

USING EPDs TO IMPROVE REPRODUCTION

Lesson 3



Introduction

For the past 33 years, beef producers have had the opportunity to use Expected Progeny Differences (EPDs) in making decisions about beef cattle selection. Like the term sounds, EPDs measure genetic differences between animals. We started with EPDs for growth and production traits such as birth weight, weaning weight, yearling weight, maternal milk, and calving ease. With the improved technology of Ultra Sound equipment in the past 10 years, we now have EPDs for carcass traits such as percent intramuscular fat (%IMF), rib eye area, external fat, and percent retail product. Qualified technicians gather and report carcass data on live animals which used to require progeny data collected at processing plants. The purpose of this educational lesson is to focus on the EPDs that can be used to affect the reproductive performance of your beef herd. Beef producers must clearly define their production goals, evaluate their cow herd, then choose breeding stock that are genetically superior in the traits needed to meet those production goals.

What are EPDs?

EPDs are an indicator of genetic value that can be used to compare specific animals of the same breed regardless of age or location of herd. Each purebred animal can have EPD values calculated for it. Purebred breeders report data to the National Herd Improvement Program for their breed, which contributes to the breed's national database. Both purebred and commercial producers can utilize EPDs, but first you must understand what they mean and how they work.

The performance of a beef animal is determined by a combination of genetics and environment (which includes management). Genetics are passed from parent to offspring, but "environment" is not heritable. The complex formulas used to calculate EPDs weed out the environmental factors and leave you with a true genetic measurement that can be used to compare individuals within a breed. EPDs are reported as plus (+) or minus (-) values in units consistent with the traits measured. EPDs for traits such as birth weight, weaning weight, and yearling weight are expressed in pounds, while EPDs for scrotal circumference are in

centimeters. EPDs for hip height are expressed in inches, while EPDs for marbling are reported in degrees, and so forth.

Use EPDs to compare animals of the same breed in terms of their genetic merit for a particular trait. The difference between the EPDs of two particular animals indicates the difference you would expect to see in their progeny due to genetics. For example, if bull A has a weaning weight EPD of +25.0 and bull B has a weaning weight EPD of +15.0, you would expect the calves sired by bull A to average 10 pounds heavier at weaning than the calves sired by bull B. EPDs can be used as a tool to increase, decrease, or maintain a specific trait within your herd. Keep in mind that maximum and minimum EPDs are not always optimum, EPDs of zero are not necessarily average, and positive EPDs are not always desirable. A good example of this is birth weight EPD.

It is also important to remember that EPDs are not constant. As more data is collected on the offspring of a particular animal, its EPDs may change accordingly. Each EPD has an accuracy value. The more offspring a particular animal produces, the more accurate the EPDs will become. Accuracy values range from 0.0 to 1.0. Values closer to 1.0 mean greater reliability. Young bulls with no progeny will have an accuracy value (ACC) around .35. As progeny records become available, ACC values will increase, and the EPD values may change. ACC values of .76 or higher are highly reliable, and little change is expected. ACC values can be classified into three categories, low (0.0 to .64), medium (.65 to .75), and high (.76 to 1.0).

What EPDs do NOT do...

- EPDs can not accurately compare animals of different breeds.
- EPDs do not predict outcomes. (If you use bull A with a weaning weight EPD of +25.0 it does not mean your calves will be 25 pounds heavier at weaning next year.)
- EPDs do not make up for poor management.

Using EPDs to Improve Reproduction

Scrotal circumference (SC) in young bulls is a useful indicator of reproductive potential. It is positively correlated with total sperm production and favorably related to semen quality. In the late 1980's several researchers looked at bull scrotal circumference and its relationship to age at puberty of the daughters. This research indicated that bulls with normal or above average scrotal circumference had daughters that reached puberty at an earlier age than those bulls with smaller than average scrotal circumferences. Research has also shown a favorable relationship between SC and age at first breeding and subsequent rebreeding in females. Using bulls with a larger, positive SC EPD can help improve the future reproductive performance of your herd.

