

# EPDs and \$ Indexes

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Development of animal breeding models, along with advances in computer technology and genomics, have provided beef producers with selection tools which allow animals within a breed to be compared for their genetic merit. These selection tools are Expected Progeny Difference (EPD) for individual traits, and \$ Indexes which combine several EPDs into one economic value. Individual beef breed associations conduct National Cattle Evaluations (NCE) at varying frequencies depending on the breed (for example, the Angus and Simmental Associations conduct them weekly, while other breed associations may be once or twice a year). The NCE combine individual records with pedigree and progeny data, along with DNA (genomic) data, to calculate EPDs. Interim EPDs are calculated for young animals whose records are processed between the times of the NCE. All bulls in the IBEP bull test are from breeds that incorporate DNA information, and sale bulls are required to have DNA information themselves, resulting in “genomic-enhanced EPDs”.

The difference in EPD of two bulls is the difference in expected performance of their progeny, assuming the bulls are mated to similar cows and their progeny are in similar management and environmental conditions. EPDs are expressed in the same units as the trait. For example, Birth Weight, Weaning Weight, and Yearling Weight EPDs are in pounds, while Carcass Fat EPD is in inches. The sign of the EPD indicates direction; positive (+) means larger (heavier weights), and negative (-) means smaller (lighter weights). Which direction is “good” depends on the trait. Positive or higher EPDs would be good for weaning weight but may be bad for birth weight. EPDs are valid only for comparing bulls of the same breed. Do not compare EPDs of bulls in different breeds.

The EPD traits can be divided into the categories of Production Traits, Maternal Traits, and Carcass Traits. Although many traits, such as birth weight and weaning weight, have EPDs in all breeds, EPDs for other traits will vary depending on the breed. Breeds will also use different abbreviations for traits. The following section describes the traits and their interpretation.

## Production Traits

- Birth Weight (BW), in pounds, predicts the weight at birth of the bull’s progeny compared to progeny of other bulls. A bull with an EPD of -1 is expected to have progeny which average 3 lb lighter than progeny of a bull with an EPD of +2.
- Weaning Weight (WW), in pounds, is a measure of the preweaning growth of the bull’s progeny. Higher EPDs mean heavier calf weights.
- Yearling Weight (YW), in pounds. Higher EPDs mean heavier weights for the bull’s progeny.
- Direct Calving Ease (CED,CE) is a measure of the ease with which a bull’s calves are born to first calf heifers. Higher EPDs mean fewer assisted births. The difference between the EPDs of two bulls is the expected difference in % assisted births.
- Docility (DOC) is a measure of the temperament or disposition of the bull’s progeny. Higher EPDs mean more favorable docility. Note that in herds where temperament problems are not an issue, the expected difference between two bulls would not be realized.
- Scrotal Circumference (SC), in centimeters. Higher EPDs mean the bull’s male progeny will have a larger scrotal circumference.
- Yearling Height (YH), in inches. Higher EPDs mean taller progeny.
- Dry Matter Intake (DMI), in lbs/day, is a measure of feed intake during the postweaning growth period. Higher EPDs mean a higher feed intake by the bull’s progeny.

- Residual Average Daily Gain (RADG), in lbs/day, measures postweaning gain of progeny given a constant amount of feed consumed. Higher EPDs mean the bull's progeny will gain more weight per day on the same amount of feed.
- Average Daily Gain (ADG), in lbs/day, measures postweaning gain. Higher EPDs mean the bull's progeny will gain more weight per day.

### **Maternal Traits**

- Milk or Maternal Milk (MILK,MM,MK), in pounds, is measured by the weaning weight of the calves. It predicts the milking and mothering ability of the bull's daughters, expressed as her calf's weaning weight. Higher EPDs mean heavier calf weights due to the daughters' milking and mothering ability.
- Maternal or Daughters' Calving Ease (CEM,MCE) is a measure of the ease with which a bull's daughters calve as first-calf heifers. Higher EPDs mean fewer assisted births.
- Heifer Pregnancy (HP,HPG), in %, is the probability of the bull's daughters becoming pregnant as first calf heifers in a normal breeding season. Higher EPDs mean a higher % pregnant.
- Udder Suspension (UDDER,UDDR). Udder suspension scores range from 9 (very tight) to 1 (very pendulous). Higher EPDs mean that the bull's daughters would have a tighter udder suspension.
- Teat Size (TEAT). Teat size scores range from 9 (small) to 1 (very large). Higher EPDs mean that the bull's daughters would have smaller teats.
- Sustained Cow Fertility (SCF). The ability to continue to calve from 3-12 years of age. Higher EPDs mean a higher probability of having one more calf, or a higher probability of remaining in the herd to age 12. The difference in EPDs of two bulls is the expected difference in probability.
- Stayability (STAY,STY,ST). The ability of a bull's retained daughters to remain productive in the herd (calving every year) through 6 years of age, expressed as a percent. Higher EPDs mean the bull's daughters are more likely to stay in the herd.

