Increasing The Effectiveness of ASA's Genetic-Evaluation System

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Part II: Introducing the Economic Selection Index

Editor's Note: *Part I of this three-part series appeared in the June-July issue of the Register and dwelled on an in-depth explanation of modifications being implemented in ASA's cattle evaluation process.*

As I mentioned in part one, we are on a mission to increase the effectiveness of our genetic-evaluation system by decreasing its complexity. Discussion in the June/July issue focused on narrowing our array of EPDs to economically relevant traits (ERTs). Though this makes life simpler, we are still faced with a difficult task—putting appropriate selection pressure on the ERTs. This is where the economic selection index (ESI) comes in. The ESI concept involves weighting multiple traits to come up with animals' overall economic value as parents.

You may be thinking that ESIs sound threatening, certainly nothing that would decrease complexity. Nevertheless, without even knowing it in most cases, we have all used ESIs in one form or another. For example, if, in the name of improving profit, you have accepted less growth to get better calving ease or poorer yield grade for better marbling, you have fashioned an ESI. The bottom line is that, whenever selection with economic implication occurs, an ESI is used.

The most common type of ESIs used in the cattle industry are what I like to call seat-of-the-pants ESIs. We've all used them; we take in information on several traits and attempt to weight it all in our head to assess the value of an animal. The reason I dub this "seat-of-the-pants" is because, even though it's typically how selection pressure is applied in beef cattle, it's a subjective, sketchy means of getting at economic value. Though I don't have data to determine how accurately it sorts animals, my suspicion is it works reasonably well, particularly for experienced breeders, when considering a small number of traits. But it loses much of its effectiveness when several traits are in the mix, as there just are too many factors to mentally process.

Other, what I'll call glorified-seat-of-the-pants ESIs, which have been derived by seedstock breeders and bull studs. For example, there are ESIs floating around in which a set of EPDs or breed rankings for EPDs are averaged to calculate an overall value. Though they may appear more official in that they move the calculation from your head to a piece of paper or computer (which earns them the "glorified" designation), nothing says they are more effective. In fact, I would argue that arbitrarily putting equal weighting on a set of traits, which is what most glorified-seat-of-the-pants ESIs do, is often less effective than deriving ESIs in your head — common sense should tell us that not all traits are of equal economic importance.

As you may have sensed, I'm not too enthusiastic about the methods of deriving ESIs described thus far. There must be a better way. In fact, there is and it's been around for a long time, serving as the primary vehicle for selection decisions in the swine, poultry and dairy industries for years.

In 1943, Leroy Hazel (a famous geneticist from Iowa State) introduced an equation that integrates genetics and economics to calculate overall economic value for an animal. The equation looks like this:

$$I = V_1ERT_1 + V_2ERT_2 + \ldots + V_nERT_n$$

I don't mean to scare anyone off — I promise this is the only equation you will see in this article. This equation is worth looking at, however, as it is essentially the mathematical interpretation of what we try to do in our heads when evaluating an animal. And actually, it's not all that complicated.

In the June/July article we discussed ERTs (i.e., EPDs with direct economic impact). Hazel's equation has a string of them, running from 1 to n (encompassing the entire array of traits that have economic impact). As you can see, the ERTs are weighted (multiplied) by Vs. The Vs are economic weightings and can be interpreted as the effect (in dollars) that a one-unit movement in its associated ERT has on the bottom line. For example, a V of 1.40 in front of a carcass-weight ERT means that for every pound of carcass weight we gain $1.40.

So, the equation itself is simple—we just multiply ERTs by their economic weightings, sum things up, and voila! we have the animal's economic value as a parent. Unfortunately, coming up with the ERTs and their economic weightings are not so easy. For the most part, we've done a reasonable job of taking care of the ERT end of the

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equation, though there are certainly important ERTs we don't yet calculate. However, when it comes to the economic weightings, we have lagged seriously behind. We have a whole host of ERTs and, for the most part, only seat-of-the-pants methods of weighting them.

At first glance, it may seem that coming up with economic weightings is easy. For example, we could assume that a pound increase in carcass weight is worth some average value. Let's say $1.40. That sounds easy enough; however, that's only part of the story. If we exceed the upper- or lower-threshold on carcass weight (e.g. less than 550 or over 950 lbs), a pound of carcass weight could be worth something very different than $1.40; it's not uncommon for heavy- or light-weight carcasses to be docked $.15/lb. Of course, the likelihood of this happening is contingent on environment/management and parental genotypes. For example, crossing two large-carcass-weight genotypes may not be a problem if the offspring go directly to the feedlot post-weaning. However, if they are run as stocker cattle for 6 months prior to being put on feed, many may exceed the 950 lb threshold, which would make a pound increase in carcass weight worth less than $1.40 in this particular system. On the flip side, if we have a small-carcass-weight cowherd with calves going straight to the feedlot upon weaning, a pound increase in Carcass-Weight EPD is likely worth more than $1.40.

"Economically Relevant Traits (ERTs) are traits that directly affect profitability."

These are just a couple examples of the complexity involved in arriving at economic weightings. Many similar examples can be given for other traits. So, how do we come up with weightings? This clearly isn't a do-it-yourself over the weekend project. Fortunately, animal geneticists have taken up the task of developing the mathematically rigorous means of deriving the economic weightings.

We are currently working with USDA Research Scientist Dr. Mike McNeil on developing economic weightings for the Simmental and Simbrah populations. Mike and collaborating scientists have developed ESIs for the Circle A Angus Alliance, Beef Boosters of Canada, Simplot and the American International Charolais Association, among others.

The resulting ESIs will be objective, well-conceived tools for applying selection pressure — tools that will guide and accelerate our movement towards producing the most economically viable animals possible. Additionally, these ESIs will simplify selection; instead of mentally ruminating and regurgitating on a mountain of traits, you will have a single trait (essentially a dollar EPD) to sort animals on — making selection easier for both you and your customers.

This month was a basic introduction to ESIs. Next month I will discuss specifics on plans to develop and implement ESIs and issues surrounding their use. ◆