Fitting cows to your operation

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Introduction

Increasing cow efficiency requires optimizing the ratio of output to input. Evaluating the market endpoint, resources, and management preferences is the first step in determining the attributes that are needed in the cow herd. The next step is identifying the biological attributes of the cow that fits your production system. Around the world the ecologies of grazing systems vary greatly. Indigenous cattle evolved within these different ecologies that were well suited to specific grazing environments. This great genetic diversity provides a great opportunity to match cows with specific attributes to a given production system. Decisions used to optimize the output:input ratio on biological bases is not necessarily the same decisions that would be used to optimize the ratio on economic bases. Some types of cattle have been used across a wider range of grazing systems than would be biologically optimum because there are economic advantages that warrant increasing the inputs that allow them to be used in those production systems.

Energy Metabolism

Energy requirements are a good index of the total nutrient requirements of a cow. Before we can evaluate the economic efficiency of a cow, we must have an understanding of the biological efficiency. After we have an understanding of the components of biological efficiency, then those traits can be given economic values. The largest portion of the energy used in beef production is associated with maintaining the cow herd (Figure 1). The large proportion of the total nutrients associated with the cow herd suggests that improving cow nutrient efficiency would greatly contribute to improving overall biological and economic efficiency of beef production. Feed costs account for 60-70% of the annual cow cost.

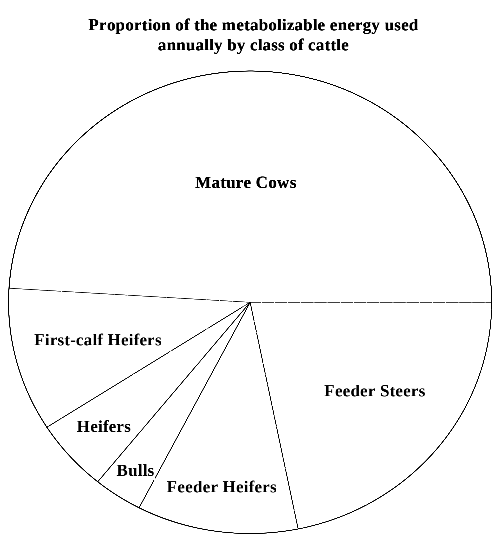

Figure 1

The nutrient requirements of cows change throughout the year and the level of nutrients required at any given time are dependent on the stage of the production cycle (Figure 2). Energy usage by a mature cow can be divided into four general categories. Energy required for activity, maintenance, pregnancy, and milk. Energy used for activity is the most variable. Grazing behaviors, terrain, forage availability and water availability all contribute to the variability in activity energy expenditure. Maintenance is the amount of energy required by a cow to maintain her body weight. Tissues are constantly degrading and reforming and these processes require energy just to maintain themselves. Daily maintenance is influenced mainly by cow size. The energy required for pregnancy is either deposited in tissues of the calf or is lost as heat. The heat energy is lost from the chemical reactions that convert nutrients to the complex molecules that make up the tissue of the calf. In addition to the energy associated with tissue growth, the energy needs of the cow increase as organs like the liver become more metabolically active to support pregnancy (Freetly and Ferrell, 1997). The energy required for fetal growth increases as gestation increases, and the greatest energy requirement is during the last third of gestation (Figure 2; Moe and Tyrrell, 1972). As with fetal growth, energy required for milk has two fates. The energy is either deposited in milk or it is lost as heat. Energy required for milk synthesis is directly proportional to the amount of milk that is being produced (Freetly et al., 2006). The heat energy given off during milk synthesis is coming from the mammary gland as well as from other tissue like the liver that support milk synthesis.

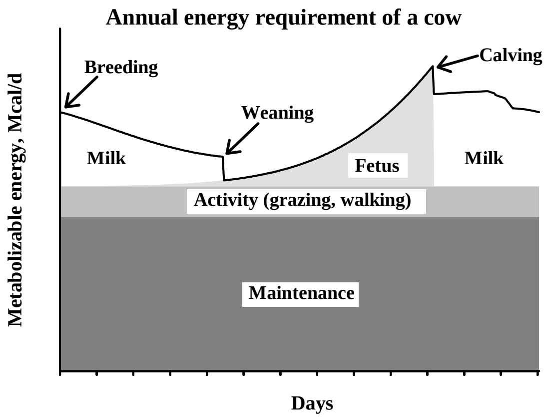

Figure 2

Variation in Energy Metabolism

When matching cows to your production environment, there are a number of factors that need to be considered when you are trying to weigh the inputs and outputs. Energy required for maintenance and lactation comprise a large fraction of the total energy used annually. Daily maintenance requirement is primarily a function of body weight. Using EPDs for maintenance that are based on cow weight may have the unattended consequence of reducing mature cow size. Reducing mature cow size will typically also reduce calf body weight at any given age (Figure 3). When calves are marketed at a given age, there can be a reduction in the weight of the calf. When forage availability is high and cow costs are fixed by the head, then larger cows can be advantageous (Jenkins and Ferrell, 1994).