### **Carcass Traits**

Carcass traits may be measured at slaughter, or measured on live animals using ultrasound. Many breeds report EPDs for carcass traits, using one type of measurement or a combination of both. All measure the expected performance of the bull's progeny. Most breeds use a constant age endpoint for carcass data; however, Gelbvieh use a constant fat endpoint.

- Carcass Weight (CW,CWT), in pounds. Higher EPDs mean heavier weights of the bull's progeny.
- Marbling (MARB,MRB,MB) is a measurement of the marbling score. It is a subjective measure of % intramuscular fat. Higher EPDs mean the bull's progeny would have higher marbling scores.
- Ribeye Area (RE,REA), in square inches. Higher EPDs mean the bull's progeny would have a larger ribeye area.
- Fat Thickness (FAT,FT,BF), in inches, measures the fat thickness at the 12th rib. Higher EPDs mean greater fat thickness for the bull's progeny.
- Yield Grade (YG) is a measure of the relative proportion of closely trimmed, boneless retail cuts. Higher EPDs mean the bull's progeny will have higher yield grades, and thus a lower proportion of retail cuts.
- Percent Retail Cuts (RET) is a measure of the percentage of closely trimmed, boneless retail cuts. Higher EPDs mean the bull's progeny will have a higher percentage of retail cuts.

## \$ Indexes

These are multi-trait selection indexes. They combine EPDs for several traits into a single economic value, which can be used to make selection decisions. The index values are interpreted like EPDs; the difference in index value between two bulls is the expected difference in average dollar value of their progeny, when the bulls are bred to similar cows. Typical beef production and economic values are used in calculating the indexes. Indexes are expressed in dollars per head, and higher indexes mean a higher dollar value per head. An index value only has meaning when it is compared to the index value of another animal of the same breed. Currently, indexes are calculated for Angus, Charolais, Gelbvieh, Hereford, Limousin, Red Angus, Shorthorn, Simmental, and SimAngus bulls.

- Angus \$M is Maternal Weaned Calf Value. This is the expected value of future progeny due to genetics from conception to weaning. It has the objective that commercial cattlemen replace breeding females with heifers from their herd, and remaining female and male progeny are sold as feeder calves.
- Angus \$W is Weaned Calf Value. This is the expected average of future progeny for preweaning performance, within a typical beef cowherd. It accounts for the economic impact of birth weight, weaning weight, maternal milk, and mature cow size.
- Angus \$F is Feedlot Value. This is the expected average of future progeny for postweaning feedlot performance.
- Angus \$G is Grid Value. This is the expected average of future progeny for carcass grid merit. It assumes cattle are marketed on a carcass grid, so it focuses on both quality grade and yield grade.
- Angus \$B is Beef Value. This is the expected average of future progeny for postweaning performance and carcass value. The \$B value combines information from \$F and \$G.
- Angus \$C is Combined Value. This combines maternal (\$M) and terminal (\$B) indexes. It has the objective that commercial cattlemen replace breeding females with heifers from their herd, and remaining female and male progeny are sold on quality-based carcass merit grid.
- Charolais TSI is Terminal Sire Index. It is the expected profit potential of terminal progeny. It incorporates growth and carcass EPDs.
- Gelbvieh TM is Total Maternal Index. It combines growth and milk as a prediction of the weaning weight performance of calves from a bull's daughters.
- Gelbvieh \$Cow is the value of an animal when retained as a replacement female. It includes maternal productivity, but also considers her future progeny's feedlot and carcass value.
- Gelbvieh EPI is Efficiency Profit Index. It aids producers in selecting for feed efficient cattle with acceptable amounts of gain.
- Gelbvieh FPI is Feeder Profit Index. This is the expected performance of progeny in the feedlot and sold on a grade and yield standpoint. It is a terminal index, including growth and carcass traits.
- Hereford BMI\$ is Baldy Maternal Index. This is the expected average performance of progeny of Hereford bulls used in rotational crossbreeding programs on Angus-based cows and heifers, with the progeny marketed on a Certified Hereford Beef LLC pricing grid.
- Hereford BII\$ is Brahman Influence Index. This is similar to BMI\$, except that the bulls are mated to Brahman-influenced cows, and progeny are marketed on a commodity-based program. It puts more emphasis on cow fertility and longevity.

