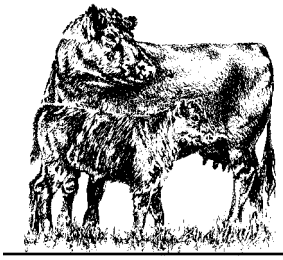

Western Beef Resource Committee *Fourth Edition*

Cattle Producer's Handbook

Genetics Section 835

Performance Records: A Tool in Cattle Herd Improvement

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Beef cattle production is becoming more competitive each year. Value-added programs have given rise to premiums being paid for cattle that exhibit superior quality and performance. Accordingly, cattle producers must look seriously at genetic improvement of their herd in order to remain competitive.

For a herd's performance to improve, the genetics of seedstock being introduced into the herd must be superior to the genetics of the herd. Performance records allow cattle producers to evaluate differences between animals, increasing the likelihood of selecting an animal that is genetically superior.

Performance Records and the Seedstock Producer

Since seedstock producers supply breeding animals to the commercial sector, their animals must be genetically superior for the commercial cattle industry to improve. Thus, seedstock producers have the greatest responsibility to track and improve genetic merit. Seedstock breeders should participate in a detailed performance testing program and should select those cattle that will meet the needs of the commercial sector.

Seedstock producers that select animals based on their expert judgment and their herd's performance data distinguish themselves and their operations as leaders within their respective breeds. Thus, it becomes imperative that the seedstock sector keep detailed and accurate records to assist other producers in bringing about measurable positive changes to the commercial cow herds. This leads to greater economic rewards for both themselves and the customers who purchase their cattle.

Also, breed associations rely upon accurate performance data submissions from their member/producers to calculate expected progeny differences (EPDs). EPDs are estimates of transmittable genetic merit for certain traits based upon the performance of individual animals and their relatives. Inaccurate, estimated, or intentionally biased performance data negatively affects the accuracy of EPDs. Since EPDs have become so important to the cattle industry, seedstock producers must ensure that the data they submit are accurate and unbiased. Data can be biased in the following ways:

Parentage—Failure to correctly identify the sire can occur when an artificial insemination (A.I.) mating is followed immediately by exposure to a clean-up bull. This can be corrected by identifying the correct sire through a DNA test.

Inaccurate Collection of Performance Data—Inaccurate birth dates are a major problem. Estimating weights through means such as heart girth tapes is not acceptable. All weights should be taken on accurate scales and within the time frames identified by the Beef Improvement Federation, which are between 160 and 250 days of age for the adjusted 205-day weight and 330 and 400 days of age for the adjusted 365-day weight (BIF 2004).

Incomplete Records—Breeders must report all data on calves, even the poor performers. If only the performance data of the best calves are reported, the resulting EPDs will be too high. Because data on poor performers are as important as data on top performers, most breed associations accept data even if the calves are not registered.

Connectedness—Data become more valid by increasing the relationship of the herd to the breed as a whole. This can be accomplished by using high-accuracy A.I. sires in the herd.

Contemporary Groups—Individuals of the same relative age and sex that are managed together are called contemporary groups. Bias in this case can be introduced when a producer has single-animal or single-sire contemporary groups. Single-animal groups occur when a producer weighs each calf at 205 or 365 days of age. Single-sire groups occur when a single bull is used on a

group of cows or when performance data are collected on only one sire. This results when producers send only one sire group to a central bull testing facility.

Even if bulls from several other sires and ranches are represented at a central bull test, the "contemporary" groups formed for the purpose of comparing performance on the test would not be viable contemporary groups for the purposes of genetic evaluation. Both of these situations result in the loss of performance data that could have been used in the calculation of EPDs.

Performance Records and the Commercial Cattle Producer

Commercial cattle producers must concentrate their selection efforts toward those economically important production traits that their partners in the industry have identified as being most critical. To accomplish this task, commercial producers must have an understanding of where the production of their cattle lies in relation to those traits. If they do not know how their cattle perform after leaving the ranch (feedlot and carcass), they must work to collect some baseline data in order to know how much selection pressure to apply to various traits.

One way to accomplish this data collection is to participate in a ranch-to-rail program. Participation in these programs allows the producer to obtain feedlot performance information, as well as carcass data. Cattle producers should enroll calves that represent the average of the herd, staying away from really big or really small calves. Also, at least five head from a particular sire should be enrolled if a producer wants to get a true snapshot of the genetic capabilities of the sires used in the herd. This will provide good baseline data relative to overall herd performance, without the necessity of maintaining complete performance records on the entire herd. Many state programs limit the number of head that can be enrolled by a particular ranch.

