

# The Ongoing Challenge of Accurate Genetic Evaluations



## The Past

Genetic evaluation methods and models have traditionally been based on the accurate recording of pedigree and performance data. In dairy cattle, the main traits of interest are only expressed in the female population so the recording of daughter performance such as production yields, type classification appraisals, etc. are primordial. Since the earliest genetic evaluation systems over forty years ago, many improvements have been made in the methods used. Two major examples were the introduction of the Animal Model in 1989, which provided genetic evaluations for cows as well as bulls, and the Canadian Test Day Model used for production traits and somatic cell score since 1999.

The accuracy of very early genetic evaluation systems relied on well-designed young sire testing program. At that time, it was extremely important for semen from each young sire to be used randomly to breed a full cross-section of heifers and cows in many different herds. In addition, elite progeny proven sires resulting from a young sire testing program were subsequently only used in the same province or region where they were proven. The nationwide usage of semen from the best progeny proven bulls in Canada became a reality during the 1990's. This was possible as genetic evaluation systems moved to using the Animal Model, which accounted for any non-random usage of young sires, whether it was in terms of mating better (or poorer) than average cows and/or usage in better (or poorer) herds.

In the 1980's and 90's, as Canadian breeders became increasingly interested in looking at genetics from other countries, semen from progeny proven foreign sires was also used here. This added to the challenge of providing accurate genetic evaluations due to higher than average semen prices for elite bulls and the increased merchandising opportunities for resulting daughters as heifers and/or cows.

## The Present

Canadian Dairy Network (CDN) published the first official genomic evaluations in August 2009. The accuracy of genomic evaluations is highly dependent upon accurate traditional genetic evaluations for proven sires and bull dams. Given that A.I. organizations have significantly expanded the worldwide selection of bull dams and genomic young sires, CDN is challenged to estimate unbiased proofs for foreign sires. MACE evaluations for foreign bulls are the best estimate available to CDN but any inaccuracies in such proofs also affect the accuracy of Canadian genomic evaluations for young bulls, heifers and cows. In addition, published genomic evaluations in Canada also include some weight on the animal's Parent Average, which is less accurate when the parents are foreign. When high-priced semen from elite foreign proven sires is used by Canadian breeders, it is done so most often to breed higher quality females in higher quality herds. This non-random usage, combined with the likelihood of differential treatment given to the resulting daughters, is a growing challenge for accurate genetic evaluations. CDN is actively researching methods to reduce or eliminate such biases and to better incorporate MACE evaluations of foreign sires and bull dams into Canadian genomic estimations and officially published proofs.

## The Future

Not only has the arrival of genomics changed how genetic evaluations are calculated but it has also significantly changed sire selection strategies by A.I. companies as well as semen usage trends by producers. A new challenge for CDN in the future stems from the simple fact that

many candidate young bulls are being genotyped for each one that eventually enters A.I. This process is a new selection step that did not exist prior to the arrival of genomics. Without accounting for the fact that the purchased young bulls were identified as having superior genetic potential compared to their full-sibs, there is a high risk that they will receive a progeny proof that is under-evaluated.

In addition, young sires that are genomically tested and purchased by A.I. companies are no longer used at random. This reality is accentuated by the fact that the price of young sire semen is no longer equal across all genomic young sires. With semen prices varying from \$15 to over \$50 per dose, genomic young sires are now used to breed a wide spectrum of mates including elite embryo transfer donor cows as well as dams of the next generation of young sires. The high level of promotion, both nationally and internationally, given to specific genomic young sires creates new challenges at CDN for the future estimation of an accurate, unbiased progeny proof. Although current genetic evaluation systems can account for some degree of non-random usage of young sires across many herds, and even across various regions across the country, no calculation method available today can account for special management treatment given to daughters of one bull compared to other bulls.

### **Summary**

Although genomic evaluations for young bulls, heifers and cows are clearly more accurate for genetic selection than former traditional evaluations, this new technology also brings new challenges to CDN in terms of delivering accurate genetic evaluations. One immediate area of importance being researched is the development of methods to reduce bias in evaluations for foreign sires and bull dams. The increasing trend towards the non-random usage of elite progeny proven sires as well as high ranking genomic young bulls creates additional challenges in terms of accurate progeny proofs in the future. CDN researchers are actively working on these areas to ensure the high quality genetic evaluation results already well-known to Canada.

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