Annual report

2019.2020

Novalait 25 1995-2020

Research Catalyst

Table of content

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• Les Producteurs de lait du Québec
• Novalait
• Université Laval
• McGill University

COMPANY PROFILE

A Strong Vision

Created by **Quebec dairy farmers** and **processors**, **Novalait** is accelerating the development of **scientific knowledge** and **skills** for the dairy industry of tomorrow.

A unique business modele

Novalait brings together all businesses that produce or process milk in Quebec – from small-scale cheese factories to family farms to multinational companies – making contributions to the research investment fund equivalent to ¢1.27/100 l of managed milk. They are represented within Novalait by three groups of shareholders. Les Producteurs de lait du Québec holds 50% of Novalait's shares. Agropur Cooperative, which represents dairy cooperatives, and the Conseil des industriels laitiers du Québec, which brings together private dairy processors, split the other half of Novalait's shares.

Calling upon the creativity and expertise of researchers from all disciplines and horizons, Novalait ensures that it meets its shareholders' research priorities. Novalait's committees evaluate the proposals received according to the potential for commercial opportunities and applications on farms and in plants. Novalait invests in the development and monitoring of the R&D projects selected. It collaborates with actors in the sector to valorize and transfer the research results. In everything it does, Novalait aims to optimize research benefits.

Novalait involves its shareholders in all of its activities, including:

Establishing research priorities | **Selecting and monitoring projects** | **Transferring research results**

Shareholding and organizational structure

BOARD OF DIRECTORS

2019.2020

Novalait is governed by six experienced administrators who represent the three groups of Novalait shareholders.

President
Michel Couture
Agropur Dairy Cooperative

Vice-president
Yvan Bastien
Les Producteurs de lait du Québec

Secretary-Tresaurer
Charles Langlois
Conseil des industriels laitiers du Québec

Administrator
Simon Robert
Agropur Dairy Cooperative

Administrator
Geneviève Rainville
Les Producteurs de lait du Québec

Administrator
Dominique Mathieu
The J.M. Smucker Company

WORD FROM PRESIDENT

Novalait: Catalysing research since 1995

Dear Shareholders,

I am pleased to share with you that 2020 marks Novalait's 25th anniversary. Since 1995, visionaries, dairy farmers and dairy processors from Quebec have been revered for their continuous investment in a unique organization to develop the knowledge and expertise that an innovative dairy industry expects.

Novalait's DNA is a shared vision of research, equal power and win-win solutions. Dairy farmers and processors are involved at every key step in the research process. Knowledge transfer is one of Novalait's top priorities. Research only produces tangible results once it's been applied on farms and in plants. From funding to project completion, Novalait has developed strong collaborations to deliver results through existing communication, training and consulting channels.

The website **novalait.ca** presents the results and impacts of Novalait's investments. Most notably, Novalait's research has generated recommendations on dairy cow diet, health, reproduction and well-being which have become common practice on farms. Dairy farmers have benefited from new decision-making and diagnostic tools to make managing their herds easier. With respect to dairy processing, the impacts of Novalait's research are numerous, from valorizing co-products to gaining a better understanding of the interactions between indigenous flora, starter cultures and milk components, to developing additives, natural preservation agents and quality control tools. Training the next generation of experts who are now innovators in today's dairy sector is by far the most valuable product of 25 years of investment in research.

REPORT FROM THE EXECUTIVE DIRECTOR

But there is still much more to discover and develop to meet the challenges that dairy farmers and processors face to remain competitive, specifically with respect to the issue of food autonomy which the pandemic has brought to light. Novalait also contributes to the development of solutions to environmental and animal well-being issues. Today more than ever, the vision of Novalait's founders aligns with our current realities. Like its shareholders, our small, agile organization is preparing for the future by innovating in its practices and partnerships to serve the dairy industry.

I would like to thank our financial partners for their confidence in Novalait's rigorous research investment choices. Thanks to these partnerships, the entire Quebec dairy industry has benefited from impressive research investments totalling $54.9 million. There is no shortage of ideas and Novalait is developing new opportunities to invest in relevant research with high impact potential for a key economic sector. We're counting on you!

In closing, I'd like to thank our founders who were visionary and daring in the creation of Novalait. I would also like to highlight the unsparing and enlightened involvement of Novalait's directors. Thank you to Novalait's dedicated and motivated management team that coordinates the essential contributions of researchers, students and knowledge transfer partners. I can confidently say that we can count on celebrating Novalait's 50th anniversary together in the future!

Michel Couture, President

Finding solutions together

Novalait held two major events to establish the current key issues in the dairy sector and identify research approaches to address them. In September 2019, a first workshop focused on the challenges of heat-resistant alternating microorganisms. On July 7, 2020, a virtual workshop brought together approximately fifty participants to discuss issues surrounding the valorization of non-fat milk solids and permeates in the dairy industry. Numerous high-potential avenues for exploration were identified. Novalait and CRIBIQ are continuing to act on their R&D mission.

Diversifying investments in R&D and financial partnerships

Through its participation in the Research–Innovation–Transformation–Agrifood Consortium (RITA), Novalait has gained access to a new network of scientific experts. Novalait also continued pursuing its objective of maintaining a critical mass of researchers by investing in the Educational Leadership Chair in Cheese Technology at Université Laval. Lastly, Novalait is currently focusing on scaling up the results of its research with a pilot project on yogurts and a new partnership with TransformAction.

COVID-19: Impacts and adaptation

Like companies around the world, Novalait adapted itself to continue its work remotely and hold virtual meetings. Events such as the Forum Techno have been postponed until they can be best adapted to the current context. Most projects were able to move forward with little impact.

25 years of collaboration

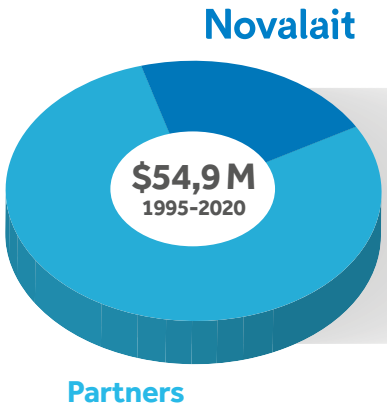
The management team would like to thank all of the inspiring individuals and organizations who have made this exciting adventure possible and who are propelling us forward to new challenges.

