EPDs and Selection Decisions

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For many years, the Red Angus Association of America has been providing its members and their customers with EPDs. An EPD is a prediction of sorts: it's a prediction of genetic merit. After all, when you buy a bull or a straw of semen, you're predicting that the genetics of that bull/straw will help you get closer to your goals. It's not much different than buying a certain type of feed additive that you predict will help cattle grow faster or convert better. The question in this article is not so much, "How to predict?" The real difficulty is in defining "what to predict." Today, RAAA publishes predictions (EPDs) for traits like birth weight, carcass rib eye area and many others. But are they indicative of a prediction that will help RAAA members and their customers attain their goals? The common goal that all commercial producers share is profit. There are other goals and objectives of our customers, but profit is the one that is most common. So, why then, is there no EPD that adequately predicts profit for all commercial beef producers and RAAA members? The root of this answer lies in the principle of Economically Relevant Traits (ERTs).

Factors that Affect Profit

Predicting profit is not a simple matter. For this article, I will discuss changes of profit as a function of changes in genetic merit. For now, we'll assume that all other influences of profit remain constant. If genetic merit is going to change profit, it can only do so through the expression of traits, such as weaning weight or feed consumption. Until recently the beef industry has focused primarily on revenue traits: those traits that generate revenue like sale weight. However, the Red Angus Association of America, as well as the rest of the industry, realized several years ago that selection for revenue traits caused correlated responses in expense traits. For example, selection solely for weaning weight can cause increased birth weights which can cause increased incidences of dystocia. Selection only for weaning weight in that example would be selection for increased revenue per calf marketed, which is not the same as selection for increased profit. The first question that needs to be addressed is, "What traits affect profit?" This question must be answered for the cow herd and the calf crop. At this point, I advise the reader to make a list of all traits that affect either revenues or expenses. It is important to seriously analyze the interface between your cattle and your economics in order to create this list. And don't limit yourself to just the traits that are commonly reported.

When the list is compiled, you then need to ask yourself, "How does each trait relate to profit?" If you can't easily explain the relationship between a trait and a revenue or expense, then that trait should be removed from the list. Weaning weight, for example, can be directly related to a revenue if you sell your calves at weaning time. However, if you retain ownership of your cattle into the feedlot, then weaning weight is probably not a trait that directly affects revenues or expenses. On page 34 of the 2001 February issue of the ARA is an excellent article that discusses what traits could be on this list.

Measured Traits vs. Traits that Affect Profit

As I mentioned earlier, not all traits that affect profit need to be measured. In our industry, we are lucky, because various traits are genetically related. Most of us are familiar with the relationship between birth weight and yearling weight. If we were to only select bulls for higher than average yearling weight genetics, it's very likely that we would be getting bulls that also have higher than average birth weight genetics. This principle is explained through the term "genetic correlations." A genetic correlation between two traits is the degree of relationship between those traits. A correlation can take on any value between –1 and +1. Values less than zero indicate that a bull with lower than average genetics in one trait will likely have higher than average genetics in the other trait. Conversely, values greater than zero indicate that a bull with higher than average genetics in one trait will likely have higher than average genetics in the other trait. A correlation of zero indicates that the two traits in question are not related at all. As an example, the genetic correlation between birth weight and weaning weight is 0.54 for Red Angus cattle. Intuitively, we would expect calves that are heavier than their contemporaries at birth to be heavier than those same contemporaries at weaning. Because of genetic correlations, we can take advantage of traits that are easily and economically measured even if they do not directly influence profit. A good example of this is birth weight. Red Angus Association of America breeders have been submitting birth weight data to the National Office for a long time. In fact, we have 673,615 birth weight records and 4,366 cattle with birth weight EPD accuracies higher than 0.70. That's great information, if you are selecting to change birth weight. But does birth weight directly affect profit? Probably not!

In our industry, birth weight is used primarily as an indicator of calving ease. Calving difficulty causes economic losses, especially in heifers. On many ranches, calving difficulty means, at best, a loss of production or, at worst, loss of a calf and cow. The trait of economic relevance, in this example, is calving ease. Birth weight is what we call an "indicator trait." It is genetically related to the trait of economic importance, but it is not directly related to profit. However, all those birth weight records still contain valuable information to help us predict the genetic merit of our trait of interest. There is a genetic relationship between birth weight and calving ease. We can use that relationship to calculate calving ease EPDs. In the case of RAAA, we use both sources of information (birth weights and calving ease scores) to calculate the calving ease EPD. The principle of genetic correlations allows us to use only birth weight data to predict calving ease, but we use both sources to increase accuracies of the EPDs. See Table 1 for a more complete list of indicator traits and economically relevant EPDs.

Prediction of ERTs

When EPDs first appeared, breed associations raced each other to see which one could publish the most EPDs first. Any heritable trait that could be measured was fair game; including scrotal circumference, hip height, mature weight, etc. In the last five or so years, RAAA has been focusing on producing the fewest number of EPDs with the most meaning. That's where the ERTs come in. If we produce ERTs instead of EPDs for every measurable trait, we will be helping our members and their customers focus in on the economic impact of selection decisions. Our most recent production of EPDs for economically relevant traits (ERTs) was showcased last Spring with the reproduction sire

summary. The EPDs (all of which are economically relevant) are Calving Ease Direct, Heifer Pregnancy, Calving Ease Total Maternal, and Stayability. Details can be found in the 2002 May/June issue of the ARA (page 27). Future EPDs include Maintenance Requirements (which measures the energy/feed intake required to maintain a cow) and a measure of feedlot performance. You can read more about Maintenance Requirements in the 2001 May/June issue of the ARA (page 24).

Using ERTs to Predict Profit

Now that we understand ERTs, we need a way to put them together so they can help to predict differences in profit among bulls. The biggest challenge facing us is that each producer and breeder will have individual circumstances that won't allow us to standardize the value of each ERT. As I mentioned earlier, not everyone will put the same value on a given set of traits. That's because of differing environments, management styles, marketing strategies, geographical locations, etc. The most ideal solution would be in the form of a system that will allow someone to specify their environment conditions, costs of production, etc. This "system" would then calculate, using ERTs, the profit potential differences between bulls. With the availability of the internet and high speed computers, such a system is very possible. Decision support systems (DSS) like this are often used to help businesses make complex decisions. One of the long range goals for the Red Angus Association of America is to develop a DSS that can be accessed by breeders and their customers.

In conclusion, predicting the affect of genetics on profit is not easy.   Individual producers have their own goals, and each manager must conform to differing management structures, marketing programs, environmental conditions, social pressures, etc. Therefore, not all seedstock buyers will have the same needs. It is becoming more important for seedstock breeders to produce bulls and replacement females that meet their customers' needs. Accountability is starting to drive our industry more and more. The Red Angus Association of America is meeting that challenge by producing ERT predictions that will apply to the vast majority of commercial selection decisions. A day will come in the near future when computer models will allow breeders and their customers to quickly make profitable selection decisions based on these ERTs.