Once a producer knows where the herd lies in terms of performance, improvement of performance can then be brought into perspective. To accomplish this, a producer must have an understanding of the performance characteristics of different breeds and how those breeds will interact genetically when used in a crossbreeding program. When seedstock animals, which have been identified as having superior performance for particular traits, are used in crossbreeding programs, the resulting crossbred animals will usually exhibit hybrid vigor. This usually leads to superior performance and increased profitability for commercial cattle operations. However, special care should be taken to match complementary breeds (e.g., sire breeds with large mature frames should not be used on small-framed cows in extensive range operations).

While some producers may find it useful to maintain a complete set of performance records on their commercial herd, often it is impractical, especially if the herd is larger than a couple hundred head. Most commercial cattle producers can exert sufficient selection pressure on their calf crop by carefully using performance records and/or EPDs when selecting bulls for their herd, while at the same time culling low-producing cows.

Obtaining Accurate Performance Records

Individual records will not tell much about the genetic superiority of an animal unless there is something to compare them against. Thus, comparison with contemporary animals is essential. When comparing the genetic capabilities of individuals within a contemporary group, the comparisons become more valid as the size of the contemporary group increases. For example, the probability that a superior-performing bull is truly genetically superior is greater if he comes from a contemporary group of 1,000 than if taken from a group of 10.

Animal performance is only partially due to the animal's genetic makeup. Other environmental factors such as nutrition, weather, health, etc., can have a marked effect on how an animal performs. Performance among contemporary animals will even vary due to these environmental factors. Some of these variables have been identified and it is possible to make adjustments to minimize their impact on genetic comparisons. These adjustments are usually accounted for in breed EPD sire summaries.

Selection of Economically Important Selection Traits

Birth Weight—Three weights are important to most beef cattle producers: birth weight, weaning weight, and yearling weight. These weights are positively correlated, meaning that as one increases the other two increase as well. Since cattle are usually sold by the pound at either weaning or as a yearling, most producers are looking for high weaning or yearling weights. However, selection based solely for one or both of these traits, without considering birth weight, can have disastrous consequences on dystocia caused by large calves.

Selection of bulls that possess high growth potential coupled with low birth weights is possible, however. In order to identify those bulls that fit this category, accurate birth weight data must be obtained on every calf born in the herd. This is especially true in purebred herds and is less critical in multiple-sire commercial herds.

Both the sex of the calf and the age of the dam at calving will influence the birth weight. All calves should be compared on a bull basis. To do this, multiply heifer birth weights by 1.07. Age-of-dam adjustments vary from breed to breed, and breed associations can provide adjustment factors for their respective breed. However, Table 1 provides a list of the Beef Improvement Federation's recommended "generic" age-of-dam adjustments (BIF 2004).

Table 1. BIF standard adjustment factors for birth and weaning weight.

Age of dam at birth of the calf	Birth weight	Weaning weight	
		Male	Female
2	+8	+60	+54
3	+5	+40	+36
4	+2	+20	+18
5-10	+0	0	0
11 and older	+3	+20	+18

Calving Ease—Dystocia, or difficult births, account for many calf deaths each year. Many breed associations calculate EPDs for calving ease as well as a separate EPD for birth weight. Calving ease EPDs correlate with the following scale:

	Difficulty	Assistance
Score 1	None	None
Score 2	Minor	Some
Score 3	Major	Hard pull
Score 4	Caesarean section	Surgery
Score 5	Abnormal presentation	NA

Some of the factors that can increase the probability of calving problems are large calves, small heifers, and heifers with a small pelvic opening. Selecting bulls with low birth weight EPDs, coupled with continued selection pressure toward small birth weights on the cow side, will mediate the problems of large calves. Usually, proper heifer development and continued good nutrition will help reduce the problems associated with small heifers and, to a certain extent, small pelvic area problems. However, this latter statement is not always true.

Some producers are measuring pelvic area using a caliper-type device to reduce the incidence and severity of dystocia in first-calf heifers. The two devices currently used by most producers are the Rice Pelvimeter and the Krautmann-Litton Bovine Pelvic Meter. An individual animal's "calving ease score" cannot be calculated using this measurement, since calf size and heifer development are major factors in determining calving ease. However, if a herd has a particularly high incidence of dystocia, culling 10 percent of the heifers that exhibit the smallest pelvic area can put significant selection pressure away from dystocia caused by small pelvic area.