Élise Gosselin, CEO

NOVALAIT IN NUMBERS

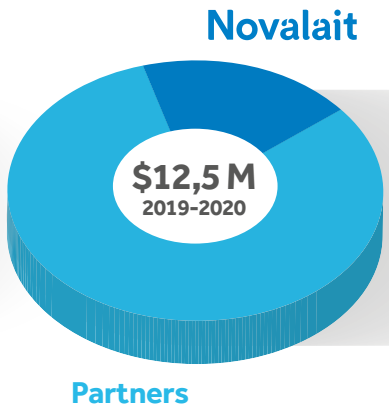
25 years of investment in R&D

Since its creation in 1995, Novalait and its partners have invested $54,9 M in research.



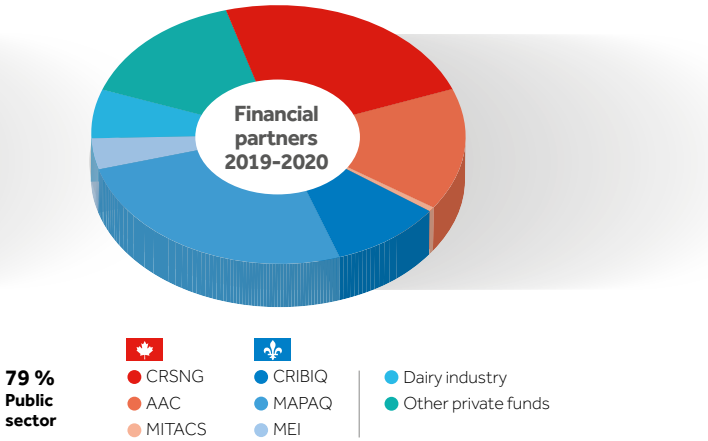
Portfolio 2019-2020

The commitments of Novalait and its partners in current researches in 2019-2020 totaled $12.5 M including $4 M for new projects.



Novalait's financial partners

Novalait maintains the performance of its leverage effect by renewing and diversifying its financing partnerships. In 2019-2020, Novalait's investments in RITA Consortium and in Educational Leadership Chairs resulted in a lever of MAPAQ, MEI and many new agri-food partners.

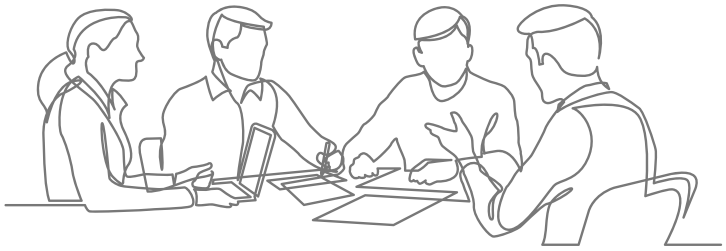


Committees' activities

8
Boards of Directors

2
Selection committees

More than 25
meetings of Steering committees for projects and chairs



Novalait extends its reach

October 4th, 2019

More than 80 participants in the technical-scientific activity "Comment tirer profit de la microbiologie du lait?" organized in collaboration with CILQ.

July 7th, 2020

More than fifty participants in the first meeting between the milk and bioprocess industries on the valorization of non-fat milk solids and permeates.

Novalait is also involved as a board and committee member:

- Strategic planning of the dairy sector
- Quebec consortium for industrial bioprocess research and innovation (CRIBIQ)
- Quebec cheese expertise center (CEFQ)
- National dairy research council (DFC)
- Digital shift committee
- Cheese Symposium organizing committee
- Dairy cattle committee (CRAAQ)
- Advisory committee (CRSAD)

Communications

Novalait.ca

- **New project's factsheets**
- **Increased visits to the site**

	Visitors	Pages viewed
2015-2016	1,448	8,833
2016-2017	3,152	14,063
2017-2018	4,095	16,052
2018-2019	6,103	13,755
2019-2020	6,698	15,875

Lait'Xpress

Pour tout savoir sur les activités de Novalait 25

5 newsletters to know everything about Novalait's activities

Subscribe today!

Forum Techno 2021

The Forum Techno is Novalait's must-attend event to learn about the latest research findings and discuss application opportunities on the farm and in the plant. It will be held virtually in the week of June 7th, 2021, in partnership with the International Cheese Symposium.

RESEARCH

Newly launched projects

RITA: a new consortium

This year, Novalait joined up with the partners of the RITA Consortium (*Recherche–Innovation–Transformation–Alimentaire*). This research co-creation network with the dairy processing industry addresses issues such as naturalness, technology and sustainability. Research activities began in 2019. Here are five research projects that are particularly significant for the dairy sector, with numerous researchers from different institutions collaborating on the projects.

Developing a smart platform to identify multifunctional natural ingredients

More and more, consumers are looking for "clean label" products free of additives and artificial preservatives. Food labels must contain as few ingredients as possible and be easy to read and recognize, all while maintaining optimal shelf life and textural and sensory properties. This project aims to develop a smart platform for identifying natural ingredients that facilitate product formulation. Using artificial intelligence techniques, the project will provide industrial partners with a platform presenting a multidimensional map of natural ingredients of interest for substitutions.

Natural food products: better understanding consumer perceptions and behaviour

People who are concerned about eating healthy vary the foods that they eat and assess their fat, sugar and sodium content, freshness, and whether they contain chemical additives. There is also a growing interest in "natural" products. However, the notion of "naturalness" is not clearly defined among neither suppliers nor consumers. This project aims to understand how companies communicate information about naturalness to consumers and how consumers perceive it. The objective is to produce a scale that can be used to measure naturalness and identify the variables of naturalness perceived by consumers. The project also supports the development and marketing of new products that meet consumers' needs.

