Call for Letters of Intent – Dairy Production Research

Dairy Research Cluster 4

2023-2028

The submission deadline for this call is February 4, 2022.

Dairy Farmers of Canada (DFC) is a non-profit organization, funded by dairy farmers across Canada and representing Canada's 10,000 dairy farms. Our organization plays a leadership role on behalf of the industry in several important areas, including funding and support of research in dairy production and in human nutrition and health. DFC has a long-standing commitment (over 30 years) of investing in dairy research to drive innovation and ensure a sustainable future for the sector.

INTRODUCTION

Since 2010, DFC has been a partner of the Canadian AgriScience Clusters Initiative of Agriculture and Agri-Food Canada (AAFC) as part of the strategic framework Growing Forward 1 (2010-2013), Growing Forward 2 (2013-2018) and Canadian Agricultural Partnership (2018-2023). The Clusters program allows to address national dairy research priorities in a coordinated and strategic approach in partnership with sector partners and government.

In anticipation of the renewal of the Clusters program under AAFC's next agricultural policy framework, which would cover the period of April 1, 2023, to March 31, 2028, DFC, in collaboration with its DairyGen partners (i.e.: Lactanet, Semex and Holstein Canada) and Novalait Inc., is launching this Call for Letters of Intent (LOIs) in preparation for the Dairy Research Cluster 4 application.

The Canadian scientific community is invited to submit LOIs for innovative and structured projects focusing on industry and government priorities as presented in the **Appendix.**

Research projects to be included in the Dairy Research Cluster 4 application will be selected through a two-step evaluation process (LOI and Full Proposal [FP]) based on the relevance for the dairy sector and on the scientific quality. ***It is important to note that funding will be pending AAFC's approval under the next AgriScience Cluster program, which hasn't been announced yet. Therefore, there is no guarantee of funding at this point.***

ELIGIBILITY

Researchers from Canadian universities and from AAFC research and development centres are eligible to apply to this Call for LOIs. Non-Canadian researchers could be considered as co-investigators or collaborators. A researcher cannot submit two LOIs under this Call for LOIs for which they are the Principal Investigator (PI).

The PI is responsible for the complete direction of the project and other activities associated with its efficient execution. The role of the co-investigator(s) and collaborators in the project must be clearly defined. Graduate students and postdoctoral fellows are not eligible to act as co-investigators.

(Please note that commercial product research and development is not eligible)

PROJECT BUDGET AND TIMEFRAME

DFC is planning a Dairy Research Cluster 4 application of $14.5 M total budget, similar to current Dairy Research Cluster 3. Research projects budget should be planned for the period that spans from July 1, 2023, to December 31, 2027.

It is important to note that funding will be pending AAFC's approval under the next AgriScience Cluster program, which hasn't been announced yet. Therefore, there is no guarantee of funding at this point.

Industry partners' research priorities	Duration of the project	Maximum budget allocated for the duration of the project
Projects addressing Dairy Farmers of Canada research priorities (refer to Appendix)		
Projects involving 1 or 2 institutions[1]	Up to 4.5 years	Up to a maximum of $300,000
Projects involving 3 or more institutions,[1] including at least 1 AAFC research and development centre	Up to 4.5 years	Up to a maximum of $800,000 (Part of the budget can be allocated for coordination)
Projects addressing DairyGen Council research priorities (refer to Appendix)		
Projects involving 1 or more institutions[1]	Up to 4.5 years	Up to a maximum averaging $200,000/yr (Part of the budget can be allocated for coordination)
Projects addressing Novalait research priorities (refer to Appendix)		
Projects involving at least 1 university and 1 AAFC research and development centre	Up to 4.5 years	Up to a maximum of $500,000

[1] Institution means a university or a AAFC research and development centre that will receive funds for conducting research.

SPECIFICATIONS FOR LETTERS OF INTENT

The Dairy Research Cluster 4 LOI form, available on the DFC website, must be used.