In order to be valid as a selection tool, pelvic area must be adjusted to a standard age of 365 days. Once this calculation is complete, each heifer can then be compared to the group. Fig. 1 shows the vertical and horizontal measurements needed to estimate pelvic area. These measurements should be taken when the calf is at or near 12 months of age (320 to 410 days of age). The equations to adjust the actual pelvic area measured to a 365-day standard are as follows:

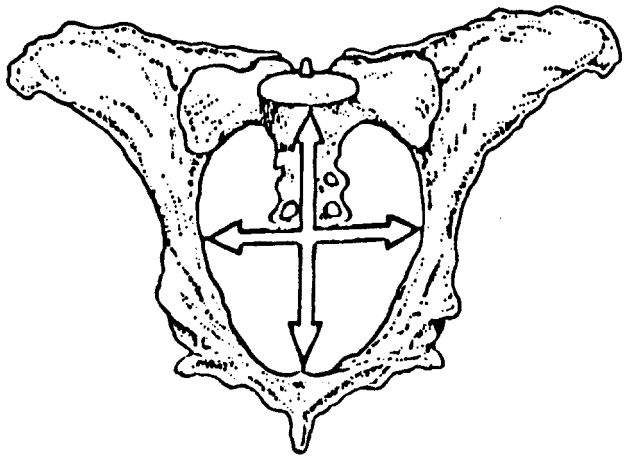

Fig. 1. Vertical and horizontal measurements needed to calculate pelvic area.

Heifer adj. 365-day pelvic area =
Actual pelvic area (cm^2) +
[0.27 x (365 days of age)]

Bull adj. 365-day pelvic area =
Actual pelvic area (cm^2) +
[0.25 x (365 days of age)]

The reason for measuring the bull's pelvic area and selecting for this trait in bulls is the fact that since this trait has a relatively higher heritability, a bull with a larger pelvic area will pass a tendency onto his daughters. Selection for this trait in bulls coupled with culling of heifers with small pelvic area will allow the producer to effectively reduce dystocia caused by inadequate pelvic area.

Weaning Weight—Weaning weight is an important selection criterion, as it measures both the cow's milk production and the calf's genetic potential for growth. Since in most herds, calves within a contemporary group are all weaned on the same day, but at different ages, weaning weights should be adjusted to a 205-day weight in order for the calves to be compared fairly. This adjustment also takes into account the age of the dam. Use the following formula to make this calculation:

$$\text{Adj. 205-day weight} = \frac{(\text{weaning wt.} - \text{birth wt.}) \times 205}{\text{Age at weaning (days)}} + \text{Birth wt.} + \text{Age of dam adjustment}$$

Once this calculation is completed for each animal, a weaning weight ratio can then be calculated that can be used to see how each individual animal compares to the average of the contemporary group. These calculations should be made separately for bulls, steers, and heifers. A producer who wishes to compare the productivity of the entire cow herd, regardless of which class of calf individual cows deliver, can do so by either adjusting to a bull or steer basis. To adjust the 205-day weight to a bull basis the adjusted 205-day weights of the heifers and steers should be multiplied by 1.10 and 1.05, respectively. To adjust the 205-day weight to a steer basis the

adjusted 205-day weights of the heifers and bulls should be multiplied by 1.05 and .95, respectively.

To calculate a ratio for adjusted 205-day weaning weight, use the following equation:

$$\text{Adj. 205-day wt. ratio} = \frac{\text{Individual 205-day wt.}}{\text{Group average 205-day wt.}} \times 100$$

Ratio values equaling 100 or more demonstrate that the animal is at or above the average of the group. Conversely, if an animal's ratio is below 100, it means that animal's performance is below the average of the group. Selection pressure can then be exerted on the herd by identifying and culling the low-producing cows, as evidenced by their calf's poor performance.

Yearling Weight—Yearling weight is also an important economic trait for which to select as it not only demonstrates the calf's ability to grow, but also has a positive genetic correlation to feed efficiency. In other words, those animals that grow more rapidly also tend to do it with less feed per pound of gain.

Usually yearling weight is adjusted to a 365-day standard. The influence of the age of the dam is about the same on yearling weight as it is on weaning weight. Accordingly, the adjusted 365-day weight can be calculated using the following equation:

$$\text{Adj. 365-day wt.} = \frac{(\text{final wt.} - \text{actual weaning wt.})}{\text{Days between weaning and final wt.}} \times 160 + \text{Adj. 205-day weight}$$

Yearling weight ratios are calculated and interpreted the same way as 205-day ratios.