Developing natural antimicrobial-based antifungal ingredients for the preservation of grated cheese

Natamycin is a compound used as a preservative in the cheese industry, which is looking for alternatives that take a "clean label" approach. The aim of the project is to develop a new technology by using natural compounds to combat mould in cheese that remain stable during the manufacturing process and storage without affecting the taste of the finished product. Multiple natural antimicrobials, such as those derived from Arctic soil bacteria, algae and essential oils, are being tested to counter mould growth in grated cheese. Ultimately, the project will identify a variety of new plant-based molecules and phenolic extracts with antifungal properties in ripened cheeses. This project falls within the scope of the priority focused on diversifying the possibilities for dairy product preservation.

Developing active packaging solutions to extend the shelf life of food products

A number of recent studies have demonstrated the potential of active packaging presenting a range of preservative properties. Whether through the presence of antioxidants, the release of antimicrobial compounds or the absorption of specific molecules into food matrices, the project is focused on developing active packaging solutions that extend the shelf life of sensitive food products. The solutions developed will consider legal constraints in terms of migration limits, environmental aspects related to the use of biodegradable polymers and commercial feasibility. This research on active packaging is part of the search for alternatives to food additives and ways to reduce food waste–a priority for the dairy sector.

New approaches to valorize carbohydrate-rich co-products as high value-added products

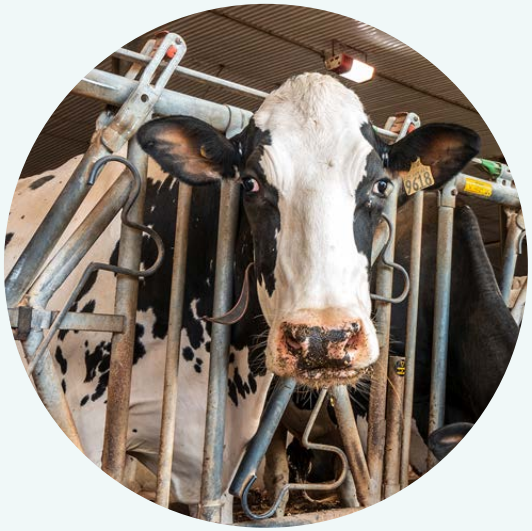
The development of processes for the production of functional ingredients, nutraceuticals and high value-added chemicals from carbohydrate-rich by-products is expanding rapidly. This project aims to develop the scientific and technological foundations of new approaches to transform carbohydrate-rich by-products (lactose, sucrose and starch) into high-value added natural compounds and sweeteners such as levulinic acid or lactosucrose. Eventually, economically viable conversion and bioprocessing technologies will be proposed. This project falls within the scope of the priority aimed at valorizing dairy and food processing co-products.

New project under development

Deciphering the molecular mechanisms behind infertility in lactating dairy cows with subclinical acidosis

Better understanding the causes of fertility problems is a research priority for Novalait due to the economic stakes at hand. Researcher Raj Duggavathi has begun a project on ovarian dysfunction in cows with acidosis to establish metabolic indicators in the cows' blood and milk.

The latest sequencing technologies will be used. Ultimately, the project will develop diagnostic and therapeutic strategies to optimize dairy cow reproduction.



New Educational Leadership Chairs

Making buildings "greener"

In dairy production, there is no shortage of construction, renovation and expansion projects. Designing a barn requires a solid understanding of cows' needs and dairy production as a whole. Barns have a direct impact on cows' productivity and well-being, as well as overall efficiency. To deepen its expertise in this field, Novalait has invested, in partnership with multiple companies and agricultural organizations, in the Educational Leadership Chair in Sustainable Agricultural Building Design. Chairholder Sébastien Fournel began his position in September 2018 at the Faculty of Agriculture and Food Sciences (FSAA) at Université Laval. The new professor-researcher will conduct research on the design of production buildings to consider current issues such as animal well-being. The chair will also focus on advanced environmental control, optimal resource and dejection management, and energy efficiency in barns.

Cheesemaking technology in the spotlight

New cheeses are being developed at an increasingly rapid pace. To support suppliers in this technological challenge, Novalait, along with several industrial partners, has invested in the Educational Leadership Chair in Cheese Technology. Its holder, Julien Chamberland, began his position in January 2020 at the Faculty of Agriculture and Food Sciences at Université Laval. In collaboration with the dairy industry, the new professor-researcher is developing a teaching and research program on cheese technologies aimed at training dairy plant managers. The program will also offer opportunities for professional development. The chair's partners include: Novalait, Agropur Dairy Cooperative, Lactalis, Saputo, the *Conseil des industriels laitiers du Québec* and the *Centre d'expertise fromagère du Québec*.

Canadian Dairy Commission Scholarship Program $226,666 awarded to seven recipients

The Canadian Dairy Commission has entrusted Novalait with the management of its scholarship program in Quebec, representing a budget of $500,000. A second call for proposals was launched in fall 2019. Novalait awarded scholarships to seven master's students for a total of $266,666.

Recipients in dairy production

Félix Huot
Université Laval
Developing methods for the detection and diagnosis of subacute ruminal acidosis in dairy cattle on commercial farms

Jessika Marquis-Hrabe
McGill University
Correlations between the primitive bacteria community in bovine rumen and concentrations of vitamin B_{12} in milk

Marie-Soleil Boucher
Université Laval
Evaluating the potential of using more digestible alfalfa on Quebec dairy farms

Nicolas Barbeau-Grégoire
Université de Montréal
Validating farm's bacteriological systems to diagnose endometritis in post-partum dairy cows

Recipients in dairy processing

Adam Classen
McGill University
The search for antifungal agents derived from Arctic bacteria active in cold environments in grated cheese

Serine Touhami
Université Laval
Valorizing the membrane of buttermilk fat globules by coupling ultra-high-pressure homogenization and microfiltration processes

Thomas Messier
Université Laval
Using genomic approaches to optimize the selection and use of texturizing bacterial strains in yogurt

Ongoing research projects 2019–2020

Ongoing projects are aimed at responding to the research priorities established by Quebec dairy farmers and processors. Want to know more about what Novalait is working on? The projects currently underway are grouped below based on the different research themes.

