Using genomics to improve dairy producers' profitability

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Four genetic projects were funded within the Dairy Cluster 2 initiative in 2014. The first two projects focus on significantly improving the accuracy of current genomic evaluation methods, whereas the other two complementary projects aim to identify novel traits, related to nutritional value of milk and animal health. Within the first project, single-step genomic evaluation was evaluated as a way to increase accuracy, while reducing bias of genomic predictions for traits with small training population. For instance, reliability for milking temperament was 10% higher for single-step and the prediction bias was decreased by 2/3. The second project involves the genotyping of 10,000 Holstein cows. Epistatic and dominance genetic variances were assessed for female fertility and reproduction traits. Epistatic variances were found to be larger than additive genetic variances for most of the traits, indicating that non-additive genetic effects play an important role in reproduction and fertility traits in Canadian Holsteins. The routine acquisition of the mid-infrared (MIR) spectra of individual milk samples by way of milk recording and the developed MIR prediction equations for groups of fatty acids established within the third project enabled fatty acid phenotypes to be available for a large number of cows. Genetic variation was discovered in the predicted fatty acid groups, which were also found to have strong genetic correlations with already evaluated milk production records, including fat to protein ratio, an indicator of metabolic diseases. Finally, the fourth project aims to provide dairy producers with herd management tools and offer a genomic evaluation to improve hoof health. Results show an exploitable genetic variation for hoof lesions, and, therefore, there is a possibility for improvement through direct selection in the long term. Genomic information was incorporated in the analysis of digital dermatitis, and analyzed using single step GBLUP. Results indicate that the use of genomic selection for digital dermatitis can improve the accuracy of selection for young bulls compared to using selection based on parent average information.

Implications: These research projects will help advance the dairy industry by providing more accurate genetic evaluations and opportunities to select for novel traits of interest to producers and consumers.