

# SIRE SELECTION *by the numbers*

*When making bull-buying decisions or selecting sires for artificial insemination programs, producers generally have more than a dozen expected progeny differences to consider. Sire-selection indexes use those numbers to find the best balance of traits for an individual operation.*

BY BRAD PARKER



BRAD PARKER PHOTO

Cattle producers have been using expected progeny differences (EPDs) to make genetic selections for years. Acceptable ranges for important traits often are established based on personal experiences or the recommendations of others.

With that in mind, consider these two situations:

- A bull's birth weight EPD is just outside the desired parameters, but his yearling weight and marbling EPDs are right on target. Should you use him?
- Only one of three sires can be chosen, and all three fit within the acceptable

ranges for all their EPDs. Which one should you choose?

Breeders face questions like these every day. The best way to find the answers, according to breeding experts, is to rank the bulls by a sire-selection index that takes into consideration a number of traits.

The objective of using a sire-selection index is to maximize profit, says William Herring, assistant professor of breeding and genetics at the University of Missouri-Columbia (MU). That doesn't necessarily mean producing the most revenue or reducing costs the most, he explains.

"In my opinion, we've made great

progress in terms of quantifying a large number of traits," Herring says. "How do you take all that and manage it into such a system so that you can identify a bull that would provide you with the most profit potential?"

"Breeders must start to use some type of indexing system to select bulls on an economic-value basis," says Roy Wallace, vice president of beef programs for Select Sires, Plain City, Ohio. Indexes help avoid single-trait selection, he adds. "They keep everyone toward the middle of the road and avoid the big wrecks."

Michael MacNeil, research geneticist for the U.S. Department of Agriculture's (USDA) Agricultural Research Service (ARS) in Miles City, Mont., agrees. He says the whole notion of sire selection has been too trait-specific with such traits as milk, growth and birth weight receiving the lion's share of attention at different times in the past.

"If the profit motive drives the operation, an index is useful," he says.

Indexes can assign a relative economic value (REV) to each trait considered important for the operation. That will result in a mathematical equation that follows this form:

$$\text{Index}_i = (\text{REV}_1 \times \text{EPD}_{i1}) + (\text{REV}_2 \times \text{EPD}_{i2}) + \dots + (\text{REV}_n \times \text{EPD}_{in})$$

Different producers — depending on their production practices, costs, marketing strategies and long-range goals — will use different indexes.

To estimate the REV for each EPD, and thus the economics associated with using a specific sire in a herd, the profit or loss that comes with changing that EPD by one unit (1 pound [lb.] of birth weight, for example) must be determined. That's not easy, Herring says, because traits are measured in different scales and differ in heritability.

Deciding which traits should get emphasis is a matter of debate within the industry and depends largely on the individual operation. MacNeil says determining the traits that affect a producer's profit or loss is the first step. Producers must develop a production-system model that includes those factors, he says.

Researchers at MU use a bio-economic computer simulation, a version of South Dakota State University's SIMUMATE modified by MacNeil, to build their models. Users input characteristics of an operation and note the profitability. They then change the variable in which they're interested by one unit, and the program calculates the new profitability. The difference in profitabilities indicates the estimated REV for the varied trait.

SIMUMATE requires the input of 76

production and economic variables, which can be difficult for the individual producer to track, Herring admits.

He says less-complicated software is being developed. "I'd like to think in another six to nine months we'd have something more user-friendly," he says.

Using a bio-economic model for an average-sized cow-calf producer who retains ownership through the feedyard, Herring says he's determined yield grade and weaning weight are the most influential traits for that type of operation, followed by postweaning average daily gain (ADG) and marbling. His calculations find less importance for birth weight. These results can change, however, with different production systems.

According to Wallace, the major economic traits are birth weight, growth, milk, fertility and carcass characteristics, such as marbling and percent retail product.

MacNeil lists his preferences as reproduction, carcass traits and growth, in that order. He points out that EPDs get more reliable as you go down his list, which creates some difficulties in establishing good indexes.

**The selection indexes** that use REV's will yield a numeric value for the bull in question. That value represents the profit or loss associated with raising one of his calves. For producers with large calf crops, a small difference in the index value can have a big effect on overall profits, Herring emphasizes.

