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Beef Cow Efficiency in the Southwest

Guide B-217

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In general, efficiency is the optimum use of resources toward a sustainable level of production. In beef production, production efficiency can be expressed as the ratio of pounds of calf weaned per unit of forage consumed. However, rainfall and forage production can be highly variable in the Southwest, so cows generally are required to be highly productive on a limited forage supply. Therefore, it is more practical to measure production efficiency as total pounds of calf weaned per pound of female exposed to a bull (or, if scales are not available, simply per female exposed to a bull). This measure combines both the reproductive performance of the cow herd and the growth characteristics of the calf relative to the total weight (or number) of cows in the breeding herd.

In the Southwest, pasture forage (that is, payment on purchased or leased land) is generally one of the largest fixed costs. So it is important to match cow type to the forage supply to achieve maximum efficiency in harvesting the forage and converting it to a cash commodity—the calf.

Many factors can affect production efficiency in the cow herd. Major factors include cow size, milking ability, and reproductive performance. The purpose of this guide is to address the relationship between these factors and beef production efficiency in the Southwest.

Cow Size

Energy intake makes up a large portion of the input into the cow herd. Maintenance energy (the amount of energy required to maintain body weight) can represent 70 to 75 percent of the total energy consumed annually by the cow herd (Ferrell and Jenkins, 1985). A cow's size or body weight does not influence her energy use efficiency (Ferrell and Jenkins, 1984a, 1984b). However, researchers from Wisconsin (Davis et al., 1983b) have shown that smaller cows can wean more pounds of calf per pound of feed than can larger cows. The same research group (Davis et al., 1983a) in a different study found that feeding larger cows a higher-energy diet did not sufficiently increase the number and total weight of calves weaned to offset the higher level of energy intake. In other words, supplying larger cows with more energy did not increase their production efficiency.

A larger cow can produce a larger calf, but her production efficiency may be less than optimal. In general, cows can be selected for improved efficiency in a certain environment, but they may not be as efficient in other environments (Ferrell and Jenkins, 1985). In an environment where feed resources are unlimited, larger cows may be able to offset the inefficiency by weaning larger calves. Generally, however, on Southwestern rangelands where forage supply is often limited, larger cows are not as efficient as smaller cows.

Cow Milk Yield

Milk yield is related to preweaning calf growth (Clutter and Nielsen, 1987), so increased milk yield often is considered an advantage in a cow–calf operation. But milk production requires high levels of energy input by the cow, and, if feed resources are limited, milk production can have a negative effect on the overall efficiency of beef production.

Researchers from the Meat Animal Research Center in Nebraska (Ferrell and Jenkins, 1984a, 1984b, 1985) have shown that energy use is less efficient in higher-milking cows. They attribute their observations, in part, to the higher-milking cows' larger internal organs and faster metabolism compared with lower-milking cows. The low energy-use efficiency of higher-milking cows means that they require more energy per pound of body weight than do lower-milking cows. Therefore, a higher-milking cow generally has a greater total energy requirement than a lower-milking cow of similar size during the lactation and dry periods (Ferrell and Jenkins, 1984a; Montano-Bermudez et al., 1990).

Scientists at the University of Nebraska (Montano-Bermudez et al., 1990) have estimated maintenance requirements for cows with low, moderate, and high

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Table 1. Maintenance Energy Required for Cows of High and Low Milking Potential But Equal in all Other Characteristics[a]

	Cow A	Cow B	Difference
Body weight (lb)	1,100	1,100	-
Milking Potential	Low	High	-
Total lb of TDN/cow/yr	3,726	4,159	433
Total lb of forage/cow/yr	6,774	7,561	787

[a]Requirements based on Montano-Bermudez and Nielson (1990).

levels of milk production during gestation and lactation. Requirements were calculated per unit of body weight, with Hereford × Angus (lowest milking potential) having the lowest requirements, and the moderate- and high-milking females having similar but higher requirements.

When calculated for cows of equal body weight, the maintenance requirement for lower-milking cows compared to higher-milking cows was 0.8 pounds less total digestible nutrients (TDN; an estimate of energy intake by the animal) per day during gestation (6.4 vs. 7.2 pounds TDN) and 0.9 pounds less TDN per day during lactation (8.3 vs. 9.2 pounds TDN). When considered across a production cycle so that energy use for gestation and lactation were both included in the estimates of energy requirements, differences were much larger (Montano-Bermudez et al., 1990). The following example (Table 1) illustrates the impact of milking ability on energy requirements of two cows of equal body weight.

