

# Expected Progeny Difference: Part II, Growth Trait EPDs

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## Expected Progeny Difference (EPD)

Most beef breed associations express estimated breeding value as an Expected Progeny Difference (EPD). 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. In other words, the EPD values for a Hereford bull may not be compared against the EPDs for an Angus or Limousin bull. The EPD values are most useful when two individuals are being compared directly. For example, consider the two sires in Figure 1 and assume that both sires are from the same breed and that the EPDs have equal accuracies.

Figure 1. Example of Birth Weight EPD

	Sire A	Sire B
EPD in pounds	+5	-2

The Expected Difference in the Progeny of Sire A and Sire B for birth weight is 7 pounds. Sire A has an EPD of +5 and Sire B has an EPD of -2. On the average, we should expect the calves by Sire A to be 7 pounds heavier at birth than calves of Sire B, if all the calves are managed uniformly and are from cows of similar genetic merit. The predicted performance difference is 7 pounds although it is not possible to estimate the actual birth weight average for these calves. The EPDs allow the prediction of performance **differences**, not actual performance.

Each individual member of a breed can have EPD values calculated for it. Purebred breeders report data to the national herd improvement program for their breeds to contribute to the breed national database. Age and sex of a calf or status as a parent are not limiting factors. A newborn calf could be assigned EPDs. It is possible to compare any two members of the breed regardless of location but comparisons cannot be made across breeds.

Each individual has its own performance and the performance of progeny, sibs, parents, grandparents, etc., that can be utilized to evaluate genetic merit. New animal breeding and computer technology result in techniques whereby the performance of the animal and information on its relatives is included in the estimate of genetic merit. Thus, EPDs are available on parent and nonparent animals. This process involves extensive calculations which only the latest generation of computers are able to accomplish efficiently.

The EPD values are available for all animals, male and female. Preferential mating of certain individuals does not bias the results. A genetically superior bull can be mated only to genetically superior cows and his EPD will not be inflated. This is accomplished by adjusting for the EPDs of the cows to which he is mated. Appropriate adjustments are made for genetic trend. For example, this adjustment allows young bulls to be directly comparable to older bulls with many progeny records.

Figure 2 is an example of weaning weight EPDs. It describes a weaning weight difference in the progeny of two bulls.

Figure 2. Example of Weaning Weight EPD

	Sire A	Sire B
EPD in pounds	+25	-10

The Expected Difference in the Progeny of Sire A and Sire B for weaning weight is 35 pounds. Sire A has an EPD of +25 and Sire B has an EPD of -10. On average, we should expect the calves by Sire A to be 35 pounds heavier at weaning than calves of Sire B, if all the calves are exposed to the same environmental conditions and are from cows with similar genetic merit.

Figure 3 is an example for yearling weight. It describes a yearling weight difference in the progeny of two bulls.

Figure 3. Example of Yearling Weight EPD

	Sire A	Sire B
EPD in pounds	+50	+10

The expected difference in the Progeny of Sire A and Sire B for yearling weight is 40 pounds. Sire A has an EPD of +50 and Sire B has an EPD of +10. On average, we should expect the calves by Sire A to be 40 pounds heavier at one year of age than calves of Sire B, if all the calves are managed uniformly and are from cows with similar genetic merit.

**Breed average EPD and Base Year.** It is frequently said that an EPD is a comparison to an average bull. This is not an accurate statement. A zero EPD represents the average genetic merit of animals in the database at the time when there was sufficient information to calculate EPDs. Therefore, it represents a historic base point, or base year. Some breed associations now set the base year to a particular year. If the breed has made any genetic change for a trait, the average EPD for the trait will no longer be zero. Breed associations publish the average EPDs in the sire summaries made available to the public. Information printed in the summaries should be examined carefully before individual EPDs are studied.

**Accuracy** is the measure of reliability associated with an EPD. Each EPD value should have an accuracy assigned to it. 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. Nonparent animals have lower accuracy values since no progeny information contributes to their EPD. From a practical viewpoint, the EPDs are used to select bulls for use in the herd, and accuracies help determine how extensively to use the bulls in the herd. Some sale catalogs do not list accuracies with the EPDs. On young animals with no progeny data, such as yearling bulls, one would realize that accuracies would be low.

**Possible Change** is the measure of the potential error associated with EPD values. Many sire summaries are starting to include such values. Possible change is expressed as "+" or "-" pounds of EPD. These values quantify the amount a certain EPD may deviate from the "true" progeny difference. Accuracy and possible change values share a relationship. As more information is accumulated, accuracy increases and possible change diminishes. For a given accuracy, the "true" progeny differences of two-thirds of all animals evaluated within a breed are expected to fall within the plus or minus possible change value. An example to illustrate this point follows:

Birth weight EPD = +2.0 pounds      Accuracy = .60  
Possible Change = ± 1.3 pounds

Of all the animals with this EPD and Accuracy, two-thirds of the animals are expected to have "true" progeny differences between +.7 and +3.3. These "true" differences have a much greater chance of falling toward the center of the range defined by the possible change value than falling close to the extremes.

Also, one-third of the individuals in the evaluation may have their "true" progeny difference values fall

outside the range of +.7 and +3.3. This means that one-sixth of the individuals may have "true" values less than +.7, and one-sixth of the individuals may have "true" values more than +3.3.

**Sire Summaries** include a sampling of the available genetic material in each breed. The summaries for breeds that conduct National Cattle Evaluations come out at least once a year. Summaries include EPDs, accuracies, graphs of the average change in EPD for the particular breed, breed average EPDs, possible change values, and other useful materials. Descriptive material written at the first of each summary describes the format for reporting the EPDs.

An example of a sire summary is listed below. The example presents EPDs and accuracy values (ACC) for traits commonly found in most summaries.

Sire	Birth wt		Weaning wt		Milk		Yearling wt	
	EPD	ACC	EPD	ACC	EPD	ACC	EPD	ACC
Bull 007	+4.0	.90	+24	.90	+12.0	.70	+50	.80
Bull 086	+2.0	.70	+12	.60	+5.0	.15	+35	.50

At least 16 beef breed associations currently conduct national cattle evaluation programs. Almost all sire summaries include birth weight, weaning weight, yearling weight and milk EPDs. A few currently include some characteristics that have a role in reproduction such as calving ease, gestation length, and scrotal circumference. Many of the breeds are currently working to include some of these other characteristics into the summaries. There is a fairly large effort to incorporate more carcass information. Carcass evaluations may result in EPDs for carcass weight, rib-eye area, fat thickness, and marbling score.

Many of the summaries contain two listings of bulls. The first is a listing of progeny proven bulls. These are older bulls that have calves with performance records; therefore, the accuracies on the birth and weaning weight EPDs are generally at least .5. The second section is devoted to younger bulls that have lower accuracies (.3 to .5 on weaning and birth weight). The criteria for listing varies among the breeds.

## Summary

Expected Progeny Difference (EPD) values let beef producers compare or rank the superiority of individual animals within a breed. These EPDs are readily available to beef producers for use in sire selection, provided bulls compared are from the same breed. Many of the beef breed associations conduct national cattle evaluations and publish sire summaries at least once per year. Growth trait EPDs for birth, weaning, and yearling weights are commonly available for most breeds of beef cattle.

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