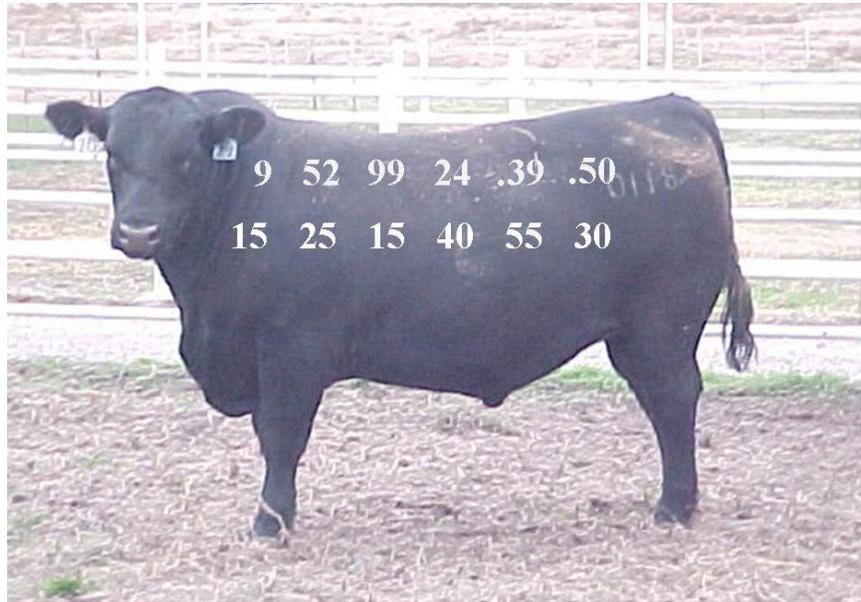


BUYING BULLS BY THE NUMBERS

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Do the bulls you buy have numbers on them?

These numbers show the EPD (top) and the percentile rank (bottom) for calving ease, weaning weight, yearling weight, milk, marbling and ribeye for the Angus bull.

Bull buying has become a numbers game if you really get specific about it. Yes, you can still go out and select a bull based on the "pretty" factor, your "gut feeling" or maybe just the dollar cost. Unfortunately, if these methods are used, your chances of buying a bull whose genetics will make needed changes in your cow herd are pretty small. There are many average and below average bulls in the world.

Numbers in the bull-buying business have become popular because of computers and the need to quantify animal performance traits. As a result of this vast array of information, you now can select a genetic package that complements your herd for a wide variety of traits. This match up is made easier if you also keep track of some performance numbers in your cow herd. If you don't keep your own cow herd's numbers religiously, keep track of the bull's numbers you use either naturally or artificially. Their performance genetics are reflected in the cow herd, assuming you retain replacement heifers.

EXPECTED PROGENY DIFFERENCE

The number one number you need to understand is Expected Progeny Difference or commonly referred to as **EPD**. There are no ifs, ands or buts about it, today's beef cattle producers need at least a basic understanding of this number or set of numbers if they expect to make genetic progress.

EPD is the *expected difference* in the performance of the calves from a bull compared to another bull's calves who also has an EPD. EPD's are developed using statistical procedures that weigh vast amounts of data that has been submitted by breeders from all over the country for an animal and their relatives.

Let's start with a simple example considering a weaning weight EPD.

Bull Number 1- Weaning Weight EPD is 39

Bull Number 2- Weaning Weight EPD is 20

If these two bulls were bred to a similarly bred and managed set of cows we would **expect** the calves (**progeny**) from #1 to average 19 pounds heavier at 7 months of age ($39 - 20 = 19$ lbs.) That's the **difference** between the two bull's weaning weight EPD.

Remember, EPDs do not predict the actual weight, height, scrotal size, ribeye area, marbling, daughter's milk, etc of an animal. They simply predict differences between two or more animals when compared in a similar environment. If you wish to know what the average performance for a breed is, some show it in their sire summaries.

I often get questions like, "**I'm buying a bull that has a birth weight EPD of 5.0, how big will his calves be at birth?**" They could be 60 pounders or they could be

90 pounders. All I could tell you is that compared to a bull whose birth EPD is 2.0, the first bull's calves will be 3 pounds heavier ($5.0 - 2.0 = 3.0$ lbs.) on average. Their calves might average 60 and 63 pounds or 90 and 93 pounds.

