



The Ranchers' Guide to EPDs

Information for the profit minded producer



Producer profits are the primary driver in the production of Red Angus EPDs.

Many breeds have focused on developing a seemingly endless number of EPDs; this has complicated and in many cases side-tracked their course of genetic improvement. Rooted in the commercial beef industry, Red Angus chose a path less traveled, and has been guided - not by selection for indicator traits - but by informed selection on **Economically**

Relevant Traits (ERTs). The concept of ERTs anchors Red Angus' goal of genetically describing Reproduction, Growth, Maintenance, and Carcass traits utilizing the fewest EPDs possible.

EPDs are the most reliable predictors of an animal's true genetic merit.

Properly employed, EPDs have "fast forwarded" beef cattle improvement and removed much of the guesswork associated with selecting range bulls. Armed with Red Angus' genetic predictions, which are calculated from unbiased data, producers are better prepared to make genetic decisions, which will undoubtedly impact their profitability.



**Absolute performance is not predictable...
RELATIVE PERFORMANCE IS.**

For Example: Suppose your old herd bull has a yearling weight EPD of 50. You buy a new bull with a yearling weight EPD of 70. **How much will the new bull boost your calves' yearling weights?**

The Answer...

We cannot predict how much performance will change from one year to the next because of varying environmental conditions (rainfall, temperature, available feedstuffs, etc). However, we do know this: the calves raised in the same contemporary group sired by your new bull will have the genetics to weigh an average of 20 pounds more at 365 days of age than calves sired by the old bull.

Land Grant universities have often shown that being a "low-cost" operation is key to survival in the cow/calf business. Ironically, the same research has shown that genetics (bulls) are the only area where low-cost producers spend more money than high cost producers.

EPDs: What, Why & How?

EPD (Expected Progeny Differences) values are relative; they do not indicate absolute levels of performance. Rather, they can be used to predict differences in the performance of progeny sired by different bulls. EPDs are calculated from comparisons within **Contemporary Groups**. A contemporary group is a group of calves that were born in the same year and season, in the same herd, of the same sex and were fed and managed alike. The differences in performance between calves are mostly genetic, because the entire contemporary group was provided an equal opportunity to perform.

For Example: differences in weaning weight of calves (once age adjusted) within the same contemporary group can be explained by the individuals' genetic potential for pre-weaning growth, and their dam's genetics for milk production.

EPDs have a clear advantage over less sophisticated predictors such as actual weights or within-herd ratios. Actual and even adjusted weights are affected by environment, nutrition and management, and may not even be comparable from one side of the ranch to the other. Contemporary group ratios are an improvement, as they account for such environmental variables. However, they do not remove variations in performance from mating bias, nor do they incorporate comparative performance data on related individuals in countless herds throughout the country.

EPDs solve all of these problems. The Red Angus EPD model accounts for which cows were bred to which bulls - removing all variation in performance that is due to mating bias. It also evaluates thousands of contemporary groups across the breed. **While weights and ratios can not be compared on animals from different herds, EPDs can.**



Understanding **ACCURACY**

Red Angus EPDs are often presented with a corresponding accuracy value, which measures the strength of the relationship between the genetic prediction (EPD) and true genetic value. Accuracies are reported as a decimal number from zero to one. As 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 has far less reliability. Although EPDs 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. **While "perfect" accuracies of 1.0, are never achieved, many heavily used Red Angus sires have accuracies greater than 0.9 (some as high as .99).**



Possible Change

EPDs are predictions, and while an animal's true genetic merit will never change, it is safe to assume that their EPDs may change from one calf crop to the next, as more information (i.e., progeny data) is evaluated.

A possible change value is an estimation of the change potential (in trait units) for a given EPD. The true genetic value of each genetic prediction would be expected to fall within (plus or minus) one standard deviation 2/3 of the time. (The other 1/3 of the time, bulls EPDs could change more than one standard deviation.) The possible change chart (right) shows the potential variation in EPD values that could be observed at different levels of accuracy for the various traits. For all traits, as accuracy increases, the possible change value decreases and vice versa.



Possible Change Example:

Assume a 60 lb yearling weight EPD had an accuracy of .30. We would expect the true genetic value to exist between 49 and 71 lbs two-thirds (2/3) of the time (60 lb YW EPD +/- possible change of 11). This is what is referred to as the confidence range.

As accuracy increases, the confidence range narrows. For example: if we increase accuracy in the above example to .80 acc., the true genetic value would be expected to fall between 57 and 63 lbs two-thirds of the time (60 +/- 3).

Confidence range estimates the potential variation between an animal's published EPD and their true genetic value. It does not imply more or less phenotypic variation in an animal's progeny. 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.