Please comply with the space and format limitations as presented in the LOI form. Do not use photo-reduced type. The font is Arial and the size is 11 points. The body of the LOI form is self-contained and must not include additional pages and/or attachments.

LOIs must be submitted to dairyresearch@dfc-plc.ca by **February 4, 2022 (11:59 p.m. – local time zone of PI).**

LOIs submitted in French will be translated for English reviewers; the PI and/or their team may not review the translation.

In the interests of improved coordination and funding efficiency, DFC reserves the right to share LOIs with other research funders.

SELECTION PROCESS

The submission of a Letter of Intent (LOI) is the first step in the selection process. Full Proposal (FP) details and the form will be provided to the PI of a selected LOI.

STEP 1 – LOI

The LOI will first be reviewed by committees of scientific and technical experts based on its research relevance and merit. DFC, DairyGen and Novalait Inc. will make the final decisions regarding the selection of LOIs to proceed to the next phase.

STEP 2 – FP

The FP will be evaluated based on its scientific merit and feasibility, team expertise, training opportunities, knowledge translation and transfer, and realistic budget. The FP will first be subjected to an independent external peer review process. Based on the external peer reviews, committees of scientific and technical experts will evaluate the FP and make recommendations to DFC, DairyGen and Novalait Inc. Decisions on selected projects to be included in the Dairy Research Cluster 4 application will be communicated to the PIs in the fall of 2022.

IMPORTANT DATES	
Week of November 15, 2021	Launch of the Call for LOIs
February 4, 2022	LOI submission deadline (11:59 p.m. – local time zone of PI)*
Week of March 21, 2022	Notification to PIs if they are invited (or not) to submit a FP
June 30, 2022	Invited FP submission deadline (for invited PIs)
November 2022	Decision on selected projects to be included in the Dairy Research Cluster 4 application communicated to PIs
Winter 2023	Review of Clusters applications by AAFC

**A confirmation of reception will be sent by email for each LOI submitted within three business days.*

All inquiries for additional information pertaining to any of the above points should be directed to dairyresearch@dfc-plc.ca.

APPENDIX

<table>
<tr><th></th><th colspan="3">AGRICULTURE AND AGRI-FOOD CANADA AGRISCIENCE PRIORITY AREAS</th></tr>
<tr><td></td><td><u>Climate Change and Environment</u>
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Focus on emerging technologies to address labour challenges, create more value-added products, and increase productivity. Research to improve productivity, develop new or improved product attributes and production systems.</td><td><u>Sector Resilience</u>
Focus on sector resilience in response to market and societal pressures (e.g., AMR, animal health and welfare, alternative production systems, AI and big data in agriculture, etc.).</td></tr>
<tr><td>DAIRY FARMERS OF CANADA RESEARCH PRIORITIES</td><td><u>DAIRY FARM SUSTAINABILITY AREA</u>
Targeted outcome: Sustainable feed cropping systems are defined for long term productivity
Key research objectives:
→ Design crop rotation systems and study complex forage mixtures adapted to the region and soil type, intercropping, interseeding, double cropping and cover crop practices to improve soil health, control weeds, optimize yields and maintain nutrient value throughout entire season.
→ Optimize best management practices for manure, nutrients, and pesticides in various cropping systems.
→ Explore alternatives to plastic silage materials (e.g., bio-degradable materials, use of milk components in the development or creation of bioplastics, etc.) while ensuring that alternatives are not damaging to the environment (e.g., non-degradable residues or microparticles).

Targeted outcome: Canada-specific strategies to cost-effectively reduce greenhouse gases (GHG), maximize carbon sequestration and adapt to climate change are identified
Key research objectives:
→ Identify strategies to mitigate GHG emissions (primarily from cows and manure management) that take into</td><td><u>DAIRY FARM SUSTAINABILITY AREA</u>
Targeted outcome: Sustainable feed cropping systems are defined for long term productivity
Key research objectives:
→ Improve forage quality, yield and resistance (drought, flooding, winter survival) through breeding and management practices (for cropping and conservation), such as increasing the nutritive value, extending productive longevity and reducing fall dormancy of alfalfa and increasing the yields of grasses (regrowth) during the summer.

