



# **Manage a Feedlot**

## **Handout 10**

### **RFI and Other Factors**

## The relationship between RFI and other traits of importance

**Let's now consider some of the relationships between RFI and other traits of importance.** Many factors affect the actual feed intake (DMI) of cattle such as body size, growth, body composition, gender, age, season, ambient temperature, physiological status, previous nutrition and diet. Most of these factors are either equal between animals during a standardized feed intake test (e.g., gender, season, ambient temperature and physiological status) or are adjusted for, such as body size, body composition, and growth so that we can make direct comparisons between animals. However, considerable within- and between-animal variation does exist in DMI and measures of feed efficiency.

### Diet type and Breed type

RFI measured on a grower diet and then again on a finisher diet is positively correlated, meaning the animals tend to rank similarly on both diets when tested. It is also true of RFI measured post-weaning in heifers and RFI measured again later in life as mature cows. However, other research showed that some animals do re-rank, meaning some will have a positive RFI or be inefficient in one test and then when tested again are efficient or have a negative RFI. This level of re-ranking for RFI, DMI and ADG occurred whether the diet changed from a grower to finisher diet or stayed the same from feeding period to feeding period. Such re-ranking was due to: 1) body weight and feed intake measurement error, 2) animal variation in response to compensatory gain, 3) animal variation in efficiency with animal maturity and, 4) animal variation in diet digestibility due to differences in feeding behaviour, rate of passage and rumen microbial population. Preliminary data also confirms the moderate to strong **repeatability of RFI over different stages of the animal's life**. Replacement heifers identified as -RFI and +RFI when they were 8-12 months of age and fed a 90:10% barley silage and barley grain diet (as fed; -0.373 vs. 0.365 kg DM/day) were also -RFI and +RFI when measured again as 4-7-year-old cows and fed a 70:30% grass hay and barley straw cube diet (as fed; -0.375 vs. 0.459 kg DM/day). These **results indicate that RFI is consistent across different stages of an animal's life**. Although, there may be a need for different test criteria (e.g., forage vs. grain-based diets) when selecting terminal and maternal bulls. Breed types destined for maternal purposes should be tested on forage diets whereas those breed types designed for terminal sire purposes be tested on grain-based diets.

- Research showed that some animals do re-rank
- Meaning some will have a positive RFI or be inefficient in one test and then when tested again are efficient or have a negative RFI
- This level of re-ranking for RFI, DMI and ADG occurred whether
- The diet changed from a grower to finisher diet
- Or stayed the same from feeding period to feeding period

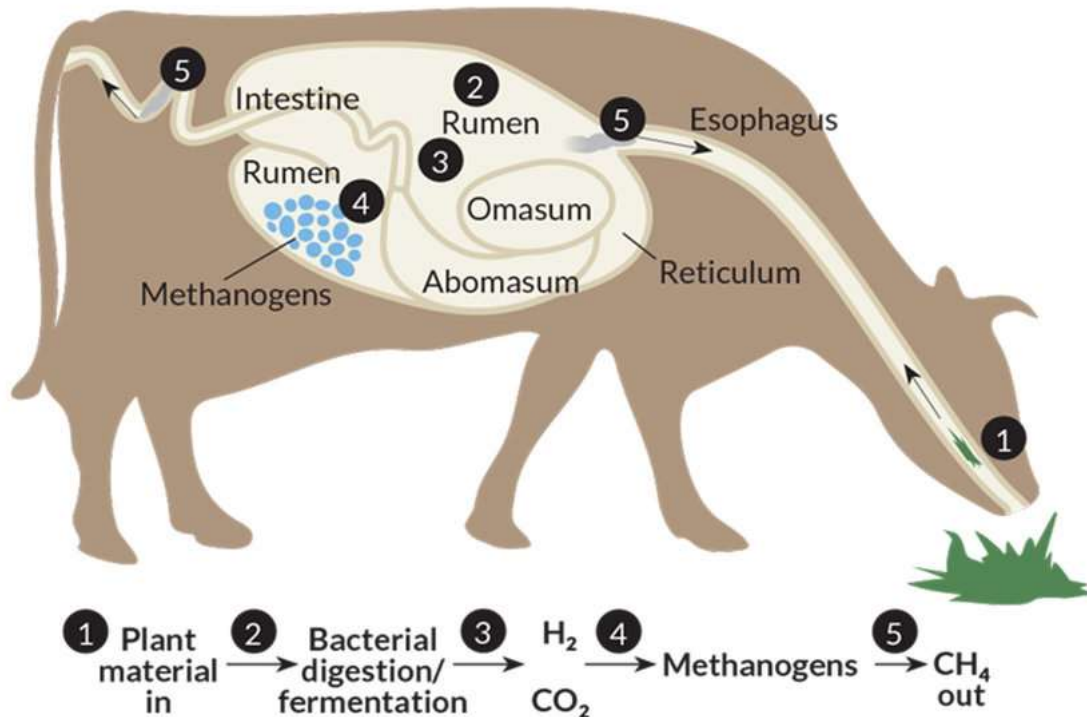
**Such re-ranking was due to**

- 1** Body weight and feed intake measurement error
- 2** Animal variation in response to compensatory gain
- 3** Animal variation in efficiency with animal maturity and
- 4** Animal variation in diet digestibility due to differences in feeding behaviour, rate of passage and rumen microbial population