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

Data Quantity vs. Data Quality

In 1995, Red Angus implemented Total Herd Reporting, and became the first breed to require the annual production of each cow and the performance of every calf raised through weaning to be reported. It had become obvious that the registration based fee structure actually discouraged the submission of data by charging for each calf. THR requires the payment of an annual assessment for each cow in the breeding herd. However, the cost of reporting performance data, registration of her calf, and subsequent transfer of that calf to a new owner are included in this assessment fee.

The net effect of THR is twofold:

- Red Angus EPDs are calculated from complete contemporary group data - not just the data from the calves good enough to register.
- Breeders have the incentive to transfer registered bulls to their commercial customers, which is the foundation of Red Angus' Feeder Calf Certification Program - a USDA Process Verified Program that adds value to feeder cattle by genotypic verification of Angus, source verification to ranch of origin and group age verification.



Garbage In... Garbage Out

The biggest benefit of THR is the elimination of reporting bias from data used to calculate EPDs. Reporting bias is demonstrated with the calf ratios shown in Tables 1 & 2. (Ratios are used in the example since they reflect the performance differences used to calculate EPDs.) When only the top three calves are reported, the ratios are negatively affected for all calves (Table 2), because the group average is raised. The ratio is the percentage of variation between an individual weight and the group average. Obviously, incorrectly raising the group average will incorrectly reduce the ratio and incorrectly report progeny data on representative sires. Perhaps even more significant is the overestimate of performance of sires whose poorer performing calves are not reported. **Only THR builds EPDs using the entire calf crop - not just the calves that were good enough to register.**

Table 1. Contemporary Group with complete data

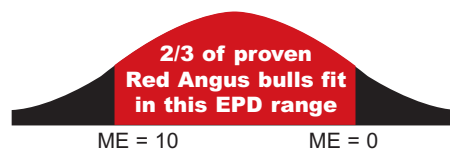
Calf ID	Weaning Weight	WWT Ratio
A	600	120
B	550	110
C	500	100
D	450	90
E	400	80

Table 2. Contemporary Group with incomplete reporting

Calf ID	Weaning Weight	True/THR WWT Ratio	"Selected" WWT Ratio
A	600	120	109
B	550	110	100
C	500	100	91
D	450	90	
E	400	80	

Cows Eat Money!

The ME EPD predicts differences in energy requirements of mature daughters of an individual and is expressed in Mega-calories per month. Differences in Maintenance Energy requirements can easily translate into differences in feed required to maintain body weight.



How does this affect me? The energy content of average quality range forage is approximately 0.86 Mcal per pound of dry matter. If a sire has an ME EPD of +20 Mcal/month his offspring will require approximately 23 lbs (20/0.86) more dry matter per month than offspring of the sire with an ME EPD of 0. **Magnify that difference over 12 months and 100 cows:** you'll have to come up with another 14 tons of feed, or get rid of a few cows.

How is ME EPD calculated?

There are three components of ME EPD: Mature Weight, Milk, and Body Condition Score (BCS). To calculate ME EPD, Red Angus breeders collect mature cow weights (taken when calves are weaned) and BCS (cows should be scored when weighed). The Mature Weights are adjusted to 5 years of age, and to a common BCS of 5. It is essential that all cows in the same contemporary group are scored by the same person. BCS plays an important role in calculating Red Angus' ME EPD as it is essential that mature weight be standardized to body condition.

Think of it this way:

A BCS 7 cow that weighs 1200 lbs is really a "FAT" 1100 lb cow. Likewise, a BCS 3 cow that weighs 1200 lbs is really a "Skinny" 1350 lb cow.

Why does Milk EPD play a role in ME EPD - My cows are dry through the winter anyway?

Higher milking cattle have greater visceral organ mass. The machinery that makes the milk still has to be maintained even when the cow is not lactating.

ME EPD helps ensure environmental fit.

Cattle run in all types of environments, and each has different available feedstuffs. When cattle have higher maintenance energy requirements than their environment will support, producers must supplement feed, decrease stocking rate or accept decreasing body condition scores of their animals, which can adversely affect reproductive performance.

Maintenance "Curve Benders"

While higher milking, higher growth (larger mature size) cattle typically have higher maintenance requirements, there are many Red Angus sire choices that defy these antagonisms - actually combining positive revenue traits (Growth and Milk) with negative Expense Traits (ME).

The Expense side of ranchers' profit equation

Profit equals revenue minus expenses. Select for ME EPD in conjunction with revenue trait EPDs to ensure feed costs don't get out of line with selection for greater performance and production. Single trait selection for ME ignores revenue, thus ignoring profit.