This is a good time to mention that EPDs do not guarantee a specific difference on each animal. There will be some extreme values show up that may cause you to question their validity. This might occur when a high accuracy, low birth weight bull throws a huge birth weight calf. Remember there can be extremes, but when several birth weights, weaning weights, etc. are averaged out the EPD, is the best predictor we have. Statistics show the EPD is 7 to 9 times better at predicting differences in animals than adjusted weights.

If you understand this approach to comparing 2 bulls or it could be 3, 4, 5, 50 or 100 bulls, you can calculate the differences on about any trait that is given for a particular breed. The majority of EPD's are referred to as pounds of difference, but it can be in other units of measure as shown in this table.

<u>EPD Trait</u>	<u>Unit</u>
Birth Weight, Weaning Weight, Yearling Weight, Carcass Weight, Mature Daughter's Weight, Milk, Total Maternal, Residual Average Daily Gain	Pound(s)
Calving Ease Direct, Heifer Pregnancy, Retail Product, Intramuscular Fat, (via ultra sound) Caving Ease Maternal	Percentage
Stayability, Temperament Or Docility	Probability
Yearling Height, Mature Daughters Height, Fat Depth	Inches
Ribeye Area	Square inches
Scrotal Circumference	Centimeters
Marbling, Intramuscular Fat	Subjective Measure
Gestation Length	Days
Grid Merit, Feedlot Merit (Index EPDs) Weaned Calf Value, Cow Energy Value, Beef Value	Dollars

As you see there are many EPD traits and the list will grow. Some breeds may report 18 or more EPD's for an individual while others keep it very simple and use the basic 5 traits. They include birth weight, weaning weight, maternal milk, total maternal and yearling weight. Calving ease is calculated in most breeds and considered a better predictor of calving ease in heifers than birth weight alone.

The best way to keep track of a breed's EPD's is to receive the breed association's annual or semi-annual sire summary. They go into more detail than I'm able to do in this review. They may be accessed via the breed's website. Now is a good time to mention *that EPD comparisons are primarily used for comparisons within a breed.* Also, remember that EPD's are constantly changing as more data is submitted by breeders. The Angus breed updates their EPDs weekly.

ACROSS – BREED EPDs

Breed adjustment factors have been developed at the Roman L. Hruska U.S. Meat Animal Research Center in Nebraska to assist in calculating EPDs that allow you to compare two or more breeds of bulls for performance in your herd.

The base for this comparison is Angus so when comparing you never add anything to the Angus animal's EPD. The add-on values for the following breeds as of 2014 include:

Table 1. Adjustment Factors to Estimate across-breed EPDs.

Breed	Birth Wt	Weaning Wt	Yearling Wt	Milk	Marbling Score	Ribeye Area	Fat Thickness
Angus	0.0	0.0	0.0	0.0	0.00	0.00	0.000
Hereford	2.7	-4.2	-23.6	-17.7	-0.31	-0.08	-0.051
Red Angus	4.1	-22.1	-29.9	1.5	-0.34	-0.02	-0.027
Shorthorn	6.2	9.9	27.8	21.7	-0.19	0.23	-0.135
South Devon	3.3	-5.2	-24.4	1.3	-0.11	0.23	-0.135
Beefmaster	6.4	37.2	33.3	6.4			
Brahman	11.0	44.8	10.1	23.9	-0.85	-0.08	-0.150
Brangus	4.4	15.4	5.2	2.1			
Santa Gertrudis	7.0	40.6	43.5	13.0	-0.67	-0.09	-0.103
Braunvieh	2.3	-23.4	-47.7	1.9			
Charolais	8.8	37.9	40.9	6.7	-0.43	1.04	-0.213
Chiangus	2.2	-19.5	-45.6	1.0	-0.43	0.46	-0.145
Gelbvieh	3.4	-19.4	-24.9	3.2	-0.35	0.67	-0.131
Limousin	3.8	-0.8	-38.7	-7.0	-0.71	1.08	
Maine Anjou	4.9	-19.0	-41.5	-7.1	-0.72	0.93	-0.224
Salers	2.2	-5.1	-24.6	3.6	-0.10	0.82	-0.206
Simmental	3.4	-6.4	-13.6	0.5	-0.41	0.46	-0.149
Tarentaise	1.9	30.7	10.3	25.1			

(2014 BIF Proceedings, Lincoln, NE)

As an example, let's compare an Angus bull with a 90 pound yearling EPD to a Charolais bull that has a yearling EPD of 60. Find the Charolais yearling

adjustment, 45.3 lbs., and add it to the Charolais, bull's actual yearling EPD ($60+45.3 = 105.3$) Now you can compare the expected progeny's performance difference ($105.3-90.0 = 15.3$) and find the Charolais bull's calves should average 15.3 lbs. heavier than the Angus bull's calves given the same management and conditions at one year of age. A similar comparison can be made on any of the traits and breeds listed above. Please note some of the values have a minus in front of them so instead of adding to their EPD you must subtract. These values are updated each year by researchers at MARC.