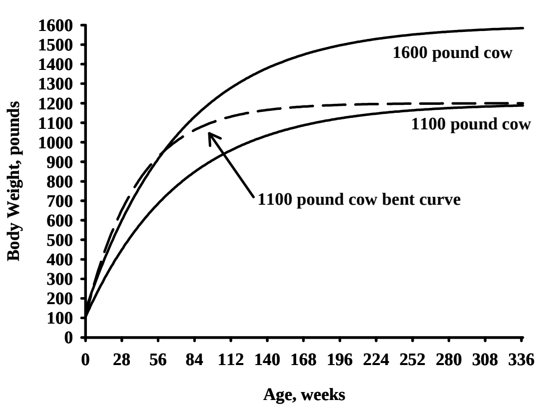

Figure 3

There are some cases where breeds of cattle deviate from the expected maintenance requirements suggesting that there is a possibility for selecting on maintenance independent of cow weight. *Bos indicus* cattle typically have a lower maintenance requirement than would be predicted based on weight, and high milk production breeds typically have a higher maintenance requirement (reviewed in Nutrient Requirements of Beef Cattle, 1996). These deviations from expected maintenance are due to changes in metabolic processes, and selection on maintenance may potentially adversely affect other desirable traits.

A proposed concept to reduce the maintenance requirement of the cow herd while maintaining the weight of calf marketed, is to create a selection program that "bends" the growth curve (Figure 3). The general concept is to select for a smaller mature cow weight, but hold weight that the calves are marketed constant. The result is a calf reaches a greater proportion of their mature weight at a younger age. While this strategy may have advantages when marketing calves at weaning, it may decrease the growth rate and market weight of fat cattle.

The previous discussion has assumed that cows are maintaining weight throughout the production year. In grazed-based production systems, availability of grass frequently does not match the needs of the cow. Cows lose weight until their body weight matches the feed availability, and they establish a "new" maintenance weight. While it takes less feed to maintain cows at the lower body weight, frequently fertility decreases and milk production can be suppressed. Consequently, cows need to regain weight before breeding. The efficiency of "weight cycling" is comparable to maintaining weight (Freetly and Nienaber, 1998) and when timed correctly during the production cycle, it can be used to offer more flexibility in managing feed resources (Freetly et al., 2000; 2005). There is evidence that there are genetic differences in the ability of cattle to adjust their metabolic rate with decreased feed intake. Jenkins et al. (1991) demonstrated that as nutrient availability decreased, metabolic rate decreased more rapidly in Herefords than in Simmentals. The ability to decrease metabolic rate during periods of limited feed, and then adjust to a higher rate during plentiful periods suggest that these cows are capable of adapting more easily to their environment. Selection against metabolic rate frequently results in a selection against feed intake and subsequent growth. Selecting for "elastic" cows may be a means to reducing feed cost in the cow herd without decreasing growth of the calves.

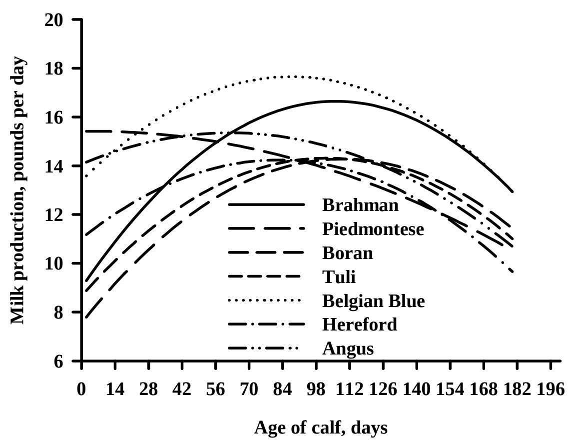

Figure 4

Matching the amount of milk that cows need to produce in order to raise a calf is an important factor in selecting cows for a production system. As mentioned earlier, selecting cows with high milk yields increase the maintenance cost of keeping the cow. Both the conversion of feed energy into milk energy (Freetly et al., 2006) and milk energy conversion into tissue energy in the calf (van Es, 1970) are relatively an efficient process. However, the sum efficiency of the two processes is not better than converting feed directly into tissue energy. In the newborn calf, milk is the sole source of food. As the calf ages, the rumen complex begins to develop and the calf begins to use other foods. There is considerable genetic diversity in both the amount of milk produced and the timing of the peak yield (Figure 4; Freetly and Cundiff, 1998). Milk provides both a source of energy as well as protein to the calf. The amount of milk that is desirable in a cow is influenced by other management decisions. The need for milk as a calf ages will depend of the availability of other feed resources including nutrient availability of the grazed forage and the decision to provide creep feed. Reduced growth rates in calves due to low milk yields late in lactation can be an acceptable strategy if calves are marketed later than weaning and an alternative feed resource is available.

Resource availability and marketing strategy will determine what attributes are needed in a cow to optimize the output:input ratio in a given production system. A “good” cow in one production system may not be a good fit in another production system. Take advantage of the genetic diversity across breeds of cattle to improve cow efficiency.

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