Practical Guide for Using EPDs in Selection Decisions

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Expected Progeny Differences (EPD) is a powerful tool to make genetic change in the beef herd. The ability to change the performance of the herd through selection has never been greater, but with these improvements in selection practices comes greater responsibility for producers to make the right choices. Improvements in selection tools increases the rate of genetic change, however, genetic change does not always equal genetic progress! It is critical for beef producers to utilize the tools available to them responsibly and correctly.

The best genetic practice available to commercial cattlemen to improve reproductive performance is crossbreeding. A well-constructed crossbreeding program can improve reproductive rates, cow longevity and overall performance of the herd (Cundiff, 1999). Also, when retaining replacement heifers, the level of heterosis should be considered. As a rule of thumb, retain females that have no more than 75% of any one breed.
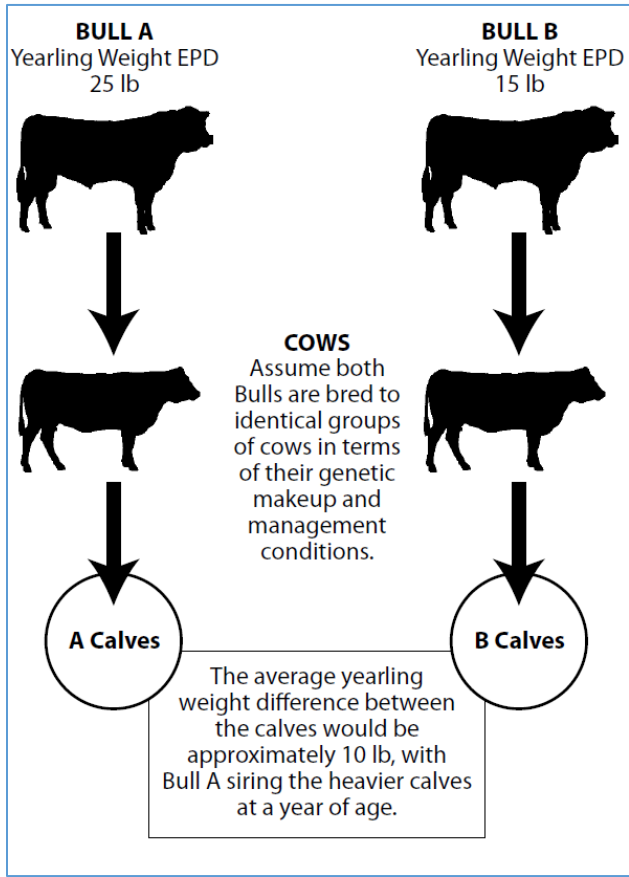
Prior to purchasing a bull there are several factors that should be considered, including: the environment the herd will be exposed to, the level of management (intensive vs extensive; fulltime vs part-time), intended marketing of the resulting calves and whether heifers will be retained. This information will help determine what traits will be important in the selection process and the optimum level of performance needed in those traits. For example, a part-time cattleman that cannot monitor heifers closely during calving season would require a higher level of calving ease than a cattleman that intensely manages heifer calving. Also, traits such as milking ability and cow size must be carefully monitored, especially in environments or management situations with limited nutrient availability, either quantity or quality (Lalman et al, 2013). All of this information is necessary to help cattlemen develop their breeding objectives, which is basically a roadmap for selection decisions.

Once the breeding objectives are determined then selection decisions should be made using the best tools available. Depending on the specific trait this can include a wide range of tools, such as, visual appraisal, phenotypic measurements, EPDs or genomics information. For the traits that EPDs are computed for, this is your best option. An example of where visual appraisal would be the necessary is for a trait such as structural correctness; with no EPD a subjective determination through visual appraisal is the best option. Also, many breeds do not have an EPD for hip height or frame size, in these cases the best option is the phenotypic measurement of the cattle. For traits such as coat color, a genomics test can determine if the animal is a carrier of the red allele.

