AN217

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# The Economic Impact of Feed Efficiency in Beef Cattle[1]

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## Introduction

A well-run, profitable commodity business is usually more efficient than its competitors. In the case of beef cattle, competition can come from two sources: other producers who sell similar classes of cattle, and other protein producing species, such as pork and poultry, which compete with beef in the marketplace. Measuring efficiency across the entire integrated beef system can be difficult due to the differing classes of cattle (growing, breeding, fed), breed differences, and how the different biological systems (nutrition, reproduction, lactation, basal metabolism) interact (for example how nutrition interacts with reproduction). There are measures of efficiency that can be used in beef production. One of these is feed efficiency.

## Feed Conversion Ratio

Feed efficiency is a measure of how much saleable product is being produced for each unit of feed consumed. In beef operations, the most common measurement of feed efficiency is feed conversion ratio (FCR), which is the ratio of feed intake to live-weight gain. A calf that consumes 15 pounds of feed per day and gains 3 pounds live-weight per day would have a FCR of 15 to 3, or 5:1, or simply 5. Feed conversion ratio is a gross measure of feed efficiency and most often used as a tool to evaluate groups or pens of growing and finishing cattle to determine costs of production and break-even prices in feeding operations. Cattle that will convert at a high rate (lower FCR) are highly desirable for cattle owners and for feedlots that charge on a gain basis. In addition, identifying cattle that have lower intakes that can optimize performance can be valuable in environments that have lower quality and/or quantity of feed resources. Feed conversion ratio is moderately heritable (Crews, 2005) and cow/calf producers who have access to these data can potentially use this information as a marketing tool to promote the sale of their feeder calves. What is the value of FCR? The example below illustrates differences in groups of calves that have differing FCR.

Assume that Pen A has 100 calves with an average FCR of 7 and Pen B has 100 calves with an average FCR of 5. The calves in Pen A will consume two more pounds of feed for every pound gained than the calves in Pen B. It will take 120,000 more pounds of feed to put 600 pounds of gain on calves in Pen A versus Pen B. If the feed for these calves averages $0.08 per pound ($160 per ton) it will have cost the

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**Table 1.** Total Pounds of Feed Needed For Gain Based on Feed Conversion Ratio (FCR)

| | Pounds Gained | | | | | |
|---|---|---|---|---|---|---|
| FCR | 100 | 200 | 300 | 400 | 500 | 600 |
| 10 | 1000 | 2000 | 3000 | 4000 | 5000 | 6000 |
| 9 | 900 | 1800 | 2700 | 3600 | 4500 | 5400 |
| 8 | 800 | 1600 | 2400 | 3200 | 4000 | 4800 |
| 7 | 700 | 1400 | 2100 | 2800 | 3500 | 4200 |
| 6 | 600 | 1200 | 1800 | 2400 | 3000 | 3600 |
| 5 | 500 | 1000 | 1500 | 2000 | 2500 | 3000 |
| 4 | 400 | 800 | 1200 | 1600 | 2000 | 2400 |

feeder/producer $9,600 ($96 per head) more during the feeding period. Assuming all other costs are equal, the calves in Pen A would have an additional $0.16 per pound added to their cost of gain compared to Pen B. As a reference, when corn is around $3.00 per bushel, the average cost of gain in the US ranges from $0.65 to 0.70 per pound.

So FCR is a useful management tool when evaluating the economics of growing and finishing cattle, but it is not a perfect measurement of feed efficiency. Feed conversion ratio is strongly correlated with growth traits (Arthur et al., 2001) so selecting for FCR can result in increased mature cow weights (Herd and Bishop, 2000), and greater carcass weights in slaughter cattle. Because FCR is so highly correlated with growth an additional concern is that selection for FCR is not a good indication of feed efficiency in pregnant or lactating mature cows, the class of cattle that consumes the most feed.

