Expected Progeny Difference
Part I, Background on Breeding Value Estimation

OSU EXTENSION FACTS

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Sally L. Northcutt
Extension Beef Cattle Breeding Specialist

David S. Buchanan
Professor of Animal Science

Throughout history, geneticists have studied methods for use in identifying superior individuals in beef cattle populations. Sire selection has tremendous value to the beef cow-calf operation. Choices of herd sires not only have an impact on the resulting calf crops, but these choices also affect the performance of the cow herd if daughters of the sires are kept as replacement heifers. Ideally, beef producers would like to select sires of desirable genetics for genetic improvement in economically important traits. Selection of desirable genetics to match with a cow herd is a challenging task. Fortunately, the concept of breeding value provides beef producers an avenue to make useful selection decisions. The background on breeding value estimation leads to a better understanding of the merit of Expected Progeny Differences (EPD).

Breeding value

Breeding value is defined as the value of an individual as a parent. Parents transfer a random sample of their genes to their offspring. Estimated breeding value gives an estimate of the transmitting ability of the parent.

Expected Progeny Difference

One-half the estimated breeding value is equal to the Expected Progeny Difference (EPD). The word difference implies a comparison. Thus, EPDs let us compare or rank the superiority of individual animals. EPDs provide a prediction of future progeny performance of one individual compared to another individual within a breed for a specific trait. The EPDs are reported in plus or minus values in the units of measurement for the trait. For example, birth, weaning and yearling weight EPDs are reported in pounds. The EPD values may be used to compare only those animals within a breed. For example, the EPD values for a Hereford bull may not be compared against the EPDs for an Angus or Limousin bull.

Genetic evaluation

The first beef cattle national sire summary was published in 1971 by a breed association. Up until the first summary, only within-herd comparisons of breeding value could be made for a given year, season, and contemporary group. The national sire summaries in the early '70s and subsequent summaries allowed cattle within a breed to be compared across herds, generations, and regions of the United States. These evaluations by individual breeds were National Sire Evaluations (NSE). However, the NSE concept had some problems.

(1) Bulls had to have progeny information in order to be included in the evaluation. This meant that only older bulls were published in the summaries.
(2) No adjustment was made for the mating of superior cows to the bulls represented in the evaluation. The purebred breeders saw this as a big problem.
(3) Progeny records were used in the evaluation, but the individual record on a bull was not included.
(4) Breeding values were calculated on sires in the evaluation, but no genetic values were computed for dams.

A mathematical model, called the Animal Model was developed in the mid-1980s to correct the problems associated with NSE. Use of the Animal Model required extensive calculations. To reduce the number of equations that needed to be solved in an evaluation, the Reduced Animal Model (RAM) was developed. This approach reduced the amount of computer memory necessary to run the genetic evaluation.

The theory behind RAM was developed much earlier, but the computer technology was needed to process large numbers of equations for many animals. With the advances in computers, major beef breed associations today conduct National Cattle Evaluations (NCE) rather than National Sire Evaluations (NSE), because of its superiority in genetically evaluating cattle within a breed. The beef industry had progressed into an era of computing EPDs for all animals within a breed; thus, the terminology of cattle evaluation rather than sire evaluation was adopted.

National Cattle Evaluations conducted using RAM

procedures calculate a genetic value for an individual within a breed, whether that individual is a sire, dam, or non-parent animal. Any combination of pedigree, individual records and progeny information is included to derive breeding values for all animals in the evaluation. The breeding values are divided by two and reported as EPDs.

The animal model approach adjusts for the merit of mates. Specific matings of inferior or superior animals are considered. Maternal genetic values, or Milk EPDs, may be computed for the maternally influenced trait, weaning weight. As with the previous evaluation (NSE), EPDs from the NCE are comparable across herds. Environmental and management differences are accounted for so that comparisons can be made.

Also, any genetic change within a breed for a particular trait is accounted for in the evaluation; therefore, comparisons may be made across generations of cattle. Young bulls with no progeny may be directly compared with older sires that have progeny.

Each EPD value should have an accuracy assigned to it. Accuracy is the measure of reliability associated with an EPD. It is expressed as a value between 0 and 1. A high accuracy (>.7) means a higher degree of confidence may be placed on the EPD and the EPD value is not expected to change much as further information is gathered. A low accuracy (<.4) means that the EPD may change a great deal as additional information is gathered.

Contemporary group

In the collection of beef cattle performance information, breed associations realize that contemporary group definition is critical. A contemporary group is a group in which animals of a given sex and age, having similar treatment, are given the equal opportunity to perform (Beef Improvement Federation Guidelines, 1990). The basis of sound performance testing relies on correct identification of contemporary groups. Accuracy in estimation of genetic differences within a group of animals is dependent on accuracy of grouping.

Summary

Breeding value estimation in beef cattle has an important history. Developments in animal breeding theory and computer technology have provided beef cattle producers with a selection tool for comparison or ranking of individual animals within a breed. This selection tool is an Expected Progeny Difference (EPD). National Cattle Evaluations conducted by individual beef breed associations combine pedigree, individual records and progeny performance to compute EPDs. The use of EPDs allows producers to make selection decisions for beef cattle traits of economic importance.

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