

Improving milk quality through grazing and spring-calving dairy systems

Lessons from the French Dairy Living Lab

Consumers are increasingly interested in the nutritional quality of dairy products and the sustainability of their production systems.

Jointly within the European INTAQT and PATHWAYS projects, this French Dairy Living Lab explored the performance of grass-based dairy systems, considering both intrinsic milk quality and extrinsic quality. These organic dairy farms of North-West of France practising spring-grouped calving and maximising grazing, provide an example of how farm management can be organised around grass availability to address to make better use of grassland resources while improving the nutritional profile of milk.

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Organising milk production around grass growth

The main principle of spring-calving grass-based dairy systems is to synchronise cows' nutritional requirements with seasonal grass growth. Grouping calvings in spring allows peak lactation to coincide with the period when fresh grass is most abundant and nutritious.

Successful implementation requires a consistent whole-farm strategy:

- Grouped spring calving: concentrating calvings over a short period to match peak milk production with spring grass growth.
- Strict reproductive management: organising a limited breeding season to maintain a compact calving period from year to year.
- Grazing-adapted animals: selecting robust, moderate-sized cows suited to extensive grazing and outdoor conditions.
- Seasonal management: planning forage harvesting, drying-off and winter feeding around grass availability.



Fig 1: Herd grazing ©Idele

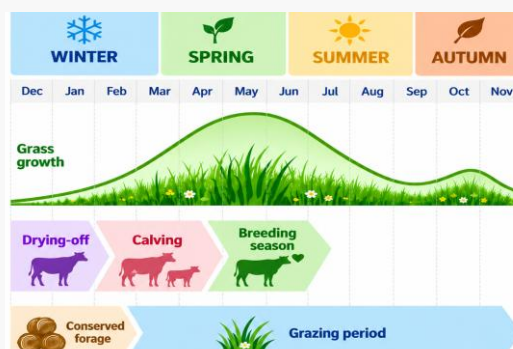


Fig 2: Seasonal organisation of a spring-calving dairy system

Grass-based feeding improves the nutritional quality of milk without deteriorating milk processability

Milk composition is influenced by the cows' diet, particularly the proportion of fresh grass consumed. The INTAQT results highlighted several nutritional characteristics associated with highly grass-based feeding systems.

Milk analyses were processed for 5 farms of this living lab at different seasons (FR1 group). Their feeding systems rely mainly on grazed grass and conserved forage, particularly hay, with little or no concentrate supplementation. Compared with milk from more intensive production systems, milk from the FR1 group showed :

- Higher concentrations of omega-3 fatty acids, particularly alpha-linolenic acid (C18:3 n-3).
- A more favourable omega-6/omega-3 fatty acid ratio.
- Higher concentrations of vitamins B2 and E.
- Higher concentrations of certain fatty acids associated with grass feeding, including conjugated linoleic acids (CLA).

These results illustrate how feeding strategies based on grazed grass can contribute to improving the nutritional profile of dairy products.

Milk from these systems also showed satisfactory technological characteristics, indicating that a high proportion of grass in the diet is compatible with milk processing requirements.

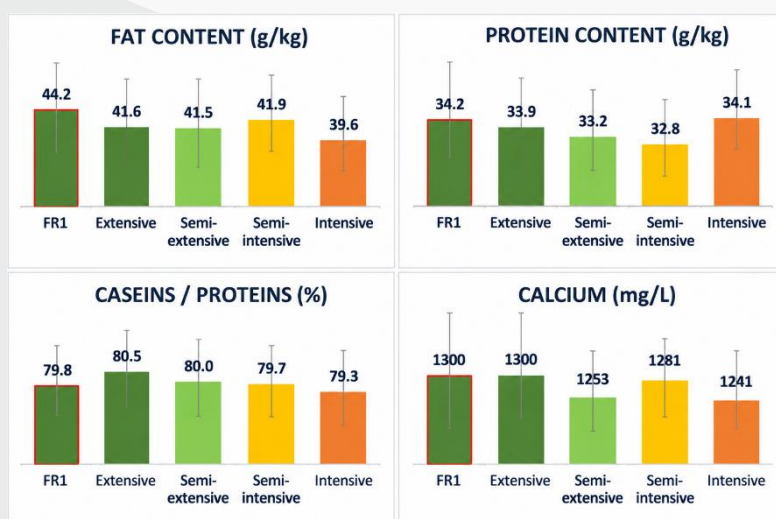


Fig 5: Fat and protein contents, casein-to-protein ratio and calcium concentration across dairy farming systems with different levels of intensification