Innovative farm practices

Recycled manure bedding: recommendations for safe use to protect milk quality
Simon Dufour, Université de Montréal

Performance and behaviour of dairy heifers according to their milk diet
Édith Charbonneau, Université Laval

Vitamins post-calving: a way to increase cow fertility?
Marc-André Sirard, Université Laval

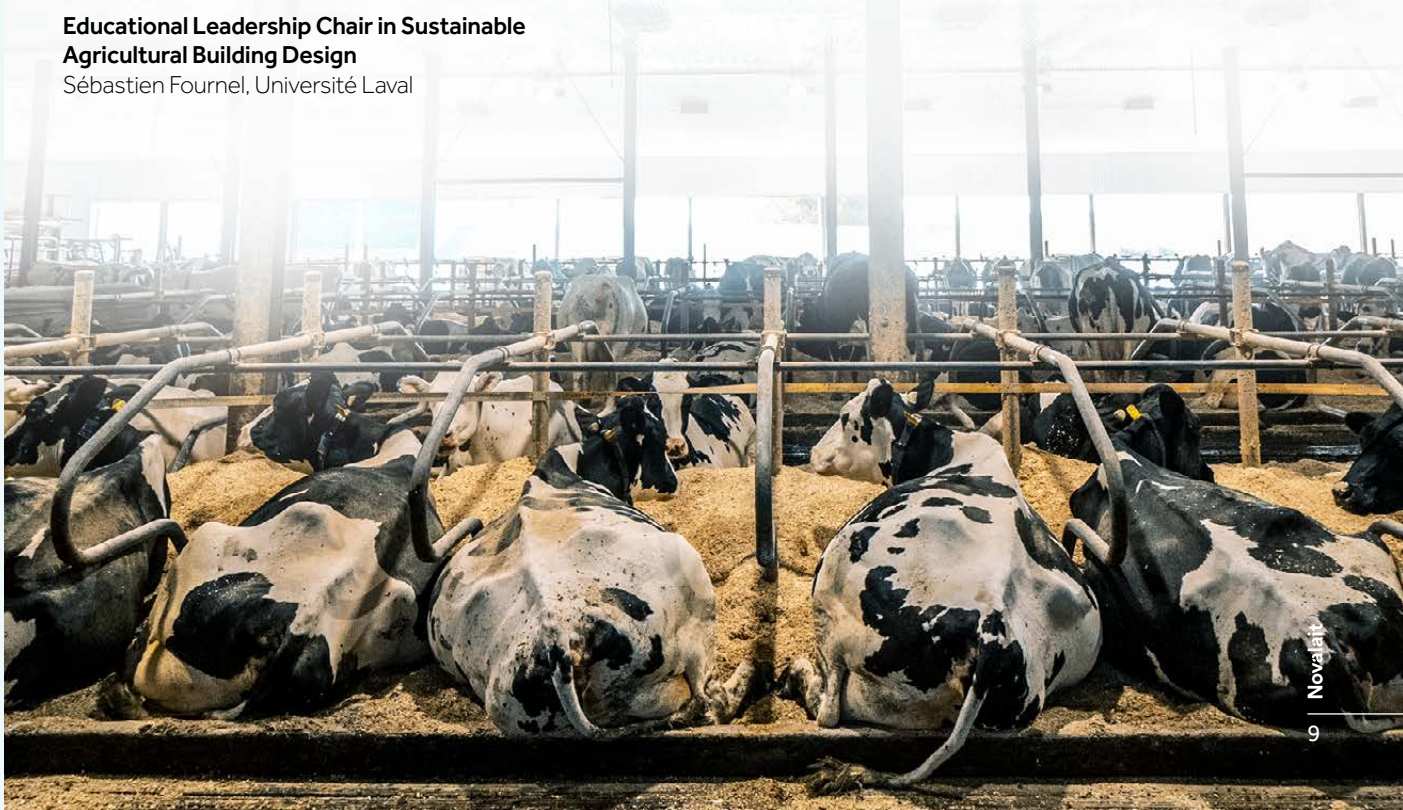
Educational Leadership Chair in Sustainable Agricultural Building Design
Sébastien Fournel, Université Laval

Dairy production and dietary efficiency

Improving cows' protein diet through new models tested in Quebec
Doris Pellerin, Université Laval

The benefits of using new, more digestible alfalfa for Quebec's dairy farms
Caroline Halde, Université Laval

Optimizing the efficiency of proteins in rations
Cristiano Cortes, Agrinova



Cow well-being and health

NSERC-Novalait-DFC-Lactanet Industrial Research Chair on Sustainable Life of Dairy Cattle
Elsa Vasseur, McGill University

Using the fatty acid profile of milk to detect and prevent ruminal acidosis in cows
Stéphanie Claveau, Agrinova

Can milk analysis predict the level of well-being and health of dairy cows?
Elsa Vasseur, McGill University

Deciphering the molecular mechanisms behind infertility in lactating dairy cows with subclinical acidosis
Raj Duggavathi, McGill University

Cheesemaking technology and process eco-efficiency

Increasing eco-efficiency by concentrating dairy fluids
Yves Pouliot, Université Laval

Educational Leadership Chair in Cheese Technology Julien Chamberland, Université Laval
Julien Chamberland, Université Laval

Co-product valorization

New approaches to valorize carbohydrate-rich co-products into high value-added products
Salwa Karboune, McGill University

An eco-efficient approach to valorizing buttermilk
Guillaume Brisson, Université Laval

Alternatives for dairy product preservation

Metabiolac-NSERC Industrial Research Chair in Metabolic Activity and the Functionality of Bioprotective Lactic Cultures
Ismail Fliss, Université Laval

Identifying bioprotective cultures that extend the shelf life of dairy products
Marie Filteau, Université Laval

Developing natural antimicrobial-based antifungal ingredients for the preservation of grated cheese
Monique Lacroix, INRS, Institut Armand Frappier

Developing a smart platform to identify multifunctional natural ingredients
Salwa Karboune, McGill University

Developing active packaging solutions to extend the shelf life of food products
Bruno Ponsard, Collège de Maisonneuve

Milk quality

How do milk's natural microflora and composition contribute to cheese quality?
Steve Labrie, Université Laval

Presence and impact of microbial biofilms on milk quality, from the farm to dairy plants
Denis Roy, Université Laval

Consumer expectations

Natural food products: better understanding consumer perceptions and behaviour
Joanne Labrecque, HEC Montréal

FOR MORE INFORMATION ABOUT EACH PROJECT, VISIT novalait.ca

RESULTS

The projects completed during 2019–2020 yielded promising results for farms and dairy plants.