<u>ANIMAL HEALTH, CARE AND WELFARE AREA</u>
Targeted outcome: Dairy cattle nutrition and feeding knowledge is refined for improved feed efficiency, reduced production costs, and optimized milk composition and quality
Key research objectives:
→ Advance knowledge in precision feeding through automation and assess the efficiency of these tools and systems. Evaluate the integration and use of precision feeding on commercial farms and methods to accurately measure and monitor individual dry matter and water intake and feed efficiency, including managing the impact of pasture/outdoor access on feeding protocols and management, and on GHG emissions.</td><td><u>ANIMAL HEALTH, CARE AND WELFARE AREA</u>
Targeted outcome: Effective solutions to prevent and mitigate diseases and sustainably reduce the use of antimicrobials are developed
Key research objectives:
→ Provide strategies to reduce overall antibiotic use, especially Category I antimicrobials. Develop evidence-based effective protocols for lower categories antimicrobials and alternatives to antimicrobials while maintaining optimal animal health and welfare.
→ Develop udder health monitoring systems, easy-to-use on-farm diagnostic tools, well-defined clinical treatment protocols and improved practices to prevent and control mastitis.
→ Design quick, accurate, consistent, cost-effective means for routine locomotion assessments on farm (using Artificial Intelligence and other automated means) and easily accessible data monitoring systems to improve early detection, treatment and pain management of lameness in individual dairy cows and younger dairy cattle.

Targeted outcome: Practical and sustainable (environmentally, economically and socially) housing and management options are identified and adapted</td></tr>
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	Climate Change and Environment Focus on GHG emissions reductions and carbon sequestration, as well as other environmental areas including climate change adaptation, soil health, water quality, air quality, biodiversity, and plastics.	**Economic Growth** Focus on emerging technologies to address labour challenges, create more value-added products, and increase productivity. Research to improve productivity, develop new or improved product attributes and production systems.	**Sector Resilience** Focus on sector resilience in response to market and societal pressures (e.g., AMR, animal health and welfare, alternative production systems, AI and big data in agriculture, etc.).
	consideration the practicality, impact/effectiveness versus costs, using trans-disciplinary approaches (e.g., living labs or open innovation). → Develop a recognized standardized methodology to measure on-farm carbon sequestration and assess its potential to offset dairy GHG emissions and to allow for global comparisons. → Identify and evaluate, in the Canadian context, practices and new genetics of plants/crops and animals to tackle current and future challenges (e.g., novel pathogens, heat and cold stress, changing seasons, drought, floods/severe water strikes) associated with climate change. → Investigate synergies/trade-offs between climate change adaptation and GHG emissions mitigation strategies. **Targeted outcome: The potential of innovative on-farm water use and conservation practices and technologies is assessed** **Key research objectives:** → Develop practices or technologies to maintain soil moisture, even in drought conditions, limit water erosion during heavy rainfall and decrease water use associated with growing crops. → Identify opportunities to re-use water and devise low cost on-farm water re-capture and treatment technologies. **Targeted outcome: Cost-effective and concrete measures to increase biodiversity are clearly defined** **Key research objectives:**	→ Increase knowledge on use/upcycling of by-products and co-products as feed ingredients in a context of sustainable development. → Understand more thoroughly the impact of water profile, feeds and feeding on milk composition/processing properties and improve the ability to monitor milk composition and quality continuously at individual and herd levels (including alternatives to increase milk fats). **Targeted outcome: Strategies and tools to improve genetics and reproduction performance are created** **Key research objectives:** → Develop targeted reproductive strategies that minimize interventions while maintaining/improving fertility. → Evaluate alternative breeding strategies (like extended lactation, beef cross breeding, etc.) that ensure reproduction efficiency and optimal management of calves destined for purposes other than dairy production. → Better understand the effects of genetics (e.g., A2) on the composition of milk and its processing properties.	**to evolving Canadian climate change for the best care and welfare of dairy cattle of all life stages** **Key research objectives:** → Define solutions to facilitate adaptation and compliance with emerging and new updates to the Dairy Code of practices.