Scrotal Circumference—Fertility and/or age at puberty of heifers can be predicted by the testicular size of their sires. Most heifers sired by bulls with a scrotal circumference of 32 cm or greater will cycle to calve at 24 months of age, if they have been developed correctly. While scrotal circumference can be adjusted to a 365-day standard, scrotal measurements should be taken on bulls as close to 12 months of age as possible.

Frame Score—Frame score, as determined by conversion of the hip height measurement, is a convenient way to look at the skeletal size of cattle, and ranges from 1 to 9. For example, a mature cow with a frame score of three (3) and a body condition score of five (5) would be expected to weigh around 1,010 pounds. Whereas a mature cow with a frame score of seven (7) and a body condition score of five (5) would be expected to weigh approximately 1,390 pounds.

The measurement is taken directly over the hip bone when the calf is between 5 and 21 months of age (Fig. 2). The measurement can then be converted to give an approximation of frame score using tables developed by the Beef Improvement Federation. These tables are available on the BIF web site:

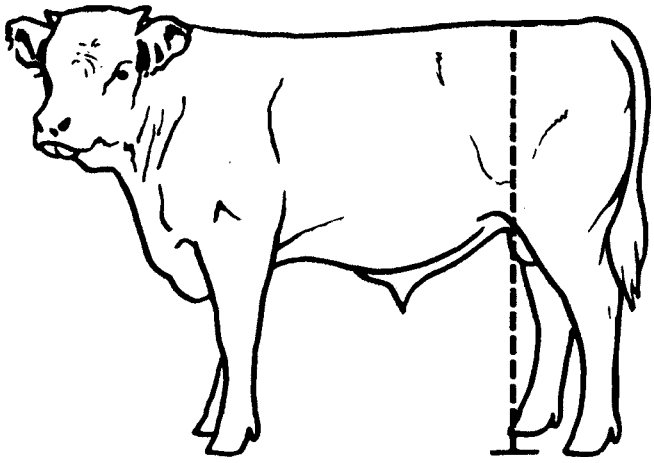

Fig. 2. Correct place for measuring a beef animal hip height.

http://www.beefimprovement.org
guidelines/Chap3.PDF

Carcass Information—Consumer preferences are becoming more of a driving factor in selection decisions with the development of numerous branded products. The advent of branded beef products have led to premiums being paid for cattle producing carcasses that rest within a narrow set of specifications. This, in turn has led to selection pressure being exerted at all levels of the industry to produce cattle that fit in the branded product niche.

Obviously, seedstock producers will not slaughter their breeding animals to obtain carcass data. In the past, most of the carcass information available on bulls has been derived from their progeny. The advent of ultrasound technology has allowed for collection of carcass measurements such as ribeye, backfat, marbling percentage, and rump fat on seedstock without the necessity of slaughtering the animal.

While this is an estimation of the actual measurements and can be inaccurate to some degree, it is an actual measurement of the animal rather than relying on its progeny. This takes out the variability introduced by the dams of the progeny, and as such, is more accurate when looking at the individual in question. As the technology improves, it is hoped that the accuracy of these measurements will improve also.

Central Testing Station Performance Records

Central testing stations are locations where animals are assembled from several herds to evaluate differences in some performance traits under uniform environmental conditions. Just as performance records cannot be compared among ranches because of different environmental factors, neither can valid comparisons be made between the performance of animals located at different test stations. Valid comparisons can only be made among animals of similar age, started on test at the same time and at the same testing facility.

Central test stations provide a good opportunity to accurately compare rate of gain among bulls subjected to the same ration and management conditions for a fixed period of time, usually between 112 and 140 days. Some stations also measure feed efficiency, scrotal circumference, carcass traits, and frame size. These traits can be compared among bulls on a central test station contemporary group and are moderately to highly heritable.

In summarizing final test results, traits such as yearling weight and weight per day of age are often calculated, but caution needs to be exercised in comparing such traits. While these traits are important to review, they are influenced by growth before coming into the testing facility and may contain some environmental bias from pre-test production conditions.

Summary

Performance records are a valuable aid for making genetic comparisons to both purebred and commercial cattle breeders. Only performance records between contemporary animals can be used for making valid genetic comparisons. It is important to collect accurate performance records and adjust data to remove any known non-genetic bias.

Most economically important traits are sufficiently heritable that change can be effected when selection pressure is applied. Which traits are chosen for selection will vary depending upon the producer's production goals and current levels of performance. Cattle producers who combine good judgment with the systematic use of good performance records will have a significant impact on improving beef production and may improve the long-term economic viability of their operation.

References

Beef Improvement Federation. 2004. Guidelines for Uniform Beef Improvement Programs.

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