WANT TO KNOW MORE ABOUT OUR RESEARCH PROJECTS? SEE THE FACTSHEETS AT
novalait.ca

Production

More digestible alfalfa

Increasing dietary efficiency is one of Novalait's top research priorities. This research project on more digestible alfalfa falls within the scope of this objective. Improving alfalfa's digestibility increases its energy content and potentially extends the harvest period without affecting its nutritional value. The objective of this project is to test the performance of more digestible cultivars in the field and in dairy cattle feed.

A total of eight cultivars were tested over a three-year period in test plots, representing 1,600 alfalfa samples harvested at two different stages: the early budding stage and 10% early flowering stage. The cultivars with increased digestibility were either conventionally selected [CONV] or genetically modified [GM]. The GM alfalfa cultivars proved more digestible than the control cultivars after the first year of production. The less lignin-rich GM alfalfa cultivars also demonstrated the capacity to increase the ration's digestibility and prolong the harvest period by several days, all while maintaining the same level of digestibility.

In a second project that excluded GM alfalfa, the research team measured the impact of an alfalfa-rich ration with a lower metabolizable protein content but better balanced in three essential amino acids: histidine, lysine and methionine. In total, eight cows received different rations over four 21-day periods. The results are promising: the dietary intake and corrected milk production remained the same despite the reduced protein intake when the ration's energy content was maintained at a sufficient level. It is therefore possible to reduce the metabolizable protein intake without negatively affecting dairy cow performance, provided that their energy and essential amino acid needs are met. This feeding strategy results in a more efficient use of nitrogen while maintaining the production level for milk components and decreasing nitrogen excretion.

The technical and economic analysis is currently underway and will demonstrate if using this type of alfalfa is profitable. This new knowledge will serve to inform the decisions made by dairy farmers.

Production

Shedding light on the use of recycled manure bedding

Novalait chose this project because it addresses two major issues: the need to validate bedding alternatives and to ensure its safe use for cow health and milk quality. Many dairy farmers consider using recycled manure bedding (RMB) because the cost and availability of bedding are becoming more considerable. This project aimed to document the physico-chemical and microbiological properties of RMB and its impact on health and milk quality.

A total of 27 farms using RMB, each with their own unique way of operating, were visited. Their results were compared to 61 farms using straw bedding. Bedding and bulk tank milk samples were taken from all of the farms. Each case of clinical mastitis was also sampled over a 12-month period.

The results obtained shed light on the use of RMB on farms. Some pathogens survived the maturation process used. As a result, RMB should not be used on young animals. In addition, to prevent zoonosis, workers should use safe bedding handling processes. The good news is that there was no difference in somatic cell counts and clinical mastitis between farms using RMB and those using straw. However, *Klebsiella pneumoniae* found on RMB was six times more likely to cause mastitis out of the 1,236 cases sampled. This finding is significant considering that a cow that has experienced an episode of Klebsiella mastitis during lactation is at a much higher risk of being culled from the herd than a healthy cow. Using RMB did not impact the quality of unripened cheeses produced within the framework of the project but their bacterial populations were different. These results call for caution and also highlight the importance of using best practices for milking and equipment washing.

USING RMB DID NOT IMPACT THE QUALITY OF UNRIPENED CHEESES PRODUCED WITHIN THE FRAMEWORK OF THE PROJECT BUT THEIR BACTERIAL POPULATIONS WERE DIFFERENT.

