Alberta Dairy Management
PREPARED FOR AND DISTRIBUTED BY THE DAIRY EXTENSION ADVISORY GROUP

Genetic Evaluations for Production Traits

The milk production traits are the most important traits when selecting for profitability. For this reason, a clear understanding of genetic evaluations for these traits is essential for genetic improvement.

Data collection

The principle role of milk recording agencies is to collect accurate lactation information particularly calving dates and milk volumes as well as fat and protein percentages in order to determine lactation yields of fat and protein.

Although several levels of service are offered by milk recording agencies, not all milk-recorded herds are eligible for use in Canadian genetic evaluations. All lactation records from an official supervised milk-recording program, either 24-hour or alternate AM-PM, are included in calculating sire proofs and cow indexes. Lactations from some owner-sampler herds are also used in genetic evaluations provided these herds meet the recognized minimum standards which are verified on an annual basis. All lactations on every cow are used and incomplete records with at least 90 days in milk are projected to 305-day yields.

Canada uses a unique method of expressing production yields called BCA or Breed Class Average (see Alberta DHI Breed Class Average infosheet). A BCA is a value expressing the yield of milk, fat or protein, after adjusting for the age and month of calving. In this way, the production of two cows in the same herd can be easily compared regardless of their age and month of calving. BCAs can be expressed in terms of mature equivalent yields using the following table showing the kilogram equivalent of one BCA point by breed.

	Milk	Fat	Protein
Ayrshire	40	1.62	1.32
Canadienne	33	1.46	1.14
Guernsey	37	1.82	1.32
Holstein	53	1.96	1.68
Jersey	35	1.87	1.33
Brown Swiss	45	1.77	1.57

The Animal Model

The principal advantages of using an Animal Model procedure include the following:

- Accounts for the selective use of animals by adjusting for the genetic merit of their mates.
- Considers the information available on all members of the family including both progeny and relatives.
- Corrects for culling as it occurs over time.
- Allows for the expression of sire proofs and cow indexes on the same scale.

Throughout an animal's lifetime, the animal model genetic evaluations are continually being up-dated as more information becomes available. The first information on an animal is derived from its parents and with time, the animal adds its own performance information and eventually progeny information. The resulting Estimated Transmitting Abilities are the most accurate predictor of the genetics which the animal can transmit to its progeny.

Adjustments

Genetic evaluations for production traits are calculated by Agriculture Canada and are published in January and July of each year. Lactation yields, expressed as BCAs, are used to evaluate sires and cows using an Animal Model procedure (see text box above). In addition to the pre-adjustments for age and month of calving when calculating the BCAs, the following non-genetic factors are also accounted for:

- *Herd-year-season-parity* whereby the production of a given cow is compared to that of other cows which calved in the same herd, same year, same season and same parity group. The two calving seasons are March to September and October to February while the two parity groups are first lactations and second or later lactations.
- *Unequal variation* in lactation records from herd to herd.
- *Permanent environmental effects* which are in common to all lactations of the cow.

After adjusting for these non-genetic factors, the Animal Model procedure estimates the genetic potential which each animal can transmit to its progeny. The resulting Estimated Transmitting Abilities (ETAs) are published by Agriculture Canada.

Interpretation

Production evaluations are published for five traits; namely, milk yield, fat yield, protein yield, fat deviation and protein deviation. The three yield traits are published both in terms of BCAs and kilograms of mature equivalent yield. A sire's rating for these traits indicates the expected difference between the 305-day yield of a future daughter compared to that of a typical daughter of a zero-rated sire. Ratings for fat and protein deviations reflect the ability of the sire to increase the percentage of milk which is fat or protein. The typical future daughter of a sire with a protein deviation of +0. 10% for example, is expected to have a protein percentage which is 0.10% higher than the typical daughter of a zero-rated sire.

Genetic progress can only be achieved by using breed improvers as parents of the next generation. It is therefore important to understand the scales used to express sire proofs for each trait.

Figure 1 shows the general distribution of sire proofs for milk, fat and protein yields expessed as BCA indexes. Two major points should be noted from this figure :

- the average sire proof for the yield traits is near +5 BCA ponts so only bulls better than this are breed improvers and;
- two-thirds (67%) of all bulls are between -2 and +12 and more than 15% of all bulls are higher than +12 with the best being around +25 BCA points.

Sire ratings for the deviation traits have an average of zero with the highest being around +0.40% for fat deviation and +0.20% for protein deviation.

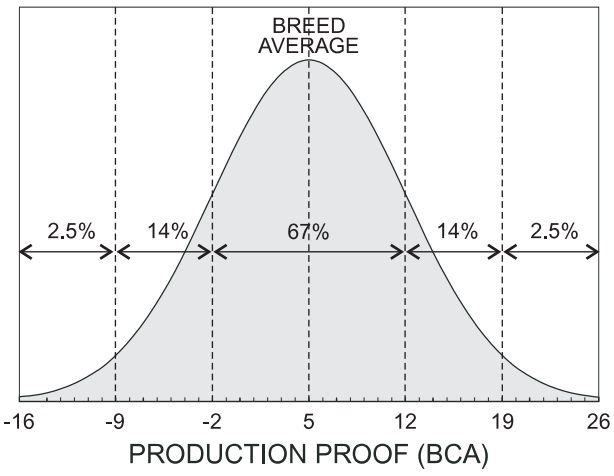

Figure 1 : General distribution of sire proofs for production traits.

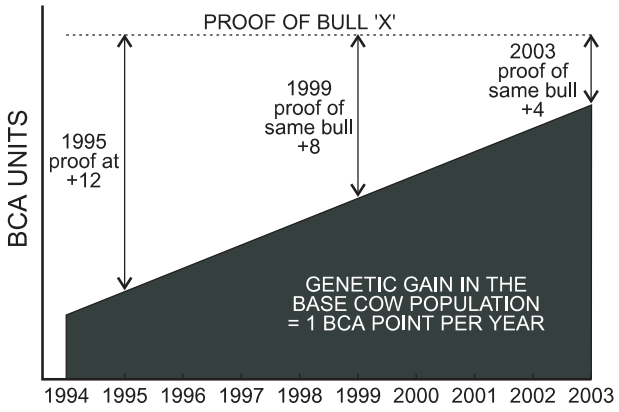

Figure 2 : Rolling genetic base for yield traits in cow population.

Rolling base

Genetic evaluations rank bulls and cows in their order of superiority compared to a defined group of animals called the base group. In Canada, the production evaluations are expressed using a cow base group which is updated at the time of the January evaluation of each year. Cows included in the base group for a given year are those which calved two years previous and have therefore had the opportunity to complete a 305-day lactation. The average index for these cows is fixed to zero and the evaluations for all bulls and cows are expressed as a difference from that average. Figure 2 depicts the evolution of published ratings for a fictitious bull X assuming all changes are due to the rolling cow base and not to additional progeny or lactation records.

As the Canadian cow population continues to make genetic gains, then the genetic level of the base group increases each year. Current genetic trends show an increase of approximately one BCA point per year for each trait. For this reason, sire and cow evaluations in Canada are expected to drop about one point per year. Using bull X in figure 2 as an example, his 1995 rating of +12 would be expected to drop to +8 by 1999 and to only +4 by the year 2003. Although his genetics have not changed over the time period, the genetic level of the base cow population has. Using a rolling cow base encourages breeders to continually use the best genetics and allows them to have accurate expectations of their potential genetic gains.

source :

Your guide to genetic improvement
Canadian Association of Animal Breeders