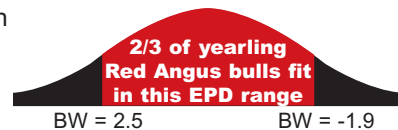




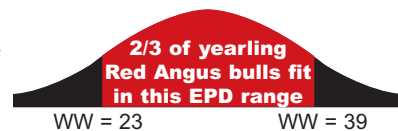
Traits that add weight to your bank account!

These beef industry standard EPDs represent obvious revenue traits for cow/calf operators and feeders. Red Angus EPDs are the only ones built through the use of **Total Herd Reporting**.

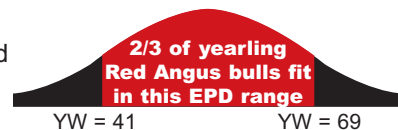
Birth Weight EPD (BW) predicts the difference, in pounds, for birth weight, and is also used in the calculation of Red Angus' Calving Ease Direct (CED) EPD.



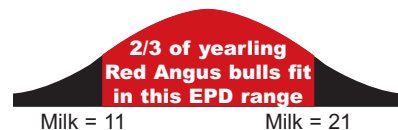
Weaning Weight EPD (WW) predicts the difference, in pounds, for weaning weight (adjusted to age of dam and a standard 205 days of age). This is an indicator of growth from birth to weaning.



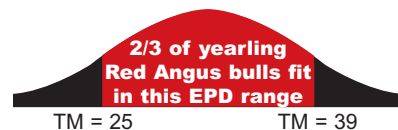
Yearling Weight EPD (YW) predicts the expected difference, in pounds, for yearling weight (adjusted to a standard 365 days of age). This is an indicator of growth from birth to yearling.



Milk EPD (MILK) predicts the difference in maternal production of an individual animal's daughters as expressed by the weaning weight of their calves.



Total Maternal EPD (TM) predicts the rancher's actual observation of weaning weights of calves raised by an animal's daughters. TM includes the daughters milk EPD plus half of her genetic contribution to her calf's weaning weight EPD. The formula for TM EPD is:

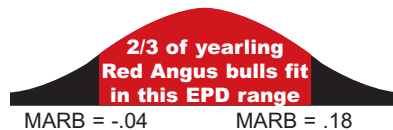


$$\text{TM EPD} = \text{Milk EPD} + \frac{1}{2} (\text{WW EPD})$$

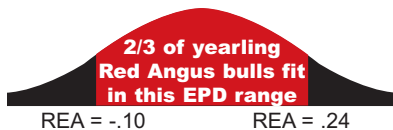
Bred in Carcass Premiums

Branded products and value-based grids have increased the focus on carcass traits as producers target these value added markets. Red Angus utilizes actual carcass data combined with real time ultrasound data to calculate their marbling and Rib-eye area EPDs. Red Angus takes the road less traveled in the prediction of Fat thickness, where only carcass data is used. Because ultrasound fat thickness is positively correlated to yearling growth and yearling REA, selection for leaner scanning bulls would select against the good doing, more heavily muscled bulls.

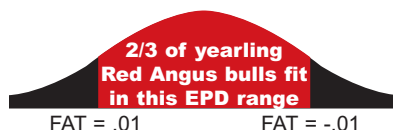
Marbling Score (MARB) predicts differences for carcass marbling score as expressed in marbling score units. Higher marbling scores are positively correlated with higher carcass quality grades.



Rib Eye Area (REA) predicts differences of carcass rib eye area between the 12th and 13th rib. Rib eye area is positively correlated with carcass yield grade which also considers fat thickness and carcass weights.



12th Rib Fat Thickness (FAT) predicts differences for carcass fat depth over the 12th rib, as expressed in inches. Fat thickness is negatively correlated with carcass yield grade which also considers rib eye area and carcass weights.



Profit starts at Reproduction!

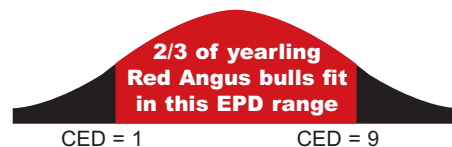
Research has shown that reproduction has four to ten times the economic impact of carcass traits. Yet many breeds have limited or no genetic measures of reproductive merit. Red Angus is the only breed that completely describes cow herd reproduction from birth through profitable lifespan. Red Angus' unique utilization of Total Herd Reporting allows the breeding and subsequent pregnancy/calving of each replacement heifer retained or purchased to be reported.

The data reported for these EPDs are categorical measures (yes or no answers) to the respective observation.

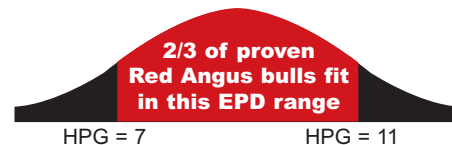
TRAIT	positive observation	negative observation
CED	unassisted birth	assisted birth
HPG	pregnant	open
CEM	unassisted calving	assisted calving
STAY	still productive after age 6	not productive after age six

Profitable Reproduction can be boiled down to success in these four Economically Relevant Traits: Each is expressed in percent probability, meaning the higher the EPD, the more likely the positive observation.