## Residual Feed Intake

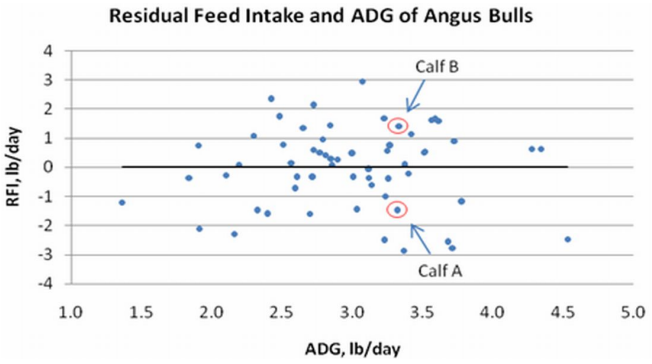


**Figure 1.** Residual feed intake (RFI) and average daily gains (ADG) from a test of Angus bulls fed at the North Florida Research and Education Center, Marianna.

Residual feed intake, or RFI, is the difference between actual feed intake and expected feed intake. Daily feed intake is measured on each individual animal. Performance, for example weight gain in growing and developing beef cattle, is tracked across the feeding period, usually a minimum of 70 days. Using the weight and intake information, expected intakes can be calculated. The difference between the expected and actual intakes is the residual. Cattle that consume less than expected are more efficient. Unlike FCR, RFI is phenotypically independent of the traits that are used to calculate it. As an example, a data set that was collected in the Feed Efficiency Facility (FEF) at the North Florida Research and Education Center in Marianna is shown with RFI and average daily gain (ADG) presented. As is usual in a data set of this size (n = 58), there is a substantial representation of different gains and variation in RFI. Calves A and B (noted in the figure) both entered the FEF weighing 819 pounds and left weighing 1051. Their weights and gains (3.32 lbs/day) are identical. Based on their weight and performance numbers, the calves were expected to consume 24.32 pounds of feed/day. However, calf A's actual daily intake was 22.86 pounds and calf B's actual daily intake was 25.76 pounds for RFI's of -1.46 and +1.44, respectively, a difference of 2.90 pounds of feed consumed per day.

Over the course of the 70 day feeding period, calf A consumed 203 pounds less feed than calf B, yet performed exactly the same. Assuming similar diets and a similar rate of gain (3.32 pounds/day) it would take each calf 180 days to gain 600 pounds but calf A would consume 522 pounds less feed. For 100 calves in a feedlot pen, this translates into 52,200 pounds less feed, and at $0.08/pound feed, this would

result in a savings of $4,176 ($41.76 per calf). Assuming all other costs are equal the resulting cost of gain in pen A would be $0.07/lb less than in pen B. Once again this is a significant savings for the feeder or owner.

Residual feed intake is moderately heritable. Lines of cattle selected for low RFI had similar weights and performance after two generations yet consumed 11% less feed (Arthur et al., 2001). In addition, there is a strong correlation with RFI measured after weaning and RFI measured in mature breeding females (Archer et al., 2002). Selecting for RFI has not increased mature weights or affected other phenotypic traits in cattle.

## Summary

Feed efficiency is not a new measure, but it is one that is receiving more attention as feed costs have increased. Many seedstock producers and bull testing facilities have installed technology that allows RFI to be determined and some breed associations have started the process of standardizing data collection and analysis and soon EPD's and Value Indices for feed efficiency will be reported. The use of DNA testing for feed efficiency is becoming more widely available. Producers who would like to include feed efficiency in their selection criterion will have several tools available to them.

## References

Archer, J.A., A. Reverter, R.M. Herd, D.J. Johnston, and P.F. Arthur. 2002. Genetic variation in feed intake and efficiency of mature beef cows and relationships with post-weaning measurements. Proc. 7th World Cong. Genet. Appl. Livest. Prod. Comm. 10-7, Montpellier, France.

Arthur, P.F., J.A. Archer, R.M. Herd, and G.J. Melville. 2001. Response to selection for net feed intake in beef cattle. Proc. Of Assoc. Advmt. Anim. Breed. Genet. 14:135-138

Crews, D.H., Jr. 2005. Genetics of efficient feed utilization and national cattle evaluation: A review. Genet. Mol. Res. 4:152-165

Herd, R.M. and S.C. Bishop. 2000. Genetic variation in residual feed intake and its association with other production traits in British Hereford cattle. Livest. Prod. Sci. 63:111-119