MATCHING BEEF COWS TO FORAGE RESOURCES[1]

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Introduction

Refining production efficiency and resource utilization in the beef industry is a challenge. Genetic changes that improve beef carcass yield or post-weaning performance may increase ranch income through increased weaned calf value and (or) improved post-weaning performance and carcass value. At the same time, continued selection for growth rate, carcass weight, and milk production could be leading to increased annual carrying costs in the beef cow enterprise. In most breeds, aggressive selection for growth continues and mature size continues to climb at a gradual rate. Similarly, selection for increased milk production is apparent in some breeds. These are indications that either the value of increased production is greater than potential change in input costs or the impact of increased output (growth or milk) on production cost is unknown.

It is clear that post-weaning growth, carcass weight, and carcass value has improved dramatically in the U.S. cattle industry over the past 30 years. During the same period, overall weaning rate and pounds of calf weaned per cow exposed to breeding the previous year have not improved (Lalman et al., 2016). At the same time, it is apparent that the ranch environment may limit expression of genetic potential for growth at weaning time in some regions of the country (Lalman et al, 2019). These observations indicate a need for profit-minded commercial cow/calf enterprises to a) maintain good records and evaluate their own trend over time in these key metrics, b) shift focus to controlling cow herd input costs, and (or) c) work to capture increased post-weaning value through marketing or some form of retained ownership.

Generally, commercial cow/calf enterprises manage their operations to minimize reproductive failure. An abundance of research indicates that body composition during gestation and early lactation has an impact on post-partum interval and overall pregnancy rate. Therefore, gradual increases in nutrient requirements associated with cow size, milk production, or growth rate may be offset over time by a gradual increase in input costs in an attempt to maintain body composition and therefore, overall reproductive rate. A mismatch is not easily identified. For example, ranchers cannot measure and track the trend in annual forage consumption of their beef cows. The long-held strategy of culling females that fail reproductively is probably the most practical method to improve on the match of cows to forage resources. However, consideration of future genetics (purchased through herd sires), provides the best opportunity to reduce the frequency of these failures over time.

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Cow Size

Consider that each 100 pounds of additional mature cow weight requires about 600 pounds of additional high-quality grass hay or moderate quality grazed forage to maintain their body weight and condition (NASEM, 2016). Consequently, feed costs, forage requirements, and ultimately ranch stocking capacity will be impacted by mature cow size. In an attempt to quantify the relationship of mature cow weight to calf weaning weight in commercial cow/calf operations, our group evaluated 3,041 records collected from 3 different operations (Bir et al., 2018). In the data set, cow weights ranged from 635 to 1,922 pounds and calf weaning weight ranged from 270 pounds to 775 pounds.

First, there was not a strong relationship between cow size and calf weaning weight (Figure 1). In other words, there was a lot of variation in weaning weight and cow size explained only a small portion of this variation. Perhaps this is a good time to point out that in almost any cow herd there will be small cows that are individually efficient (relatively high weaning weight for their mature size) and there are large cows that are individually efficient. After all, using mature size is an indirect attempt to estimate relative annual forage consumption. While there is a positive relationship between mature size and feed intake (NASEM, 2016), there will be substantial variation that is not explained by mature weight. Obviously, mature weight is a trait that is easily measured whereas mature cow forage intake is difficult and expensive to measure.

Although the relationship of cow weight to calf weaning weight was not strong, it was statistically significant and positive. It was determined that for each 100 pounds of additional cow weight, calf weaning weight increased by an average of 6.7 pounds. Arkansas data published in 2016 (Beck et al. 2016) indicated that this relationship was 19 pounds for each 100 pounds of additional cow weight and more recent data from North Dakota (Ringwall, 2017) documented a 28-pound increase in calf weaning weight. Climate and management practices likely have substantial impact on this relationship. We suspect, without solid evidence, cows in a challenging environment will wean less calf weight per added 100 pounds of cow weight, perhaps closer to 6 pounds. In less restrictive environments the relationship will likely be at the upper end or closer to 28+ pounds per 100 pounds of added cow weight. “Less restrictive” can be interpreted as higher quality, more abundant forage throughout the growing season, lower stocking rate (allowing the cattle to select a better quality diet), more harvested forage feeding, more supplementation, more winter annual grazing, less heat or cold stress, less parasite exposure and so on.

