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1982

Animal Science Reports

1982

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Jim Gosey
University of Nebraska-Lincoln

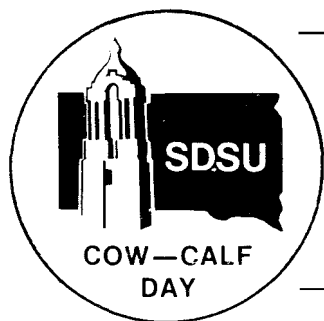
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Recommended Citation

Gosey, Jim, "Breeding Values for the Commercial Cattleman" (1982). *South Dakota Cow-Calf Field Day Proceedings, 1982*. Paper 3.
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BREEDING VALUES FOR THE COMMERCIAL CATTLEMAN



Jim Gosey
Extension Beef Specialist
Department of Animal Science
University of Nebraska
Lincoln, Nebraska

Breeding values should be used as a vital part of the selection goals for bulls being evaluated by commercial cattlemen. When commercial cattlemen buy bulls, they are really buying what those bulls will transmit to future calf crops. Breeding values estimate what will be transmitted.

Background

Breeding values are the result of a mathematical method of fairly combining production trait information from a given animal and various numbers of his relatives into one meaningful figure. At this point, most discussions of breeding value try to convince the reader that breeding values are complex and difficult. While there are some intricacies involved in their calculation, the concept of breeding values is easily understood and quite simple. If you accept and understand the following basic genetic principles, then you understand breeding values: (1) genes have their effects in pairs, (2) an animal transmits a sample one-half of his genes to his progeny and (3) only a portion of the variation measured in a trait is due to genes (heritability). A breeding value for an individual utilizes the heritability of that trait and production records from the individual and his relatives, weighted according to the genetic relationship between the individual and the relatives.

Breeding values can be estimated on any animal for any trait and are usually expressed as ratios with an attached accuracy figure for each trait breeding value ratio. Breeding value is commonly referred to as "EBV," for estimated breeding value, and accuracy figures are usually labeled "ACC" and placed adjacent to the EBV.

All breeding values are "estimates," since the "true" breeding value is not known with any degree of accuracy unless a bull is randomly mated to an infinitely large number of females in many herds and the progeny fairly evaluated. Accuracy figures attached to breeding values tell you how closely the "estimated" breeding value predicts what the "true" breeding value really is. Thus, an accuracy figure attached to an EBV is simply the correlation between the estimated and the true breeding value of an animal for a particular trait. If the only information available on a bull is his own individual performance in a given trait, like yearling weight, then the accuracy of his breeding value is the square root of heritability for yearling weight. If yearling weight is 50% heritable, then the accuracy of an individual's breeding value based only on his own yearling weight is the square root of 50% or about 70%.

Table 1 illustrates a very important point concerning accuracy of breeding values. Breeding values estimated from only an individual record have relatively good accuracy for traits that are highly heritable (ACC =

Table 1. Accuracy of Records on Relatives for Estimating Breeding Value of Individual Animal

Relatives	Number	Genetic relationship	Heritability		
			20%	40%	60%
Parent	1	1/2	.22	.31	.39
Paternal half-sibs	10	1/4	.30	.36	.40
	40	1/4	.41	.45	.47
Maternal half-sibs	2	1/4	.15	.22	.26
	4	1/4	.21	.28	.33
Individual	1	1	.45	.63	.77
Progeny	10	1/2	.59	.72	.80
	40	1/2	.82	.90	.94

77% for individual records when heritability is 60%). However, progeny records improve accuracy for lowly heritable traits a relatively greater amount than they do for highly heritable traits compared to the individual record alone.

For example, (from table 1) the addition of 10 progeny records to the individual record adds 14% to accuracy (.59 - .45 = .14) for traits that have a heritability of 20% but only 3% to accuracy (.80 - .77 = .03) for traits that have a heritability of 60%. Accuracy obviously increases as the genetic relationship, the number of relatives and the heritability increase.

Breeding values are generally calculated for growth traits (weaning and yearling weight), maternal performance and occasionally for birth weight. Maternal EBV is an estimate of how a bull's daughters will milk. Maternal performance is lower in heritability than growth traits and has two other obvious limitations, (1) it is expressed only in females and (2) it is expressed one generation later than growth. Thus, maternal EBV gives the cattleman a powerful predictive tool for building in milk performance in a herd.

