



Making Progress with Feed Efficiency – the case for RFI (Residual Feed Intake)

Improving the feed efficiency of a herd can mean big savings for producers. Since feed costs represent greater than two thirds of total production costs in a beef operation, reducing them can have huge advantages to

your bottom line. A 5 % improvement in feed efficiency could have an economic effect four times greater than a 5 % improvement in average daily gain (ADG). This means improving feed efficiency will have an effect on the unit cost of production and the value of the breeding stock and feeder animals.

How is feed efficiency measured?

Traditionally, feed efficiency has been measured by comparing the feed to gain ratio (Feed:Gain or FCR). Basically, this is the calculation of the feed consumed per unit of weight gained. However, this measure typically only gives you a group average and does not tell you what an individual animal was eating for the gain it got. While a group average might be useful in a feedlot situation, it really is of little value to a breeding herd where you want to make progress through genetic selection. Genetic evaluation of ratio traits like FCR are problematic in that selection response is unpredictable, usually placing higher than expected emphasis on the trait with higher genetic variance.

Many beef cattle breed associations have adopted a slightly different method of evaluating individual feed efficiency, called net feed efficiency, **residual feed intake, or RFI**. Residual feed intake is defined as the difference between an animal's actual feed consumed, or eaten, and the animal's calculated feed requirements based on its body weight and ADG during a standardized test period. Essentially, RFI describes the variation in feed intake that remains after the requirements for maintenance and growth have been met. Efficient animals eat less than expected and have a negative or low RFI, while inefficient animals eat more than expected and have a positive or high RFI.

Typically, RFI is measured in young cattle (7-10 months of age) in feedlot pens fitted with feeding stations designed to automatically monitor individual animal feed intake over a 70 day test (GrowSafe Systems Ltd., Airdrie, Alberta, Canada) following a three week adjustment to their test diet. Cattle are weighed before feeding on two consecutive days at the start and end of the test period and at approximately 14-28 day intervals. Because RFI is independent of mature size and body composition, they are also measured for ultrasound backfat thickness (mm), rib eye area (cm²) and marbling score at the start (optional) and end of the test period.

Individual feed intake is currently monitored with technology from GrowSafe® Systems of Airdrie, Alberta. This system collects phenotypic data to determine RFI.

Those animals that maintain themselves on the least amount of feed possible for acceptable performance will be the ones that save you in feed costs. The challenge is finding out who they are and selecting their genetics for the next generation so you continue to make genetic and economic progress.



Photo taken at the University of Alberta beef ranch, Kinsella, AB

Lessons learned

The pork and poultry industries have both taken advantage of genetics to select for feed efficiency. The pig's feed:gain improved from 3.8 lbs. per pound of gain back in 1972 to 2.6 lbs. in 2007. The broiler chicken also improved its feed:gain over that time period from 3.0 to 1.7 lbs.



Feed requirements moved from 836 lbs to produce a 220 lb market hog in 1972 to 715 lbs of feed in 2007 to produce a 275 lb market hog.

(adapted from David Casey, PIC Inc.; Graham Plastow, 2012)

For the beef cow, both the measures of DMI (dry matter intake) and ADG (average daily gain) are related to body size, growth and composition of gain. So, selection for improved F:G has resulted in cattle that grow faster (increased ADG), have increased mature size, and increased maintenance and feed requirements.

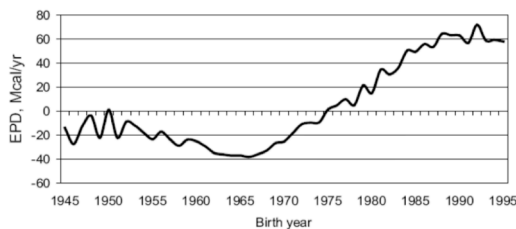


Figure 1. Average EPD (Mcal/yr) for mature cow maintenance energy requirements by birth year in Red Angus cattle (Evans et al., 2002).

The figure to the left shows 50 years of making bigger cows that ate more by selecting for the output of ADG. What has been forgotten to some extent is the selection for factors that could lower costs within the production cycle, like feed efficiency. Measuring and selecting for the *inputs* and not just the *outputs* needs some attention for the beef operation to continue generating income, but also to enhance sustainability and save costs.