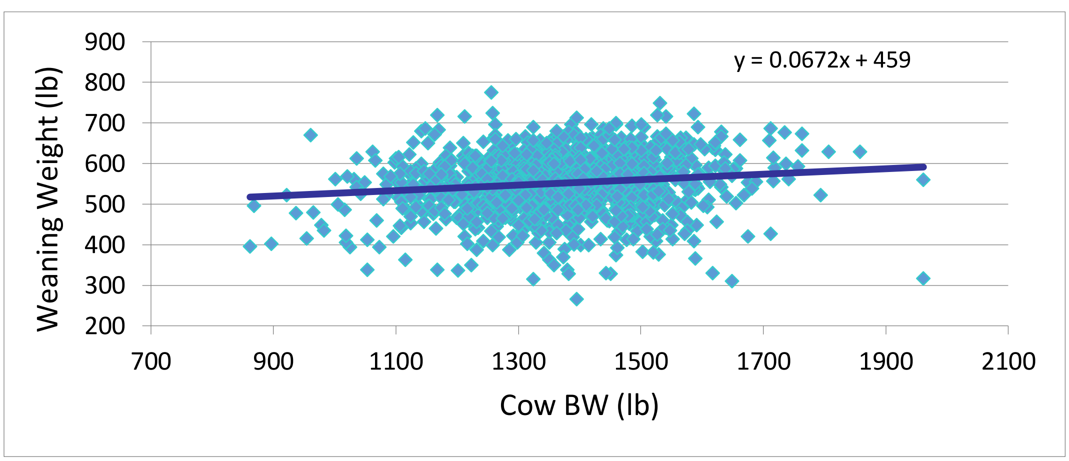

Figure 1. Relationship of mature cow weight to calf weaning weight in commercial beef cow/calf operations (Bir et al., 2018).

Based on the evidence available; it appears that each additional 100 pounds of cow weight generates about $6 to $35 of added calf income depending on the calf market. However, in a 2011 study, the addition of each 100 pounds of cow weight cost an additional $42 due to increased feed costs and grazing land required (Doye and Lalman, 2011). To take this a step farther, in several published economic evaluations of varying cow size and a given land resource, smaller and moderate cows have a financial advantage for three primary reasons: 1) higher stocking rates for smaller cows result in more pounds weaned per acre; 2) lighter calves sell for a higher price per cwt; and 3) the increased revenue from added weaning weights do not offset the higher feed costs of larger cows.

Producers are encouraged to consider evaluating this simple relationship in their own operation. A lower response to cow weight suggests that moderate cow size would be a better match for their environment and management system. Some may find a greater calf weaning weight response to cow weight. In that case, given modest grazing and feed cost, larger cows may be a better match.

Items 2 and 3 in the list above assume little to no market discount for smaller-frame calves that may have lower growth rate and likely have lighter carcass weights. Feed efficiency, carcass weight and quality grade are major drivers in post-weaning enterprise profitability. Therefore, post-weaning performance and carcass quality should not be ignored. Multi-trait selection indexes are designed to simplify these decisions. These indexes consider both the input (cost) contribution related to cow size as well as the output (income) contribution of greater genetic potential for post-weaning gain, feed efficiency and carcass weight.

Larger mature cow size generates more cull cow income, and this is considered in previously mentioned economic evaluations. One factor often overlooked when crediting larger cows with increased cull income is the original cost of the added weight. It is not free. For example, comparing 1,100 pound cows to 1,400 pound cows and a $60 per cwt cull cow price, 1,400 pound cows generate an additional $180 at culling time. However, the additional 300 pounds of growth required additional nutrients through the development stages and about 6 to 7 years of age when they finally reach their mature weight. While forage is generally the cheapest feed resource on a ranch, the conversion of forage (even high quality forage) to cow weight gain is very poor. Consequently, the increased cull cow income will be substantially offset by the economic cost of developing or growing the added cow weight.

Milk

Milk EPDs are reflective of genetic potential for milk production and weaning weight associated with level of dam's milk and her mothering ability (Diaz et al., 1992; Marston et al., 1992; Mallinckrodt et al., 1993). However, there is a limit to the amount of milk that forage or grazing systems can support (Brown et al., 2005; Edwards et al., 2017). Therefore, it is important to consider the relative contribution of milk to calf weaning weight and the cost associated with producing the milk.

In the latest *Nutrient Requirements of Beef Cattle* publication (NASEM, 2016) the committee reviewed the literature and suggested that increased genetic capacity for milk and growth are positively related to maintenance energy requirements. Most of the work related to this issue was completed 20 to 30 years ago. Therefore, with substantial changes in genetic potential for numerous traits, it would seem wise to revisit this fundamental nutritional principle.

In the work of Ferrell and Jenkins (1987) and Montano-Bermudez et al. (1990), each 10% increase in peak milk yield was associated with about 4.5% increase in maintenance requirement. If this relationship holds, each 10% increase in peak milk yield would result in increased maintenance requirement of approximately 143 Mcal of net energy for maintenance (NE_m) per year for a 1,200-pound cow. The cow would need to consume 118 Mcal of NE_m more to produce the additional milk. For perspective, 261 Mcal of NE_m is equivalent to about 500 pounds of high-quality grass hay.

When beef cows are fed a high-quality diet or allowed to graze high-quality forage, not all of the feed energy consumed is partitioned to milk production. Some of it goes to replenish maternal tissue. In fact, anytime a lactating beef cow consumes energy beyond the amount required to maintain her body weight, part of the added energy is used to increase milk production and part of it is used to gain weight. This assumes that milk yield is not already at maximum genetic capacity when the cow is at maintenance. In one of our recent projects (Spencer et al., 2017), we have shown that the proportion of energy partitioned to maternal tissue increases with increasing feed energy intake (up to about a third of the added energy; Fig. 1). This effectively reduces the efficiency of added feed energy for added milk production.

