

Written by:

JIM SPRINKLE

Area Extension Agent, Animal
Science

For additional information on this
title contact Jim Sprinkle at
sprinkle@ag.arizona.edu or your
local cooperative extension
office.

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Understanding EPDs

Currently, most registered bulls have information available from their own performance records, progeny, or relatives which enable us to predict the performance of future offspring for various traits. An *expected progeny difference* or EPD is the difference in some trait (usually expressed as pounds, but sometimes as inches for carcass type traits) which one can expect when compared to other animals of the same breed. For example, if a bull's birth weight EPD is +5.0, then on an average his offspring should weigh 5 pounds more at birth than does a bull with a birth weight EPD of 0. The actual difference you will realize within your herd for a particular trait will depend upon how your herd compares to the breed as a whole. For example, if weaning weights on a particular ranch are greater than the observed breed average, then it is conceivable that a bull's weaning weight EPD in this herd may be less than that listed for the breed.

The traits which are commonly available for sires include birth weight, weaning weight, yearling weight, milk or maternal milk, and total maternal. For all of these traits, an EPD is expressed in pounds deviation + or - from the breed base average of 0. (Note: The breed base average is often outdated by several years, so actual base averages for a given year often exceed 0.) It must be pointed out that milk EPD values are *not* pounds of milk, but the pounds of weaning weight in the offspring of daughters of a bull which can be expected due to milk production alone. In explanation, an EPD value of +12 for milk means that on an average you can expect grandsons and granddaughters of calves from a bull's daughters to weigh 12 pounds more at weaning due to the influence of milk production in the daughters. Total maternal EPD values in grandsons and granddaughters are total pounds of weaning weight expected due to the combined influence of milk production and growth genetics from dams.

Accuracy (often shown as ACC) is the amount of confidence one can place in the estimated EPD. This accuracy figure is related to the number of progeny of a particular bull for which records exist. An accuracy of .93 basically means you are 93 percent confident that the bull's EPD will be what the record says it is. An accuracy of .40 would be more unreliable. Young, unproven bulls have low accuracy figures.

The EPD values for a bull must be compared within breed. A birth weight EPD of +5 for a Charolais bull would not have the same effect upon calving difficulty as a +5 for an Angus bull in a commercial crossbred herd, because breed averages are different. The respective breed averages for a particular year can usually be obtained by contacting breed associations or reviewing breed sire summaries. Table 1 contains information from more than 4,000 offspring (from Angus x Hereford dams) along with 30 sires per breed. This data was collected in one environment only (Clay Center, Nebraska) and sires were adjusted for 1991 EPD breed averages. Some of the respective rankings may change as cattle move from one environment to another.

In order to utilize heterosis and combine complementary breeds in cow herds, crossbreeding is practiced. One may be concerned about matching cattle to the environment or in meeting a particular marketing niche. To aid in these

decisions, across breed EPDs can be estimated using Table 1 and the individual bull EPDs. The actual difference between bulls of different breeds can be estimated by adding the EPDs to the respective breed averages and then comparing the resulting sums. For example, assume we wish to compare a Charolais bull with a birth weight EPD of +4 and an Angus bull with an EPD of +6. Using the breed averages from Table 1, progeny of the Charolais bull should be 6.4 lbs. heavier at birth than Angus progeny (at Clay Center, Nebraska).

$$\begin{array}{rcl} (86.0 + 4) & - & (77.6 + 6) \\ \text{Charolais} & & \text{Angus} \end{array}$$

In this example, the Charolais bull is expected to sire calves with heavier birth weights than the Angus bull even though the birth weight EPD was greater for the Angus bull. While this method does not fully account for the effects of heterosis when combining males and females of two unlike breeds, it is a good starting point for planning breeding programs.

Table 1. Breed Averages for Some Traits

BREED	Birth Weight	Weaning Weight	Yearling Weight
Angus	77.8	441	810
Polled Hereford	80.3	450	806
Hereford	81.4	442	800
Shorthorn	83.5	461	832
Brahman	87.8	447	744
Simmental	86.0	471	860
Limousin	83.1	450	798
Charolais	86.0	458	819
Maine-Anjou	87.8	458	826
Gelbvieh	87.3	465	822
Pinzgauer	82.4	440	783
Salers	80.9	464	830

Averages of offspring sired by bulls with EPDs in MARC's GPE project. Adjusted for 1991 EPD breed averages. From *Beef*:Sept. 1993.

