

## **Bull Proof Accuracy and Stability**

With the globalization of genetics, the accuracy and stability of domestic genetic evaluations within any country is of great importance. Given that Canada exports twice as much semen internationally compared to what is needed to meet the needs of Canadian dairy producers, proof accuracy and stability is even more critical. Of course, the primary goal at Canadian Dairy Network (CDN) is to provide timely genetic evaluations to assist Canadian dairy producers and industry partners in making accurate genetic selection and mating decisions in order to maximize profitability at the farm level.

### **Defining Proof Accuracy versus Stability**

With traditional young sire testing programs, bulls are normally five years of age before achieving progeny proven status and receiving an official LPI. On average, bulls proven in Canada have a Reliability of at least 85% for both production and type when they attain their first official LPI. When CDN refers to proof accuracy, the goal is to provide genetic evaluation services such that each bull's first official proof closely resembles what it becomes years later when the performance of several thousand daughters is included. Proof stability, however, makes reference to any changes that may occur from one genetic evaluation release to another over time. The ideal scenario is to have each bull's first official proof as close to what it will be years later (i.e.: high accuracy) and that very little change occurs over time between these start and end points (i.e.: very stable).

### **Factors Affecting Proof Stability**

Once a bull receives its first official progeny proof and associated LPI, there are numerous factors that can affect how stable it remains from run to run. The most obvious source of proof change is the addition of more daughters as well as more performance data on daughters already included. Since genetic evaluations for production traits are based on test day records, the addition of more performance data means that test day records later in first lactation are added to those already recorded with fewer days in milk. In addition, once daughters progress to second and third lactation more test day records contribute to the sire's published proof and LPI. Other traits, such as Somatic Cell Score, Daughter Fertility and Herd Life also have daughter data being continually added as a bull ages, which may result in some change to their official proof over time.

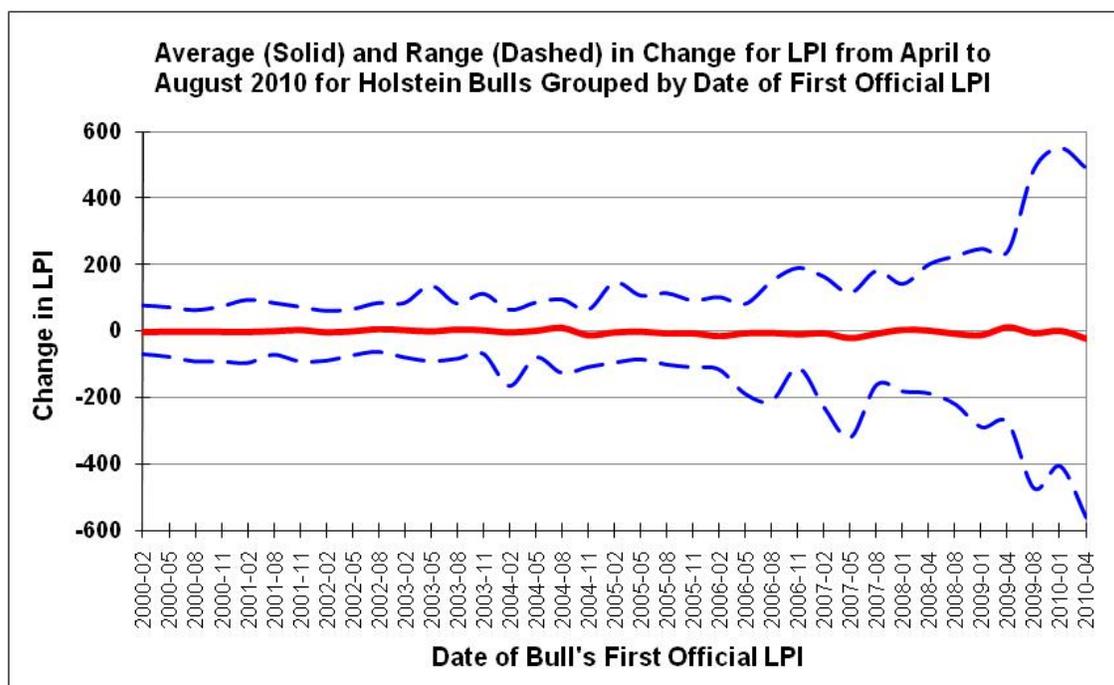
Since August 2009, genomics has also become a potential source of change in published genetic evaluations for males and females. While a change may be expected for newly genotyped animals, since genomics is an independent source of information for predicting an animal's genetic merit, other animals may also be affected. For example, the published evaluation for an animal may change when either or both of its parents are newly genotyped even if the animal itself is not genotyped. Also, with the release of new official genetic evaluations in April, August and December of each year there is a group of over 500 newly proven sires genotyped in North America that are

then also included in the process for estimating genomic evaluations in Canada. The addition of these new sires creates changes in Direct Genomic Values for various animals in the population.

A third factor affecting proof stability includes changes in the genetic evaluation methods and models. For example, in 2009 the genetic evaluation system for production traits was modified to account for the number of days pregnant each cow was on each test day compared to open cows as well as the inclusion of an adjustment for extreme test day yields relative to normal expectations. More recently, proofs released in January 2010 experienced increased change following the implementation of updated estimates of heritabilities and genetic correlations across each of the first three lactations. These new genetic parameters had little impact for the majority of bulls but did result in more variability from the August 2009 proofs for bulls adding daughters in second and/or third lactation.

### Analysis of Proof Stability

Geneticists at CDN recently conducted an analysis to quantify the degree of change in proofs calculated for the August 2010 release compared to April 2010 evaluations. The graph shows the results for LPI for all bulls first proven since February 2000, grouped by the genetic evaluation release when they received their first official LPI. The solid line represents the average LPI change from April to August, which is very close to zero for all groups of bulls. This line demonstrates that no systematic bias exists and bulls have an equal chance of increasing or decreasing from run to run. The two dashed lines reflect the most extreme LPI change within each group that generally includes more than 100 proven sires. As expected, individual bulls newly proven in the past year may experience a wider range of change (i.e.: up to 500 LPI points in either direction), due to the numerous factors possibly affecting their proof. In addition, there is a second group of individual bulls first proven 3-4 years ago that may also experience increased proof variability as they add their second crop of daughters.



## Summary

Genetic evaluations are used daily to make sire selection and mating decisions at the farm level and by AI companies for future young sire purchases. Pregnancies and resulting calves represent an important investment in the advancement of the herd and breed improvement in general. Also, given the lengthy time period that each cow is expected to remain productive in the herd, breeding decisions today have a long term impact on herd profitability. For these reasons, CDN aims to provide the highest possible level of proof accuracy and stability given the various factors that may contribute to their variability. A recent look at proof stability over time has shown no systematic bias in terms of average LPI change and a maximum range in change as expected given the average LPI Reliability near 85% for newly proven sires. Analysis in this area will continue at CDN as it relates to the accuracy of first official proofs versus those three to four years later.

Author: Brian Van Doormaal  
Date: July 2010