By the Numbers

► by ***American Angus Association staff***

Angus EPDs at work in the real world

Breeders sometimes ask questions concerning the effectiveness of expected progeny differences (EPDs). Do they really work? How much emphasis should I put on them? And why did I get a heavy-birth-weight calf from that sire with a low-birth-weight EPD? Answers to these questions are best provided using examples of how EPDs perform in the real world.

Important principles

So, let's review some actual data originating from Angus farms and ranches across the U.S. Birth weight will serve as our example trait on how EPDs make a measurable impact in herds just like yours. We will focus on birth weights from 2004-born Angus bulls for the analysis we're going to conduct. Important EPD principles are illustrated here using genetic-to-phenotypic relationships for birth weight. The concepts outlined below can be applied to other traits as well.

Keep reading! We are confident your knowledge of cattle breeding and EPDs will be enhanced if you follow this article through to its conclusion.

BW differences in two sire groups

Genetics give rise to physical, or phenotypic, differences. EPDs quantify genetic differences, which predict how much phenotypic difference to expect in future groups of progeny under randomized conditions. If one sire has a birth weight (BW) EPD that is 5 pounds (lb.) higher than another sire, their calves will have an average birth weight difference of approximately 5 lb., assuming the two sires are mated randomly to a comparable group of females in the same environment.

Let's look at a sample of actual birth weight data from 2004-born calves recorded in the American Angus Association's database. We'll review two sire groups that produced thousands of bull calves out of 2-year-old Angus dams: 1) sires with BW EPDs less than 2 lb., and 2) sires having BW EPDs greater than 4 lb.

Table 1 shows the average BW EPD for each sire group, as well as the resulting average birth weight of their sample progeny. As expected, the 4.6-lb. genetic difference in sire BW EPD is expressed almost exactly pound-for-pound in progeny performance, resulting in a 5-lb. average difference in phenotypic birth weight between the sire groups.

Keep in mind that this example does not depict the birth weights you would record in your herd, but rather the effect of selecting sires on BW EPD. Other factors, such as genetics of the dams, herd of origin, nutrition, season, weather, geography and many other environmental factors, would affect the phenotypic birth weights observed in your calf crops.

Variation part of biological systems

This example demonstrates how BW EPDs accurately predict the average difference in birth weight between groups of progeny. The key phrase to remember here is *average difference*.

Variation is still a reality in every biological system, cattle birth weights included. There is no way to escape it. A wide range of actual birth weights occurs in the progeny of both sire groups, as shown in Fig. 1. Plotting a frequency distribution of all observed birth weights results in two overlapping bell curves with different means (averages), but the same basic shape.

The lower-BW-EPD sire group produces a higher percentage of lower birth weights (69% under 80 lb. in this data sample), but a few heavy calves still show up (3% over 90 lb.). In contrast, the higher-BW-EPD sires produce fewer birth weights under 80 lb. (45%) and more over 90 lb. (12%).

EPDs do not eliminate biological variation. What they can do through informed selection is shift a trait's bell curve in the direction you want it to go. Suppose you want a higher percentage of low-birth-weight calves from your first-calf heifers. Using low-BW-EPD sires in heifer matings will accomplish this objective, but you still may possibly have a few heavy calves from time to time.

EPDs work in small herds, too

We've now demonstrated how EPDs work across large numbers of progeny. But what happens in small herds that produce smaller numbers of calves? Are the results the same? The short answer is *yes,* though it may be more difficult to recognize the effectiveness of EPDs in herds with limited progeny numbers and small contemporary groups.