Expected Progeny Differences are very easy to use and are a reflection of the transmitting ability of the animal it is computed for. This is the best measure we have for genetic merit of that animal for that trait. EPDs can be used to compare one animal to another within that breed (Example 1) or to determine where an animal ranks within their breed for a particular trait (Example 2).

Example 1. How to Use EPDs to compare bulls.

Bull A has an YW EPD of +25 lbs and Bull B has an YW EPD of +15 lbs. If these bulls were bred to an identical set of cows (in terms of genetics and environment), you would expect a difference of 10 lbs in the average YW of their calves. Therefore, Bull A's calves would weigh approximately 10 more pounds at 365 days than the calves sired by Bull B.

BULL A
Yearling Weight EPD
25 lb

BULL B
Yearling Weight EPD
15 lb

COWS
Assume both Bulls are bred to identical groups of cows in terms of their genetic makeup and management conditions.

A Calves

B Calves

The average yearling weight difference between the calves would be approximately 10 lb, with Bull A siring the heavier calves at a year of age.

Example 2. How to use EPD Percentile Charts

Find the percentile chart that pertains to the breed of your animal and sub-population (i.e. Purebred Simmental – Current Sires). Find the EPD for the trait in question from the sales catalogue or registration papers (i.e. Marbling = .27). In the column for that trait find the value closest to the value of the animal's EPD and follow the row to the left to determine the percentile ranking (i.e. 20th percentile). In this example, the bull ranks in the top 20% of the breed for marbling.

2018 Purebred Simmental Percentile Table

Bull pedigree / EPD header:

30 PVF Insight 12 · NB Magic Sugar

S A V Brilliance · PVF Missie · Triple C Majic Man · NB Sugar & Spice

CE	BW	WW	YW	MCE	Milk	MWW	Marb	REA	API
14	-0.6	62	104	8	30	61	0.27	1.2	131

Row labels (left): Purebred, Fullblood, Simbrah, Hybrid, Top Fifty Sires, Possible Change

