

Industry Payback from Investment in Research

In addition to being the national genetic evaluation centre for dairy cattle in Canada, Canadian Dairy Network (CDN) also has the mandate of coordinating industry led research and development in the area of genetic improvement. To fulfil this mandate the CDN Board of Directors appoints members to its Dairy Cattle Genetics Research and Development Council, commonly known as DairyGen. This 14-member advisory committee includes research scientists, industry experts and dairy producers keen to set priorities and reflect practical outcomes as it relates to investing in research.

Industry Investment

The DairyGen Council of CDN was established in 1999 and has coordinated genetic improvement research on behalf of the industry partners including breed associations, A.I. organizations, Canadian DHI partners and Dairy Farmers of Canada. As part of the CDN service fee structure, approximately \$420,000 is collected from these partners for the sole purpose of research activities coordinated through the DairyGen Council with the approval of the CDN Board of Directors. Funds are used to support high priority research conducted in various universities and government research institutions across the country. Funds not allocated in any given year are carried over to the budget for the following year.

During the past 5 years, the DairyGen Council of CDN has provided over \$1.7M in industry funds to support more than 25 different research initiatives. Through various federal government matching programs, an additional sum of nearly \$1.9M was received for the same projects, yielding a total research investment of \$3.6M, averaging \$727,000 per year.

The Payback

All research is an investment into the future. Some initiatives may be very practical in nature while others may be very theoretical and/or exploratory. The outcome of research is often an improved understanding by scientists, which leads to further research down a more informed pathway. In some cases, however, various projects supported by DairyGen have had, or are expected to have, an important payback to the industry and Canadian dairy producers. The following is a brief summary of key research initiatives in recent years that are at the stage of transfer to producer benefit in the near future:

Body Condition Score

Extensive research has been carried out using Body Condition Score (BCS) data collected by Valacta as part of its herd management services as well as the appraisals for this trait carried out by Holstein Canada classifiers via the All Breed Classification service. BCS is moderately heritable and can be used as an indicator trait for female fertility, disease incidence and longevity. In the short term, CDN will be introducing official bull proofs for BCS in all breeds in December 2012 based on classifier assessments in first lactation. In the future, inclusion of BCS data collected through Canadian DHI partners may be possible to improve the accuracy of published genetic and genomic evaluations.

Mastitis Resistance

In 2007, data collection services offered by Canadian DHI partners across the country were expanded to include eight key diseases that affect dairy herd profitability and show promise for genetic improvement, including clinical mastitis, lameness, cystic ovarian disease, displaced

abomasum, ketosis, metritis, milk fever and retained placenta. Presently, five years later, over 40% of all herds enrolled on milk recording submit health records associated with these production limiting diseases and benefit from the associated herd health management reports. Due to the level and quality of reporting for clinical mastitis incidences, research efforts have now reached a point whereby CDN intends to offer genetic and genomic evaluations for Mastitis Resistance in all breeds, commencing in 2013. Genetic variation among the best and worst sires indicates a 25% difference in terms of the percentage of their respective daughters having clinical mastitis (i.e.: 8% versus 33% respectively).

Selection for Immune Response

Following nearly a decade of novel and dedicated research focused on genetics associated with immune response in dairy cattle, there is now a significant payback soon to be available to Canadian dairy producers. A specific protocol has been established to identify animals that are high, medium or low immune responders, which provides an overall assessment of how resistant or susceptible they are to various diseases, including mastitis. In addition, this research identified specific markers associated with immune response, which provide opportunity for genomic selection in the future.

Genetic Analysis of Johne's Disease

In addition to using best management practices for controlling the spread of Johne's disease and reducing its impact on dairy herd profitability, the DairyGen Council has supported research aimed at this disease from a genetic perspective. An important outcome has been the identification of specific candidate gene markers that are associated with resistance to infection of the bacteria causing Johne's disease. In the future, these markers may be useful for incorporation into genetic selection tools to reduce the incidence of Johne's in dairy cattle.

Milk Fatty Acids

The fat in dairy cow milk includes various components including saturated fatty acids, commonly known as "bad fat" in terms of human health, as well as monounsaturated and polyunsaturated fatty acids (i.e.: "good fat"). Recent research has shown that several of these fatty acids are moderately heritable and therefore can be altered by genetic selection in favour of the "good fat" and against the "bad fat". Research is continuing in this important area linking milk composition to human nutrition and health.

Improvements in Genomics

Following official implementation by CDN of genomic evaluations for Holsteins in Canada, research has continued to improve the application of this major new technology. Outside of specific improvements in terms of methods for genomic evaluation estimation, an important advancement has been in procedures for imputing 3K or 6K genotypes into 50K genotypes, which is applicable for all breeds. Of keen interest to breeds other than Holstein has been research examining the value of using high density (HD) genotypes with nearly 800,000 markers for conducting across breed genomic evaluation estimations, thereby improving the accuracy in Ayrshire, Jersey, Brown Swiss and Guernsey breeds.

Promising Initiatives

Most recently, the DairyGen Council of CDN has provided funding for projects in four different areas affecting Canadian dairy producers. Recognizing the importance of mobility and locomotion of cows on the profitability of dairy herds, funding has been allocated to assess various tools as indicators of lameness as well as towards the establishment of a national system for collecting hoof health data in a uniform manner from hoof trimmers across the country. Another project that has both a national and international component aims to identify measures and indicators of feed efficiency in the dairy herd.

Of keen interest to Holstein breeders is a project initiated recently aimed at examining the genetics associated with crampiness (spastic syndrome) in dairy cattle. Should the research identify markers and/or genes related to the expression of crampiness, there would be opportunity to establish genetic selection strategies to reduce its incidence in Canadian dairy herds. Another very practical project started in 2011 is one aimed at identifying markers and/or the specific Variant Red gene that yields red coat colour in Holsteins but with a mode of transmission different than the traditional red gene known in the breed.

Summary

Investment in research is critical to continued improvement of dairy cow profitability. Such initiatives must balance novel ideas for the future with practical applications that affect the farm level in the short- to mid-term. On behalf of the partners in dairy cattle improvement in Canada, the DairyGen Council of CDN has provided seed funding that has generated over \$3.6M of industry led research during the past five years that has been conducted in various Canadian universities and government research institutions. The payback of this investment to dairy producers has been very significant leading to the development of genetic evaluations for new traits, genetic and genomic tools for improving the health, fertility and mobility of dairy cattle, as well as genetic selection opportunities to alter milk composition aimed at improving human health. Ongoing projects also show early promise for improving on-farm profitability for Canadian producers.

Authors: Brian Van Doormaal, CDN
Dr. Filippo Miglior, AAFC Research Scientist at CDN

Date: June 2012