Calving difficulty leads to problems with cow and calf survival and difficulty in getting the cow rebred in a timely fashion. While Birth Weight EPD can be used to influence calving ease in your herd, remember that other factors (such as pelvic area, age of dam, etc.) also come into play. Also, by simply selecting for smaller birth weights, you can negatively impact weaning weight, yearling weight, and pelvic area. Therefore, most breeds have

developed EPDs for Direct and Maternal Calving Ease. Calving Ease Direct (CED) describes the probability that an animal's progeny will be born unassisted. This is a very important trait for bulls used on virgin heifers. The second is Calving Ease Total Maternal (CETM), which described the probability that a sire's daughters will calve unassisted. These EPDs help predict the probability of a sire's or dam's ability to have unassisted progeny at birth (CED) and produce daughters that calve unassisted (CETM) or (CEM).

Heifer pregnancy (HPG) EPD is a new trait EPD recently introduced by the Red Angus breed with the assistance of the researchers at Colorado State University. HPG EPD measures the expected difference in probability of a sire's daughter conceiving to calve as a two year-old. The EPD for heifer pregnancy is expressed as a percent. This means that when we compare HPG between bulls, the higher number equals a higher percent chance that their progeny will conceive as yearling heifers.

The Stayability (Stay) EPD measures the difference in probability of daughters staying in the herd to at least the age of six years. Since cows are usually culled for being open before the age of six, the EPD is primarily a measure of sustained fertility in female offspring. Stayability data consists only of calving records and is reported only in breeds that have a Total Herd Reporting system. In these breeds all activity on a cow is noted, so breeders report if a cow calves or if the cow was culled and why. Stayability is affected by breeders' culling criteria. Given the primary emphasis in most herds on pregnancy, stayability is likely to be more a measure of sustained fertility than anything else. Stayability EPDs for bulls are the prediction of the genetic differences between their daughters probability of staying in the herd to at least the age of six years. Stayability is expressed as a percent, and the higher the number the better.

One breed association has also included a measurement of temperament. The American Limousin Association uses docility EPDs. The breed is making an effort to identify bulls within the breed that will produce daughters and sons with better dispositions. This could be a reproductive related trait if you cannot catch a cow or keep her restrained in an AI program. Docility EPD is based on a scoring system from 1 = Docile, 2 = Restless, to 5 = Nervous, and 6 = Very Aggressive.

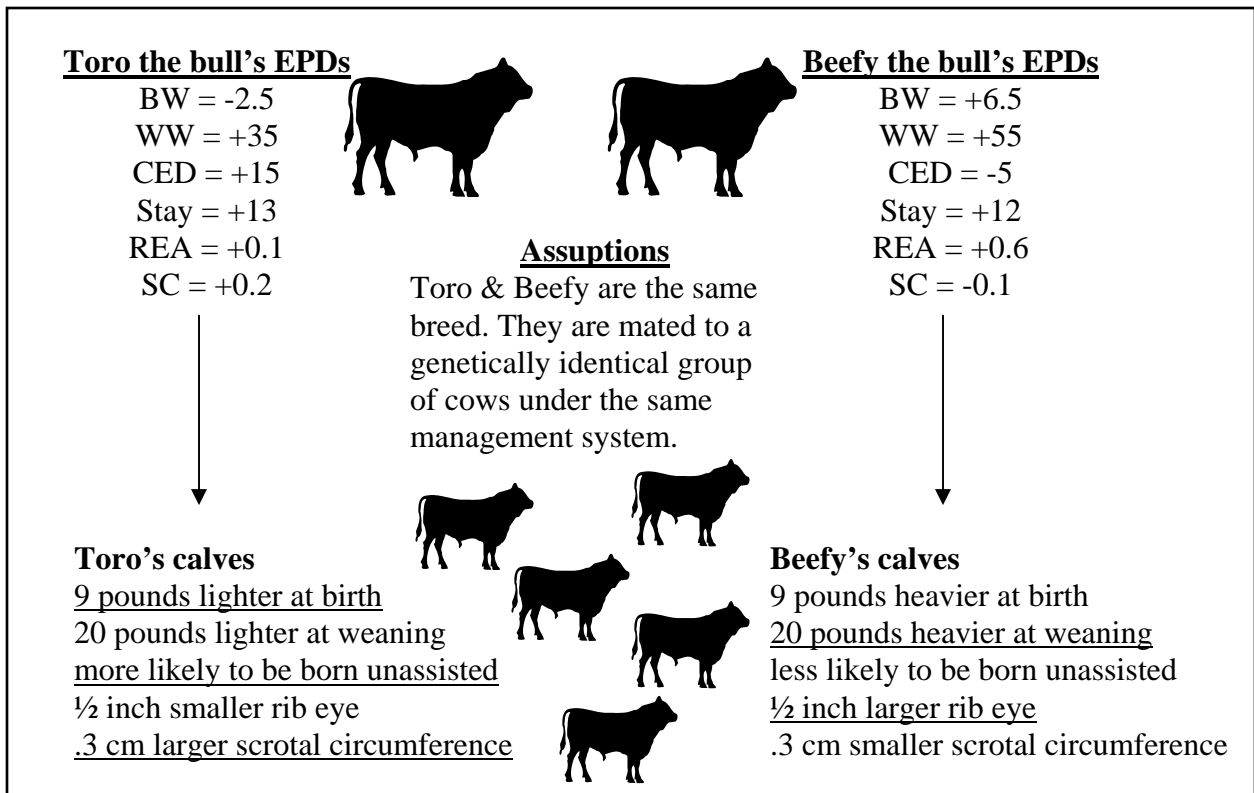
The trend in the cattle industry for over 30 years was to increase the growth rate of beef cattle. With this increase in growth rate we also saw an increase frame size and mature weight. Since we have measurable differences between cattle, we now have EPDs for mature weight and height. The current evaluations were taken from mature females 5-11 years of age. As the size of the breed database increases, we expect data from 2 years olds after weaning their first calf to be included in the mature size and mature weight evaluation. To calculate these values the analysis uses cow body condition along with weight and height information taken at weaning time. This information combined with other performance EPDs assists producers in adjusting cow size and weight to fit the needs of their program. Mature size and height indicate differences in maturity and can influence body condition and reproductive performance. These factors are also affected by the amount of feed supply available, length of the interval between calving and weaning, and the age of the cow. Large framed cows with mature sizes in the upper 25% of the breed are probably not suited for herds where feed supplies are short or the cows need to cover large areas to consume adequate forage.