RFI is not related to pre- and post-weaning growth, body size, slaughter weight and carcass traits in beef cattle and the phenotypic and genetic correlations are near zero. Experiments have shown no difference in carcass weight, dressing percentage, or marbling grade between cattle of positive and negative RFI values. However, the muscle of efficient animals was found to be slightly leaner and also have slightly more calpastatin than inefficient steers, which may negatively affect meat tenderness. Tenderness is being monitored in efficient animals to see if these results are repeatable in other cattle populations. RFI is moderately to highly correlated with feed intake and feed conversion ratio (FCR). This implies that selection for -RFI will decrease feed intake at equal levels of body weight, growth and body fatness, and will improve feed-to-gain ratio in feeder cattle and growing replacement heifers.

## Methane emissions



The fact that efficient cattle have decreased feed intake at equal levels of body weight, growth and body fatness also imply that selection for low RFI will decrease methane ( $CH_4$ ) emissions (g/animal/day) because methane emissions are proportional to feed intake. Generally, the higher the DMI, the higher the methane emissions are. These estimated reductions in methane emissions of 9-12% also coincide with a 15-17% reduction in manure production. Improvements to feed efficiency will influence the carbon footprint of cattle making beef more sustainable.

## Body condition and adaptability



Observations of beef cows in extensive Canadian winter conditions has shown that –RFI (efficient) cows actually maintain themselves in better body condition score with no differences in productivity compared with their +RFI herd mates. Dams that produced -RFI progeny consistently had 2-3 mm more back fat thickness, on average, over the 12th and 13th ribs and lost less weight during early lactation (pre-calving to pre-breeding) than mothers that produced +RFI progeny. In addition, –RFI (efficient) heifers calving for the first time had lower calf deaths within 30 days of birth than +RFI (inefficient) heifers. Lower calf death loss suggests that the improved early life survival of calves from -RFI mothers may be due to their improved feed efficiency resulting from more available nutrients and a better uterine environment compared with +RFI mothers.

Recent research confirms these findings in that –RFI cows gained more body fat and body weight than +RFI cows when both groups swath grazed forages for the first time during Canadian winters where night time temperatures dropped below -20° C and animals grazed through the snow from November to March. Previous to this, both –RFI and +RFI young cows had been wintered together in smaller holding areas and fed barley silage to meet their nutritional requirements. Even though efficient cattle have documented lower feeding event duration and frequency and lower feed intake when bunk fed in an RFI test, this does not mean that –RFI animals cannot compete or acquire forages during extensive grazing. Instead it may imply that efficient animals are more adaptable and less susceptible to stress than +RFI or inefficient animals.

## Fertility and productivity

The relationships of RFI on fertility and productivity in heifers and cows have recently been reviewed showing, -RFI and +RFI cows and heifers were similar in culling, pregnancy, calving and weaning rate, calving pattern and kilogram of calf weaned per mating opportunity. However, -RFI (efficient) cows calved 5-6 d later in the year than +RFI (inefficient) cows. When RFI was adjusted for body fatness (final off-test backfat thickness; RFI<sub>fat</sub>) no differences were observed in percentage of -RFI<sub>fat</sub> and +RFI<sub>fat</sub> heifers reaching puberty by 10, 11, 12, 13, 14 or 15 months of age nor in the percentage of calves born by day 28 of the calving season. Calving difficulty, age at first calving, calf birth weight, calf pre-weaning ADG, calf actual and 200-d weaning weight and heifer productivity, expressed as kg calf weaned per heifer exposed to breeding, were also similar between -RFI and +RFI heifers. Figure 8 below shows how –RFI (efficient) heifers appear to reach puberty later and get pregnant later in the breeding season compared to +RFI (inefficient) heifers. However, this small difference is likely a feature of the RFI testing procedure itself. Heifers reaching puberty near the start of the test period may actually have greater energy expenditures (5% greater) because they are cycling throughout the test due to their sexual development and greater activity compared to heifers that reach puberty near the end of an RFI test. So, this explains why they may breed and calve somewhat later. What is important is that all the heifers reached puberty by 15 months of age and all heifers were pregnant before 40 days of a breeding season; both suitable management targets.

### Bull fertility



Fertility of young bulls, as measured by scrotal circumference, breeding soundness evaluation, calves born per sire and semen characteristics, for the most part has been unrelated to RFI, though several weak associations have been observed with sperm morphology and motility. What this is suggesting is that perhaps the efficient –RFI bulls are younger and have less developed sperm. These observations

may also reflect the need to adjust RFI for off-test ultrasound backfat thickness and feeding behaviours in an effort to prevent the selection for later maturing bulls. A study showed there was no difference in the number of calves sired by –RFI bulls compared to +RFI bulls. One must be careful to not interpret poor sperm morphology with infertility, since libido in addition to other aspects of a breeding soundness evaluation are important to ensure any bull, regardless of RFI status, is acceptable to be put into a breeding situation.

Data continues to be collected from collaborative research projects focused on feed efficiency and residual feed intake. 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 you cow herd toward increased feed efficiency. However, with time and continued improvement in technologies, the ability to detect efficient animals will improve and increase our ability to select superior animals.