Using National Sire Summaries to Improve Selection Skills

Oregon State University - CL 1037

W.A. Zollinger,
Extension Beef Specialist

Genetic improvement of breeding stock has been the goal of cattle producers for centuries. The desire to select superior animals as seedstock has led to several traditions in the beef industry. Much of the heritage of old west cattle history in the U.S. revolves around the change from the native cattle to the "meatier" domestic cattle resulting from importation of cattle from Britain. The showring was established as the selection place for superior breeding animals. As the value of different production traits was recognized, producers attempted to quantify those traits (i.e., measure them by a weight scale).

The worth of individual animals were compared using within-herd ratios. Thus, an animal's relative worth was measured as a percentage difference from the herd average. With the advent of the computer, in the 1960s and 1970s, breed associations began to report and use estimated breeding values (EBVs) as a numeric representation of an animal's genetic worth. An EBV is a systematic way to combine information of heritability with the performance of relatives and progeny to define an animal's breeding value. This procedure provided more accurate selection than phenotypic selection (visual appearance). While individual performance records increased the accuracy of selection within a herd, they did little to assist the breeder trying to select bulls from the total population. Within-herd comparisons are useful for selection of replacement females, but breeders who want to make maximum genetic progress need to be able to compare and select superior bulls from the entire population.

Epected Progeny Difference (EPD)

Advances in computer technology led to the ranking of non-parent bulls and heifers in the total population. The "Reduced Animal Model" procedure, which produces expected progeny differences (EPD) and estimates accuracies (ACC), requires a large computing base. Estimates use all available progeny and performance records of close relatives. EPDs can be calculated for bulls and cows with progeny and all non-parent bulls and females with legitimate records. Non-parent bull and female EPD calculations combine the individual performance and all collateral relative performance. Primary ancestral information going into young non-parent EPD calculations comes from the animal's sire and dam. Producers should not be concerned about the formulas or calculations but should begin to use the information in making replacement selections. EPD values are an across-the-breed evaluation that allows breeders to compare sires on an equal basis from many different herds, born during different years. The dairy industry has successfully used this approach in its breeding program for years.

Most beef breed associations are now using National Sire Evaluation Data to provide EPDs based on comparison of the progeny performance of bulls by using reference sires. This breeding plan allows for comparative results in different herds and environments. One of the limitations of this approach is the measurable traits involved in the reports. Most sire summary reports will include birth weight, weaning weight, yearling weight, and maternal ability (milking ability) estimates for each bull. Some group reports add calving ease scores, carcass traits, or combinations of these traits.

Not all producers select for one or more of these trairs directly. Growth traits are positively genetically correlated to each other, so selecting for an increase in any one trait will increase the other weights also. For example, an increase in weaning weight is usually associated with an increase increase in birth weight. Calving ease decreases as birth weight increases (negative correlation). Thus, if you select for weaning weight alone, you select indirectly for increased calving problems. It's not the intent of this publication to define selection criteria but to show the usefulness of EPDs when you select sires (and daughters) for herd replacements. By studying EPDs for different sires, you might avoid some of the pitfalls inherent in situations we've just described.

EPDs reflect the expected results from using different sires and are based on the average of the population. Each breed association must make the calculations with a reference population as a base and a designated year each timethe estimates are made. The reference population year may change from time to time. So the EPD values may channge year to year, and the average may not be zero. A review of the printed sire summary describes these changes and averages. Thus, your major use of EPDs may be to compare two or more individuals for relative merit -- not to be used as absolute values of genetic worth.

Try this example, two bulls each appear to be functionally sound. The EPDs for weaning weight are +35 and +15, respectively. The first bull is expected to produce calves 20 pounds heavier than is the second bull. The progeny would be 35 or 15 pounds, respectively, heavier at weaning than the average in the reference breed. If, on the other hand, they're mated to cows above average in performance, then the magnitude of the increased weight would be smaller. However, the 20 pound average difference in progeny performance between the two bulls should be constant if the bulls are mated to cows of similar genetic merit. The EPD value is the best predictor of performance of future progeny of a sire in comparison with progeny of other sires when both are mated to comparable cows.

