

Genetics for Improved Feed Efficiency

Residual Feed Intake (RFI) data is coming of age for a new era of efficiency.

by Kindra Gordon



Researchers developed the RFI equation to select for efficiency.

PHOTO BY GEORGIA BERRETT

After the sky-high feed costs of 2008, the beef industry has a renewed momentum toward finding ways to produce cattle more efficiently — particularly with a focus on reducing feed costs.

“It should be pretty clear to cow-calf producers that feed cost is the largest variable cost on their operations,” says Jason Ahola, an Extension beef specialist with the University of Idaho. But, he adds that it is a variable over which they have control.

Ahola points out that the “profitability equation” of profit = revenue – expenses means

that if expenses like feed can be reduced, then profit increases.

Ahola explains that in the past the seedstock industry has primarily focused on developing genetic predictions for growth and carcass traits, since they were easy and inexpensive to measure. But, unfortunately, these traits only focus on the “revenue” side of the profitability equation. Further, most producers have inadvertently focused on maximizing production of these traits in an attempt to maximize revenue, with limited consideration for cost.

But, today new efforts to develop expected progeny differences (EPDs) to help combat key “cost” traits, such as feed efficiency, are coming of age.

“The ability to reduce feed intake (and, therefore, feed cost) without negatively affecting reproduction, growth, carcass performance or meat quality is becoming a priority in beef cattle selection programs,” Ahola says.

Challenges in measuring feed efficiency

According to Ahola, in the past there have been two major hurdles associated with genetically predicting feed efficiency: 1) historical methods used to calculate and select for feed efficiency are generally lacking, flawed, and/or unproven and 2) the collection of daily feed intake on individual cattle is very expensive.

He explains that, historically, feed efficiency has been primarily measured and reported as a ratio — the Feed

Conversion Ratio or FCR. It is calculated by dividing the amount of feed consumed by the number of pounds gained. So, for an animal that consumes 21 lb. of feed (on a dry matter basis) and gains 3 lb., its FCR would be 7 (21 lb. ÷ 3 lb. = 7).

“The challenge with using the simple FCR calculation is that it ignores an animal’s body weight, rate of gain and composition (i.e. amount of fat stores). As a result selection based on FCR unintentionally leads to animals that are faster gaining but also have a greater mature size. In some cases this can lead to deleterious effects on reproduction and profitability,” Ahola says.

The second challenge has been that collecting individual daily feed intake on seedstock cattle is very expensive and labor intensive, Ahola says. For instance, unless animals are fed alone in individual pens, the only methods to collect individual intake data for cattle in group pens require the use of costly technologies such as Calan gates or GrowSafe pens. Cattle weight gain must also be measured regularly, and to generate valuable data, uniformity in rations, rates of gain and test length is needed among test locations.

Moving toward RFI

Today, a new method to evaluate seedstock cattle for Residual Feed Intake (RFI) — instead of the traditional Feed Conversion Ratio — is underway. An animal’s RFI value is the difference (in pounds) between the animal’s actual feed intake and its predicted feed intake. These two numbers are acquired easily but still require that an animal’s daily feed intake and bi-weekly weight be recorded during a uniform test period, Ahola explains.

The RFI method is based on the approach that Australian seedstock producers have taken toward predicting feed efficiency. The Angus Society of Australia already publishes an expected breeding value or EBV (generally equivalent to an EPD) for a trait referred to as Net Feed Intake — commonly called RFI in the U.S.

To calculate an animal’s RFI, Ahola offers the following explanation:

The first value — an animal’s actual feed intake — is collected daily during a

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standard 70-day post-weaning test of an entire contemporary group of calves (from the same management group, cohort and sex). The second value — the animal's predicted feed intake — is generated from a statistical calculation (known as a regression), which compares the animal's feed consumption, weight and gain with that of its contemporaries.

An animal's RFI value is reported as the number of pounds of feed (on a dry matter basis) that it actually consumed compared to what it was predicted to consume. Therefore, an RFI of -2.0 indicates that an animal consumed 2 lb. less per day at the same rate of gain than an animal with an RFI of 0.0. Thus, a negative RFI value is considered desirable, Ahola says.

"Surprisingly, the RFI trait appears to be independent of growth rate (average daily gain, ADG), which enables the selection of more efficient animals without affecting performance or mature weight," Ahola says. The relationship among RFI and carcass performance or reproduction traits has not yet been studied as extensively; however, preliminary data indicate that RFI is probably independent of these traits as well, he reports.