To simulate the effect EPDs have in a small herd (30 total progeny), we randomly selected 15 2004-born bull calves from each of the two sire groups discussed above. Birth weights from these 30 bull calves are paired in order of selection and presented in Table 2. Because these calves were drawn completely at random from a large data pool

Table 1: Effect of sire birth weight genetics on sample of 2004-born Angus bull calves born to 2-year-old dams

Sire group	Sire avg. BW EPD, lb.	Avg. BW, lb.
BW EPD < 2lb.	0.3	75
BW EPD > 4 lb.	4.9	80
Difference	4.6	5
	Genetic difference	Phenotypic difference

Table 2: Random sample of bull-calf birth weights, lb., from different sire BW EPD groups

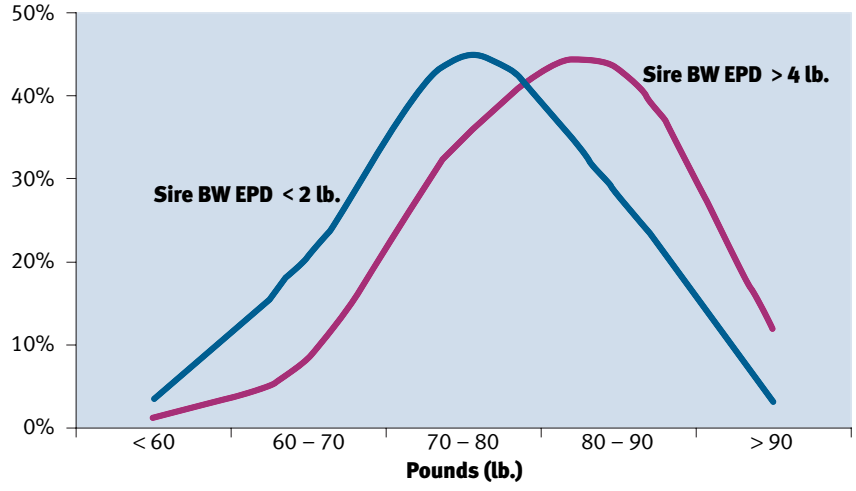
	Sire BW EPD	
Calf no.	< 2 lb.	> 4 lb.
1	66	78
2	75	82
3	82	58
4	75	69
5	75	85
6	78	88
7	79	88
8	73	85
9	68	72
10	70	81
11	84	70
12	78	77
13	55	82
14	64	74
15	64	80
Average	**72**	**78**

of Angus bull calves, the resulting birth weights reflect what might be seen in a single herd that used sires fitting the parameters of our two BW EPD groups.

Several observations can be made from this small herd simulation. First, the heavier-BW-EPD sires did, in fact, produce heavier calves, as expected. Second, the average birth weight difference was 6 lb. (72 lb. vs. 78 lb.), only slightly larger than projected by the 4.6-lb. difference in the two sire groups' EPDs. The conclusion must certainly be that the EPDs did their work well, but it is also apparent that small progeny groups result in less precise EPD expression.

Environmental influences are present in every biological system (as discussed above), and these influences are a major source of phenotypic variation. Small progeny numbers make it somewhat more difficult to distinguish genetic differences from those caused by nongenetic factors. This is also the reason why correct contemporary grouping is so important in genetic evaluation. Notice how widely varied the actual birth weights are in our two samples. The first group ranged from 55 lb. to 82 lb. (27-lb. range), while calves from the heavier-BW-EPD sires ranged 30 lb. from high to low (58 lb. to 88 lb.). Any producer who accurately weighs his calves will agree that birth weights vary significantly, even within a single calf crop.

Fig. 1: Distribution of Angus bull-calf birth weights by sire BW EPD group (out of 2-year-old dams)



Nonetheless, we've now seen that EPDs are effective tools that can — and do — influence phenotypic outcomes in both large and small herds. The data and discussion presented here make that point clear. EPDs have been used with tremendous success in the real world of the U.S. beef industry for one simple reason — they work!

Editor's Note: *"By the Numbers" is a column by Association performance programs staff to share insights with Angus members about data collection and interpretation, the National Cattle Evaluation (NCE), genetic selection, and relevant technology and industry issues. If you have questions or would like to suggest a topic for a future column, contact Sally Northcutt, director of genetic research, or Bill Bowman, director of performance programs, at (816) 383-5100.*