Comparison of cows produced by *in vitro* fertilization and artificial insemination based on fertility, health, and productivity

Duration: 2020-2023

Highlights

- The use of in vitro fertilization (IVF) is steadily increasing in the dairy genetic material industry. A considerable proportion of bulls and cows of high genetic value today are the product of IVF.

- Currently, there is no phenotypical monitoring of these animals, although fertility data and some data on health and productivity are recorded by different stakeholders including Lactanet. As a result, there is no structured analysis for connecting the effects of IVF and the resulting phenotype despite the amount of data available on cattle and the data published on mice and humans.

- In those species, the phenotypic manifestations of IVF are strikingly similar to the manifestations observed and are in line with the mother's metabolic status and therefore suggest that cattle could respond to a metabolic program geared toward milk production.

- The purpose of the project is to match (based on genetics and environment) hundreds of animals produced by IVF and compare them to cows produced by artificial insemination based on productivity, fertility, and longevity (health) parameters.

- It will answer an extremely important question about the use of new reproductive technologies.

Objectives

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Results and potential benefits

In dairy cattle, the current goal of selection is to increase the average number of lactations per cow and therefore revenue by selecting cows with fewer health and fertility problems, such as infections and poor embryo quality. While we know that these traits have low heritability, recent Canadian estimates show variability between the extremes in the bull population, which offers a certain advantage for genetic improvement. In addition, this project aims to include epidemiological information in dairy cattle selection strategies to improve longevity and lifetime milk production. For genetics companies, knowledge of the presence or absence of a phenotypic effect arising from IVF is important for product development and improvement if there is a negative difference or for amplification if there is a positive difference. We must also consider that the phenotype that could arise from IVF is affected by environment and therefore could be adjusted by adapted conditions (e.g., limiting food a bit more) that mitigate the potential effects on production or reproduction.

With Boviteq, a phenotypic analysis of cows produced by IVF will enable the creation of subcategories according to the conditions present during IVF (e.g., age of the donor and bull, feed, culture medium, place of production, type of receiver) and the refining of production parameters that promote favourable phenotypes. Furthermore, producers could have the competitive advantage of having useful information on the phenotypic effects of IVF in order to make the best use of it in and outside Quebec.

Innovative aspects

• Use of a large-scale epidemiological approach

• Creation of epidemiological data on the phenotype of IVF dairy calves in terms of fertility, longevity and productivity

Professional trained

Doctoral student **Simon Lafontaine** was recruited for the project.

For further information

The results of the research will be quickly transferable to dairy producers, and an article will be written for the journal *Le Producteur de lait québécois*. In addition, a presentation may be given during the Quebec Reference Center for Agriculture and Agri-food's Quebec Dairy Cattle Symposium. Other outreach events (articles and talks) are planned for collaborators (e.g., Novalait, Lactanet and Boviteq), and a presentation will be given at the Novalait Forum Techno.

Financial contributions

• Natural Sciences and Engineering Research Council (NSERC)

• Quebec consortium for industrial bioprocess research and innovation (CRIBIQ)

• Boviteq

• Lactanet

• Novalait

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