Novalait

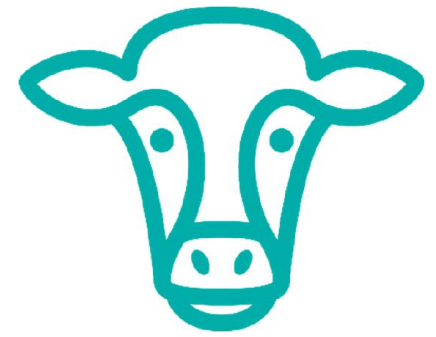**Research priorities**

Dairy cattle feeding and nutrition

ISSUES AND CHALLENGES

Feed is the biggest expense associated with dairy farming. Thus, optimizing the resources used to produce quality feed at a competitive cost on a farm is crucial for the profitability and sustainability of Quebec's dairy farms. Quebec's climate and regions present both advantages and unique disadvantages for producing dairy cattle feed. The quality of feed has a major impact on the performance of dairy cows, and its price fluctuates with the global market. The nutritional requirements of dairy cattle vary according to several factors including age, parity, gestation and the stage of lactation. In addition, feed efficiency in cows also varies according to different factors, including health status, physiology, environmental and nutritional factors, and individual genetic profile. In this context, dairy farms must develop strategies to produce very high-quality feed at the best cost possible.

RESEARCH DIRECTIONS

Researchers are invited to develop comprehensive, innovative approaches to:

- Optimize the efficiency of the production, harvest and conservation of forages and other feed produced on a farm

- Promote forage consumption, and prefer forage milk and resources from the farm, taking into account regional and climatic specificities

- Improve water quality as well as the nutritional value and conservation of dairy cattle forages and feed by reducing toxins, among other means, and develop indicators and tools to precisely measure quality

- Increase knowledge about the nutritional requirements of dairy cattle (based on age, gestation, lactation, physiology, health status, transition, breed, genetic profile and feeding behaviour)

- Optimize the use of concentrates and other inputs, and assess new ingredients and food additives

- Optimize rations to reduce losses and emissions, including GHGs, nitrogen, phosphorus and other nutrients

- Improve feeding strategies, recommendations and practices to increase feed efficiency, reduce costs and formulate more precisely balanced rations

- Explore the relationships between diet, health and reproduction

- Develop indicators to measure the performance of diet management methods and design decision-making tools

Dairy cattle health and welfare

ISSUES AND CHALLENGES

Maintaining and improving dairy herd health is a priority for dairy producers. In addition to the economic impacts herd health has on farms, it is an industry-wide issue. Health prevention and management strategies to reduce cattle mortality and morbidity and the associated costs are important issues. Decreasing the use of medication, in particular antibiotics, is also a priority for the dairy sector in order to achieve sustainable production.

Responding to consumers' concerns about dairy cows' welfare and comfort remains a priority. Welfare is a major factor in the profitability of farms, which seek to improve cows' health and longevity.

RESEARCH DIRECTIONS

Researchers are invited to develop comprehensive, innovative approaches to:

- Improve the understanding of the factors promoting health and of those causing diseases, including mastitis, foot and leg problems, and infectious and metabolic diseases

- Highlight the relationships between the different management components (diet, environment, genetics, production level) and herd health and welfare

- Improve screening and control strategies as well as health management practices as part of a holistic approach aiming to reduce risks and costs

- Improve disease prevention, decrease the use of medication, in particular antibiotics, and develop alternatives

- Develop knowledge and practices to improve the comfort and longevity of dairy cattle

- Develop welfare and health indicators and design decision-making tools

Dairy cattle fertility and reproduction
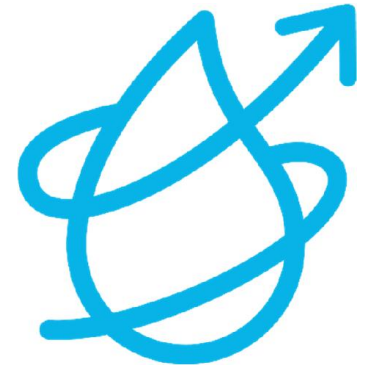
ISSUES AND CHALLENGES

Reproductive problems are the first reason for the involuntary culling of cows, causing more than 18% of animals to be removed from their herd. Breeders have been noticing a decrease in the fertility of cows for years now. This decrease translates mainly into a drop in conception rates—despite an increase in mating rates—and results in significant financial losses. There are multiple complex and interrelated factors behind the decreased performance of dairy cows.

RESEARCH DIRECTIONS

Researchers are invited to develop comprehensive, innovative approaches to:

- Improve the understanding of the causes behind the decline in fertility and of the factors that could explain decreased reproductive performance (disease, diet, physiology, genetics, management, productivity, comfort, etc.)

- Develop strategies, practices and tools to facilitate and improve estrus detection in order to increase reproductive performance and reduce costs

- Decrease dependence on estrus synchronization programs and the associated hormone use

- Develop reproductive performance strategies and indicators, and design decision-making tools

Technological properties of dairy matrices

ISSUES AND CHALLENGES

Understanding the multiple properties of dairy matrices and ensuring continuous control of interactions and evolution during the packaging, processing and aging processes, and even after packaging, is an ongoing challenge. Increasing knowledge on those topics is essential to achieving consistent production and developing new products.