ACCURACY

Each EPD trait has an accuracy value with it. This is a measure of the reliability of the EPD. It is reported as a decimal number between zero and one. The greater the amount of data reported, the closer the accuracy moves to 1.0. The closer to 1.0, the greater the certainty that a bull's EPD will not change significantly in the future. Accuracies only go to 0.99

Each breed develops a table for their sire summary that shows how much a bull's EPD could change for each accuracy value. For example in the Angus breed, an accuracy value of only 0.1 for weaning weight EPD means the bull could vary 10.4 pounds, up or down, from whatever EPD value he had. However, as he sires calves that are reported to the association his accuracy after several years moves to 0.8. His EPD variation now is down to only 2.3 pounds, up or down, according to the breed's table.

Even a low accuracy value is better than just guessing on what a bull might produce. If you can afford the risk, there's nothing wrong in using a low accuracy (<0.50) bull that had an EPD that should move you in the desired direction. If you can't stand the risk, as might be the case with breeding virgin heifers, then look for low birth weight, calving ease bulls with an accuracy over 0.90. I feel quite confident when a bull attains an accuracy around 0.75.

As a rule, young sires that have no progeny will have an accuracy of .1 to .4 depending on how much data has been compiled on their ancestors. Most animal's EPD's tend to move toward the breed average for a trait as data is collected from their progeny.

OTHER ACCURACY DEFINITIONS

The breeds have various ways of denoting EPD trait accuracies when not shown as a decimal value. The following may show up in lieu of accuracy.

P or PE Pedigree estimates based on sire and dam EPD averaging. Accuracies of .05 typically are pedigree estimates.

P+ Includes pedigree estimates adjusted for the individual's relative performance within it's contemporary group.

Interim An EPD calculated by the breed association as new information is processed from the animal's own performance and/or the EPD of it's parents before the data is run by a university's national cattle evaluation program. It may be just a pedigree estimate if no new data has come in.

BKS Backsolution used to obtain breeding values of non-parents. The BKS EPD is the same as it would be from the full model.

Several breeds now have genomically-enhanced EPDs based on DNA testing for some traits. This increases the accuracies as if the individual actually had from 7 to 20 progeny data submitted to the breed association.

PERCENTILE RANK

Most sire summaries and many sale offerings report a "percentile rank" for an EPD. I really like this as it's a numeric way indicating if a bull's EPD is average above or below for his breed. If you determine from your records and observation that your cow herd needs a change, either up or down, you can choose a bull from the top 10 or maybe the bottom 10 percentile just to show the extremes. A percentile rank of 50 means the bull's EPD is average for that trait. There are a lot of average bulls out there and probably as many below as above average. Below average bulls mated to average or below average females tend to produce a lot of below average calves.

A bull can be above average in one EPD category and way below average in another. For instance, an Angus bull with a calving ease EPD of -2 is in the 95th percentile of the Angus breed for calving ease. Basically then, 95% of the Angus bulls will sire calves that are easier calving out of heifers than this bull. He would not be considered a "heifer" bull. At the same time, this bull's weaning weight EPD is 60 pounds which gives him a 10 percentile rank. This means he will sire growth in his calves and should rank him in the top end of the Angus breed for his progeny's growth at weaning.

Don't be too exacting or precise when evaluating an EPD. In this precise, computer-age it's easy to get caught up in the EPD race and decide that you must have for instance a Simmental bull with an EPD for

milk of 30 pounds. That places the bull you're seeking in the top 10 percentile of the Simmental breed for milk. I guarantee if I found a Simmental bull that met my other specs except he had a 26 milk EPD, I'd use him. The 26 milk still places him in the top 25% of the breed and that's respectable.

I prefer to group bulls into broader ranges such as the top 20, 25 or 30 percentile and so on and forget about a precise EPD. ***EPD's are not perfect but they're way ahead of whatever is in second place as a means of genetic evaluation.*** Sure, EPD's can be manipulated if breeders do not report data accurately or if they fail to group animals into proper contemporary groups for comparison. These inaccuracies are minimized if several different breeders report data from all across the country. Artificial insemination helps in this regard and assists in boosting accuracy values.

