

STRATEGIES FOR USE OF EXPECTED PROGENY DIFFERENCES (EPD's)

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INTRODUCTION

Expected progeny differences (EPD's) are valuable tools for use in replacement bull and female selection. EPD's can and should be used by purebred and commercial cattlemen alike since research has shown that they represent the most effective means to make progress through selection.

DEFINITION AND EXPLANATION

An EPD is an estimate of what a bull or cow will transmit to their offspring. EPD's are calculated by breed associations for any animal that has sufficient performance data. Pedigree information, the animal's own performance, and eventually progeny data are used in EPD calculation. Currently 16 breeds calculate EPD's and publish a sire summary (includes only bulls) or a cattle evaluation manual (may include data on some females).

EPD's are calculated for several traits including birth weight (BW), weaning weight (WW), yearling weight (YW), milking ability (MA), total maternal, direct calving ease, maternal or daughter's first calf calving ease, hip height, scrotal circumference, ribeye area, fat thickness and marbling. Every breed association that calculates EPD's reports them for BW, WW, YW and MA, EPD's the other traits are reported only by some of the breeds.

For growth traits, EPD's are expressed in pounds of live weight, relative to breed average. A few EPD's, such as calving ease, are expressed as ratios. Others are expressed in other units such as inches (hip height EPD) or centimeters (scrotal circumference EPD). Since EPD's are expressed relative to breed average, the average EPD of all cattle in a breed for a given trait is 0.0 lb, inches, etc. (or 100 if

expressed as a ratio), approximately one-half of the cattle will have EPD's above 0.0, one-half will have EPD's below 0.0. For example, an Angus bull may have a YW EPD of +40 lb. This means that his calves would be expected to weigh approximately 40 lb more at a year of age than those sired by a breed average bull (YW EPD of 0.0), if both bulls were mated to identical cows. A negative EPD does not mean that an animal is terrible, just below breed average for a given trait. Thus if a Simmental bull has a WW EPD of -2.5, his calves would be expected to weigh 2.5 lb less at weaning than those of an average Simmental bull. Thus they would require an extra day in the feedlot or bring about \$2 per head less at weaning. If the bull has other outstanding traits (calving ease, maternal potential, muscling, etc.) he could still be a good choice in some situations.

The current sires list. Stating that the average EPD for a given trait is 0.0 is an oversimplification of the facts. EPD's are calculated using the relationship between all cattle in the breed that have ever been part of a contemporary group and had performance records. In breeds that have a long history of performance records, such as the British breeds, this includes cattle born 20 or 30 years ago. The average of any EPD, considering all historic records is 0.0, but the average EPD of those cattle that are **available for selection today** could be very different from 0.0. This difference reflects that selection that has gone on in the breeds. For instance, on average today's Angus cattle are larger, grow faster and have higher birth weights than Angus cattle of 20 years ago. Thus, the average of the "current (or active) sires list", which includes all bulls who have sired recorded progeny in the past two years, is much different from 0.0. Below are the current sires list averages for some breeds (1990 sire summaries, except Angus values which are from fall 1989):

Breed	BW EPD	WW EPD	YW EPD	MA EPD
Angus	+ 1.3	+ 4.9	+ 10.6	+ 1.4
Limousin	+ 0.5	+ 2.0	+ 3.9	+ 0.3
Polled Hereford	+ 2.7	+ 16.5	+ 24.9	+ 0.8
Simmental	+ 0.1	+ 1.9	+ 6.3	+ 0.9

It is also important to consider the range in EPD's within a breed. Following are the average and range in YW EPD's from four breeds.

Range of YW EPD's

Breed	Average YW EPD	Range
Angus	+ 10.6	- 41.5 to + 101.7
Limousin	+ 3.9	- 24.8 to + 51.0
Polled Hereford	+ 24.9	- 24.0 to + 80.1
Simmental	+ 6.3	- 85.2 to + 98.2

Milking ability and maternal EPD's. The MA EPD is expressed in lb of weaning weight due to factors other than genetics for growth. This primarily represents milk production, but may also represent some other, unaccounted for, aspects of maternal environment. A total maternal EPD is often reported. To calculate a total maternal EPD, add the MA EPD to 1/2 of the WW EPD. This reflects that a bulls' daughters will contribute all the milk, and 1/2 of the genetics for preweaning growth to any calves they raise. For example:

Bull	WW EPD	MA EPD	Total maternal EPD
A	+ 10.0	0.0	+ 5.0
B	0.0	+ 10.0	+ 10.0
C	+ 5.0	- 1.2	+ 1.3
D	+ 22.6	+ 6.0	+ 17.3
E	- 8.8	+ 10.5	+ 6.1
F	- 4.6	- 1.3	- 3.6

Note that a bull can have a negative MA EPD and still have a positive total maternal EPD (bull C above).