Some breeds have an EPD for Gestation Length. It is measured in days, and it predicts the difference in gestation length (a smaller number would indicate a shorter gestation length). Gestation length can be related to calving difficulty and post-partum interval.

Using EPDs (*example*)

A common way to utilize EPDs for selection is when comparing two (or more) bulls as potential sires for your herd. EPDs should be used in combination with a visual evaluation to ensure the bulls are structurally sound, and a physical examination to ensure the bulls are reproductively sound. To accurately compare the EPDs, we must assume that the bulls are the same breed, the accuracy values of their EPDs are not drastically different, and that they would be mated to an identical set of cows (in terms of genetics and environment). Then we can compare **Toro the bull** with the following EPDs: (BW = -2.5, WW = +35, CED +15, STAY = +13, REA +0.1, SC = +0.2), to **Beefy the bull** with the following EPDs: (BW = +6.5, WW = +55, CED -5, STAY = +12, REA +0.6, SC = -0.1). Comparing **Toro** to **Beefy** using the above assumptions, we would expect **Toro's** calves to average 9 pounds lighter at birth (6.5 - -2.5), and 20 pounds lighter at weaning (55-35). **Toro's** calves are more likely to be born unassisted (+15 is better than -5). The stayability EPD is almost identical. **Toro's** calves would average .5 less inches of rib eye area (.6-.1), and .3 cm larger scrotal circumference (.2 --.1). In this case, if you are trying to improve some of the reproductive traits, **Toro** appears to have the advantage. If you wanted to improve weaning weight and muscle, then **Beefy** looks like the better choice.

It is also advantageous to know the breed averages for the traits you are considering, and you should know the average EPDs for your cow herd. One bull may be better than another, but if it worse than breed average (or worse than your herd average), you may not want to use him. That way you can identify which traits need the most improvement and prioritize your selection accordingly. It is highly unlikely that you will find individuals that are superior in all traits, so by knowing what important traits you need to improve, you will have an easier time choosing breeding stock that will benefit your herd. You can find breed averages in sire summaries provided by breed associations. Breed Association offices to contact for sire summaries is found in Appendix A at the end of this lesson.



What are interim EPDs?

New performance data arrives at breed associations daily, so EPDs for young animals rapidly become out of date. Therefore, interim EPDs are calculated as new performance information is processed. Interim EPDs combine the EPDs of a young animal's parents with that animal's new performance record and an estimate of the average genetic value of his or her contemporaries. Like any EPD, interim EPDs can be compared against EPDs of animals in other herds. Interim EPDs do not have accuracy values associated with them. Actual accuracies will be low.