Percentile rank allows for a general comparison between breeds without resorting to the MARC across-breed adjustments. All you need do is have an idea of what a breed will add to your crossing program then decide within that breed how extreme a change you need to make. For instance you may have a crossing system that needs a dramatic increase in marbling (intramuscular fat). This would necessitate going to a high marbling breed, like Angus and selecting a bull that ranks in the top one-third for marbling. That should help move your program in the right direction for a single trait. Of course most of the time you don't wish to only look at one trait without considering the animal's complete EPD profile.

Since EPD's are so useful in choosing seedstock, they do allow for rapid changes in direction if you use the "extreme" bulls. This is especially true if those extreme bulls also carry a high accuracy value. Selection for extremes in only one trait probably should be avoided over several generations. Ideally, we prefer a bull that can "do it all." That is, he adds milk to his daughters, maintains above average growth and carcass value and calves easily. When you find those kind, they're worth some money and may already be in an AI stud.

The question often arises about "fire and ice" matings. This is when two individuals with widely different EPD percentile rankings are mated. It might be breeding a bull with growth in the top 5% for his breed to females that are in the bottom 5%. Some argue that you'll get more consistency in the progeny's growth if you mated individuals that were both in the mid-range

but that's not what research bears out. Go ahead and use extremes in order to make changes.

If you wish to compare bulls within a breed for their trait balance you may do so by averaging their percentile ranks for the traits you consider important. Let's say in your selection program you want to improve calving ease, weaning weight and Beef Value (\$B) while using Angus sires.

These 3 bulls are available with the following percentile ranks. Which bull has the best balance for those 3 traits?

	A	B	C
Calving Ease	20%	22%	45%
Weaning Weight	35%	55%	15%
Beef Value (\$B)	40%	30%	15%
Average of 3 traits	31.7%	35.7%	25.0%

Assuming all other features of these bulls are equal, bull C would average out the best for those traits with the lowest average at 25%. If one trait is extremely high or low, you may need to make some allowance in the averaging process.

FRAME SCORES

Frame scores have been around since the early 70 's and are a useful means of describing cattle. When cattle were viewed as too small framed or short, emphasis was placed on using breeding stock with higher frame scores (taller cattle). In the 70's the average frame scores of most British breeds (Angus, Shorthorn, etc.) were 3's and the European breeds like Charolais and Simmental were 5's. After several generations of selection for larger size, we had extremes of 10 even 12 frame score cattle and the averages had moved up about 2 frame scores or 4 inches in hip height at one year of age.

What is the desired frame score today? This varies with feed resources, terrain and your target market. Based on the target carcass weights the industry seems to prefer today of 700 to 950 pounds, (1100 to 1500 pounds live weight) a 4 to 6 frame seems logical. The 4's should obtain the desired Choice finish condition at the lighter weight while the 6's would be considerably heavier when slaughtered.

Frame size has several traits correlated with it. In general, as frame size increases, birth weight increases, age at sexual maturity increases and mature size increases. When buying bulls the breeder may provide you with frame scores broken down to tenths of a score like a 5.8, 6.5, 7.1 score. Once again, be careful and

don't determine you must have a 6 frame size and turn down a 5.8 or 5.9 bull that has everything else you want.

Even though the last 5 years has seen a slight reduction in increasing frame size, we must be careful and not go too far. The packing industry has shown no interest in reducing carcass weights, in fact they are moving up. A 750 pound carcass results from a 1200 pound live steer. An old rule of thumb was that the finished weight of a steer should be about equal to the dam's mature weight and the yearling weight of a bull. Animals in the 5 frame range tend to fit these weights.

SCROTAL CIRCUMFERENCE

This measurement is reported as an EPD in some breeds. At our tested bull sales a value for scrotal circumference is usually reported in centimeters. We view scrotal circumference in young, breeding age bulls as a useful indicator of reproductive potential. It is positively correlated with total sperm production and favorably related to semen quality. There will be some breed variation as with all traits, but the minimum acceptable size at 12 to 15 months of age is in the 30 centimeter area. The Brahman breeds tend to average less on their scrotal size. Greater size may be helpful up to 36 or 38 centimeters, but after that, stressing greater size may not result in much improvement. The most recent Angus sire summary lists the average scrotal size for yearling Angus bulls as 36.2 centimeters.