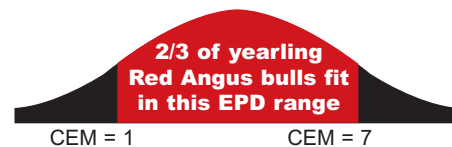
Calving Ease Direct (CED) - predicts the probability of calves being born unassisted out of two year-old heifers. Producers want live calves - born unassisted. Selecting on actual birth weight is flawed; it is influenced by non-genetic factors such as nutrition and weather (ambient temperature). While BW EPD removes these non-genetic factors, Red Angus' CED EPD is the best predictor of calving ease. The CED EPD includes variation in BW plus other influential genetic factors such as gestation length, calf shape, etc.



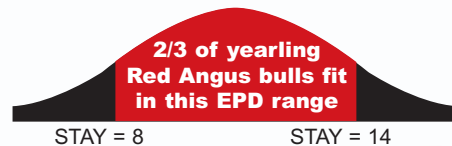
Heifer Pregnancy (HPG) - predicts the probability of heifers conceiving to calve at two years of age. Many breeds offer genetic predictions of yearling bull scrotal circumference as an indicator of age of puberty. While puberty is a prerequisite, many factors influence pregnancy rate. Red Angus' HPG EPD offers a tool which selects for what is economically relevant to ranchers - pregnant heifers.



Calving Ease Maternal (CEM) - predicts the probability of a given animal's daughters calving unassisted at two years of age. Replacement heifers should be able to calve on their own. Red Angus' CEM EPD offers the industry's most reliable prediction to address that concern. It includes not only the predisposition for a female to calve unassisted, but also her contribution to her calf's traits (birth weight, calf shape, etc.) that make it more likely to be born assisted.



Stayability (STAY) - predicts the probability that a bull's daughters will remain in the herd until at least six years of age. University studies have shown the breakeven point on replacement heifers is five to six years of age. Females that don't stay in the herd that long are losing money, and they also contribute to a higher rate of replacement females that producers must retain instead of being cash cropped.





Target your market and work backwards to find the right bulls...

After all, your marketing objectives become part of your operation's environment - same as rainfall and available feedstuffs.

Therefore, follow these steps when selecting bulls:

- 1) Know the markets you wish to hit: feeder calves, yearlings, value based grids, replacement females.
- 2) Have a true appraisal of how close your cow herd is to that target; understanding your cows have to continue to live and reproduce in your environment.
- 3) Identify bulls whose EPDs predict the ability to move your cow herd in the right direction for the traits required to hit your market endpoint.

Genetic decisions come with long term implications for producer profits... Match selection pressure to meet your program's needs:

1. Building a cow herd?

- Combine low expense traits (ME EPD) with acceptable revenue traits (TM, WW) to breed efficiency into the cow herd.
- Improve fertility with selection pressure on HPG EPDs.
- Sleep through the night by selecting high CEM EPDs.
- Lower replacement rates by selecting higher than average Stayability (STAY) EPDs.

2. Breeding virgin heifers?

- Select for CED EPD as the most meaningful predictor of calving ease. BW is nested in this prediction, so selection for higher CED EPDs will typically select for lower BW EPDs.

3. Selling calves or yearlings?

- Heavier payweights may be achieved by selecting higher WW EPDs, but...make sure heavier is what you want. Heavier weaning weights mean heavier payweights for calf feds, however, for those who background their calves, too much weaning weight could translate into yearlings that are too heavy when they enter the feed yard, and finish too late. **Overshooting performance goals can be just as detrimental as falling short.**
- Enhance your reputation - improve traits that impact feeder profits, such as carcass traits and post-weaning gain (YW).

4. Retaining Ownership?

- Docile and fast starting, Red Angus are easy to start on feed and keep on feed.
- Balance YW EPD of potential bulls with the existing cow herd to pinpoint needed improvement for post weaning gains.

5. Selling on a Grid?

- Fine-tune marbling (MARB), rib eye area (REA), and back fat (FAT) EPDs to target quality or yield grade based grids.
- Balance Carcass EPDs against existing cow herd; breeding towards a goal of Choice YG 3's or better.
 - Cowherds of higher continental influence may require additional selection pressure on marbling EPD to improve quality grade.
 - High percentage British cowherds typically benefit from selection for larger ribeye Red Angus or Red Angus x Continental hybrid bulls.

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Please feel free to contact the Red Angus Association of America if you have further questions, or need assistance with EPDs or in the selection of new herd sires(s).