%	API	TI	CE	BW	WW	ADG	YW	MCE	MLK	MWW	STY	DOC	CWT	YG	MRB	BF	REA	SF
1	163.73	86.19	18.4	-2.4	85.8	0.30	131.1	15.7	32.7	68.5	19.3	15.2	53.8	-0.49	0.49	-0.100	1.17	-0.51
2	159.11	84.28	17.4	-1.9	83.3	0.29	126.8	14.9	31.4	66.8	18.5	14.7	50.9	-0.46	0.45	-0.094	1.12	-0.48
3	156.19	83.07	16.8	-1.6	81.7	0.28	124.1	14.3	30.5	65.6	17.9	14.4	49.0	-0.45	0.42	-0.091	1.09	-0.47
4	153.99	82.16	16.3	-1.4	80.5	0.27	122.1	13.9	29.9	64.8	17.5	14.2	47.6	-0.44	0.40	-0.088	1.07	-0.46
5	152.20	81.42	15.9	-1.2	79.5	0.27	120.4	13.6	29.4	64.1	17.2	14.0	46.5	-0.43	0.39	-0.086	1.05	-0.45
10	146.07	78.87	14.5	-0.5	76.2	0.25	114.7	12.4	27.6	61.7	16.0	13.3	42.5	-0.40	0.33	-0.079	0.98	-0.42
15	141.93	77.16	13.6	-0.1	73.9	0.24	110.9	11.6	26.4	60.1	15.2	12.9	39.9	-0.38	0.30	-0.074	0.94	-0.40
20	138.63	75.79	12.9	0.3	72.1	0.23	107.8	11.0	25.4	58.9	14.6	12.5	37.8	-0.37	0.27	-0.070	0.90	-0.39
25	135.81	74.63	12.3	0.6	70.6	0.22	105.2	10.5	24.6	57.8	14.1	12.2	36.0	-0.35	0.24	-0.067	0.87	-0.37
30	133.26	73.57	11.7	0.9	69.2	0.22	102.8	10.0	23.9	56.8	13.6	11.9	34.4	-0.34	0.22	-0.063	0.84	-0.36
35	130.92	72.60	11.2	1.1	68.0	0.21	100.7	9.5	23.2	55.9	13.1	11.7	32.9	-0.33	0.20	-0.061	0.82	-0.35
40	128.68	71.67	10.7	1.3	66.7	0.20	98.6	9.1	22.5	55.0	12.7	11.5	31.4	-0.32	0.18	-0.058	0.80	-0.34
45	126.53	70.78	10.3	1.6	65.6	0.20	96.6	8.7	21.9	54.2	12.3	11.2	30.1	-0.31	0.16	-0.056	0.77	-0.33
50	124.40	69.90	9.8	1.8	64.4	0.19	94.6	8.3	21.3	53.4	11.9	11.0	28.7	-0.30	0.14	-0.053	0.75	-0.32
55	122.27	69.02	9.3	2.0	63.2	0.18	92.6	7.9	20.7	52.6	11.5	10.8	27.3	-0.29	0.12	-0.050	0.73	-0.31
60	120.12	68.13	8.9	2.3	62.1	0.18	90.6	7.5	20.1	51.8	11.1	10.5	26.0	-0.28	0.10	-0.048	0.70	-0.30
65	117.88	67.20	8.4	2.5	60.8	0.17	88.5	7.1	19.4	50.9	10.7	10.3	24.5	-0.27	0.08	-0.045	0.68	-0.29
70	115.54	66.23	7.9	2.7	59.6	0.16	86.4	6.6	18.7	50.0	10.2	10.1	23.0	-0.26	0.06	-0.043	0.66	-0.28
75	112.99	65.18	7.3	3.0	58.2	0.16	84.0	6.1	18.0	49.0	9.7	9.8	21.4	-0.25	0.04	-0.040	0.63	-0.27
80	110.17	64.01	6.7	3.3	56.7	0.15	81.4	5.6	17.2	47.9	9.2	9.5	19.6	-0.23	0.01	-0.036	0.60	-0.25
85	106.87	62.64	6.0	3.7	54.9	0.14	78.3	5.0	16.2	46.7	8.6	9.1	17.5	-0.22	-0.02	-0.032	0.56	-0.24
90	102.73	60.93	5.1	4.1	52.6	0.13	74.5	4.2	15.0	45.1	7.8	8.7	14.9	-0.20	-0.05	-0.027	0.52	-0.22
95	96.60	58.39	3.7	4.8	49.3	0.11	68.8	3.0	13.2	42.7	6.6	8.0	10.9	-0.17	-0.11	-0.020	0.45	-0.19
Avg	124.40	69.90	9.8	1.8	64.4	0.19	94.6	8.3	21.3	53.4	11.9	11.0	28.7	-0.30	0.14	-0.053	0.75	-0.32

Genetic Trend data from the USDA Meat Animal Research Center (USDA-MARC) (Kuehn, 2016) indicates that breeds are changing their production traits through selection decisions (Charts 1-4). Most breeds have shown substantial increases in the size of their cattle, with differing changes to birth weights and milking ability. For example, Angus has gone from one of the lighter breeds for yearling weight growth to the heaviest yearling weight breed, while maintaining relatively light birth weights.
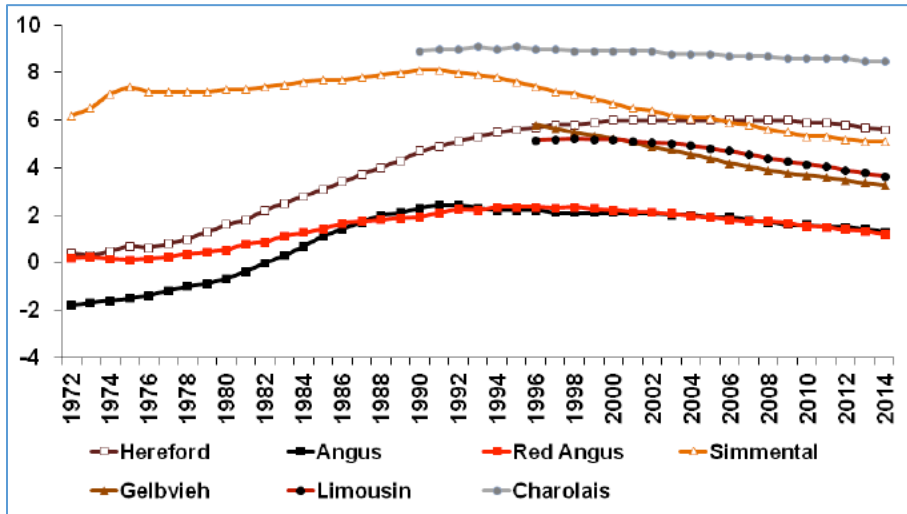
Chart 1. Birth Weight Genetic Trends