RATIOS

You may still find breeding stock offered for sale that do not have EPD's on them. Instead the breeder will give ratios. Ratios are helpful in evaluating bulls within the same herd, the same age range and handled together. In other words, the bulls were in a contemporary group.

A ratio of 100 represents an average value for a trait. A 90 ratio represents an animal that is 10% below average while a 110 ratio means it is 10% above average. Remember, EPD's are developed from these ratios.

There are still breeds that do not have EPDs or a sire summary. In these instances, the ratio system is the best you can use but it is of very limited value when you compare animals from two or more different environments or management groups.

INDEX

You may encounter an index at some sales. It is a number that combines performance values, such as

ratios or EPD percentile ranks into a single value for each animal. A good index will weight the traits for their relative economic importance. The index is often used to establish a sale order and may have minimal benefit to your breeding program. When indexes are reported, read the front of the catalog closely to see if it includes measurements that you consider important. Indexes are of greatest value when the subject animals have been managed alike such as in a test station. The index number is usually based around 100 as an average value for the group. The higher the index number, the more superior the bull is compared to his test mates. Most sales will eliminate the extreme low end index bulls.

\$VALUE INDEX

Several breeds now report a \$ Value Index. They are listed in dollars and cents and allow you to select for several traits at once. They should simplify multi-trait selection at least when you're considering post-weaning and carcass merit traits.

The \$ Values are sensitive to the assumptions for industry-relevant traits used in calculating \$ Feedlot, \$ Grid, and \$ Beef values. For instance, those traits include feed costs, days on feed, finished cattle prices, premiums and discounts for carcass quality and yield grades as well as heavyweight discounts. Other selection indexes from different breeds include: Mainstream Terminal Index, Terminal Sire Index, All-Purpose Index, Baldy Maternal Index, Brahman Influence Index and Terminal Sire Profitability Index.

ADJUSTED WEIGHTS

Cattle weights are adjusted or corrected to a constant age such as 205 or 365 days. In some cases they are also adjusted for the age of the dam. We know a first-calf heifer does not milk to her mature cow potential so a percentage or absolute amount of weight is added to her calf's 205 day weaning weight. This allows the calf and the cow to be compared equitably with older cows in that same management or contemporary group. Adjusted weights don't tell much unless you know what the average and extremes within the group are. Yes, it's impressive to tell someone a bull had a 900 pound, adjusted 205 day weight but if his mates averaged 920 pounds, he's below average. The group must have had near perfect conditions pre-weaning to show such growth. Don't forget, an animal can never perform above his genetic potential. I'm sure we have lots of cattle that never come close to reaching their genetic potential for growth and milk production due to a substandard environment.

MILK EPD AND MATERNAL MILK

The milk EPD is hard for us to comprehend. It's represented in pounds of weaned calf by a bull's daughters that is attributed to their milk production. It is not a true pounds of milk value such as the dairy industry uses. It is a useful number to use when adjusting milk levels in daughters destined for your replacement program. If you do not save heifers as replacements, you basically can ignore this EPD.

As mentioned earlier, don't split hairs or get too picky and worry about tenths of a pound of "milk." Look at the bigger picture. This is one EPD that most of us like a fairly high accuracy on indicating a bull has daughters in production. I personally like for the daughters to be in several herds to remove some management bias. It is possible for a cow with a below average milk EPD to be an outstanding milker in your herd or vice versa. For most traits remember the bell-shaped curve is alive and well.

If milk EPD is selected to extremes, you will see cows that lose body conditions, are hard keepers and fail to breed back. If your cattle must survive on low quality forage, you may need to stick with the lower milking breeds and EPDs that are about average or even below in the percentile rank for these breeds.

SOUNDNESS SCORES

Here's another set of numbers we use primarily at regional tested bull sales and at bull clinics. It is a subjective measure meaning it's not an absolute value such as pounds, inches, centimeters, etc. It is a number assigned by one or more persons and relates to the visible characteristics of a bull for breeding soundness and structural correctness.

The soundness ratings run from 1 to 10. A 1 is a bull that is unsound, incorrect and should have been steered long ago. A 10 would be the ultimate, sound, perfectly correct bull in feet and leg makeup. Most bulls I score fall somewhere in the 3 to 8 range. The following gives an idea of what the bulls might have as faults and correctness.

SOUNDNESS SCORING

Hoof and soundness scoring is not an exact science, but in order to place a subjective score on these bulls for your consideration, a committee or individual evaluates them considering hooves, joint angularity and movement. Keep in mind, perfection is seldom attained. Conditions that might be encountered and relative scoring are as follows.