You can evaluate bulls and define their usefulness according to EPD groupings. The top 5 percent of bulls in a breed are the elite group and should be used in purebred herds for maximizing growth in the foundation stock of the industry. This group of bulls has the highest chance of being the superior sires of the future. The next group of bulls (50 to 60 percent of total bulls) include those that will increase growth in the commercial cattle population. Those grouped below these levels of EPD should not be used as sires to increase weights.

There's a natural conflict between many economically important traits in beef cattle. Different segments of the industry have different priorities for important traits, which can be confusing to a cow-calf producer at the beginning of the production chain. As a producer, you need to identify those traits most important to your management and marketing program. The total production ideal probably does not exist. Once your production goals are clearly stated, you can develop an effective selection strategy involving EPDs.

You'll need to balance traits when you use EPDs. Your production goals might be to improve weaning weights without large changes in either yearling weight (for replacement female mature size) or birth weight (

to reduce calving difficulty). Because the genetic correlation between the three traits is positive, the expected increase in weaning weight is lower than if you select only for this one trait. Bulls are available that fit this criteria. This is why different breeders select different sires to meet their breeding objectives.

Maternal EPDs

A Maternal EPD predicts the weaning weight performance of a sire's grand progeny, which is an indication of the value of his daughters as replacements in the cow herd. Weaning weight is the result of the genetics for growth and the ability of the dam to produce milk. An individual receives half of the genetics to grow from each of its parents. Thus, the estimate for a grand-progeny to grow is half of the grandsire's EPD for weaning weight. The estimate of Maternal EPD is the sum of one-half the EPD for weaning weight plus the EPD for milk. If an estimate can be made for two values, you can easily calculate the third.

Maternal Milk EPD describes the milk level that a bull's daughters are expected to produce compared to other cows in the reference population. An estimated value can be calculated for an unproven bull using production data on daughters of his sire and paternal and maternal grandsires plus his dam's progeny. Once a bull's own daughters come into production the value is calculated using the records of his own daughters in addition to those of his sire and paternal and maternal grandsires.

An Example of Sire Selection

This example is based on the 1985 Polled Hereford Sire Summary. The selection procedure you use depends on whether your goal is to obtain maximum gain in a single trait or improve two or more traits simultaneously. The more traits you select for, the less improvement is expected in any one trait. However, when net profit is considered, maximization of a single trait without concern for other traits may be costly. The mini-summary (Table 1) and selection examples (Table 2) show how the Sire Summary can be used for different production goals by four different breeders.

Breeder No. 1 (Table 2) has decided to maximize growth regardless of birth weight or maternal performance, consequently Sire C is chosen.

Breeder No. 2 wishes to improve growth while maintaining an adequate level of maternal performance. Sire B is chosen.

Breeder No. 3 wants to improve growth and maternal performance while minimizing increases in birth weight. Sire A is chosen.

Breeder No. 4, who wants to improve maternal performance, maintain acceptable growth, and reduce birth weights, selected Sire D.

Table 1. Mini sire summary

	Birth	Weaning	Yearling	Carcass cutability	Marbling Score	Lean Yield	Maternal

Sire	EPD	ACC[1]	EPD	ACC	EPD	ACC	EPD	ACC	EPD	ACC	EPD	ACC	EPD	ACC
A	1.5	0.8	33.5	0.86	52.1	0.8	0.214	0.63	0.061	0.63	3.2	0.7	23.2	0.88
B	5.6	0.75	39.1	0.85	65.2	0.78							12.8	0.85
C	8.5	0.71	45.2	0.85	80.6	0.75	0.352	0.65	-0.63	0.65	8.5	0.72	-5	0.91
D	-0.5	0.73	24.3	0.78	42	0.75							28	0.9

[1]ACC = Accuracy of the estimated EPD. Indicates the reliability of the EPD.