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	→ Assess and demonstrate the short- and long-term benefits and impacts of increased biodiversity on dairy farms. → Investigate the potential of strategies such as pasture lands, complex crop mixture, use of plants in intercropping or on uncropped land (riparian zone, wetland restoration, woodlots, etc.), and other initiatives (e.g., bat boxes) to promote plant and animal biodiversity and pollinating insects. **ANIMAL HEALTH, CARE AND WELFARE AREA** **Targeted outcome: Practical and sustainable (environmentally, economically and socially) housing and management options are identified and adapted to evolving Canadian climate change for the best care and welfare of dairy cattle of all life stages** **Key research objectives:** → Create housing designs of the future that will increase animal welfare and mitigate environmental impact, incorporating features of naturalness, using renewable materials and resources, adapted to Canadian climate change (wide temperature variations, heat stress, cold stress), integrating precision livestock farming technologies and considering wise energy consumption and generation while preventing stray voltage.		

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DAIRYGEN RESEARCH PRIORITIES	**Environmental Impact and Efficiency** The dairy cattle industry is under significant pressure to reduce the environmental footprint of milk production. Genetic evaluation for feed efficiency was recently launched in Canada, but other traits need to be evaluated. In this context, international efforts might enable national genomic evaluations for other difficult- and/or expensive-to-measure traits, such as methane emissions and nitrous oxide. Therefore, there is an immediate need to establish optimal methods to combine heterogeneous data from different sources and develop enhanced genomic evaluation systems for these traits. Studies to evaluate the feasibility of different statistical methods to improve the quantification of actual emissions and accuracy of predictions using limited datasets are also desirable. Potential traits and their indicators to be evaluated include: • Emission of greenhouse gases, such as methane and nitrous oxide • Enhanced evaluations for feed efficiency, quantity and quality • Water consumption efficiency and availability **Resilience and Adaptation to Climate Change** Intensive selection to increase milk production has led to a higher generation of metabolic heat in dairy cows compared to other animals, which has been a major	**Genetic Diversity, Breeding Strategies and Economic Indexes** Given the significant developments allowing for the application of genomics to improve the accuracy of genetic evaluations, especially for young bulls, heifers and cows, research is needed to compare the benefits of various strategies for breed improvement and selection. Also of interest is the development of genetic selection strategies and tools aimed at controlling the current reduction in genetic variation due to increased inbreeding levels in dairy cattle populations. The only tangible manifestation of inbreeding depression so far has been through lethal recessives and genomic information has provided relatively affordable solutions to tackle the problem. This might have mistakenly given the perception that inbreeding is a less pressing issue. However, if increasing selection intensity for greater productivity takes place at the expense of maintenance of genetic diversity there may be significant long-term costs. Thus, there is a strong need to develop new tools for the management of genetic diversity in dairy cattle. Methodologies are needed to differentiate harmful or risky inbreeding from more benign inbreeding. Breeders need tools to help them limit the riskiest matings in terms of negative shorter-term impacts on animal performance for economically important traits. Additionally, with release of genetic evaluations for many novel traits, there is an immediate need to	**Animal Health and Welfare** Dairy farmers are adapting to evolving consumer demands to maintain their social license to operate. They strive to be efficient at producing high-quality food products ensuring good animal health and welfare. Thanks to industry investment matching public funding, multiple projects and initiatives have resulted in the implementation by Lactanet of a series of genetic evaluation systems to enhance health (resistance to mastitis, metabolic diseases and fertility disorders) and animal welfare (hoof health). However, we have limited metrics to objectively measure animal welfare, therefore, methodologies that measure and demonstrate improved welfare are needed. Nevertheless, it remains a priority to improve accuracy of genetic selection for various health traits and broaden disease resistance by adding new phenotypes including Johne's Disease, Leukosis and calf health and survivability to the health evaluation portfolio. There is a strong need to continuously improve young stock management for long-term health and performance, thus looking at traits in this area from a genetic perspective including genetic variation and relationships with other economically important traits. Potential phenotypes/traits and their indicators to be evaluated include: • New emerging diseases • Calf health traits and livability