Definition of Terms

Accuracy (Acc). A measure of the reliability of an EPD. Accuracy values are reported as decimal numbers between zero and one. Values closer to one indicate larger amounts of available information and greater certainty that a bull's EPD will not change significantly as more progeny information becomes available.

Birth Weight (BW) EPD. The expected birth weight deviation of calves of this individual excluding maternal influences, expressed in pounds. It is correlated with other weights (weaning, yearling) and calving ease.

Calving difficulty (Dystocia). Abnormal or difficult labor, causing difficulty in delivering the fetus and/or placenta. Difficult births lead to increased cow and calf mortality and to more difficult rebreeding of the cow.

Calving ease. The opposite of calving difficulty. An easy calving is one that does not require assistance and does not impose undue strain on the calf or dam.

Calving ease direct (CED) EPD. The expected differences of calving ease measured as the probability difference (between sires) of unassisted calvings among offspring.

Calving ease total maternal (CETM) EPD. The expected differences of calving ease measured as the probability difference (between sires) of daughters that calve unassisted.

Docility EPD. Based on a scoring system ranging from 1 = Docile, 2 = Restless, to 5 = Nervous, and 6 = Very Aggressive. Expressed as a percent deviation, and represents the likelihood that an individual's offspring will be docile.

Genetic correlations. Correlations between two traits that arise because some of the same genes affect both traits. When two traits (e.g. weaning and yearling weight) are positively and highly correlated to one another, successful selection for change in one trait will result in change in the same direction in the other trait. When two traits are negatively and highly correlated (e.g. birth weight and calving ease) to one another, successful selection for change in one trait will result in change in the opposite direction in the other trait.

Gestation Length EPD. Predicts the average difference in gestation length in days. It is related to calving difficulty and post-partum interval.

Heifer pregnancy (HPG) EPD. The expected difference in probability of a sire's daughter conceiving to calve as a two year-old.

Mature Daughter Height (MH) EPD. A predictor of difference in mature daughter height of daughters of a particular sire, expressed in inches.

Mature Daughter Weight (MW) EPD. A predictor of difference in mature daughter size of daughters of a particular sire, expressed in pounds.

Scrotal Circumference (SC) EPD. The transmitting ability of scrotal size expressed in centimeters. It is related to fertility in bulls, and age at puberty in daughters.

Stayability (Stay) EPD. The expected difference in probability of daughters staying in the herd to at least the age of six years. Since cows are usually culled for being open before the age of six, the EPD is primarily a measure of sustained fertility in female offspring.

Summary

There are a multitude of EPDs available to assist beef producers in making selection and breeding decisions to improve their herd. Focus on traits that are important to your particular system. Since reproduction is often one of the most important factors in determining the economic success of a beef enterprise, we are fortunate to have EPDs that will help producers make better choices. Open cows have little value, so these EPDs are important tools to improve cow/calf productivity. The reproductive traits are:

- Scrotal Circumference is an indicator bull fertility (sperm volume and quality), and is favorably correlated with age at puberty of the bull's daughters.
- Calving Ease Direct measures the ability of offspring of an individual to be born unassisted.
- Calving Ease Total Maternal measures the ability of an individual's daughters to give birth unassisted.
- Heifer Pregnancy EPD measures the ability become pregnant and calve as a two-year-old.
- The likelihood of a cow staying in the herd for at least six years is measured by Stayability.
- Several other EPDs, such as mature size, mature weight, docility, birth weight, and gestation length, may influence reproduction either directly or indirectly.

Purebred and commercial cow-calf producers have EPDs available as a powerful selection tool. EPDs allow comparisons between individuals within a breed for various traits. Purebred breeders may obtain EPDs on cattle in their herd by participating in the evaluation services offered by their respective breed association. Commercial producers may use EPDs provided in sire summaries, bull sale catalogues, and other sources to make genetic changes in their beef herd.

