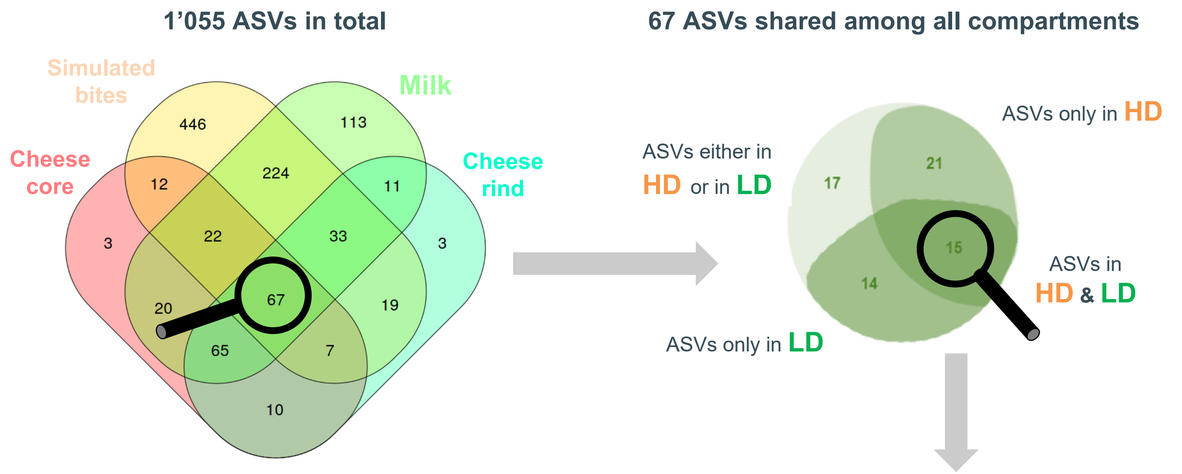
HD cheeses were more fat and tended to be less firm than LD cheeses

- **Odour and flavour of HD and LD cheeses**



HD cheeses had a more intense "dry fruit" odour and flavour than LD cheeses

- **Shared ASVs among compartments**



Among the most abundant ASVs common to HD and LD, 3 ASVs of particular interest for ripening

ASV name	Relative abundance in bacterial community (%) Simulated bites	Milk	Cheese core	Cheese rind	Species
2535950da4f5ce2e05509946880e1912	0.20	5.94	93.03	49.40	*Lactococcus lactis*
4b7d82b0d94caafd265a16ec66ded57e	0.005	0.004	0.008	17.31	*Brachybacterium sp.*
17dfc19d75554282393e010d9c051027	0.018	0.0009	0.0061	8.20	*Brevibacterium aurantiacum*

Low relative abundance of bacterial species known for their role in cheese ripening

Conclusions

- **Some ASVs are shared among all compartments** of both HD and LD systems, whereas **some ASVs** common to all compartments **are specific to HD or LD.**
- The botanical diversity of pastures may contribute to shaping the bacterial communities of milk and cheese through the transfer of microorganisms from the grassland surface to raw milk and raw milk cheese.

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References

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- Frétin et al., 2018. Bacterial community assembly from cow teat skin to ripened cheeses is influenced by grazing systems. Scientific Reports 8:200.
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