By the Numbers

► by *American Angus Association staff*

Real-world test for WW EPD

Let's review how weaning weight (WW) expected progeny differences (EPDs) can be applied in a typical purebred Angus cow herd. Say you've selected for heavier weaning weights by using registered sires with higher WW EPDs. Will your weaning weights actually increase? And what about the environmental factors that influence weaning weights? Real-world cattle records drawn from the American Angus Association's database can be used to answer these questions. Two straightforward genotypic-to-phenotypic comparisons are discussed below to illustrate the effectiveness of Angus WW EPDs.

Comparison 1

Sires with relatively high WW EPDs of 40-50 pounds (lb.) are compared to sires having lower WW EPDs between 20 and 30 lb. The two sire groups' WW EPDs are evaluated against the average 205-day weight of their respective 2003- and 2004-born bull progeny after being mated to a similar set of cows.

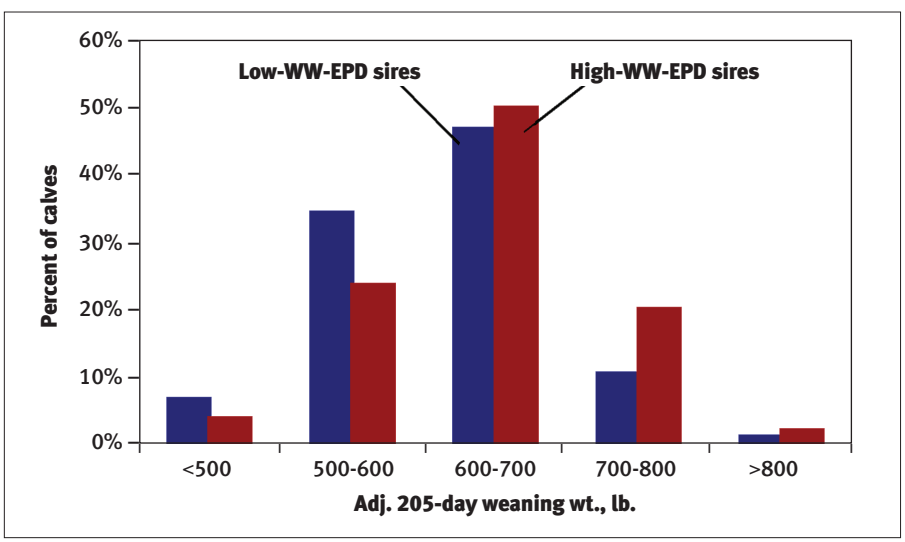
The cow side of this comparison is "fixed" so that it has no bearing on the outcome. Only calves born to dams with WW EPDs ranging from 20 to 30 and Milk EPDs from 15 to 20 are used in the evaluation. Females must also be 3 years of age or older to be included. The size and flexibility of the Association's database allows us to draw out only the performance records matching these specific parameters. Results are shown in Table 1.

The high-weaning-growth sire group had an average WW EPD of 45 lb., 19 lb. heavier than the lower-growth sire group (WW EPD average = 26 lb.). The average phenotypic difference in bull calf weaning weights amounted to 27 lb., somewhat larger than (but directionally consistent with) the WW EPD difference between the two sire groups.

Table 1: Comparison of progeny performance of higher- vs. lower-WW-EPD sires

Bull progeny head count	Sire's avg. WW EPD	Bull progeny avg. adj. 205-day wt.
8,528	+45 lb.	642 lb.
2,070	+26 lb.	615 lb.

Fig. 1: Distribution of Angus bull calf weaning weights by sire WW EPD group



EPDs on low-accuracy sires are included in this analysis, which partially explains why the observed phenotypic difference exceeds the genotypic difference of the two sire groups. EPDs on low-accuracy animals are calculated in a conservative manner. Only the accumulation of significant progeny records allows the Association to more precisely predict how an animal's progeny will perform.

In this case, it appears that a significant number of the unproven sires in the high-growth sire group may be transmitting a bit more weaning growth than their low-accuracy WW EPDs suggest. Additional progeny records will tell the story, one way or another.