Using Breeding Values

Breeding value is what the seedstock producer has to sell and what the commercial cattleman buys, generally in the form of bulls intended for natural service but also in semen form for those commercial cattlemen who use artificial insemination.

In most commercial herds, if cows are culled rigorously on function, then there is little room left to cull on production. Thus, the burden for genetic improvement falls directly on the bulls used. In fact about 85 to 90% of the genetic improvement in a herd will be due to the bulls used in that herd. It should be no surprise that bull selection is critical to the success of any commercial herd. The bull selection process is the point where breeding value should be used.

The first step in successful bull selection is to develop a breeding plan. The breeding plan should include a complete inventory and analysis of resources, environment and market for your product. If crossbreeding is part of the plan, careful consideration of crossbreeding systems best suited to your situation is vital. Traits which receive emphasis in bull selection should reflect how those bulls are to be used in your breeding/crossbreeding plan. The various breed types available today can be broken into three categories, (1) maternal, (2) terminal and (3) general purpose. Primary trait emphasis in maternal breed type bulls should be on functional traits like fertility, milking ability, calving ease, udder conformation and structural soundness, while for terminal breed types the trait emphasis should be on growth and carcass traits.

Once you have determined what breed types are needed in your breeding/crossbreeding plan, then you can develop a list of selection goals for each breed type. Obviously, the selection goals will and should differ between breed types. Table 2 presents an example of a list of selection goals for bulls of two breed types, maternal and terminal.

Table 2. Bull Selection Goals Listed by Breed Type

Trait	Selection goals	
	Breed type	
	Maternal	Terminal
<u>Function</u>		
Fertility		
Semen examination	Live sperm	Live sperm
Reproductive tract	No defects	No defects
Scrotal circumference	Min. 34 cm at 1 yr	Min. 32 cm at 1 yr
Calving ease		
Score	1 = unassisted	Minor assist accepted
Birth weight	65 to 85 lb	70 to 100 lb
Structural soundness	Excellent	Adequate
<u>Milk Production</u>		
Maternal EBV	102 to 110	Not important
<u>Growth</u>		
Weaning EBV	98 to 102	104 +
Yearling EBV	98 to 102	104 +
<u>Market Acceptance</u>		
Frame score (1 year)	4 to 5.5	5 to 6
Fat thickness (1100 lb)	.2 to .4	<.2

The list of selection goals in table 2 represents a plan for "specification buying" of bulls by commercial cattlemen. Breeding values form a vital part of the specifications, not the only part, but a vital part. The beauty of using specification buying is that it forces the buyer to sit down and evaluate what is needed in his program.

Presentation/Interpretation of Breeding Value Information

There is no good excuse for a seedstock breeder failing to have maternal, weaning and yearling EBV's and their corresponding accuracies available for inspection on all bulls offered for sale, even if those bulls are sold at 13 to 14 months of age. Breed association programs are proficient enough to make this possible for all breeders within most breeds today. Even if the complete information is not in the sale catalog, the prospective buyer should be able to call, write or visit and receive the complete data, at least by sale day.

Most sale catalogs (some are excellent) represent pitiful examples of presenting meaningful production data and/or breeding values. First, all abbreviations and traits should be defined in a prominent place in the sale catalog. Second, the same information should be presented in the same format for all cattle in the catalog. Third, accuracy figures should be included on all breeding values. Fourth, footnotes should be kept to the bare minimum. Fifth, a page devoted to that breeder's selection/culling philosophy and goals that says more than how long he's been in business is informative and useful.

The recent publication of performance pedigrees by some breed associations affords seedstock breeders an excellent opportunity to present meaningful data in a logical format to prospective buyers. Performance pedigrees make the traditional ancestral pedigrees "come alive" in meaning, but they are not a prerequisite for the commercial cattleman to do a good job of bull selection. Clearly presented, pertinent production data (including breeding values) in a consistent format will accomplish the same objective.

Summary

Breeding value is a measure of what a bull can transmit to progeny in a particular trait. Breeding value should be a vital part of bull selection goals. Bulls should be evaluated on the basis of whether they meet the specifications needed in a herd. Commercial cattlemen should demand and receive accurate, complete and readable production data from seedstock breeders.