

UNDERSTANDING AND COMPARING FEED EFFICIENCY MEASURES

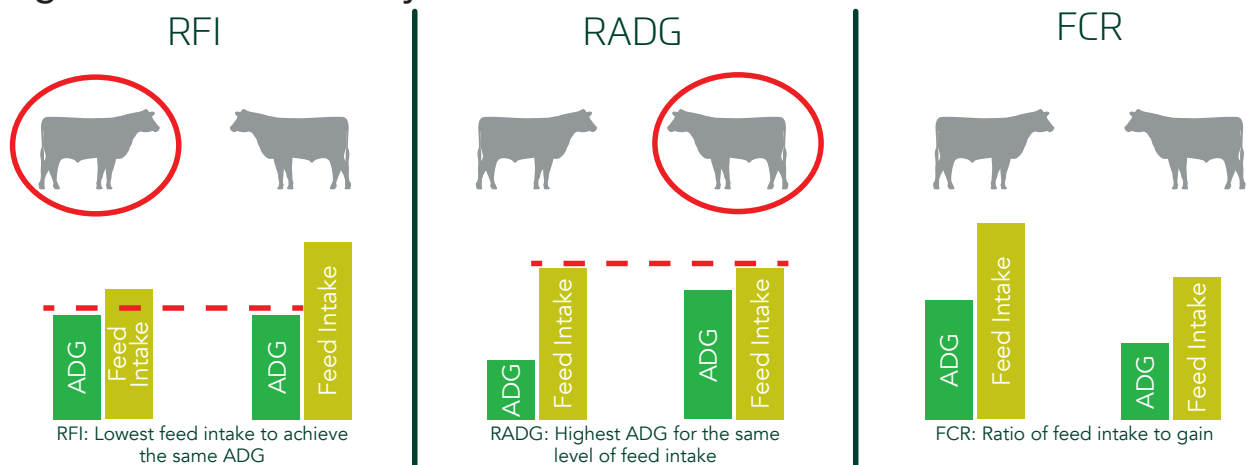
There are several different ways in which feed efficiency of beef cattle can be measured. Although all measures of efficiency contain the same or similar components, such as dry matter intake (DMI) and average daily gain (ADG), the efficiency results do not mean the same thing. It is important to realize that not all measures produce the same outcomes when used to making breeding decisions. Historically, measures of feed efficiency relied upon direct comparison of feed intake to growth, the measures continued to be modified to include metrics such as backfat and body weight. Currently, the most common measures of feed efficiency include: residual feed intake (RFI), residual average daily gain (RADG) and feed conversion ratio (FCR), all of which will be described in detail below.

Feed Conversion Ratio

Historically, cattle efficiency measures were dependent on the feed conversion ratio (FCR), a ratio of intake to body weight gain, often also calculated on a group rather than individual animal basis. Animals with a low FCR consume less feed per pound of body weight gain, while

animals with higher FCR consume more feed for unit of weight gain. Even though FCR is a moderately heritable trait, it has little value as a trait used to genetically improve feed efficiency (Crews 2005). The greatest limitation of FCR is that it represents a gross measure of feed intake, meaning that it does not distinguish between growth and maintenance requirements. Because FCR deals with a gross measure of energy intake, it is difficult to select for low maintenance requirements because it is related to both growth rate and body size (Arthur et al. 2001). Selecting for improved FCR and increased growth is likely to result in increased maintenance requirements and increased animal body size (Van der Werf 2004). Additionally, when it comes to FCR, genetic selection can be problematic because usually more emphasis is placed on the trait with greater genetic variance (Van der Werf 2004). Genetic correlation between the numerator and denominator in a FCR relationship is positive, suggesting selection for improved FCR leads to cattle that grow faster, with greater mature size and greater maintenance requirements, therefore, selection decisions based on FCR are likely to decrease efficiency in the long run.

Figure 1. Feed Efficiency Measures



RFI compares DMI for the same level of gain and looks for animals with lower DMI while RADG compares ADG for same level of DMI and looks for animals with increased ADG. FCR looks for cattle with the lowest ratio, both animals shown have a similar ratio of DMI to ADG even though one of the animals has a much lower intake.

Residual Feed Intake

Residual feed intake is considered, by GrowSafe Systems®, to be the gold standard of feed efficiency. The concept of RFI was first defined by Koch et al. in 1963. It is a unique measure of efficiency because, unlike FCR, it separates feed intake into two different components, including 1) feed intake for a given level of production, and 2) the residual portion of feed. Residual feed intake is calculated as the difference between an animal's actual intake and its expected intake for a given body weight and level of production. Cattle with low RFI values are more efficient than cattle with high RFI values. Along with the trait's moderate heritability, RFI is considered to be independent of production, growth and body size (Koch et al. 1963), making it an ideal trait to select for feed efficiency as it does not compromise other economically viable traits.

Residual Average Daily Gain

Another commonly recognized measure of feed efficiency is RADG. Residual average daily gain is a measure of the difference between an animal's actual weight gain and its predicted gain based on its DMI, body weight maintenance and fat cover (Northcutt 2010). Although the concept of RADG appears to be similar to RFI as they both contain the same or similar components, the two concepts work in very different ways. Residual average daily gain puts each animal's feed intake on the same playing field and looks at differences in average daily gain while RFI puts each animal's growth and body size on the same playing field and looks at differences in feed intake. When selecting for RADG, cattle with higher values are more desirable than those with lower values, meaning that they had greater ADG for the same amount of feed. Although selection for this trait is likely to produce cattle that grow faster, it is also likely to increase mature animal size and therefore also increase maintenance requirements, in which case they will require more feed.

The Advantage of RFI as a Feed Efficiency Measure

Feed efficiency traits like RADG and FCR are beneficial when used in the feedlot, as they seek to produce cattle that gain faster on the same or less feed. However, because they have a tendency to increase mature animal weight and increase maintenance requirements, they are not ideal when it comes to selecting for feed efficiency that will impact and benefit the full production cycle including the cow-calf herd. Residual feed intake can be utilized in both a feedlot and cow-calf environment. Not only does selection for RFI reduce the maintenance and feed requirements of feedlot, breeding and mature animals, it can also be used alongside other economically viable traits without having a negative impact.

Literature Cited

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