

Dairy Cattle Genetics Research & Development (DairyGen) Council of Canadian Dairy Network

5-Year Research Priorities

September 2016

DairyGen is the national dairy cattle genetics research council of Canadian Dairy Network (CDN) and regroups all dairy cattle improvement organizations including AI, breeds, milk recording and Dairy Farmers of Canada (DFC). With an annual budget of approximately \$420,000 collected from the industry organizations, and the accompanied government matching support, the **DairyGen Council of CDN supports high priority research in the area of dairy cattle genetic improvement**. To maximize the coordination of dairy cattle research projects funded by national organizations, CDN works closely with DFC in all areas including the establishment of research priorities, the planning and preparation for the Dairy Research Cluster programs offered by the federal government and the allocation of funds towards projects fitting within the mandates of the DairyGen Council of CDN.

The DairyGen Council of Canadian Dairy Network invites researchers in the areas of quantitative genetics, genomics, economics, food science, as well as other areas related to the genetic improvement of dairy cattle, to submit Letters of Intent or Full Applications for proposed research to be carried out during the 5-year period commencing in 2017 that coincide with at least one of the priority topics below. Electronic submissions of Letters of Intent or Full Applications are highly preferred and should be sent to Filippo Miglior (Miglior@cdn.ca) and Émie Désilets (Emie.Desilets@dfc-plc.ca). Submission forms as well as DairyGen Guidelines for Grant Application are available via a link to the DairyGen Council on the CDN web site (www.cdn.ca) or by contacting either aforementioned person. Consistent with the National Dairy Research Strategy developed by the Canadian Dairy Research Council (CDRC) of Dairy Farmers of Canada, the DairyGen Council of CDN has established the following areas of high research priority related to dairy cattle genetics:

Reproduction

Poor female fertility still remains a major cause of cow culling. Female fertility evaluations are currently based on phenotypes that have low accuracy and heritability. Additionally, epigenetics may play an important role in both female and male fertility. There is, therefore, interest in looking at traits in this area from a genetic and epigenetics perspective including genetic variation and relationships with other traits, as well as the identifications of new fertility phenotypes close to the reproductive physiology of the animal. Such new phenotypes, albeit more expensive to collect, may have significantly higher heritabilities than current conception ratios and interval traits.

Animal Health and Disease Resistance

Health related problems at the farm level are of high producer and industry priority. While good herd management practices are imperative for proper animal health and disease control, genetic aspects play an important role in the longer term. Improving animal health is also expected to have a positive impact on human health through increased product safety, reduced human exposure to pathogens, decreased microbial resistance to antibiotics and drugs, etc. There is, therefore, interest in looking at traits in this area from a genetic and genomic perspective including genetic variation and relationships with other traits and disciplines.

Production Efficiency and Sustainability

Sustainably improving production efficiency is a major priority, as producers strive to stay in business in a cost-effective manner. While good management can alleviate some of the stresses associated with high production, producers are looking for genetic means to build a more efficient and robust cow for both current and future production environments. Genetic parameters for traits of economic importance need to be identified and validated, thus permitting the development of improved genetic evaluation

systems for traits associated with 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.

Milk Components

Previous research globally has identified compounds in milk that have human health benefits such as nutraceutical properties. Satisfying the needs of consumers that are increasingly health conscious may provide economic benefits for producers. Further research should focus on the possibility of genetically optimizing levels of fine milk components (i.e.: fatty acids, cholesterol, lactoferrin, etc). Furthermore, using genetics to enhance milk properties for cheese production can provide opportunities for the dairy industry and processors.

Epigenetics and Gene Expression

While the research focus in the past has concentrated on the transmission of genes for genetic improvement, there is a growing need to examine the impact of epigenetics and gene expression on economically important traits under selection in dairy cattle. Additionally, gene expression, functional information, and other “omics” technologies may be used to increase the accuracy of genomic evaluations.

Breeding Strategies

Since the implementation of genomics, the accuracy of genetic evaluations for young bulls, heifers and cows, has significantly increased. Genetic and genomic evaluations are now underway for a series of novel and economically important traits. Furthermore, new tools may be soon adopted such as gene editing, genotype by sequencing and recombination rate. Thus, research is needed to compare the benefits of various strategies and tools for breed improvement and selection. This includes the estimation of economic weights for new and existing traits, and the development of genetic selection strategies aimed at controlling the current reduction in genetic variation due to increased inbreeding levels in dairy cattle populations.

Advancements in Methodologies

Research in this area should focus on new advancements in genetic evaluation methods, and on ways to maximize the use of on-farm data systems in order to increase the accuracy of genetic evaluations. This may apply to genomic as well as phenotypic data.

Novel Ideas and New Technologies

The seven main areas of research priorities for the DairyGen Council of CDN, as outlined above, reflect those that are currently of greatest interest to producers and the industry. The DairyGen Council of CDN also encourages researchers to submit proposals incorporating novel ideas and new technologies, either through quantitative genetics, genomics or epigenetics that might have a beneficial impact on dairy cattle improvement.