EPD's are for within breed use only. EPD's are calculated within breeds only and cannot be used to compare cattle across breeds. Do not make the mistake of thinking that a bull with a +40 lb YW EPD in one breed will sire faster growing calves than a bull with a +20 lb YW EPD in another breed. He may or may not, depending on how the breeds compare for growth. For instance, a Charolais bull with a YW EPD of 0.0 would be expected to sire faster growing calves than an Angus bull with a YW EPD of 0.0. Although both bulls are average within their breeds, Charolais as a breed are faster growing than Angus, so an average Charolais bull should sire faster growth than an average Angus bull. Similarly, a Simmental bull with a MA EPD of +8.0 should sire heavier milking daughters than a Limousin bull with a +8.0 MA EPD, because of the breed differences. A Hereford bull with a BW EPD of -1.2 will sire smaller calves at birth than a Gelbvieh bull with a BW EPD of -1.2.

Remember that EPD's can be used for comparison, but not for prediction. EPD's will not predict how much your calves will weigh on any given day, but they will tell you which bull in a group will sire the heaviest calves. A breeder who has a cowherd with an average WW EPD of +20 lb should not expect his calves to weigh exactly the same amount as another breeder who has cows with similar EPD's. The reason for this is that EPD's reflect genetic capability but the environment will dictate the extent to which a given animal expresses its genetics.

PUTTING EPD's TO WORK

When using EPD's to select breeding stock, the following questions should be answered:

1. How are the selected cattle to be used (purpose)?
2. Under what conditions are the cattle expected to perform (situation)?
3. Based on the purpose and the situation, collectively termed the **production scenario**, which traits are most important (priorities)?

Following are some example production scenarios which illustrate selection of bulls to match priorities.

Example #1

Scenario: Yearling Simmental bulls are selected for use in a three-breed rotational crossbreeding system. Bulls will be mated to 1100 lb Angus x Hereford cows and heifers. The cows in the herd need more milk, feed is plentiful, labor is limited at calving time and all calves will be sold at weaning.

Priorities: Calving ease would be assigned high priority status in this example because bulls of a large breed will be bred to first-calf heifers of moderate size. This becomes even more important since labor is limited. Milk production would be the next priority since calves are sold at weaning and the cows are low in milk. Although growth is important in any beef herd, it would be a lower priority than calving ease and milk in this situation.

EPD's for Yearling Simmental Bulls

Bull	BW EPD	WW EPD	YW EPD	MA EPD
A	+ 0.2	+ 3.3	+ 13.6	+ 6.2
B	+ 4.4	+ 7.4	+ 24.3	- 4.2
C	- 2.6	+ 1.4	+ 2.1	+ 13.1
D	- 2.9	+ 4.7	+ 12.7	+ 10.8
Breed average	+ 0.1	+ 1.9	+ 6.3	+ 0.9

Bull D would appear to be the best choice for the scenario listed above since his EPD's are below average for BW and above average for MA and growth (WW and YW). Bull C would be almost as good a choice because of his low BW EPD and high MA EPD, but he is lower in growth than D. This is a case, however, where both bulls are well suited to the scenario and traits other than EPD's could be used to choose between them. Bull A would be a third choice and bull B is unacceptable for this scenario because of his high BW EPD and low MA EPD. Bull B would however be a good choice with a different scenario that emphasized growth as the highest priority. If the bulls were to be used in

a terminal sire program (no daughters kept as replacements), bred to large cows and not to heifers and all calves fed to slaughter by the breeder, B would be the best choice and C the poorest.

Example #2

Scenario: Yearling Angus bulls are selected for use in a three-breed rotational crossbreeding system. They will be mated to 1200 lb Polled Hereford x Limousin cows, but not to heifers. Pasture conditions are adequate to support slightly more milk than the cows are producing but not as plentiful as in the first example. Family labor is plentiful. All steers, and all heifers not kept as replacements, are fed to slaughter by the breeder.

Priorities: Growth would receive the highest priority, moderate milk would be more appropriate than either very high or very low, and calving ease would not be a high priority.

EPD's for Yearling Angus Bulls

Bull	BW EPD	WW EPD	YW EPD	MA EPD
A	+ 7.2	+ 25.4	+ 45.7	+ 3.6
B	+ 6.2	+ 29.4	+ 48.7	+ 15.2
C	+ 5.2	+ 30.2	+ 54.7	+ 6.0
D	+ 4.1	+ 15.2	+ 28.1	+ 0.7
Breed average	+1.3	+ 4.9	+ 10.6	+ 1.4

Bull C would be the best choice for this scenario, A would be next, followed by B. Although the bulls are relatively similar in growth (due to low accuracy values for yearling bulls), C presents the most growth. A would be the second choice over B because of his more moderate MA EPD. The heavy milking daughters that B would be expected to sire could have trouble breeding back with the pasture conditions as described. Bull D would be a poor choice in this scenario.