Table 2. Some Selection Examples

Breeder No.	Selection goals	Birth EPD	Weaning EPD	Yearling EPD	Maternal EPD	Bull selected[1]
1	Maximize growth	none	maximize	maximize	none	C
2	Improve growth and maintain adequate maternal performance.	none	+35.0	+60.0	+10.0	B
3	Improve growth, improve maternal performance, minimize increase in birth weight.	+3.0	+30.0	+50.0	+20.0	A
4	Improve maternal performance, reduce birth weight, maintain acceptable growth.	0.0	+20.0	+35.0	+25.0	D

1985 Polled Hereford Sire Summary

Many combinations of selection criteria are possible, including carcass data (which were left out in the above example for the sake of simplicity). Unless your selection criteria are very strict, several bulls in the Sire Summary will meet your standards.

Accuracy of EPD Estimates

Whenever an estimate like an EPD is calculated, there's some degree of probability that the estimate is correct and an offsetting chance it's not. Each association reports an accuracy figure (ACC) for each individual estimate, which is an expression of reliability of the EPD. Also, ACC is a measure of the relative amount of information used to estimate the EPD. Values for ACC can range from 0.0 to +1.0, with values closer to 1.0 indicating greater reliability.

The accuracy values for EPDs (for traits with moderate heritabilities) can be categorized as estimates with:

Low reliability	(ACC less than .65)
Medium reliability	(.65 to .75)
High reliability	(.76 or more)

Accuracy values for EPDs on bulls without progeny will not be as high as values for bulls with progeny. As the number of progeny records increase, so will reliability of the estimate increase. A young bull's EPD for weaning weight accuracy is about .35 and can change as progeny records are added. When adequate progeny records are available, the accuracy will quickly exceed .76, which indicates that the EPDs are reliable and little change should be expected in the estimate. As a general rule, the ranking of older bulls goes down as younger bulls with greater genetic potential are added to the population.

Standard Error

A brief description of the statistical term "standard error" might help us understand what is happening. Standard error indicates the size of the expected changes in particular estimates. Remember: The estimates are specific to a breed. We can show this by using data from the American Hereford Association Sire Summary for 1986 (Table 3).

Table 3. American Hereford standard error of genetic traits at two accuracy levels.

	Standard error	
Trait	**.35 ACC**	**.90 ACC**
Birth weight	±3.0	±0.4
Weaning weight	±15.0	±2.5
Yearling weight	±23.0	±3.5
Milk	±15.0	±2.2

If a group of young bulls all +30 pounds for weaning weight are selected for use, 68 percent of the actual breeding values of these bulls will be within a range of +15 to +45 pounds EPD (within one standard error of the predicted value). Almost all (98%) would be within a +2 standard error units (0 to 60 pounds) when progeny is proven. Predicted EPDs on young bulls can change over time as progeny records are added.

However, on older bulls the standard error ranges are much narrower. The true progeny difference for a proven bull with an ACC of .90 and a weaning weight EPD of +30 is within the range of +25 to +35 pounds. A breeder who understands that estimates can change over time can group the bulls and select on price if the EPDs are similar.

While the estimated EPD accuracy values for nonparent bulls appears to be low, their estimates are still more

usable than within-herd ratios or breeding values.

Summary

Producers now have the information to make a more accurate selection of breeding cattle than ever before. The opportunity for breed improvement is directly on the breeders.

Breeders who mate the correct bulls with their cows will be the breeders with successful programs and will be those who move the breed forward. The only way a breed can move ahead is by getting a high percentage of the cows within that breed bred to superior bulls. The top bulls in the breed should be used on a wide scale to ensure genetic improvement.

EPDs are also an important tool for commercial cattle producers. The criteria for selecting the herds that you use as sources of bulls dictates the genetics you're buying. If a commercial breeder is concerned about birth weight, and the seed stock producer is concerned with maximum weaning weight response, that herd may not be a good source of genetics for this commercial breeder. Therefore, a commercial breeder must evaluate the purebred breeders selection programs and emphasis herds, as well as the individual bulls, for sources of genetic material.

Use of EPDs in selection can help the purebred breeder reach production goals more rapidly. In addition, the commercial producer can select seed stock based on fact --not just guesswork as the "eye" sees it. Each producer can gain insight into the genetics of selected breeding stock and maximize genetic progress for economically important traits by using these selection aids.

Back to the Sire Summaries Page

Back to the South Florida Beef-Forage Program HomePage

July 22, 1998