Understanding EPD Accuracies and Possible Change

by Dr. Bob Hough, RAAA Executive Secretary

EPDs are one of the most powerful tools the beef industry has ever had. They have literally revolutionized the way we as an industry design breeding programs and select seedstock. With EPDs, breeding beef cattle has moved from an art form to a science. Our industry desperately needs these reliable objective genetic predictions calculated from unbiased data to compete with other protein sources.

Our competition — the pork and poultry industries — certainly do not design their product genetically utilizing romanticized selection procedures or by following ever changing fads. They utilize scientific principles to design animals that optimize production and produce a consistent product. We must do likewise, and EPDs are by far the best tool we have to help us in this effort.

To utilize EPDs correctly, a person must understand what these genetic estimates represent and what they do not. EPDs work, and the average of the EPDs for all the Red Angus sires used in a given year should remain constant. Although the average EPDs of the group should not change, certain sires' EPDs will turn out better than expected while others will be a disappointment. Because of this, a herd that has the luxury of sampling a large number of sires, exposes themselves to little risk from possible EPD change due to low accuracy predictions. Conversely, a producer utilizing only one sire in their herd must weigh the possible risk inherent in utilizing a low accuracy sire. This dictates the need for a clear understanding of EPD accuracies and possible change by both seedstock and commercial cattle producers.

Accuracies

Accompanying the EPDs released by the Red Angus Association of America are accuracy values (Table 1). An accuracy is a relative measure of the strength of the relationship between genetic prediction and true genetic value. Accuracies are reported as a decimal number from zero to one. When unbiased data (e.g. complete reporting from THR) are utilized to calculate EPD genetic predictions and as the accuracy value approaches 1.0, the EPD is "accurately" or closely estimating the true genetic merit of an animal for a given trait. By the same token, accuracies closer to zero indicate that the EPD prediction has far less reliability.

A guide for interpreting accuracies is presented in Table 2. One important point must be made here. Although the genetic prediction for low accuracy animals can be considered unreliable relative to higher accuracy EPDs, they are still the best objective measure of an animal's genetic merit. EPDs are far better than ratios, adjusted weights, raw weights and visual appraisal. It has been said that even a low accuracy EPD is many-fold more reliable than all of these other measures. The reason for this is the fact that all of these pertinent objective measures (adjusted weights, etc.), plus many more factors, are all taken into account when an EPD is calculated.

Possible Change

Possible change is another method of visualizing how accuracies function. Since EPDs are predictions, not true values, we can expect that they will change from one year to the next as more information is collected (e.g., progeny data) and includ-

Table 1. Example EPDs and accuracies for three fictitious sires.

ANIMAL NAME	BIRTH DATE	GRPS PROG.	DTRS PROG/DTR	BIRTH EPD ACC	WEANING EPD ACC	YEARLING EPD ACC	MILK EPD ACC
RAA RELIABLE	01/01/90	125 500	210 2.3	1.0 .90	35 .90	50 .90	15 .90
RAA NEXT STEP	01/01/94	10 25	5 1	0.5 .60	36 .50	55 .50	18 .40
RAA NEW WAVE	01/01/98	0	0 0	0.0 .20	40 .20	60 .20	15 .20

Table 2. Interpreting accuracies.

Acc.	Degree of Risk	Comments
<.40	Low	Unreliable, but still the best guess
.40 to .60	Low/medium	Worth looking at, but still risky
.60 to .80	High/medium	Quite trustworthy, make comparisons with some confidence
>.80	High	Good accuracy, compare with confidence

Table 3. Possible change of Red Angus EPDs.