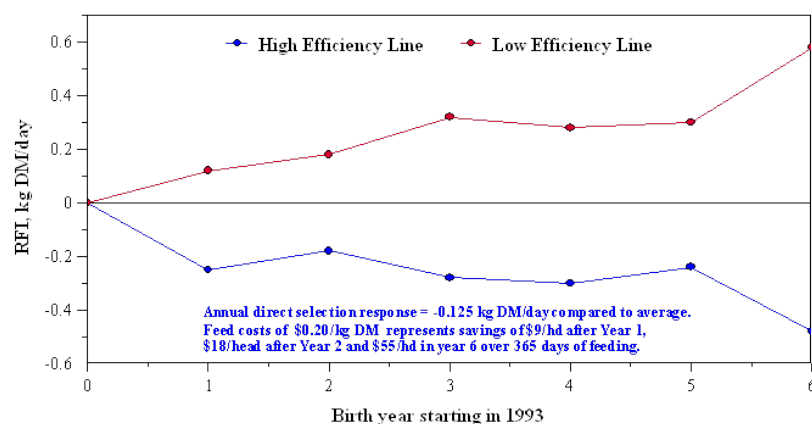
What we don't want to do is select for growth only, at the expense of fertility and longevity. We need cows to stay in the herd and produce live calves.

Feed savings from -RFI cattle

RFI is considered to be a moderately heritable trait, suggesting substantial progress can be made if selecting for it. The feed efficient cattle are those with negative RFI in the example from Australia below. The average animal has an RFI of 0. Over 6 years, the savings in feed costs would amount to \$55/head.

Tremendous genetic and economic improvement is possible as long as you consider multiple traits like growth and fertility along with the feed efficiency trait.

Trends in estimated breeding values for residual feed intake (RFI) for High and Low feed efficiency selection lines from 1993 to 1999
Trangie Agricultural Research Centre, NSW, Australia. Adapted from Arthur et al. 2001



Using RFI in a multi-trait selection breeding plan

A summary of research on RFI by JA Basarab, Alberta Agriculture and Rural Development, (Tiffin Conference, January 2012) has shown that selection for low RFI (efficient cattle) will:

- Have no effect on growth, carcass yield & quality grade
- Reduce feed intake at equal weight and ADG by 10 to 12%
- Improve feed to gain ratio by 10-15%
- Reduce net energy of maintenance by 10% and reduce methane emissions by 25% and manure production by 15% (reducing the carbon footprint of cattle)
- Have little if any effect on age at puberty
- Have no effect on calving pattern in first calf heifers
- Have no negative effect on pregnancy, calving or weaning rate
- Have little effect on bull fertility
- Have a positive effect on body fatness or weight particularly during stressful periods
- Predict efficient mature cattle from younger growing animals.
- Will reduce feed costs: \$0.07-0.10/hd/day feeders; \$0.11-0.12/hd/day in cows



Photo of BeefBooster bulls taken at Thorlakson Feedyards Inc., Airdrie, Alberta

Finding negative RFI cattle

Currently, the easiest way to find feed efficient cattle (if you are not testing your own cattle) is to purchase feed efficient or negative RFI bulls to use on your cow herd. Genotyping, genomics technology and infra-red thermography are other methods being used to determine feed efficiency in cattle. Many bull test stations and large private feedlots, conducting research, have the technology to measure RFI for paying producers.

The Future of RFI

Data continues to be collected from collaborative research projects focused on feed efficiency and residual feed intake both in Alberta and internationally. Careful interpretation of the data when applying or adopting the technology to your beef operation is up to you to make the most of it. While there exists a large variation in the range of RFI values in animals, more than 35%, and because the trait is moderately heritable, significant genetic progress can be achieved in breeding programs resulting in cost saving benefits. For now, because we can't possibly test all cattle for RFI, contact your breed association to get a list of RFI tested sires for sale at upcoming bull sales. Introducing sires with a known RFI value is a first step to moving your cow herd toward increased feed efficiency since 80-90 per cent of the genetic improvement in a herd comes through the sires. However, with time and continued improvement in genomics and infra-red thermography technologies, the ability to detect efficient animals will improve and increase our ability to select superior animals.

References

Arthur, P.F., G. Renand and D. Krauss. 2001. Genetic and phenotypic relationships among different measures of growth and feed efficiency in young Charolais bulls. *Livestock Prod. Sci.* 68:131-139.

Evans, J.L., B. L. Golden, and B. L. Hough. 2002. A new genetic prediction for cow maintenance energy requirements. http://www.bifconference.com/bif2002/BIFsymposium_pdfs/Evans_02BIF.pdf.

This is the first in a series of fact sheets on RFI. The other titles are: "The Economics of RFI" and "Frequently Asked Questions about RFI".

For further information on feed efficiency go to www.agriculture.alberta.ca to search for RFI, Residual Feed Intake or Net Feed Efficiency for cattle producers. Additional information can be found at www.livestockgentec.com and www.growsafe.com



Agriculture and
Agri-Food Canada

Agriculture et
Agroalimentaire Canada



UNIVERSITY
OF MANITOBA