Additional References and Readings

*Angus Herd Improvement Records Publication, American Angus Association, St. Joseph, MO. To obtain this publication please contact the “**American Angus Association**”, **3201 Frederick Blvd. St. Joseph, Missouri 64506, Phone: (660) 383-5100, Web Site: www.angus.org**

*Beef Improvement Federation Fact Sheet, “Use of EPDs”, Mark V. Bogges, FS5.
Website: www.beefimprovement.org

*Beef Improvement Federation Fact Sheet “Understanding and Using Sire Summaries”, Don Boggs, 1992. Website: www.beefimprovement.org

*Maternal Traits EPDs”, Oklahoma Cooperative Extension Service Division of Agricultural Sciences and Natural Resources, N0.3161, 1997.
Website: okstate.edu/ag/media.htm.

*Commercial Beef Sire Selection, Ronnie Silcox, Extension Animal Scientist, Florida Cooperative Extension Service Cattle Producer’s Library, CL 1038.
Website: www.ifas.ufl.edu/www/extension/ces.htm

This lesson prepared by:

Keith VanderVelde
UW Extension, Marquette County
Box 338
Montello, WI 53949
(608) 297-9161
keith.vandervelde@ces.uwex.edu

Reviewed by:

Jeremy Geske, Regional Extension Educator
Dakota County
4100 220th St W, STE 101
Farmington, MN 55024
(651) 480-7704
geske002@umn.edu

Lori Schott, Regional Extension Educator
Mille Lacs County
620 Central Ave N
Milaca, MN 56353
(888) 680-8317
weddl002@umn.edu

Appendix A

Breed Association Offices to Contact for Sire Summaries

<p>American Angus Association 3201 Frederick Blvd. St. Joseph MO 64506 Phone: (816) 383-5100 Fax: (816) 233-9703 Web Site: www.angus.org</p>	<p>American Salers Association 7383 S. Alton Way #103 Englewood CO 80112 Phone: (303) 770-9292 Fax: (303) 770-9302 Web site: www.salersUSA.org</p>
<p>American Belgian Blue Breeders, Inc. P.O. Box 35264 Tulsa, OK 74153-0264 Phone: (918) 477-3251 Fax: (918) 477-3232 Email: belgianblue.org</p>	<p>American Shorthorn Association 8288 Hascall Street Omaha NE 68124 Phone: (402) 393-7200 Fax: (402) 393-7203 Web Site: www.beefshorthornusa.com</p>
<p>American Blonde d'Aquitaine Association P.O. Box 12341, 1912 Clay Street N. Kansas City MO 64116 Phone: (816) 421-1305 Fax: (816) 421-1991 Web site: www.blonddecattle.org</p>	<p>American Simmental Association 1 Simmental Way Bozeman MT 59718 Phone: (406) 587-4531 Fax: (406) 587-9301 Web Site: www.simmgene.com</p>
<p>American Brahman Breeders Association 3003 South Loop West, Suite 140 Houston TX 77054 Phone: (713) 349-0854 Fax: (713) 349-9795 Web Site: www.brahman.org</p>	<p>American Tarentaise Association P.O. Box 34705 N. Kansas City MO 64116 Phone: (816) 421-1993 Fax: (816) 421-1991 Web Site: www.usa-tarentaise.com</p>
<p>American Chianina Association P.O. Box 890, 1708 N. Prairie View Road Platte City MO 64079 Phone: (816) 431-2808 Fax: (816) 431-5381 Web Site: www.chicattle.org</p>	<p>Beefmaster Breeders United 6800 Park Ten Blvd. Suite 290 West San Antonio TX 78213-4211 Phone: (210) 732-3132 Fax: (210) 732-7711 Web Site: www.beefmasters.org/</p>
<p>American Gelbvieh Association 10900 Dover Street Westminister CO 80021 Phone: (303) 465-2333 Fax: (303) 465-2339 Web Site: www.gelbvieh.org/~aga</p>	<p>Braunvieh Association of America P.O. Box 6396 Lincoln NE 68506 Phone: (402) 421-2960 Fax: (402) 321-2994 Web Site: www.braunvieh.org</p>
<p>American Hereford Association P.O. Box 014059 Kansas City MO 64101-0059 Phone: (816) 842-3757 Web Site: www.hereford.org</p>	<p>International Brangus Breeders Association P.O. Box 696020 San Antonio TX 78269-6020 Phone: (210) 696-8231 Fax: (210) 696-8718 Web site: www.int-brangus.org</p>
<p>American International Charolais Association 11700 N.W. Plaza Circle, P.O. Box 20247 Kansas City MO 64195 Phone: (816) 464-5977 Fax: (816) 464-5759 Web Site: www.charolaisusa.com</p>	<p>North American Limousin Foundation Box 4467, 7383 S. Alton Way Englewood CO 80155 Phone: (303) 220-1693 Fax: (303) 220-1884 Web Site: www.nalf.org</p>
<p>American Maine Anjou Association 760 Livestock Exchange Building Kansas City MO 64102 Phone: (816) 474-9555 Fax: (816) 474-9556 Web Site: www.maine~anjou.org</p>	<p>North American South Devon Association Box 68 Lynnville IA 50153 Phone: NA Fax: NA Web Site: NA</p>
<p>American Pinzgauer Association 21555 State Route 698 Jenera OH 45841-8964 Phone: (419) 326-8711 Fax: (419) 326-5501 Web Site: www.afn.org/~greatcow/</p>	<p>Red Angus Association of America 4201 Interstate 35 Denton TX 76207-3415 Phone: (940) 387-3502 Fax: (940) 383-4036 Web Site: www.redangus1.org</p>
<p>Texas Longhorn Breeders Association of America 2315 N Main, Suite 402 Ft. Worth TX 76106 Phone: (817) 625-6241 Fax: (817) 625-1388 Web Site: www.tlbaa.org</p>	<p>Santa Gertrudis Breeders International P.O. Box 1257 Kingsville TX 78364-1257 Phone: (361) 592-9357 Fax: (361) 592-8572 Web Site: www.sgbi.org</p>
<p>Compiled by: University of Minnesota Extension Service Mille Lacs County 12-15-00</p>	