Ahola says that studies are yielding new insight on feed efficiency. As an example, he says in a typical group of yearling steers receiving a growing ration (high in forage), it appears that variation in feed intake of more than 35% is common. For instance, in a group of 54 Angus steers evaluated for RFI during a 70-day test at the University of Idaho, two steers gained an average of 3.2 lb. per day



Collecting individual daily feed intake is expensive and labor intensive. Unless animals are fed alone in individual pens, the only methods to collect individual intake data for cattle in group pens require the use of technologies such as Calan gates or GrowSafe pens as pictured here.

but consumed 27 lb. and 38 lb. of feed (dry matter basis), respectively. This difference of 11 lb. of feed per day represents the typical variation inherent in any beef cattle population, Ahola says.

Ahola concludes, "RFI is becoming the broadly accepted 'gold standard' for measuring feed efficiency. Due to the variation of RFI within a population and the fact that RFI is moderately heritable, it offers a genetic selection method to improve beef cattle feed efficiency without negatively affecting growth rate, mature size or performance." **HW**

DNA tests for feed efficiency

As the beef industry begins to build a database on feed efficiency in cattle, cost is still one of the greatest hurdles to collecting residual feed intake (RFI) data, explains University of Idaho Extension beef specialist Jason Ahola.

The most reliable data result from actually measuring RFI in multiple progeny during a standard 70-day post-weaning test, but that can be quite expensive. Thus, researchers have begun to search for useful indicator traits for RFI including blood hormone concentrations and candidate genes to reduce the cost of determining RFI values.

Currently, this DNA marker technology has enabled two companies to offer genetic tests for feed efficiency: Pfizer Animal Genetics offers a GeneStar test, and Merial offers the Igenity profile.

Since these tests are relatively new, it is not yet clear how much genetic improvement in feed efficiency they will enable seedstock producers to achieve, Ahola says. Also, both tests include only a very small number of markers, even though a very large (but unknown) number of markers actually influence feed efficiency.

Ahola adds that much of the initial research to create these tests was conducted in Australian cattle where the cattle were evaluated for RFI while receiving a grain-based finishing diet. "In the U.S., initial indications are that cattle should really be evaluated for RFI only during the growing phase when a forage-based diet is fed. This schedule enables cattle to be evaluated at a time when body composition (relative amounts of muscle, fat and bone) is similar across the contemporary group," Ahola says. In contrast, composition is usually more varied during the finishing phase when mostly grain is fed.

The National Beef Cattle Evaluation Consortium has initiated a Commercial DNA Test Validation Program to independently verify genetic tests offered by genomics companies. Updates on the status of the validations are available at www.nbceec.org/nbceec/index.html. It is essential that data from indicator traits or genetic tests be validated and referenced to absolute measures of RFI before their adoption is widespread, Ahola emphasizes.

Producer education

Producer education is also a critical step as the beef industry moves toward implementing new residual feed intake selection methods, Ahola says.

At the recent Beef Improvement Federation (BIF) symposium held in early May in Sacramento, Calif., Ahola reported the results of a survey conducted to determine producer awareness of feed to gain ratio (F:G) and RFI, evaluate willingness to pay for RFI data, and predict willingness to adopt RFI as a production practice.

The survey asked what genetic prediction information is currently used and asked respondents to compare it to the information they would like to use. Results showed that producers still use and seek raw data, ratios and expected progeny difference (EPD) data; however, the demand for genetic marker data is substantially larger than for other types of data.

Producers indicated they're making efforts now to select for feed efficiency by evaluating mature body size, growth rate and body condition score (BCS). However, more than 60% of respondents said they had "no knowledge" or "limited knowledge" of F:G ratio. Only about one third of respondents said they were aware of the term "residual feed intake."

The survey also asked how much more respondents would be willing to pay for bulls that had been evaluated for RFI via a 70-day postweaning test. About 28% said they would not be willing to pay anything extra, 24% would pay \$1-\$100 extra, 19% would pay \$101-\$200 extra and about 29% said they would pay more than \$200 extra. About 51% of the seedstock respondents said they would pay \$1-\$100 per head to have a bull evaluated for RFI.

The survey was conducted in January-February 2008 by the University of Idaho and the Red Angus Association of America (RAAA) using a stratified random sample of 1,888 names from the Idaho Cattle Association, the RAAA and Red Angus bull buyers. The response rate was 49.9%, consisting of 13% seedstock producers, 59% commercial cow-calf producers and 28% producers that identified themselves as both commercial and seedstock. **HW**

