Réseau laitier canadien
Canadian Dairy Network

Interpreting "Daughter Fertility"

This is the second of two articles describing the new genetic evaluation system for daughter fertility traits to be introduced in Canada in August 2004.

Introduction

In a previous article, a description was provided of the data and traits available for genetic evaluation of dairy sires for "Daughter Fertility". The new system to be introduced with the August 2004 release is based on the calculation of bull proofs for four different traits related to the fertility of dairy cattle. These include the Age at First Insemination for heifers, the 56-day Non-Return Rate (NRR) in heifers, the interval from Calving to First Insemination within each lactation for cows and the 56-day NRR in cows. The second article will focus on the expression of the published bull proofs for "Daughter Fertility" as well as their proper interpretation and use within a sire selection program.

Proof Expression

In terms of phenotypic trends, the existing data at Canadian Dairy Network show very little trend across time for Age at First Insemination and NRR in heifers. In the Holstein breed, for example, the average Age at First Insemination has been quite stable at 16.4 months while the average heifer NRR is 76%, which is essentially the same as the level of fertility in Jersey and Brown Swiss heifers (Table 1). Based on research done in several countries, it is clear that the genetic selection for increased yield in the Holstein breed has resulted in a sacrifice for cow fertility, which in Canada is currently at 61% NRR. In Table 1, heifers and cows in each breed are also considered together as a whole population and the variation across breeds for the average overall non-return rate is shown. While the Jersey breed has the highest fertility at 70% NRR, followed closely by Brown Swiss at 68%, the poorest breeds are Ayrshire (62%) and Guernsey (63%) with Holsteins in between at 66%.

Table 1: Breed Averages for Female Fertility Traits

	Holstein	Ayrshire	Jersey	Brown Swiss	Guernsey
Age at 1st Insemination (months)	16.4	16.9	15.5	16.7	16.5
Calving to 1st Insemination (days)	90	88	92	93	93
NRR in Heifers (%)	76%	68%	75%	74%	68%
NRR in Cows (%)	61%	59%	68%	65%	60%
Overall NRR for the Breed (%)	66%	62%	70%	68%	63%

The output from the genetic evaluation system will be a proof for each of the four specific traits analyzed; two for heifer fertility and two for cow fertility. In order to publish only one proof for Daughter Fertility for each bull, the proofs for the four individual traits will be combined into a single value. The relative weights placed on each of the four traits has yet to be finalized but will be determined such that the expected genetic gain for cow fertility over the next 10 years is maximized without increasing the interval from calving to first insemination in cows.

Published bull proofs for Daughter Fertility will be expressed on a descriptive scale such that the average bull proof equals the overall NRR for each breed (Table 1). The range in bull proofs will generally be 10 percentage points above and below the breed average. For Holsteins, this means an average bull will have a proof of 66% for Daughter Fertility and the range in proofs will be approximately from 56% to 76%.

Proof Interpretation and Use

In Canada, bull proofs are widely published for a list of over 40 traits in each breed, excluding the Lifetime Profit Index (LPI) that combines the most important traits into a single national genetic selection tool. The arrival of Daughter Fertility proofs will mean one more trait for producers and industry to consider when making sire selection decisions. For this reason, care should be taken to accord the proper amount of attention to this new trait without over-emphasizing it.

Firstly, it should be recognized that the heritability of Daughter Fertility is less than five percent, which clearly indicates that it is primarily controlled by management and environmental factors rather than genetics. Given the high economic value of fertility, however, or perhaps better stated as the significant economic loss due to poor fertility, some attention should be placed on this new genetic information available. Rather than avoiding the use of an elite bull due to a below-average proof for Daughter Fertility, it would be appropriate to select him for breeding heifers and cows that have good fertility. This corrective mating approach allows for some usage of all sires that are elite for other traits while controlling the overall level of fertility within the herd and breed.

Secondly, one should think about the expected difference in the fertility of daughters from the various sires being considered. For example, examine two elite bulls that differ in their proof for Daughter Fertility by five percentage points, say one at 68% and the other at 63%. The breed average of 66% represents the overall likelihood that a first insemination would result in a conception since no other insemination would occur within the following 56 days. In the case of the example bulls, the first would have daughters that are expected to get pregnant for 68% of their first inseminations while daughters of the second bull would have an expected success rate of 63% for their first inseminations. Across 100 daughters of each bull, this translates to a difference of five daughters that are expected to get pregnant at their first insemination after each calving.

Lastly, producers must be careful not to confuse Daughter Fertility proofs with bull ratings that are published based on the non-return rate of their semen. Previous research globally has generally shown a very poor relationship between the fertility of a bull's semen (ie: Semen Fertility) compared to the fertility of his daughters (ie: Daughter Fertility). A.I. organizations will generally be providing both Daughter Fertility and Semen Fertility on domestic proof sheets and both will have a similar scale of

expression. While Daughter Fertility represents the expected genetic potential of the bull's daughters for fertility, Semen Fertility simply reflects the likelihood that his semen will lead to a successful conception.

Conclusion

"Daughter Fertility" will be added as an official new trait in August 2004 and appropriate consideration should be given to it by producers and industry for sire selection decisions. Care and understanding is required such that this new tool is not over-emphasized given the current global trend and concern towards poorer reproductive performance.