Genetic Gains

Genetic evaluation of feed efficiency — are EPDs on the way?

Story by
TROY SMITH

Much has been said about the successful application of expected progeny difference (EPD) values to predict genetic potential in beef cattle. Savvy application of EPD-based genetic selection has been credited for major advancements in growth rates, reproductive rates and carcass merit.

Who will deny it? Certainly not Denny Crews, a quantitative geneticist at the Agriculture and Agri-Food Canada (AAFC) Research Centre, Lethbridge, Alta.

What does bother Crews, however, is that while breed associations have developed EPDs for an increasing number of genetic traits, most of these selection tools relate to traits that increase productivity. It's not that there is anything wrong with selecting for increased productivity, but what if producers could also select for traits that would help lower costs of production?

"Most of the focus has been on increasing outputs, and response to selection has been positive. But there has been very little focus on reducing inputs, like the cost of feed — the largest non-fixed cost of beef production," Crews says. "Feed efficiency is of great economic importance to the beef industry, and a breeding tool for this trait has long been sought."

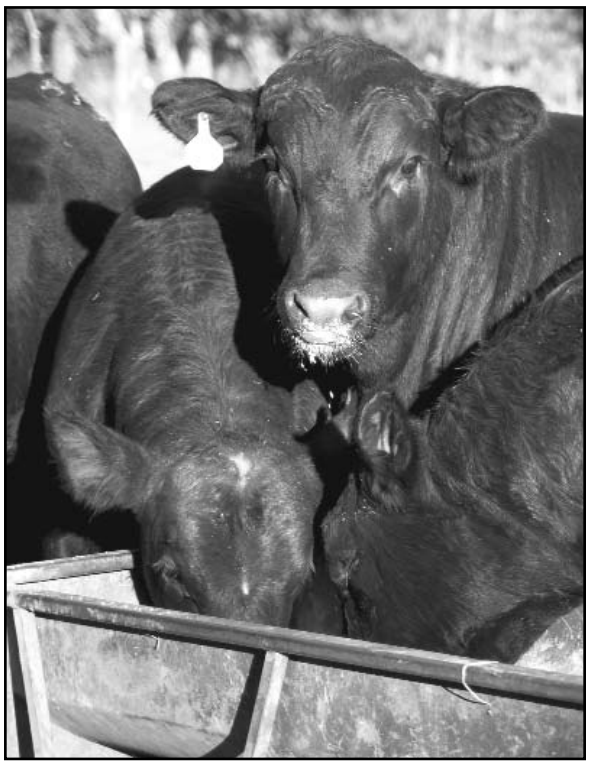
There are other reasons why selection for increased feed efficiency is desirable, such as the ability to reduce turnaround time for cattle in the feedlot and to enhance carcass merit or lessen environmental effects due to animal waste. But, every producer can appreciate the economic advantages of selecting for animals that require less feed.

Crews and his colleagues are working toward development of EPD values for feed efficiency, but they aren't talking about efficiency in the traditional sense. Most producers think of measuring efficiency in terms of a feed conversion ratio — the pounds of feed needed to produce a pound of weight gain. However, feed conversion is tied directly to growth rate and mature body size. By selecting for improved feed conversion, producers end up selecting for increased size as well.

Bigger cows that require more feed and bigger beef carcasses probably aren't goals of efficiency-minded producers. A useful feed efficiency EPD, Crews says, should allow selection for increased efficiency of feed utilization, without a major effect on mature size or maintenance requirements.

Defining efficiency

Crews says a more appropriate measure is net feed efficiency, also referred to as residual feed intake (RFI). Defined as the variation in feed intake that remains after requirements for maintenance and growth are met, RFI is calculated as the difference between an animal's actual feed intake and its predicted requirements for maintenance and production. In terms of RFI, a negative number is good. Animals that eat less feed than predicted, based on their growth rate and body size, would have higher net feed efficiency indicated by a negative RFI. Conversely, less efficient animals whose actual feed intake is greater than expected would have a positive RFI.



RFI is defined as the variation in feed intake that remains after requirements for maintenance and growth are met. [PHOTOS BY SHAUNA ROSE HERMEL]

Animal scientists in Australia have been looking at RFI for several

(Continued on page 82)

Genetic Gains *(from page 81)*

Denny Crews, a quantitative geneticist in Canada, says molecular geneticists see RFI as a likely candidate for marker-assisted selection. If low RFI can be associated with a genetic marker, animals possessing that gene could be identified and targeted for measurement of feed intake.

years. Their studies, along with the research in Canada, indicate that considerable variation for RFI exists among individual animals within breed types or genetic strains. The heritability of RFI appears to be comparable to many growth traits, ranging from 0.26 to 0.43. Therefore, it is reasonable to expect a positive response to selection for RFI.

Most importantly, the research in Australia and Canada suggests selection for low RFI may allow producers to breed animals exhibiting reduced feed intake and improved feed conversion, without affecting growth rate or animal size. Crews says it is reasonable to expect, as a result of selection, at least a 10% reduction in feedlot maintenance requirements. Daily feed intake might be reduced by 12%-15%. Other objectives, achievable through RFI-based selection, include as much as a 10% reduction of carcass back fat and reduced weight of visceral organs. It would be reasonable to expect environmental benefits, too, including a 9%-12% reduction in methane emissions and 15% reductions in nitrogen (N), phosphorus (P) and potassium (K) contained in manure.

"While we don't have a lot of data from cows, the reductions (in maintenance requirements and feed intake) we see in the feedlot seem to transfer nicely to cattle on grass," Crews says. "Due to selection based on low RFI, we can expect cows to eat less but produce just as much. We could expect a 15% improvement in calf weight per cow feed intake."

In pursuit of the data on which to build EPD values for efficient feed utilization, the AAFC Research Centre has been measuring RFI among high-impact bulls representing the Angus and Charolais breeds. Also being measured are entries to the annual bull test conducted by Olds College, Olds, Alta., Canada. Evaluation of cows and replacement heifers has begun at the Research Centre to see how measures of efficiency affect reproduction. A limited amount of progeny testing is underway to measure RFI in feedlot steers and heifers.

There are other projects involving measurement of RFI, such as the bull test conducted by the Beef Development Center of Texas (BDCT), Navasota. And, researchers agree that the data should be used to develop feed efficiency (FE) EPD values. The biggest challenge will be measuring intake for enough animals to create EPDs that are meaningful. As anyone who has been involved with progeny testing knows, gathering data is expensive in terms of time and money.

On the bright side, Crews says molecular geneticists see RFI as a likely candidate for marker-assisted selection. If low RFI can be associated with a genetic marker, animals possessing that gene could be identified and targeted for measurement of feed intake. Crews says Alberta studies are concentrating on the leptin gene, among others, which has been associated with regulation of appetite and nutrient partitioning. As a potential marker, it looks promising.

"Will all of this lead to a widespread effort and implementation of national cattle evaluations for efficiency of feed utilization? I don't know," Crews admits. "There are alternatives (to RFI) for measuring efficiency. There is no clear ideal trait. But any meaningful evaluation will be measured and not estimated."