A producer who sells weaned calves may consider a different set of traits or place different emphasis on them compared to a producer who retains ownership through the feedyard. Herring stresses this is why anyone interested in establishing a sire-selection index must have accurate production records and a long-range marketing plan.

"They need a good picture, financially, of what's going on in their operation," he says, adding it's critical to know annual cow costs and break-even points before starting to establish an index. "Even those doing a good job of keeping production records need to gather more information."

MacNeil says producers need a well-developed set of genetic evaluations for their cattle (in the form of EPDs) and they must know, in economic terms, how much those traits contribute to profit and loss. The most difficult part of developing a sire-selection index is the information a producer doesn't have, he says.

"There's been some work done to estimate economic values for specific production scenarios," Herring says, so some general recommendations are available for producers trying to develop

selection indexes. If a producer's actual operation varies in any way from the model used to generate the REV's (and most do), using them could introduce error.

"That's where the customization is somewhat necessary," Herring adds.

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**With some selection indexes** the resulting values given to bulls are not as important as the rankings that can be determined from them. In these cases, the index doesn't specifically provide a profit or loss estimate for the sire, but it does render a basis for comparison. (See page 38.)

Those types of indexes can be better than single-trait selection, MacNeil says, but they don't provide real economic conclusions. They're a compromise to using REV's.

Using indexes in this manner can provide producers with a simpler method for choosing from among several options, as in the second situation mentioned earlier.

When deciding if a particular sire will be profitable within a herd, as in the first situation, a selection index that yields an estimated economic value is required.

There's still a need for research, development and extension in the industry to help producers get the information they need to establish a useful sire-selection index, MacNeil says. "The typical producer is going to need some help." Breed association personnel and Extension breeding specialists are good places to start.

**Scientists have not found** a single set of recommendations establishing a sire-selection index that fits all producers.

Reproduction is one of the traits on which experts hold differing positions. Some say fertile bloodlines have been naturally selected over time. Others argue reproductive inefficiencies have such a large economic effect that the lowest level of occurrence greatly affects profitability.

Wallace doesn't include reproductive traits in his selection index. Scrotal size is the only indicator available, and he says it is only one small part of overall fertility. Conception rates for the sire are more important.

He goes on to say 95% of the variability in reproduction is caused by environmental factors. "There's no silver bullet for

reproduction," Wallace says, adding management is the best way to increase reproductive performance.

Besides, he argues, there's no available data to establish reproductive qualities.

MacNeil agrees scrotal circumference alone is not enough to predict fertility. Other means of gauging reproductive performance need to be developed, he says. He suggests it may be possible to predict fertility by looking at carcass traits. Animals that hang up more desirable carcasses tend to be less efficient in terms of reproduction, he says, so carcass EPDs could be used as "inverse predictors" of fertility.

MacNeil, however, says heritability for reproduction may be as high as 10%. Previous studies, he says, have tended to err toward the low estimates for safety's sake. "Reproduction is heritable enough to include."

He also says some studies have indicated reproduction may be five to 20 times more important to profitability than growth characteristics. If reproduction is that much more important, MacNeil asks, how heritable does it have to be?

**Newer selection indexes** are placing more emphasis than before on carcass characteristics. The experts agree the end point of the bull's progeny makes a difference. For example, producers of terminal-cross calves will place more emphasis on marbling and eliminate the consideration of milk production.

MacNeil cautions cow-calf producers who sell soon after weaning not to ignore carcass traits. "If the consumer doesn't like your product, and demand decreases, it indirectly will affect your profit," he says.

He adds carcass traits won't just figure into the commercial producers' selection indexes. Seedstock producers must include them too because seedstock producers have the responsibility of making genetic improvement in the industry.

Indexes that are high in profit for the seedstock producer aren't the right target, MacNeil warns. They need to increase profit for their commercial customers. "A seedstock producer needs to consider in his genetic evaluation those folks who ultimately use the germ plasm he produces."

The seedstock segment doesn't add dollars to the cattle industry; that comes from the consumers of the end products, he says. "It's what those folks want that needs to be considered."

Although carcass characteristics are important, MacNeil cautions, producers must remember the goal of sire-selection indexes is to find the most profitable balance of traits.