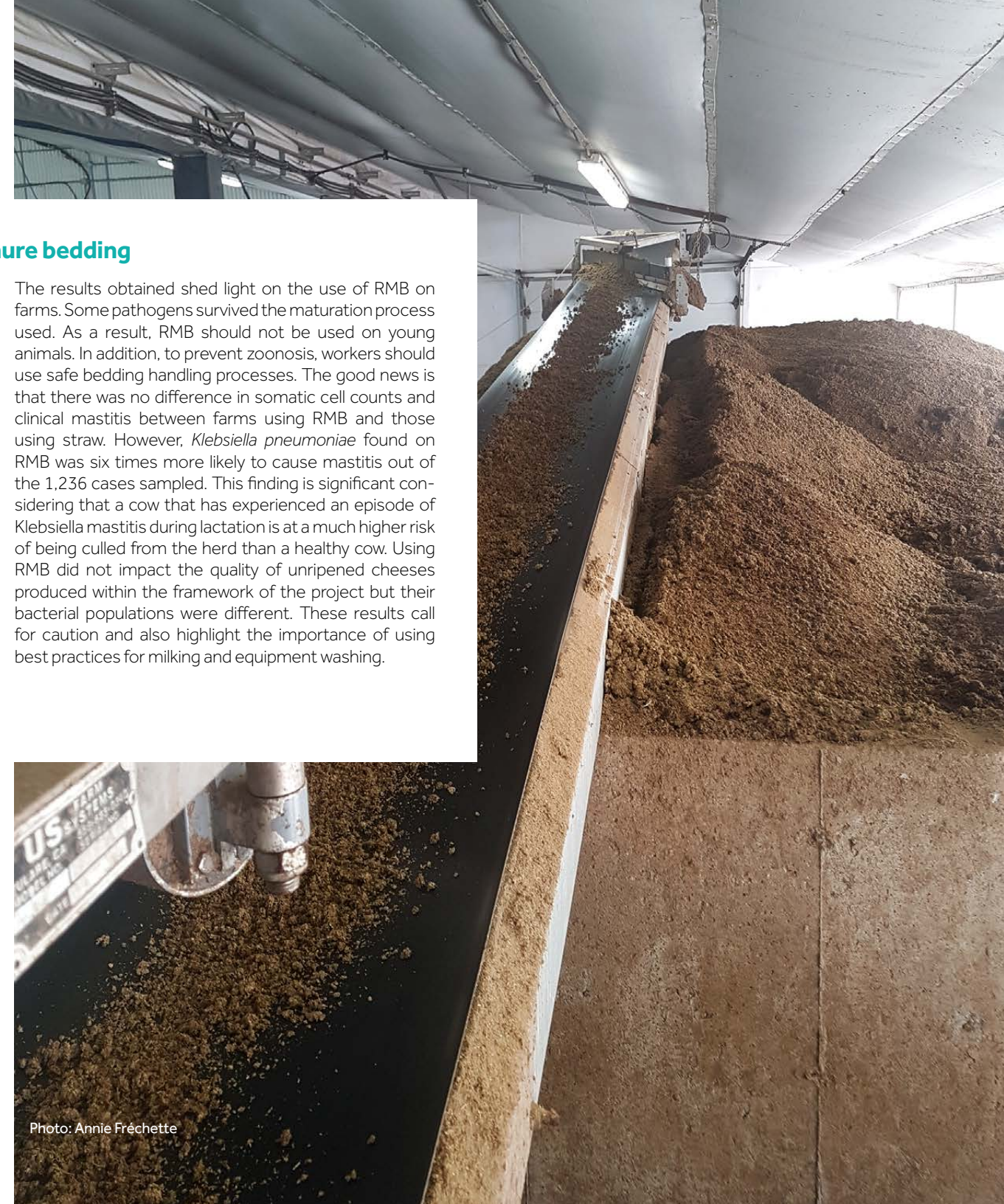


Photo: Annie Fréchette

Production

Industrial Research Chair on Sustainable Life of Dairy Cattle

At Novalait's initiative and to fill a gap in expertise in Quebec on dairy cattle well-being, this Chair resulted in the creation of a new research position at McGill University for its holder, Elsa Vasseur. The Chair is in its fifth year of activity and has trained more than thirty students. In particular, the research team is studying cow longevity in relation to profitability and the relationships between well-being, longevity and profitability. Here are the latest advances in its ongoing research.

First incidence of lameness or mastitis

During her master's research, Maria Puerto identified the critical periods when the first episode of mastitis or lameness has the greatest impact on production and economic performance. The research team leveraged the databases to analyze 13,000 observations of first-lactation dairy cows in Quebec between 2003 and 2014. The most significant losses were observed during the transition period. Cases of mastitis and lameness produced 600 kg and 1,300 kg less milk, respectively, than healthy cows during the transition period. Over 305 days in lactation, these production decreases resulted in gross profit losses of approximately $500 per case of mastitis or lameness. A good start therefore guarantees a successful lactation and a higher profit for first-calf heifers, as well as their retention in the herd.

To stay up-to-date on the chair's activities, subscribe to the blog **cowlifemcgill.com** or visit **novalait.ca**

THE RESULTS FROM THE COMFORT COMPONENT WERE PRESENTED TO DAIRY PROCESSORS AT A HIGHLY ATTENDED SPECIAL PRESENTATION!

New prototype combining longevity and profit

Post-doctoral researcher Daniel Warner has developed a prototype for a decision-making tool leveraging cost-benefit analysis. His research aims to pinpoint the best criteria for identifying the dairy cows that should be retained for an additional lactation and, more importantly, quantify the real profits of this decision. The analysis, based on health and feeding data from 114 herds in Quebec, revealed higher costs for culled cows at the end of lactation compared to cows retained for an additional lactation. To help make culling decisions, the next step is to develop an interactive interface for the prototype to situate a herd according to benchmarks and identify the most profitable cows.

Ongoing research

Longevity indicators starting at livestock production?

PhD student Gabriel Dallago is currently leading new research on longevity. His objective is to develop early indicators of longevity in order to select the animals with the best potential for longevity, and therefore profitability, prior to the first lactation.

More movement for cows?

Research continues on identifying exercise access conditions that promote locomotor activity in lactating cows. This involves analyzing the frequency and duration of exercise, thermal comfort, and hoof and member health. The research team is also completing a profile of the cows' reaction at the time of exit in order to develop handling recommendations for tie-stalls.

Processing

Metabiolac Industrial Research Chair in Metabolic Activity and the Functionality of Bioprotective Lactic Cultures

To develop alternatives to synthetic antibacterial agents and antibiotics, Novalait has teamed up with other partners from the food industry and industry suppliers in the METABIOLAC Chair. Established at Université Laval, METABIOLAC's mission is to harness the power of lactic acid bacteria with promising antimicrobial or antifungal properties. Finding alternatives to combat pathogens is at the heart of this research investment. The chair is beginning its last year and has already trained more than twenty students over the course of its activities. Here are the latest advances in its ongoing research.

Studies are underway on controlling *Clostridium tyrobutyricum* and halting butyric swelling in cheeses. After confirming the reduction of Clostridium populations in cheeses, the research team developed an innovative formula composed of alginate and starch to encapsulate the antimicrobial consortia and allow for their progressive release into the cheese matrix. The capsules that were developed are non-toxic, biocompatible, biodegradable and economical. A pilot project is being developed to repeat the experiment in Gouda and Swiss cheeses.

The research team continued its work on identifying alternatives to natamycin, an antifungal compound used in yogurt production. After confirming the antifungal properties of reuterin during the storage of commercial yogurt, the bacteriocin was tested as an ingredient in the production of stirred yogurt. Incorporating reuterin at the stirring stage completely inhibited the growth of *A. Niger* mold for 15 days. In addition, the compound has been shown to be more effective than natamycin in inhibiting mold growth in yogurt.