If you have an idea of what your herd averages are for various traits, Table 2 may be more useful to you. Table 2 allows comparison of EPDs across breeds with Angus EPD values being specified as 0 for all traits. For example, an Angus bull with a birth weight EPD of +5 should sire calves with birth weights 5 lbs. heavier than the average Angus bull. If you used a Limousin bull in your commercial herd with a birth weight EPD of +2, then you could expect him to sire calves weighing 8.6 lbs. (2 + 6.6) heavier than an average Angus bull. Table 2 information is also from Clay Center, Nebraska and will not completely account for changes in breed rankings with different environments.

Expected progeny differences can be used as a tool to predict future performance and to plan goals for genetic improvement in your cow herd. Available resources should be evaluated and genetic change should be planned to match these resources. In planning genetic trend in your herd, it should be remembered that one genetic trait is often correlated with another. For example, as yearling weight increases, so does birth weight and mature weight. An environment with 10 inches of rainfall may not be the place to use a sire with a yearling weight EPD of +70 unless all replacement heifers were purchased elsewhere. Otherwise, mature weight of the cows will increase. In arid western climates with limited forage availability, often the use of smaller cows is required to obtain acceptable conception rates. Bulls with low or negative birth weight EPDs should be used on first calf heifers. High milk production may be a liability in arid environments, so milk EPD values should be moderate. The American Angus Association reported the observations of a breeder who had evaluated EPDs in a range operation. He suggested that for Angus cattle under range conditions, an EPD for milk from -5 to +9 was adequate for calf growth and still allowed for rebreeding success.

In addition to using EPDs in charting genetic change, ranchers with commercial herds can predict genetic change in their herds with the formula below. When this value is divided by 2 (parents only contribute 1/2 of their genes to offspring), it approximates an EPD value on a herd-wide basis.

$$\text{Genetic change per generation} = h^2 \times \text{selection differential}$$

The heritability (h^2) of birth weight is around .35 to .50, for weaning weight is around .25 to .30, and for yearling weight is around .40.

The selection differential is the difference between selected individuals for a specific trait (e.g. weaning weight) and the average for all animals by sex in the herd. For example, the selection differential would be 60 pounds if heifers at weaning averaged 400 pounds

and selected heifers weighed 460 pounds. When calculating selection differentials, it is important for the animals being compared to have been treated similarly. In other words, if one group of selected heifers were grazed on irrigated pasture and another group was grazed on rangeland, it would not be appropriate to compare these groups without applying a weaning weight discount to the irrigated pasture group.

An example in calculating genetic change is shown below. Selected heifers weigh 60 pounds more at weaning than the average of all heifers in the herd. The heritability of .25 is multiplied by 60 to give 15 pounds genetic superiority.

$$60 \text{ lbs.} \times .25 = 15 \text{ lbs.}$$

This must be divided by 2, since the heifers will only contribute ½ of the genes to offspring. Therefore, 7.5 pounds will be added from the female side. A selected bull has a weaning weight EPD of +25 pounds when used in your herd. Therefore, the predicted increase in weaning weight for the selected heifers and this bull would be 32.5 pounds.

The above example shows the response per year which can be expected for single trait selection. Selecting for more than one trait at a time usually reduces the genetic change expected in single trait selection.

Table 2. Across Breed EPDs for Some Traits

BREED	Birth Weight	Weaning Weight	Milk	Yearling Weight
Angus	0	0	0	0
Polled Hereford	5.9	11.3	-27.4	8.8
Hereford	6.1	6.4	-3.7	7.3
Shorthorn	8.7	25.2	11.9	31.9
Brahman	13.8	28.8	34.4	-21.1
Simmental	10.5	49.8	25.4	79.2
Limousin	6.6	28.8	-8.5	20.0
Charolais	9.7	37.2	3.7	52.4
Maine-Anjou	11.9	31.5	23.1	39.7
Gelbvieh	9.6	38.6	27.1	41.8
Pinzgauer	8.7	21.6	7.1	16.4
Tarentaise	4.4	22.3	20.1	10.5
Salers	6.8	30.8	11.9	31.7

EPDs adjusted to a 1992 base with Angus EPDs set to zero in MARC's GPE project. From Barkhouse et. al., 1994. Proc. Beef Improvement Federation 26th Research Symposium and Annual Meeting, West Des Moines, Iowa. June 1-4, 1994.

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