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	cause for concern during climate change. Moreover, the current debate about the use of antibiotics has limited its use in dairy farms. As a consequence, dairy farmers are looking for more resilient cows - meaning cows that can maintain (or quickly recover from) sustainable production levels through several adversities, such as climate and environmental changes. In this context, an optimal definition of resilience needs to be identified and validated. Genetic and genomic evaluation systems need to be developed for various resilience indicator traits, which may include resistance to heat stress and diseases. Studies to incorporate the different resilience indicators in the same selection index are also required. In addition, the potential short- and long-term socio-economic impacts of selective breeding for resilience need to be assessed. Resilience indicators to be targeted may include: • Production: milk production and quality • Fertility: estrous expression, embryo survival and abortion • Health: fertility disorders, metabolic disorders and calf health	develop selection indexes for overall health and environmental efficiency to significantly benefit from the use of new genomic evaluations for selection. **Cow Profitability** In conjunction with selection placed on improving levels of production, producers are striving to increase their net profits. While good management can alleviate some of the stresses associated with high production, producers are looking for the genetic means to build a more profitable cow for both current and future production environments. Genetic parameters for traits of economic importance need to be identified and validated, which can then contribute to national selection indexes reflecting cow profitability. Studies involving the economic analysis of the various components related to cow profitability are continuously needed. Cost effective data collection methods are required to channel relevant data into these systems. Traits of major importance include: • Genetic variation and economics of locomotion, mobility, lameness and crampiness • Economics of reproductive performance traits • Beef on dairy, body weight and growth of crossbred animals	• Colostrum quality intake and transfer of passive immunity • Genetic abnormalities • Animal contentment

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NOVALAIT RESEARCH PRIORITIES		**Novel Ideas and New Technologies** The five main areas of research priorities for the DairyGen Council, as outlined above, reflect those that are currently of greatest interest to producers and the industry. The DairyGen Council also encourages researchers to submit proposals incorporating novel ideas and new technologies (i.e.: artificial intelligence algorithms and machine learning), either through quantitative genetics or genomics, related to dairy cattle improvement of potentially beneficial impact.	
		MILK QUALITY **Issues and challenges** Milk quality is an issue shared by dairy farmers and processors. Milk is a complex raw material. Its composition and microbiota 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.	

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		Research directions Researchers must develop comprehensive, innovative and interdisciplinary approaches that combine expertise in milk production and in milk processing in order to: → Determine and control the factors that modulate milk composition, protein quality, the fatty acid profile and organoleptic properties. → Understand the interactions between farm management and milk microbiota (bacteria, yeast, mould, viruses), and modulate them to increase beneficial microbiota. → Study the biochemical and metabolic activity of secondary microorganisms affecting milk properties, in particular thermoresistant microorganisms. → Better understand the dynamics in microbial communities and get a deeper understanding of the impacts of native microorganisms. → 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.	

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		ADDED VALUE TO NON-FAT SOLIDS OF MILK **Issues and challenges** All of the fat in milk produced in Canada is used in the manufacture of dairy products. However, the amounts of protein and lactose required for processing differ from the natural composition of milk. This situation generates surpluses of non-fat solids (NFS) in the milk that are difficult to valorize. **Research directions** Researchers must develop comprehensive, innovative and interdisciplinary approaches that combine expertise in milk production and in milk processing in order to: → Develop new concepts to add value to NFS for human nutrition. → Reduce surpluses at source by adjustment of milk composition. → Identify paths of valorization of NFS on farm or in production areas - circular economy.	