The search for alternatives to combat bovine mastitis has also progressed over the past year. With a view to preventing mastitis, the research team verified the in vivo efficacy of bacteriocins in reducing the bacterial load on the teat skin. Bacteriocins were applied both alone and in combination in a teat bath and compared with iodine and salt water. Nisin reduced the levels of staphylococci, streptococci and the total bacteria count while reuterin only impacted the total bacteria count. The combination of bacteriocins significantly reduced the bacterial load of all species taken together. The next step is to validate the intramammary efficacy of bacteriocins in treating mastitis.

INCORPORATING REUTERIN AT THE STIRRING STAGE COMPLETELY INHIBITED THE GROWTH OF *A. NIGER* MOLD FOR 15 DAYS.

IMPACTS AND BENEFITS

Merging science and technology to meet the challenges faced by dairy production and processing companies

Through its investments in research, Novalait promotes the development of knowledge and know-how in its field. It also contributes to the emergence of new talent trained at the master's and doctoral levels, ready to tackle the challenges that dairy companies face.

A new cheese expert

During her studies at Université Laval, Isabelle Fournier explored multiple avenues to improve the performance of dairy concentrates obtained through reverse osmosis in cheesemaking. She obtained particularly conclusive results with respect to whey drainage. Her experience at the NSERC-Novalait Industrial Research Chair on Process Efficiency in Dairy Technology gave her much more than just scientific knowledge, she explains.

Isabelle Fournier
Innovation and Product Development Specialist–Cheese,
Agropur Dairy Cooperative

"My master's allowed me to develop an efficient project planning and management method. Right away, I also had the chance to specialize in the dairy sector and to expand my understanding of science down to its fundamental elements. The cutting-edge knowledge I acquired about analytical methods, new technologies and the physico-chemical aspects of dairy products now serves me in my daily work. I am thankful to have had the opportunity to complete my graduate studies in collaboration with Novalait and am incredibly pleased with my smooth transition into the job market."

"Congratulations on rendering the industrial research chair in process eco-efficiency so productive! From the start, the goal was to develop local expertise in eco-efficiency in dairy technology. I can confidently say *mission accomplished!*"

Michel Pouliot, VP Research and Science, Agropur Dairy Cooperative

Perseverance: A by-product of buttermilk?

As part of her PhD at Université Laval, Marie-Pierre Gauvin studied how buttermilk components influence milk coagulation by rennet. Thanks to a grant from the Canadian Dairy Commission, she developed professional skills that she now applies in her work.

Marie-Pierre Gauvin
Cheese Specialist, Saputo

"At the doctoral level, you try to push the boundaries of your knowledge of a specific subject. However, it isn't always smooth sailing. Things get called into question, you change courses and backtrack until you cross the long-time coming finish line with the thesis defence. What I will especially retain from my graduate school experience is the perseverance and resiliency I developed in the face of more difficult projects. These skills are especially useful to me today in an industrial research context, where you have to apply scientific rigour while knowing how to adapt to the production constraints in dairy plants."

From the lab to hay field

Having grown up on a dairy farm, Jean-Philippe Laroche has always been interested in cows and what they eat! He made it his topic of study, developing leading-edge skills in nutrition and fodder. As a recipient of a grant from the Canadian Dairy Commission, he completed his master's degree at the Animal Science Department at Université Laval, a decision he doesn't regret.

Jean-Philippe Laroche
Nutrition and Fodder Expert,
Lactanet

"I had the opportunity to do my master's as part of an applied research project on dairy cattle nutrition. In my experience, I've found that graduate school is a lot more than just managing a research project and taking courses. It also means learning how to apply a scientific method to a problem, increasing your knowledge, participating in the advancement of knowledge, expanding your network of contacts, and much more! Equipped with this knowledge, I obtained a strategic position on Lactanet's innovation and development team. To my great satisfaction, I am able to apply my expertise in my work for the benefit of the Canadian dairy industry."

For greener... Greek yogurt?

As an agri-food engineer, Catherine Houssard obtained her PhD at the International Reference Center for Life Cycle of Products, Services and Systems at Polytechnique Montréal. Her research focused on adapting tools for sustainable development to the dairy industry, specifically Greek yogurt production. Through her many exchanges with dairy processors, she dove deeper into sustainability-related issues in the industry. Having an entrepreneurial spirit, she also co-founded the non-profit organization PolyCarbone, which encourages Quebec's university community to reduce its greenhouse gas emissions.

Catherine Houssard
Corporate Responsibility Advisor,
Groupe AGÉCO

"My PhD focused on the development of eco-efficiency and life cycle assessment tools for the dairy industry. In the process, I sharpened my critical thinking skills and acquired an understanding of multi-disciplinary concepts, as well as cutting-edge expertise in dairy technology and sustainable development. Within the framework of the project, the partnerships that I formed with Novalait between researchers from Polytechnique Montréal or Université Laval and the dairy industry facilitated the knowledge transfer process. Today, equipped with this magnificent experience, I am pursuing my passion of promoting the transfer of scientific knowledge as the corporate responsibility advisor for the AGÉCO Group."

New expertise in the dairy sector

Through its participation in the development of educational leadership chairs at Université Laval, Novalait has contributed to the creation of numerous researcher positions. These world-class experts help dairy farmers and processors better respond to the scientific and technological challenges that they face.

Excellence in cheese technology

This year, the Educational Leadership Chair in Cheese Technology was also created at Université Laval. Thanks to an unprecedented collaboration between stakeholders in the dairy industry, who contributed to the project funding, Julien Chamberland was hired for the new position. Dr. Chamberland completed his PhD at the NSERC-Novalait Chair on Process Efficiency in Dairy Technology. He has acquired solid expertise as a consultant for Quebecois cheesemakers and as a postdoctoral fellow at the Science and Technology of Milk and Eggs Laboratory in Rennes, France. With his current team, he aims to train highly qualified professionals while developing new knowledge in cheese technology.