Lesson 3 Quiz

Using EPDs to Improve Reproduction

1. True or False You can't compare the EPDs of a Hereford bull raised in Minnesota to the EPDs of a Hereford bull raised in Texas because the climate is so different.
2. Why do young bulls typically have lower accuracy values than older bulls?
3. Using bulls with larger scrotal circumference EPDs will have what affect on the replacement heifers you keep out of those bulls?
4. Explain the difference between Calving Ease Direct , and Calving Ease Maternal EPDs.
5. Which EPD measures the likelihood that daughters of an individual will remain in the herd for at least 6 years?
6. The Heifer Pregnancy EPD is expressed in _____.
7. The Gestation Length EPD is expressed in _____.
8. True or False Positive (+) EPDs are always better than negative (-) EPDs.
9. In terms of EPD accuracy (ACC), what values would be considered low reliability _____, what values would be considered medium reliability _____, and what values would be considered high reliability? _____
10. Why are EPDs a more accurate selection tool than visual evaluation or using production records?

Please list on the back any questions you may have that weren't answered in this lesson:

Name _____ Phone _____

Address _____

(Optional) Fax _____ E-mail _____

Lesson 3 Quiz Answers Using EPDs to Improve Reproduction

1. True or **False** You can't compare the EPDs of a Hereford bull raised in Minnesota to the EPDs of a Hereford bull raised in Texas because the climate is so different.

You can compare animals within a breed regardless of location of herd.

2. Why do young bulls typically have lower accuracy values than older bulls?

No (or less) data on the progeny of young bulls.

3. Using bulls with larger scrotal circumference EPDs will have what affect on the replacement heifers you keep out of those bulls?

They will reach puberty earlier, and may be younger at first breeding.

4. Explain the difference between Calving Ease Direct , and Calving Ease Maternal EPDs.

Direct calving ease relates to the probability that an individual's offspring will be born unassisted. Maternal calving ease relates to the probability that the daughters of an individual will be able to calve unassisted.

5. Which EPD measures the likelihood that daughters of an individual will remain in the herd for at least 6 years?

Stayability

6. The Heifer Pregnancy EPD is expressed in percent.

7. The Gestation Length EPD is expressed in days.

8. True or **False** Positive (+) EPDs are always better than negative (-) EPDs.

Some traits you may want to reduce like birth weight, gestation length, or mature size.

9. In terms of EPD accuracy (ACC), what values would be considered low reliability 0.0 to .64, what values would be considered medium reliability .65 to .75, and what values would be considered high reliability? .76 to 1.0

10. Why are EPDs a more accurate selection tool than visual evaluation or using production records?

Animal performance is influenced by genetics and environment (including management). Parents pass genetics on to their offspring, but they can't pass on environment. The formulas used to calculate EPDs weed out the environmental influences and measure true genetic merit. Visual evaluation and production records can't separate out environmental effects.