

# The Economic Impact of Feed Efficiency in Beef Cattle<sup>1</sup>

Travis D. Maddock, Darren D. Henry, and G. Cliff Lamb<sup>2</sup>

## Introduction

The definition of *efficiency* is the ratio of outputs to inputs. Businesses use measures of efficiency to establish benchmarks and goals for production and finance. Measuring efficiency may result in decisions that increase productivity without increasing costs of production, resulting in greater margins. 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 (cow/calf, backgrounding, fed), breed differences, and ways in which the biological systems (nutrition, reproduction, lactation, basal metabolism) interact. There are a multitude of measures of efficiency in beef production, with feed efficiency being one of the most economic.

## Feed to Gain Ratio

Feed efficiency is a measure of how much saleable product is produced for each unit of feed consumed. In beef operations, the most common measurement of feed efficiency is the feed to gain ratio (F:G), which is the ratio of feed intake to live-weight gain during a specified period of time. A calf that consumes 15 lb of feed per day and gains 3 lb live-weight per day would have a F:G of 15:3 or 5:1. Feed to gain ratio is a gross measure of feed efficiency and is 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 convert at a high rate (lesser F:G) are highly desirable for cattle owners and feedlots that charge on a gain basis. In addition, the ability to identify cattle with lower intakes that can, in turn, optimize performance is valuable in environments with lower-quality and/or fewer feed resources. Feed to gain 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 F:G? The example below illustrates differences in groups of calves that have varying F:G.

Assume that pen A has 100 calves with an average F:G of 7:1 and pen B has 100 calves with an average F:G of 5:1. 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 lb of gain on calves in pen A vs. pen B calves. If the feed for these calves averages \$0.108/lb (approximately \$200 per ton), it will have cost the feeder/producer \$12,000 (\$120 per head) more during the feeding period. Assuming all other costs are equal, the calves in pen A would have an additional \$0.20/lb added to their cost of gain compared to the pen B calves. As a reference, when corn is around \$3.00/bushel, the average cost of gain in the US ranges from \$0.65 to \$0.70/lb.

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2. Travis D. Maddock, former post-doctoral research associate, owner, Dakota Global; Darren D. Henry, graduate assistant; and G. Cliff Lamb, professor; Department of Animal Sciences, North Florida Research and Education Center; UF/IFAS Extension, Gainesville, FL 32611.

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F:G 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 to gain ratio is strongly correlated with growth traits (Arthur et al. 2001) such that selecting for F:G can result in increased mature cow weights (Herd and Bishop 2000) and greater carcass weights in slaughter cattle. Because F:G is highly correlated with growth, selection for F:G is not a good indication of feed efficiency in pregnant or lactating mature cows, which consume the most feed throughout the beef production system.

**Table 1. Total Pounds of Feed Needed for Gain Based on Feed to Gain (F:G).**

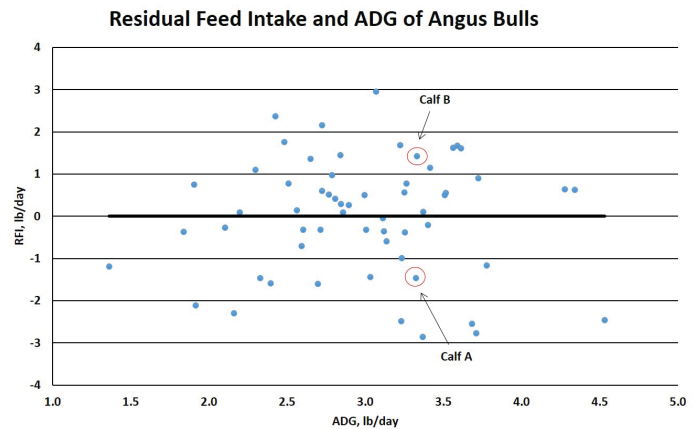
F:G	Pounds Gained					
	100	200	300	400	500	600
10:1	1000	2000	3000	4000	5000	6000
9:1	900	1800	2700	3600	4500	5400
8:1	800	1600	2400	3200	4000	4800
<b>7:1</b>	<b>700</b>	<b>1400</b>	<b>2100</b>	<b>2800</b>	<b>3500</b>	<b>4200</b>
6:1	600	1200	1800	2400	3000	3600
<b>5:1</b>	<b>500</b>	<b>1000</b>	<b>1500</b>	<b>2000</b>	<b>2500</b>	<b>3000</b>
4:1	400	800	1200	1600	2000	2400

## Residual Feed Intake

Residual feed intake, or RFI, is the difference between actual feed intake and expected feed intake. Daily feed intake is measured in each individual animal and performance. Weight gain in growing and developing beef cattle, for example, is tracked across the feeding period, which is usually a minimum of 70 days. Using the weight and intake information, one can calculate expected intakes by evaluating average intakes and gains of the group. Unlike F:G, 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 (58 head of calves), there is a substantial variation in feed intake relative to weight gain (RFI). Calves A and B (noted in Figure 1) both entered the FEF weighing 819 lb and left weighing 1051 lb with identical ADG (3.32 lb/day). Based on their weight and performance, the calves were expected to consume 24.32 lb of feed/day; however, calf A's actual daily intake was 22.86 lb and calf B's actual daily intake was 25.76 lb for RFIs of -1.46 and +1.44, respectively, a difference of 2.90 lb of feed consumed per day.

Over the course of the 70-day feeding period, calf A consumed 203 lb less feed than calf B, but performed

exactly the same. Assuming similar diets and rates of gain (3.32 lb/day), it would take each calf 180 days to gain 600 lb, but calf A would consume 522 lb less feed. For 100 calves in a feedlot pen, this translates into 52,200 lb less feed. At \$0.10/lb of feed, this would result in a savings of \$5,220 (\$52.20 per calf). Assuming all other costs are equal, the cost of gain in pen A would be \$0.09/lb less than in pen B. Once again, this results in significant savings for the feeder or owner.



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

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Residual feed intake is moderately heritable, with an  $h^2$  (the heritability that estimates how much of the genetic diversity of a phenotypic trait in a population is due to genetic differences, with a value of 0 having 0% heritability due to genetic differences and a value of 1 have 100% heritability due to genetic differences) ranging from 0.24 to 0.58 in multiple studies. Lines of more efficient cattle selected for low RFI had similar weights and performance after two generations yet consumed 11% less feed (Arthur et al. 2001). Residual feed intake is also strongly correlated with F:G such that RFI allows a producer to identify those animals that have lower F:G without increasing mature weight. 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 receiving more attention as feed costs have increased. Many seed-stock producers and bull testing facilities have installed technology that allows RFI to be measured. Certain breed associations have EPDs and Value Indices for feed efficiency. DNA testing for feed efficiency is becoming a more widely accessible option. Producers who would like to include feed efficiency in their selection criteria now have several tools at their disposal.

## References

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