RESEARCH DIRECTIONS

Researchers are invited to develop comprehensive, innovative approaches to:

- Characterize the physicochemical and technological properties of dairy matrices, their synergistic or antagonistic relationships and the factors that influence them, and develop approaches to control them

- Understand and control the organoleptic properties of dairy products

- Better understand the dynamics in microbial communities, identify the conditions affecting microbial activity in dairy matrices and their synergistic or antagonistic relationships with ferment in order to better control them, and get a deeper understanding of the impacts of native flora

- Promote the value of milk fat and its functionalities

- Improve curd mineralization management

- Better recover milk sugar

- Improve tank standardization processes for lactose and colloidal calcium phosphate

- Validate alternatives to reduce the use of salt, preservatives and texturing agents, and control dairy product fortification

Indicators and control tools

ISSUES AND CHALLENGES

In an industry dominated by precision management and automation, businesses must be able to count on reliable indicators as well as efficient decision-making tools and analysis and control methods. The challenge is to perform ongoing monitoring of the evolution of dairy products at the processing, aging and post-packaging stages.

RESEARCH DIRECTIONS

Researchers are invited to develop comprehensive, innovative approaches to:

- Develop indicators of physicochemical quality and measurement tools to monitor dairy product making in real time. For example:

    o Evaluate the rate of intact proteins that have not undergone proteolysis as the cheese ages

    o Facilitate ongoing quality control and make tests and tools more efficient

- Model the activity of native and maturing flora during cheese making and aging. For example:

    o Assess a cheese's aptitude for aging

- Monitor the conservation of dairy products after packaging

- Develop reliable methods to predict shelf life, especially for pasteurized or UHT products (microbial and organoleptic quality)
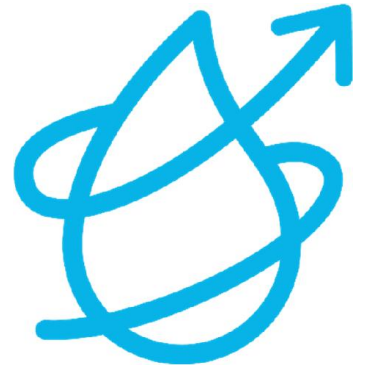
Eco-efficiency of processing methods
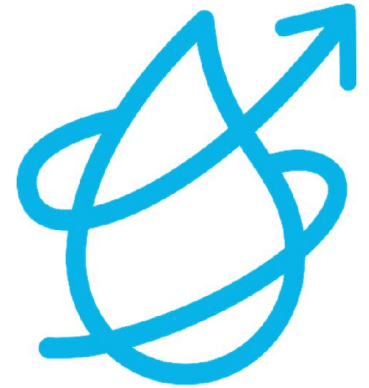
ISSUES AND CHALLENGES

This strategic research priority is part of a sustainable development approach that aims to increase the eco-efficiency of dairy processing methods to optimize economic, environmental and social benefits. As defined by the World Business Council for Sustainable Development, a business's eco-efficiency is achieved by the delivery of competitively priced goods and services that satisfy human needs and contribute to quality of life, while progressively reducing ecological impacts and resource use throughout the life cycle to a level that is acceptable based on the earth's estimated carrying capacity. In short, it is concerned with creating more value with less impact.

RESEARCH DIRECTIONS

Researchers are invited to develop comprehensive, innovative approaches to:

- Optimize the use of dairy processing methods with regard to the consumption of inputs (energy, water, cleaning products, etc.) and residues (dairy effluent, wash water, etc.). For example:

  o Optimize energy efficiency processes

- Optimize the management and recovery of coproducts and residues. For example:

  o Develop processes that reduce or eliminate coproducts or residues

  o Develop economical and efficient methods to recover milk permeates, buttermilk, whey and acid whey

  o Optimize dairy effluent recovery

  o Recover lactose and its derivatives

  o Recover water from milk

Milk quality

ISSUES AND CHALLENGES

Milk quality is an issue shared by dairy producers and processors. Milk is a complex raw material. Its composition and flora modulate the possibilities for its industrial and artisanal processing and give it unique organoleptic properties. The cow, its environment and the management of the herd all influence milk composition and processing possibilities in terms of desirable or undesirable flavours and positive or negative native flora, among other things. The industry has developed stringent standards, which it has to maintain to meet the requirements concerning milk quality and safety.

RESEARCH DIRECTIONS

Researchers must develop comprehensive, innovative and interdisciplinary approaches that combine expertise in milk production and in milk processing in order to:

- Develop strategies to control the somatic cell count in cows as well as spoilage or pathogenic flora

- Determine and control the factors (genetics, diet, management) that modulate milk composition, protein quality, the fatty acid profile and organoleptic properties

- Understand the interactions between farm management and milk flora (bacteria, yeast, mould, viruses), and modulate them to increase beneficial flora

- Study the biochemical and metabolic activity of secondary flora affecting milk properties, in particular thermoresistant flora

- Understand and control the organoleptic properties of milk

- Characterize the physicochemical and technological properties of milk and dairy matrices, their synergistic or antagonistic relationships and the factors that influence them, and develop approaches to control them

- Better understand the dynamics in microbial communities and get a deeper understanding of the impacts of native flora