ACC	BW	WW	YW	MILK	ME	CED	HPG	CETM	ST	MARB	REA	FAT
0.0	3.0	12	15	9	3	9	11	9	7	0.24	0.31	0.03
0.1	2.7	11	14	8	2	8	10	8	6	0.22	0.28	0.03
0.2	2.4	9	12	7	2	7	9	7	5	0.19	0.25	0.02
0.3	2.1	8	11	6	2	6	8	6	5	0.17	0.22	0.02
0.4	1.8	7	9	5	2	5	7	5	4	0.14	0.19	0.02
0.5	1.5	6	8	4	1	4	6	4	3	0.12	0.16	0.01
0.6	1.2	5	6	4	1	3	4	4	3	0.10	0.12	0.01
0.7	0.9	4	5	3	1	3	3	3	2	0.07	0.09	0.01
0.8	0.6	2	3	2	1	2	2	2	1	0.05	0.06	0.01
0.9	0.3	1	2	1	0	1	1	1	1	0.02	0.03	0.00
1.0	0.0	0	0	0	0	0	0	0	0	0.00	0.00	0.00

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ed in the biannual RAAA National Cattle Evaluation. Because of this inclusion of new data in each evaluation, the EPDs calculated for a sire represent the best estimate of the animal's true genetic merit. This means that change in EPDs over time for a sire should be viewed positively since the EPD is more "accurately" describing the animal. The amount of change that can occur in an EPD estimate is referred to as "possible change."

Table 4. Example EPDs, accuracies, possible change, and confidence range for three fictitious sires.

ANIMAL NAME	BIRTH DATE	GRPS PROG	DTRS PROG/ DTR	BIRTH EPD ACC	WEANING EPD ACC	YEARLING EPD ACC	MILK EPD ACC
RAA RELIABLE	01/01/90	125 500	210 2.3	1.0 .90	35 .90	50 .90	15 .90
Possible Change				±0.3	±1	±2	±1
68% Confidence Range				0.7 to 1.3	34 to 36	48 to 52	14 to 16
RAA NEXT STEP	01/01/94	10 25	5 1	.5 .60	36 .50	55 .50	18 .40
Possible Change				±1.2	±6	±8	±5
68% Confidence Range				-0.7 to 1.7	30 to 42	47 to 63	13 to 23
RAA NEW WAVE	01/01/98	0 0	0 0	0 .20	40 .20	60 .20	15 .20
Possible Change				±2.4	±9	±12	±7
68% Confidence range				-2.4 to 2.4	31 to 49	48 to 72	8 to 22

A possible change value is a measure of the possible change (in trait units) that can occur for a trait. The possible change chart (see Table 3) represents one standard error of prediction (standard deviation) for the range of accuracies for each trait. The true genetic value of each genetic prediction would be expected to fall within plus or minus one standard deviation 68 percent of the time. This means that as accuracy increases, the EPD prediction is known to be closer to the true genetic value, so the possible change value decreases. An example of this would be a forty pound weaning weight EPD. At .30 accuracy, we would expect the true genetic value to fall somewhere between 32 to 48 pounds 68 percent of the time (40 ±8), while at .80 acc., the true genetic value would be expected to fall somewhere between 38 and 42 pounds 68 percent of the time (40 ±2). This is what is referred to as the confidence range. The higher the accuracy the narrower the confidence range. Table 4 again shows our three example sires, viewing their accuracies in the light of possible change and confidence range.

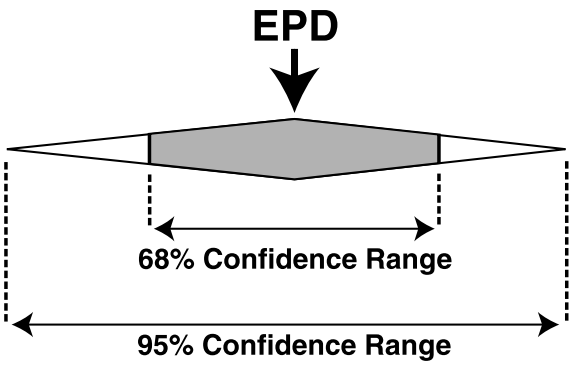

Figure 1. Graphical presentation of EPDs (Bourdon, 1996)

One common misconception is that confidence range is an indicator of expected variation in a calf crop. Confidence range does not in any way predict progeny variation. It instead shows the expected range on which the true EPD genetic value, if known, would be expected to be located given the accuracy of the estimated EPD. This means that a low accuracy sire should not be expected to have any more or less variation in his progeny than a high accuracy sire.