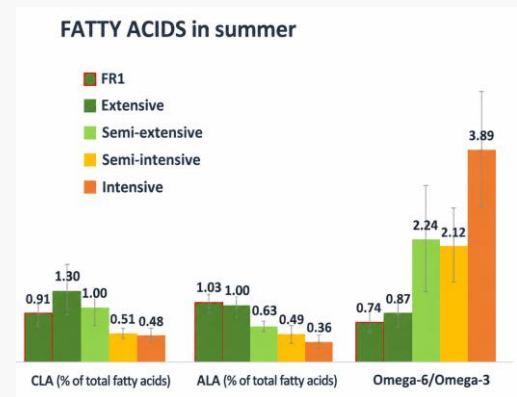


Fig 3: Fatty acids proportions across dairy farming systems with different levels of intensification

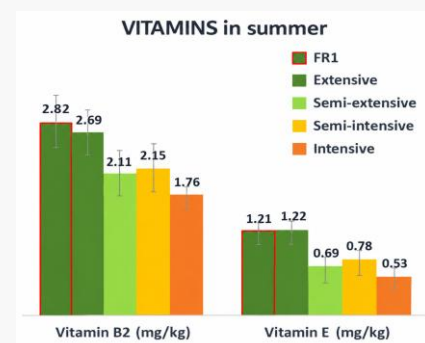


Fig 4: Vitamin B2 and vitamin E concentrations across dairy farming systems with different levels of intensification

Consumer tests were conducted on standardised UHT milk from three French dairy production groups, including FR1. Results revealed differences in colour, aroma and texture between production systems, highlighting the distinctive sensory profile of grass-based milk.

Grass-based dairy systems also provide environmental and economic benefits.

Grass-based dairy systems offer environmental and economic benefits through low-input management and efficient use of grassland resources.

Compared with conventional maize-based dairy farms in Western France, the 10 grass-based dairy farms from the Living lab had smaller herds and lower milk yields (4,500 vs. 7,900 L/cow/year). They relied mainly on permanent grassland, with no maize in their forage area, longer grazing periods (283 vs. 144 days/year), and substantially lower use of purchased concentrates, fertilisers and pesticides.

Despite lower milk production, these systems achieved good economic performance through reduced production costs and lower dependence on purchased inputs.

Tab 1: Performance of grassland-based dairy systems compared with conventional systems

Indicator	Living lab farms	Reference farms
Number of farms	10	3,839
Utilized agricultural area (ha)	75	108
Main forage area (ha)	70	72
Maize in forage area (%)	0	45
Dairy cows (n)	48	80
Milk yield (L/cow/year)	4,500	7,900
Labour (FTE)	2.1	1.9
Grazing duration (days/year)	283	144
Concentrates (kg/1,000 L milk)	18	171
Feed costs (€/1,000 L milk)	56	132
Net carbon footprint (kg CO ₂ -eq/L milk)	0.47	0.88
Available income (€/1,000 L milk)	275	161

The French Living Lab also demonstrated the value of farmer-to-farmer exchanges and collaboration with researchers.

Sharing farm results and practical experience helps farmers identify suitable solutions and communicate the benefits of grass-based systems to wider audiences.

Concentrate use was nearly ten times lower (18 vs. 171 kg/1,000 L milk), resulting in reduced feed costs (€56 vs. €132/1,000 L) and higher available income per 1,000 L of milk (€275 vs. €161).

Permanent grasslands also contribute to carbon sequestration and biodiversity preservation. Accounting for carbon sequestration, the estimated net carbon footprint was substantially lower (0.47 vs. 0.88 kg CO₂-eq/L milk), representing a reduction of nearly 47%.

Furthermore, grass-based systems contribute to more circular and resource-efficient agriculture by making better use of land unsuitable for crop production, thereby reducing competition between animal feed and human food production.

These findings highlight the potential of grass-based systems to combine nutritional milk quality, environmental benefits and economic viability.

The experience of the French INTAQT-PATHWAYS Dairy Living Lab highlights that improving milk quality through grass-based feeding requires more than simply increasing grazing time. It involves adapting the entire farming system to seasonal grass availability.

Key lessons include:

- Think at whole-farm level: coordinate calving, reproduction, grazing, forage harvesting and winter management.
- Adapt the herd to the system: favour animals capable of maintaining production and reproductive performance under grazing conditions.
- Make the most of grassland resources: maximise the contribution of grazed grass while limiting reliance on purchased feed.

Spring-calving grass-based dairy systems offer a coherent strategy to improve milk nutritional quality while making efficient use of grassland resources. Results from the INTAQT-PATHWAYS French Dairy Living Lab highlight higher concentrations of several nutritionally valuable milk compounds, alongside low-input production strategies and positive environmental and economic performances.

The main lesson is that the benefits of grass-based feeding depend on the organisation of the whole farming system. By aligning herd management with grass growth, farmers can produce milk with distinctive nutritional characteristics while contributing to more sustainable dairy production.



Fig 6: Communicating with younger generations about grazing-based farming systems: a priority for the farmers in the INTAQT-PATHWAYS French Dairy Living Lab. ©idele



Fig 7: Herd grazing in spring ©Idele



Fig 8: Bale grazing in winter ©Idele