The fact remains, however, that the high WW EPD sire group did produce progeny with higher average weaning weights. These higher-growth sires actually shifted the bell curve toward the right (heavier weights), as shown in Fig. 1. In fact, 72% of the progeny from the high-growth sires weighed 600 lb. or more vs. 59% for the low-WW-EPD sires.

Going even further up the weight scale, 22% of the high-growth group exceeded 700 lb. compared to 12% in the low-growth group. The EPDs did their job well.

An important point to understand is that, while EPDs can be used to effectively shift the distribution curve for a given trait, the distribution curve itself will remain. EPDs do not eliminate the variation present in all biological systems.

A wide range of environmental factors affect phenotypic weaning weights, regardless of the genetic selections a breeder makes. So there will always be a bell curve to deal with. EPDs can help move that curve in the direction you want to go according to your selection objectives, but variation will still be present, meaning you will likely get a few light-weaning calves from that high-WW-EPD sire from time to time. Likewise, you'll wean a few heavy calves from a low-growth sire.

Comparison 2

The first comparison demonstrated how EPDs work across large numbers of progeny. But what happens in smaller herds that produce a relatively small number of calves? Are EPDs equally effective in herds, say, of fewer than 50 head?

Table 2: Random sample of bull calf weaning weights, lb., from different sire WW EPD groups

Calf No.	Sire WW EPD = 20 to 30 lb.	Sire WW EPD = 40 to 50 lb.
1	647	561
2	484	693
3	593	701
4	570	796
5	697	760
6	545	698
7	664	665
8	559	614
9	460	589
10	709	567
11	586	747
12	568	695
13	683	583
14	684	584
15	674	741
Avg.	**608**	**666**

The short answer is a definite *yes.* EPDs do their work quite well in both large herds and small. However, it may be more difficult to recognize that EPDs truly are creating phenotypic differences in herds with limited progeny numbers and small contemporary groups.

To simulate the effect WW EPDs have in a small herd (30 total progeny), we randomly selected 15 Angus bull calves born in 2003 and 2004 from each of the two sire groups discussed above. Adjusted weaning 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 of Angus bull calves, resulting weaning weights represent what might be seen in a single herd that used sires fitting the parameters of our two WW EPD groups.

While EPDs can be used to effectively shift the distribution curve for a given trait, the distribution curve itself will remain.

Several observations can be made from this small herd simulation. First, the higher-growth, higher-WW-EPD sire group did produce heavier calves, on average, as expected. Calves sired by the higher-WW-EPD group averaged more than 50 lb. heavier than those by lower-WW-EPD sires. That difference is larger than the EPDs predicted, but remember, limited progeny numbers allow for less precise EPD expression.

The observed difference in phenotypic weaning weights is being affected by the small sample size. If we compared only the last five calves in each group (pairs 11-15), the difference in average weaning weight drops to 31 lb. — still favoring the heavier-WW-EPD sires, but by a smaller weight differential.

If we looked at only the first pair of calves, we might wrongly conclude that the sire WW EPDs did not work at all. The first bull calf by a lower-WW-EPD sire outweighed the first calf from the higher-growth sire group (647 lb. vs. 561 lb.). But, of course, a sample size of two head is too small to accurately measure the effects of genetic selection. Once the contemporary group increases to 20 or 30 head, genetic differences are more clearly visible, though again, precise genetic expression (phenotypic differences matching EPD differences) often requires large numbers of progeny.

Yet we see that EPDs are effective. And small herds do benefit by actively using EPDs in their selection decisions.

The second observation is that environmental influences are present in every biological system. Such influences are a source of major phenotypic variation. Just look at the range in weaning weights in our two small groups of bull calves.

Weights in the first group range from 561 lb. to 796 lb., a difference of 235 lb. The other group is similar, with a range from lightest to heaviest of 249 lb. That is tremendous variation — but not untypical, as anyone who accurately weighs his or her calves will attest. Small progeny numbers make it more difficult to distinguish genetic differences from those caused by non-genetic factors, which underscores the need for correct contemporary grouping in genetic evaluation.

Conclusion

Putting EPDs to the test is always an interesting process. Much can be learned from analyses of this kind. Most importantly, we see that EPDs do just what they are designed to do. Time and time again they work! So what is the best way to punch up your weaning weights? Use registered Angus sires with high WW EPDs.

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 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.*