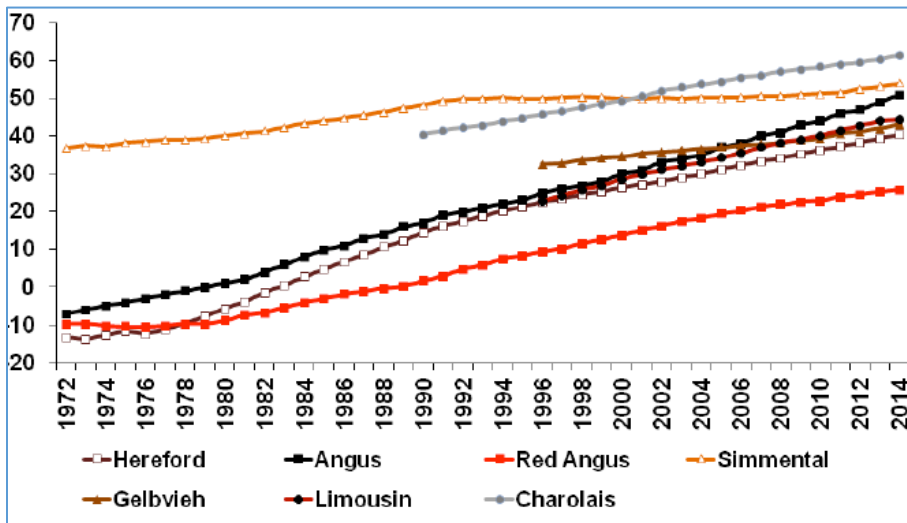## Chart 2. Weaning Weight Genetic Trends