- Hereford CHB\$ is Certified Hereford Beef Index. This is the expected average performance of progeny of Hereford bulls mated to mature commercial Angus cows, with all progeny sold as fed cattle on a Certified Hereford Beef LLC pricing grid. It is a terminal sire index, including growth and carcass information only, since all progeny are marketed and no females are retained in the herd.
- Limousin \$MTI is Mainstream Terminal Index. This is the expected average profit per carcass of progeny of Limousin bulls mated to British-cross cows, with all calves placed in the feedlot and sold on a mainstream grid. It is a terminal sire index, including growth and carcass information only, since all calves are marketed and no females are retained in the herd.
- Red Angus ProS is Profitability and Sustainability Index. This is an all-purpose index that covers economically relevant traits from conception to carcass. It is the expected average performance of progeny where replacement heifers are retained in the herd and remaining progeny are fed out to slaughter and marketed on a quality-based carcass grid. It is expressed as dollars per head born.
- Red Angus HB is HerdBuilder Index. This is the expected average performance of progeny where replacement heifers are retained in the herd and all remaining progeny are marketed at weaning.
- Red Angus GM is GridMaster Index. This is the expected average performance of progeny which are fed out to slaughter and marketed on a quality-based carcass grid.
- Shorthorn \$CEZ is Calving Ease Direct. This index assumes a bull will only be mated to heifers. It is the expected average performance of progeny for profitability, which is measured by the incidence of live calves at birth.
- Shorthorn \$BMI is British Maternal Index. This is the expected average performance of progeny of Shorthorn bulls when mated to a British cow base. It has a balance of growth and carcass traits, with a strong maternal component.
- Shorthorn \$F is Feedlot. This is the expected average performance of progeny when sold on the fed market. It has a strong emphasis on growth and carcass traits.
- Simmental and SimAngus API is All-Purpose Index. This is the expected average performance of progeny of Simmental bulls used on the entire Angus cowherd, with a portion of the daughters being retained for breeding and the remaining progeny being put on feed and sold grade and yield.
- Simmental and SimAngus TI is Terminal Index. This is the expected average performance of progeny of Simmental bulls mated to mature Angus cows, with all offspring placed in the feedlot and sold grade and yield. It includes growth and carcass information only, since all progeny are marketed.

## Accuracy

Most EPDs are reported with an Accuracy (ACC) value, which ranges from 0 to 1. It is a measure of the reliability of the EPD. EPDs will change and become more accurate as additional data on the bull and his relatives are processed by the breed association. For most yearling bulls, ACC is low, because they have not sired any progeny; however, genomic testing will increase the accuracy of the EPDs to the level of a bull with several progeny. Some breeds report the accuracy of the EPDs of young bulls as BK, I, P, P+, or PE. These indicate that the EPD is based on pedigree data, or is an interim EPD based on pedigree data and the bull's own performance.

Accuracies are not reported in the IBEP sale catalog, as there will not be large differences in accuracy among IBEP sale bulls of a given breed. However, accuracies are reported with EPDs on the breed association's web site if you look up the bull's registration number.

## Percentiles and Percentile Tables

Average EPDs for most traits are not zero. The actual average will be different for each breed. You can always compare EPDs of two bulls (of the same breed) to see which one is expected to produce better progeny, but that doesn't tell you how good the bull is compared to the entire breed. To do that, you need to look at the % that is reported with the EPDs. This number comes from the breed association, which has compared the EPD to percentiles for non-parent bulls of that breed (all bulls of the breed, not just bulls in this IBEP test). "Non-parent" means young bulls that have not sired a calf crop with progeny data submitted to the breed association.

For example, if a bull's EPD has a percentile ranking of 20%, it means he is in the top 20% of non-parent bulls of his breed for that trait. If his EPD has a percentile ranking of 75%, it means he is in the top 75%, or just above the bottom 25%, of non-parent bulls of his breed for that trait.

Remember that for most traits, a positive EPD is desirable. However, for traits such as Birth Weight, Carcass Fat, and Yield Grade, a negative EPD is desirable. Percentiles have taken this into account. A Birth Weight EPD with a percentile ranking of 10% means the bull is among the best 10% (most negative EPDs) for Birth Weight EPD.

Breed associations will have Percentile Tables available, which give the same information. You can look up an EPD in the table to see where that animal ranks in its breed. There are separate tables for sires, dams, and non-parent animals. These percentile tables will be available on the breed association's web site.