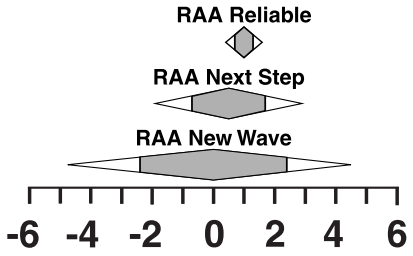

Figure 2. Graphical presentation of birth weight EPDs for three fictitious sires.

Why Do Some Sires Change More Than the Possible Change Values Indicate?

This is one of the most frequently asked questions. The possible change chart gives the impression that sires will not change more than the value in the table for a given trait at a given accuracy. Without understanding the possible change chart, the fact that the possible change or standard error of prediction only reflects a 68 percent confidence range can easily be missed. The true genetic value can vary more than the

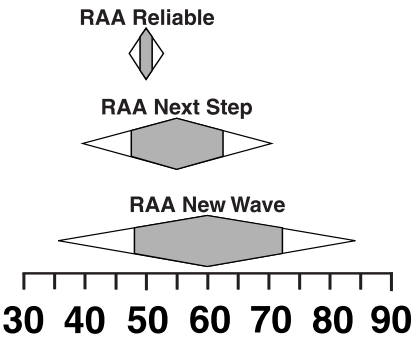

Figure 3. Graphical presentation of yearling weight EPDs for three fictitious sires.

plus or minus one standard deviation represented in the possible change chart. If we expand to a 95 percent confidence range, the true genetic value will be plus or minus two standard deviations/possible change units. Beyond the 95 percent confidence range, an additional five percent of the sires can be expected to move more than two standard deviations. Let's go back and review the example of the forty pound weaning weight EPD at either .30 or .80 accuracy. The 68 percent confidence range was 32 to 48 pounds for .30 accuracy and 38 to 42 pounds for .80 accuracy. If we now expand to a 95 percent confidence range, we would expect the true genetic value to be between 24 and 56 pounds [40 $\pm$ (2 X 8)] for .30 accuracy, and between 36 and 44 pounds [40 $\pm$ (2 X 2)] for .80 accuracy.

Dr. Rick Bourdon proposed displaying EPDs and their confidence ranges graphically at our 1996 RAAA Brain Trust Meeting in Denver. Although not implemented due to space limitations in the Sire Summary, Dr. Bourdon's concept does an excellent job putting possible change/confidence range in perspective (Figure 1). Utilizing his model, we can graphically demonstrate the EPDs and confidence ranges for our three example animals' birth weight and yearling weight EPDs (Figures 2 & 3). This underscores the value of utilizing high accuracy sires, and it also sheds light on just how dangerous it is to make selection decisions without EPDs, since low accuracy EPDs are still more reliable than weights and ratios. It is also important to understand that for many sires, the low accuracy estimates will change little as they increase in accuracy.

Conclusion

Today's cattle industry has certainly become very sophisticated. As the industry has changed, so have the demands on modern cattle producers. Cattle breeders must now be able to make important business decisions utilizing a wide variety of objective information. EPDs are one of the cornerstones of this new age. Understanding accuracy, possible change and risk is an important component of fully analyzing these genetic predictions. Although possible change must be considered when evaluating a sire, we must not be overwhelmed by this information. It is also hoped that in the future, as we move to more and more electronic delivery of information, that concepts such as Dr. Bourdon's recommendation for graphic presentation of EPDs and confidence ranges will become a reality. Yes, cattle breeding is changing, but the information available to producers will allow our industry to improve at a pace no one could have imagined just twenty years earlier. Utilized correctly, we do not currently have a more powerful tool than Red Angus EPD predictions.