SUGGESTIONS

Choose a breed first. Each breed has relative strengths and weaknesses. The production scenario, along with the merits of each breed, determine which breed is best suited. After selecting the breed that is most appropriate, EPD's can be used to select the best bull of that breed for the scenario.

More is not always better. Since EPD's allow more rapid progress than any other selection tool, they allow breeders to attain too much of any trait most rapidly. That is why analyzing the scenario properly and choosing the proper production goals is important. Not all environments can support increased growth or milk production. Not all labor situations can tolerate calving difficulty. Following

is a characterization of the effect of the MA EPD of an Angus sire on his daughter's production average:

Sire's MA EPD	Effect on Daughter's Production Average Prior to Any Selection or Culling		
	+15 and above	Rarely	needed
commercially - use only in herds very low in milk.			
+10 to +14	Calves wean in excellent condition in relation to genetic capability for growth. A few daughters may have difficulty breeding back unless their nutrient requirements are met, particularly at younger age.		
+5 to +9	Suitable to many range conditions and allows the more growthy is sustained.		
-5 to +4	Adequate under most range conditions to wean a healthy, good-doing calf.		
-10 to -6	Calves' frame growth may be expressed but generally not carrying the condition/weight that more milk usually provides.		
-15 to -11	Under less than ideal conditions, calves show some signs of milk shortage and some reduction in frame and growth potential.		
-20 to -16	Calves show signs of nutritional shortages, rough hair coats and		
-21 and below	Unthrifty calves with poor weaning weights - some stunting appears depending on environment; additional feeding may be required to obtain potential growth.		

Stack pedigrees. The short-term strategy for use of EPD's in either a commercial or purebred herd is to match strengths to weaknesses. The long-term strategy should be to stack pedigrees. After the production goals have been set, use of bulls with EPD's that fit those goals for several generations is the best means to build a uniform cowherd that matches the environment and has predictable performance.

Keep current. Breed associations recalculate EPD's annually for all cattle, some breeds may begin to update EPD's twice annually. These updates result in increased accuracy as more information becomes available. This has two important ramifications. First, the EPD's on all cattle will change each time they are updated. The changes can be minimal or large, depending on the accuracy value (see next section). Thus, when selecting or merchandising cattle, only their most current EPD's should be used, since they are the most accurate. Secondly, the current sires list average will change each time the EPD's are updated. A further possible consideration is that some breeds may choose to set the current sires list average back to 0.0 occasionally or change the base year used in the calculations. In that case, the highest yearling weight bull in a given breed could see his YW EPD drop from +90 to +40, as an example. The bull would not be any better or worse than he had been previously, he would simply be compared against a different standard than previously.

Consider accuracy. Each EPD is published with an accompanying accuracy value. Accuracy will range from .00 for an animal that has only pedigree information (these may be reported as P or P+ instead of .00) to the highest possible value, .99, for EPD's of bulls that have sired hundreds of progeny

in a number of different herds. The potential change in any EPD becomes less as the accuracy increases. The following table describes the relationship between accuracy and potential range of WW and MA EPD values for Angus bulls.

Accuracy	WW EPD	Potential range	MA EPD	Potential range
.10	+ 30.0	+ 18.1 to	+ 41.9	+ 5.0 - 5.6 to + 15.6
.30	+ 30.0	+ 19.3 to	+ 40.7	+ 5.0 - 4.5 to + 14.5
.50	+ 30.0	+ 20.6 to	+ 39.4	+ 5.0 - 3.4 to + 13.4
.70	+ 30.0	+ 22.3 to	+ 37.7	+ 5.0 - 2.0 to + 12.0
.90	+ 30.0	+ 24.7 to	+ 35.3	+ 5.0 + 0.1 to + 9.9

CARCASS EPD's

A few breeds calculate and publish EPD's for various carcass traits. While just as accurate and effective as other EPD's, they are not utilized much. The reason for this is that, for the most part, only older bulls have carcass EPD's due to the length of time required to amass enough useful carcass information. Hopefully, future developments in ultrasound or other technology will make calculations of carcass EPD's on young bulls a reality.

SUMMARY

In the past several years, EPD's have gone from a new concept that many people had heard of but maintained a wait-and-see attitude about, to a tool that some purebred and commercial cattlemen would be reluctant to do without. Confusion remains about proper use and interpretation of EPD's but breed associations, breeders and extension personnel are providing information to those who seek it. Use of EPD's presents the only means of attaining predictable, consistent performance in economically important traits, across an entire herd. It is the opinion of the author that those who utilize EPD's properly will enjoy the greatest success in coming generations of cattle breeding.