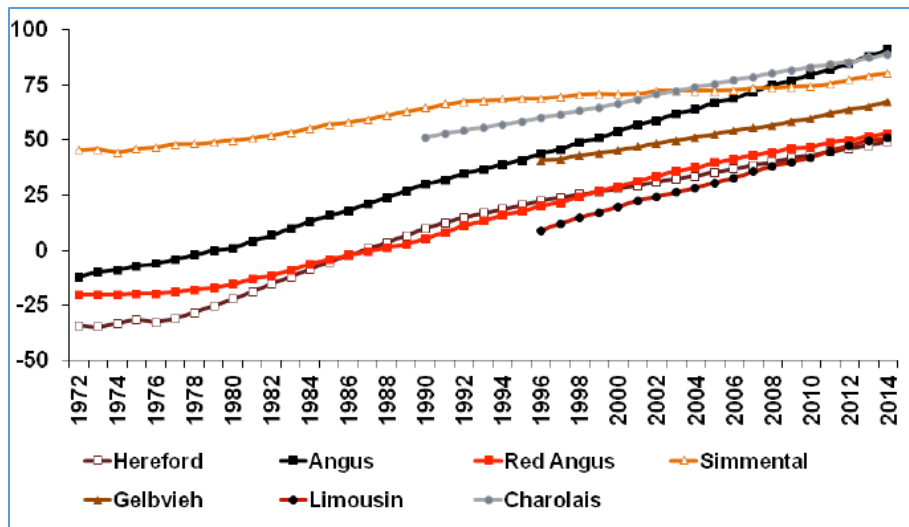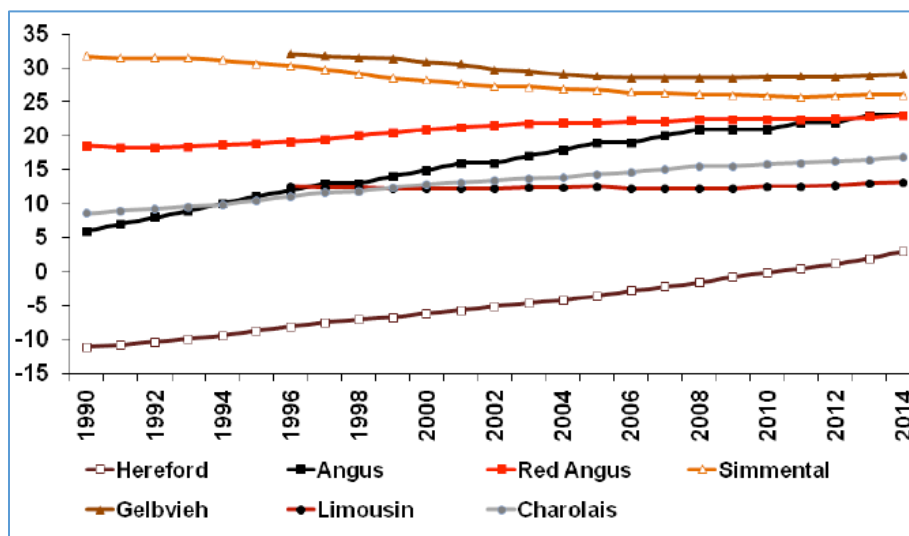

Chart 3. Yearling Weight Genetic Trends

Chart 4. Milk Genetic Trends

Until recently, EPDs were computed using pedigrees and phenotypic information through National Cattle Evaluations (NCE). Now genomics information is being incorporated into NCE, which improves the accuracy of the EPDs (Miller, 2016). For example, for a trait such as Calving Ease Direct, an EPD computed using genomics information is equivalent to computing the EPD with 24 records of progeny data (Table 1). This technology has greatly enhanced our ability to make selection decisions, while keeping the selection process (EPDs) the same. It is important to note that even with the advancements in genomics technology it is still critical for seedstock producers to collect phenotypic data and submit those records to their breed associations; both NCE and genomic predictions are dependent on accurate on-farm records and correctly identified contemporary groups.

Table 1. Genetic Correlation between genomic prediction results and phenotypic American Angus Association data, including progeny equivalent of genomic information.

Trait	h²	r	Progeny Equivalent
Calving Ease Direct	.20	.67	24
Birth Weight	.42	.69	13
Weaning Weight	.20	.56	19
Yearling Weight	.20	.68	24
Dry Matter Intake	.31	.73	17
Scrotal Circumference	.47	.80	16
Docility	.37	.68	11
Heifer Pregnancy	.13	.62	22
Milk	.14	.37	14
Carcass Weight	.38	.60	7
Marbling	.45	.65	8

Once your goals have been established (breeding objectives), you have determined limitations such as nutrition and labor, and you have determined the likely marketing method of future offspring it is time to make your selection decisions. The following are recommendations for selecting for various traits, realizing that single trait selection is not advised.

Calving Ease

To determine if a bull is going to be an easy calver use the Calving Ease Direct EPD. Differences in this EPD indicates the difference in unassisted births when bred to heifers with higher values meaning more unassisted births. Common mistakes are for producers to use this EPD in conjunction with actual birth weight (BW), BW EPD and/or the body shape of the bull. This additional information does not improve your ability to identify a calving ease bull, on the contrary, it diminishes the accuracy of your selection. When selecting a bull to generate replacement heifers with good calving ease, use the Calving Ease Maternal EPD. Bulls with higher values will produce daughters with greater calving ease.