Julien Chamberland
Educational Leadership Chair in Cheese Technology and researcher at the Department of Food Sciences at Université Laval

"What an honour to head up such a unifying project for the dairy industry! Expectations are high: to meet them, the Chair creates teaching and research programs that are adapted to users' needs. I want to set up university training courses that are useful both for future graduates and for the many industry stakeholders who are looking for a high level of professional development that is entirely achievable through distance learning. My long-term wish is to make Université Laval a centre of excellence in cheese technology. I want to train future dairy plant managers and accelerate their integration into the job market, offer continuing education opportunities at the Université Laval campus through a spring school, and above all, do dazzling research, all of which undoubtedly presents a competitive advantage for stakeholders in Quebec's dairy sector."

A researcher that's ready to build the future

Sébastien Fournel, a new adjunct professor at Université Laval, credits the creation of the Educational Leadership Chair in Sustainable Agricultural Building Design for his position. His research interests include the optimal management of resources and waste, energy efficiency, the advanced control of indoor environments and advanced production systems. His goal is to develop experimental approaches to better build the agricultural buildings of the future and to ensure the sustainability of those that already exist.

Sébastien Fournel
Educational Leadership Chair in Sustainable Agricultural Building Design at the Soil and Agri-Food Engineering Department at Université Laval

"Major investments are needed to modernize livestock production facilities and increase the competitiveness of Quebec's agricultural companies. The world is changing: agriculture is intensifying, markets are expressing concern about issues such as animal health and welfare, and climate change is creating pressure to reduce the environmental footprint of farms. The chair that I'm leading aims to support financial decision-making in this context. Its mission is to develop a qualified workforce that is able to advise farmers on best practices and to generate and disseminate new knowledge on tomorrow's green infrastructure."

25 YEARS OF RESEARCH AT THE SERVICE OF AN INNOVATIVE DAIRY INDUSTRY

From left to right: Gaston Lajoie and Dimitri Fraeys de Veubeke (Lactel Group), Claude Lambert and Donat Roy (CILQ Research), Alain Bourbeau and Jean Nobert (Producteurs de lait du Québec), Jacques Cartier and Robert Poirier (Agropur Dairy Cooperative)

Visionary founders

In the early 1990s, the dairy sector hit a rough patch and lost some of its market share. To stimulate innovation, dairy farmers and processors created the *Fonds de développement de l'industrie laitière du Québec* [Quebec Dairy Industry Development Fund] in 1993 and jointly invested 1¢ per 100 litres of managed milk. Today, this advancement is equivalent to 1.27¢ per 100 litres of managed milk. Once the funds were raised, all that was left to do was agree on a governance and management model. In the end, Novalait's visionary and bold founders chose to make it a research company. It took two years to develop a unique business model that is still firmly established 25 years later.

Novalait's DNA

Novalait's share capital is held equally by Quebec dairy farmers and processors. Every investment that Novalait makes generates win-win returns for its shareholders. Dairy farmers and processors provide leadership in research by setting research priorities, selecting projects, participating in the monitoring of the work underway, and leveraging research results.

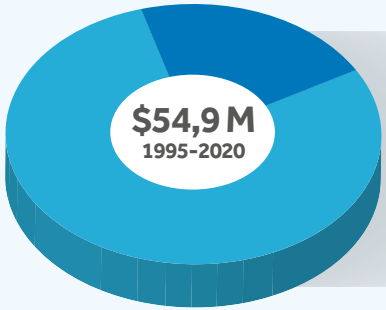
A small, agile organization that operates as a network

Novalait is a research catalyst. The company calls upon a wide network of scientists to develop and carry out research projects that meet the established priorities. Novalait also develops partnerships with knowledge transfer stakeholders to deliver results to farms and dairy plants.

Impacts and benefits

One of Novalait's strengths is its ability to leverage its research investments through funding partnerships. In addition to the discoveries it makes and the solutions it provides as fodder for innovation on farms and in plants, Novalait's investments have resulted in the training of more than 400 professionals and bolstered a scientific network through the creation of 11 new specialized researcher positions. Novalait has also implemented measures to capitalize on its R&D results, notably through licenses with industry suppliers and royalty-sharing agreements.

Novalait



Partners

125 projets

2 strategic networks

8 chairs

400 professionals

11 researcher positions

28 patent applications

3 royalty-sharing agreements

2 licences

Success stories

Summarizing 25 years of research is no easy task. We would nevertheless like to highlight that Novalait has unceasingly supported the dairy industry throughout the years. Since its inception, the Chair in Serum Proteins has provided valuable data on the use of membrane filtration processes to valorize these proteins. A few years later, thanks to the Chair's work on cheese typicity, the dairy industry appropriated genomic tools for quality control purposes and to explore the world of cheese.

Novalait's investments have also resulted in the development of a brand-new field of expertise in dairy process eco-efficiency, both within companies and in research. Over the years, the researchers that Novalait has supported have notably contributed to solving issues related to trans fats and the reduction of salt content in dairy products. Milk quality, both in terms of component profile and microbiological content, is consistently a research theme at Novalait. A chair has been devoted to the topic and many ongoing projects focus on native flora, biofilms and thermoduric bacteria.

MILK QUALITY, BOTH IN TERMS OF COMPONENT PROFILE AND MICROBIOLOGICAL CONTENT, IS CONSISTENTLY A RESEARCH THEME AT NOVALAIT.

Team of researchers and students at the Industrial Research Chair on Cheese Typicity

With respect to production, many of Novalait's projects are carried out on commercial farms, which accelerates the adoption of new practices such as short dry-off periods, adjusted milking and selective dry-off treatments. Novalait continuously backs projects that increase dietary efficiency, improve cow health and increase reproduction performance. In response to a gap in expertise identified by dairy farmers, Novalait initiated the Chair in Sustainable Life of Dairy Cattle and created a research position specializing in animal well-being and comfort in tie-stalls.

Ethical and sustainable production, naturalness, clean label approaches, alternatives to microbial agents and antibiotics... there is no lack of ideas to find new solutions in a dairy industry that's constantly innovating.

Dairy farms and plants are regularly put to the test in a rapidly changing environment. In this context, Novalait offers the advantage of a flexible and relevant R&D investment capacity. After 25 years of accomplishments, the vision of Novalait's founders persists: investing in research means investing in the future.

Novalait 25 1995-2020
Research Catalyst

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