CHANGES IN GENETIC EVALUATION
OF DAIRY CATTLE:
THE ANIMAL MODEL

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Introduction

The July 1989 USDA Sire Summary introduced a new system for genetic evaluations in dairy cattle. These evaluations, known as the Animal Model (AM), include several new features that help to increase the accuracy of evaluations compared to the way sire summaries were calculated in the past.

Background

Since 1974, the United States Department of Agriculture (USDA) has calculated dairy cattle evaluations using the Modified Contemporary Comparison (MCC) method. It included the MCC-evaluated animals that calved in the same herd/year/season and also accounted for the genetic levels of herdmates by including the sire of contemporaries in calculations.

The Animal Model makes the following enhancements to the MCC calculations: 1) merit of mates; 2) cow families; and 3) change in accuracy calculations. Probably the most publicized change in the animal model has been the inclusion of more information from the maternal side of pedigrees (cow families). The illustration below shows how each evaluation system works:
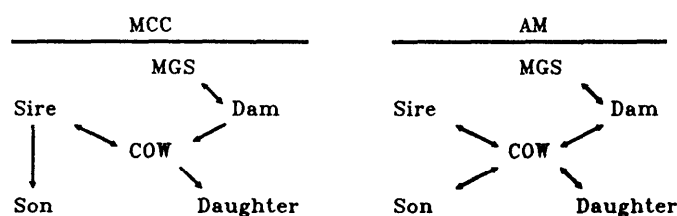
Lines signify the direction of information flow

With the AM, the performance of a cow's offspring is included in a cow's evaluation. Using MCC, the offspring's performance affects only a sire's evaluation. What the son or daughter of a cow did had <u>no effect</u> on the evaluation of the COW. In addition, a bull's pedigree information used in his evaluation includes only the sire's and maternal grandsire's characteristics and no information from the dam or any of her relatives.

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Evaluations according to the AM use <u>all</u> known relatives of an animal. This task involves tracing pedigrees back as far as all relatives are known. Not only will information from a cow be used in calculating an evaluation of her dam and sire, it will also be used in the evaluations of her daughters and sons. The advantage of using all the known relatives is that it provides us with more information (thus more accuracy) in predicting the true genetic merit of an animal.

The merit-of-mates feature of the AM ties closely to the use of all known relatives. Since all of the relatives in the pedigree of an animal are now included, an adjustment can be made to account for the merit of mates. If a bull is only used on superior cows, his daughters should have a certain amount of superior-producing genes that they inherited from their dams. An adjustment can be made to increase or decrease a bull's evaluation depending on the genetic merit of the cows to whom he was bred. This is also the case now in calculating a cow's evaluation, depending on the type of bulls to whom she was mated.

Another facet of the AM is the change in accuracy calculations of bulls. Because of the inclusion of more pedigree information in evaluations, accuracy figures are higher than in the past. This is particularly true for bulls with few progeny.

Terminology Changes

In addition to a new method for calculating proofs, several new terms for genetic evaluations are being used by USDA. Predicted Difference (PD) or Cow Index (CI) are now <u>both</u> called Predicted Transmitting Ability (PTA). This is the estimate of the genetic level an animal will transmit to its offspring. PTA's will be calculated for milk, fat, protein, and component percentages as they have been in the past.

The accuracy of evaluations also has a new name. Under MCC, the term Repeatability was used as a measure of accuracy. Using AM, the term Reliability (Rel) will be used.

Economic indexes are calculated using the AM, just as using MCC. Instead of PD$, the term will now be PTA$. These indexes will be calculated for milk-fat dollars (PTA$), milk fat-protein dollars (PTAP$), and Cheese Yield dollars (CY$). Something that has changed in the economic indexes is that bulls in most listings are now ranked by PTAP$. As more and more emphasis is put on protein nationwide, there is a strong move to include protein production in the way a bull or cow ranks. This is done with the amount of milk, fat, and protein transmitted all being included in the PTAP$ index.

Conclusions

Although there will certainly be some changes and refinements in the AM, it uses more information in computing genetic evaluations than did the MCC. As before, one should remember that this is a ranking system and the best way to select animals for use in a breeding program is to start at the top of the list and work down.