Growth

The growth trait that should be focused on is the one that is closest to the marketing endpoint. For example, if you plan to market weaned calves then Weaning Weight EPD should be your selection tool, however, if selling carcasses, then Carcass Weight EPD would be the tool of choice. Be aware that growth traits are correlated with other traits that can impact the herd. Higher growth rates usually lead to heavier birth weights and potentially greater calving

difficulty, lower milking ability in replacement females and larger mature size of the cow herd. Balancing adequate growth with calving ease and acceptable mature size is the key.

Maternal

The first trait that comes to mind when discussing maternal characteristics is milking ability. This trait is often called Maternal Milk, Weaning Milk or Milk and higher values means replacement females will be heavier milkers. Five pounds difference in two bulls' Milk EPD means that daughters from the bull with the higher value will raise calves that weigh 5 more pounds at weaning due to greater maternal ability, primarily milk. The caution here is that with greater milking ability comes greater nutrient demands. Cows with an abundance of milking ability in an environment with limited nutrition results in reduced body condition and ultimately lower reproduction rates. Often, the impact is realized in failure to get cows to rebreed after having their first calf.

Another maternal trait of great importance is reproduction. There are several EPDs that estimate the genetic merit of several reproductive traits: Heifer Pregnancy, 30-month Pregnancy, Stayability and Sustained Cow Fertility. Depending on your breed and your target of focus, these EPDs can be used to improve various components of cow reproductive productivity. However, these traits have relatively low heritabilities which means genetic progress will be slow.

Carcass

If you sell your calves on the rail, or have some way of capturing greater returns by producing cattle with better carcass characteristics, most breeds have EPDs for carcass traits and these can be used to improve these traits. These typically include carcass weight, some indication of quality and factors affecting yield. The level of emphasis on these traits will be dictated by the grid the cattle will be sold on or based on your customers' preferences.

Disposition

Docility was once considered a convenience trait, but research as shown that cattle with poor disposition tend to be less productive in the feedlot and in carcass performance (Burrow and Dillon, 1997). This trait is heritable and can be selected for. For breeds that have Docility EPDs, they can be used to select for improved docility in future generations, however, the bull should be visually observed to determine if his temperament is acceptable. Even bulls with good genetics for docility can have poor temperament if they are not handled correctly and can cause problems. For breeds that do not have Docility EPDs, selection for calmer animals can improve herd temperament over time, but the process is slower.

Scrotal Circumference

Scrotal circumference is an important male reproduction trait; larger scrotal circumference indicates higher semen volume (Hahn et al, 1969) and may be an indicator of greater carrying capacity. Seedstock producers should use Scrotal Circumference EPDs in their

breeding program to produce bulls with large scrotal circumferences. Commercial producers, on the other hand, are not interested in increasing the scrotal circumference of the calves they are producing, so they should focus on the actual scrotal circumference of the bulls they are considering purchasing.

Selection Indices

Many breed association are computing various selection indices for their cattle that can be used to simplify the selection process. Selection Indices are basically a way to select for multiple traits at the same time using one value. Differences in two animals indices values is the expected average value difference of their calves. So if we compare two bulls with an index difference of 5, we would expect the bull with the higher value to have calves that average $5 more of potential profit. Selection indices take into account both income and cost factors. Indices are based on assumptions in regard to management, environment and marketing, so the better these assumptions fit your operation the better the index will work for you. Take the time to study the indices available and choose the one that best fits your situation.

Summary

Commercial cattlemen should be practicing crossbreeding to position themselves for improved production and profitability. Once the breed has been determine then selections should be made to fit the herd's environment, management, replacement female scheme and market. Tools that are available for selection are visual appraisal, actual measurements, EPDs, genomics and selection indices. A well suited selection index is likely the best option with the least risk of making a poor selection decision. If the other tools will be utilized then multi-trait selection should be practiced and EPDs should be the tool of choice for the traits that they are available for. When available, EPDs should be used alone (i.e. Calving Ease Direct) and not in conjunction with indicator EPD (i.e. Birth Weight EPD) and/or actual measurements (i.e. Actual Birth Weight). For traits of importance that EPDs are not computed for, selections can be made based on actual measurements or visual appraisal depending on the trait.

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