The cow herd used in the experiment shown in Fig. 1 has a peak milk yield of about 31 pounds per day during early lactation. This project was conducted during the last 100 days of lactation when average milk yield would be declining. Even so, milk yield in these high-producing cows was highly sensitive to increased energy availability. Few ranch environments relying strictly on grazing resources would be able to sustain the highest energy level used in this experiment for more than a few weeks each year. Weight and condition loss between calving and weaning is a good indication that the animal's maintenance energy requirement and (or) genetic capacity for milk production is beyond the capability of the grazing resource. If cows gain substantial weight and body condition during lactation, then the implication is that either a) more genetic potential for milk production is justified or b) stocking rate could be increased, thereby increasing income per acre and effectively lowering the quality of forage consumed.

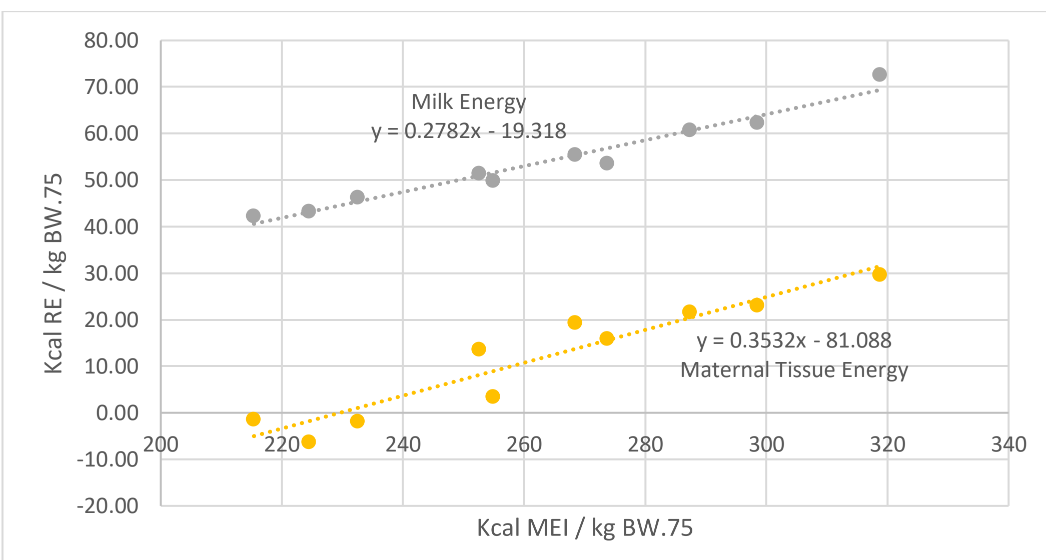

Figure 1. The relationship of metabolizable energy intake to milk energy production and maternal tissue retention in Angus cows (Spencer et al., 2017).

To calculate the profitability of added (or increased) milk production, one needs to determine the conversion of milk yield to calf weight gain. This of course is not practical in a production setting. Unfortunately, the available published literature reveals a wide range in the efficiency of milk production for increasing calf weaning weight. In ten experiments, this conversion ranges from about 12 to 71 pounds of milk for each additional pound of calf weaning weight. Increased milk consumption by the calf is associated with reduced forage consumption. Therefore, this ratio would appear to be more efficient in systems where cows have low genetic capacity for milk production because the ratio does not consider the contribution of forage grazed by the calf. Nevertheless, averaged over the 10 experiments, calf weaning weight was increased by one pound for each 42 pounds of increased milk production. In our recent experiment (Fig. 1) each additional pound of 69% TDN feed increased milk yield by about 0.75 pounds. Using the 42-pound study average, this suggests that about 56 pounds of a high-quality mixed diet or high-quality forage would be required to increase calf weaning weight by one pound. Remember that this calculation does not consider any potential change in cow maintenance energy requirement. More work is needed to better understand the relationships between feed inputs, milk yield, calf weaning weights and post-weaning performance in grazing systems.

Summary

Managers should consider tracking average mature cow weight at weaning, cow body condition at weaning and again around the time of calving or breeding. Recorded and monitored consistently over the years, these data can become a powerful tool. Combined with herd average trends in calf weaning weight and pregnancy rate within a restricted breeding season, these metrics are valuable in assessing the match to forage resources and the "environment" in general. A flat weaning weight trend over a long period of time, low weaning weight response to increasing cow size within a herd, cows that are consistently marginal to thin condition at weaning or breeding, requiring gradual increases in feed inputs or resulting in low pregnancy rate, are all indications that moderation in herd-level mature size and milk production should be considered. In recent years, development in mature cow weight and height EPDs represent a major advancement in managers' ability to control mature cow size through purchased herd sires. Similarly, herd sire milk EPDs can be used to control the level of milk production over time.

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