- 10 Perfect or near perfect in hoof size, toe shape, joint angles and movement. No blemishes.
- 9
- 8 Bulls would be considered basically sound.
- 7 Good foot size, even toes, good heel depth, correct slope to pasterns, legs and shoulders.
- 6
- 5 Bulls in this range have acceptable soundness with no serious problems. Would include mild toe evenness, slight rolling of toes, moderate heel depth, some possible toe growth and only slightly excessive angle or straightness to shoulder, hock, and pasterns.
- 4
- 3 One or more serious faults that impair their movement and expected longevity.
- 2
- 1 Includes excessive toe growth, spread toes, hooves that roll under, corns, uneven toes, cracked hooves, too little or too much angle to shoulder, hock and/or pastern resulting in short or long strides. Possible swollen joints.

When I score a bull, I'm critical on hooves and the predisposition to corns. Bulls with long, slightly curled toes in the 3-4 ranges may be okay for smoother, less rocky areas but likely will need some hoof maintenance annually. If a buyer asks whether a 4 soundness bull will work, I always encourage them to go and study the bull closely, out of the stall and on the move. They need to be aware of problems before bidding.

I see fewer corn problems now than in the past. Corns are rough, warty like growths that develop between the toes, either front or rear. They may be small or large and in one or all four feet. Obviously the more extensive they are, the lower the soundness score. Corns are the result of untrimmed hooves, muddy lots, inactivity and overfeeding. There is also a genetic link to the susceptibility to corns. If I'm at a breeder's farm or a sale and see several unsound or borderline sound bulls, it tells me something about the breeder. Over the years, it seems the real critical problem arises after the bulls come off test at 12 months and before they sell at 15 to 18 months. Overfeeding, inactivity and muddy lots sure can do a lot of damage at this time. A good hoof trimmer who puts the bulls on a table and shapes their hooves at 12 months, will head off problems that could develop later in life.

DOCILITY

Docility or disposition is a score you may not see very often, but buyers value a calm type of temperament. Some breed associations have developed a docility EPD that is based on the probability that an animal's progeny will be of calmer behavior. In the Angus the top 10% for a docile temperament have EPDs that range from a 20 to a 30. The breed average is a 9. Of course the less calm animals would be down in the 4 to -10 or so range. Those bigger numbers are probabilities that their offspring will be scored as docile or just restless and not be troublemakers.

These EPDs are derived from subjective scores placed on calves while they're being worked through a chute, scale or in a pen. The breeder or a third party such as an extension person puts the score on them. Here's the basic scoring systems used by the Angus breed for assessing temperament. These numbers are a bit tricky so remember if you're looking at just a score, you want a low number, 1 or 2. If you're looking at an EPD, you want a higher number to indicate docility.

1 - Docile	Gentle, easy to handle, almost dull
2 - Restless	Slightly restless pulls back on headgate, some flicking of tail
3 - Nervous	Typical temperament, manageable, but nervous, impatient with tail flicking Repeated pushing or pulling on the headgate
4 - Flightly (wild)	Jumpy and out of control, quivers, may bellow and froth at mouth, exhibits long flight distance, runs fence line and may jump when penned by self
5 - Aggressive	Similar to 4, but with aggressive behavior toward persons when left alone
6 - Very Aggressive	"Killers", pronounced attack behavior

CONCLUSION

I hope all these numbers don't overwhelm you and cause you to go back to *"just buying a pretty bull, or buying the cheapest or the biggest bull"* You may only need to focus on a few of these numbers. So long as you don't sense a need for drastic change in any specific trait in your herd, you may not worry about them.

The main message is we have meaningful ways of evaluating a wide variety of traits in the beef industry today. The numbers of traits will grow in the future. Genomically enhanced EPDs will expand in most breeds. Currently, birth weight or calving ease, some measure of growth rate and marbling and milk rank highest with most buyers. Carcass traits are popular among persons who will be marketing finished steers and heifers through a value-based system.

Perhaps the real valuable EPD's of the future will be ones rating feed efficiency and even profitability. They are being worked on. It's even possible a fescue toxicosis EPD could be developed to evaluate hair and heat tolerance features. This may not ever occur since fescue toxicosis is more of a regional problem than an industry-wide problem.

EPDs and subjective scores are intended to help, not confuse you! If you're in need of more help in learning the numbers jargon, contact your University of Missouri Extension Livestock Specialist or contact the breed association you're interested in and request their current sire summary.



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