Both cows weigh 1,100 pounds, but Cow A has a low potential for milk production and Cow B has a high potential. Both are grazing native rangeland pastures in the southwestern United States. Range forage averages 55 percent TDN across the year (Krysl et al., 1987). Cows are in a normal production cycle, calving on March 1, breeding on May 15, and weaning a calf on October 1.

This example demonstrates that the higher-milking cow requires nearly 800 pounds more forage per year. In a 500-cow herd, this difference translates to 393,500 pounds of additional forage per year to support a higher level of milk production. However, the question remains: Can the higher-milking cows produce calves that are heavy enough to pay for this increase in forage demand?

According to Montano-Bermudez and Nielsen (1990), when production efficiency was estimated as weight of calf weaned per unit of energy intake, lower-milking cows were more efficient producers to weaning; the calves retained this efficiency advantage through the feedlot. This efficiency advantage to weaning appears to remain throughout the lifetime production of the lower-milking cows (Davis et al., 1983a, 1983b).

Cows that produce more milk have been shown to wean heavier calves than low-milkers (Clutter and Nielsen, 1987), but the higher weaning weight may not be economical because of the efficiency loss and increased cost. Calves from low-milking cows tend to replace milk nutrients by increasing their nonmilk feed consumption at an earlier age (Montano-Bermudez et al., 1990). However, research conducted at New Mexico State University indicates that after about 60 days of age, average daily gain is similar for both high- and low-milk-consuming calves (Ansotegui 1986). Ultimately, the saving in inputs due to increased efficiency can be a desirable trait in nutrient-restricted environments.

Reproductive Performance

Reproductive performance is the most influential factor determining profitability of the cow–calf operation. Improving reproductive performance can influence profitability independent of other measures. Clearly, the energy status of the cow has an effect on reproduction (Short and Adams, 1988), and reproductive performance is of paramount importance to the production efficiency of the cow herd.

Calving date relative to the calving season (early, middle, or late) also can influence production efficiency. Earlier calving cows generally wean older and heavier calves and use feed more efficiently than later calving cows (Marshall et al., 1990). This advantage results in higher net returns from earlier calving cows. Additionally, cows that maintain a shorter postpartum interval are more efficient throughout their lifetimes (Davis et al., 1983b).

Combined Effects of Cow Size, Milking Ability, and Reproductive Performance

The previous discussion separates the influence of cow size, milking ability, and reproductive performance on production efficiency. However, the combination of these effects is the driving force behind cow production efficiency in the Southwest. Researchers in Montana have described the approximate priority of energy use by cows (Table 2).

Table 2 shows that the energy required to initiate estrous cycling after calving is only available if the requirements for all the previously listed functions (including lactation) have been fulfilled. Therefore, it is important that adequate energy (forage) is available and that the cow's energy demands are not so high that there is not enough energy left to support cyclicity and rebreeding.

Scientists at the Meat Animal Research Center (Jenkins and Ferrell, 1994) have also evaluated the

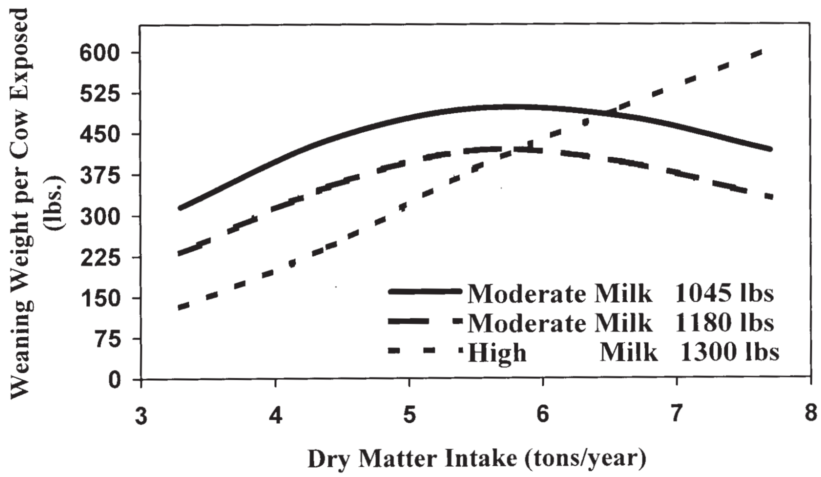

Figure 1. **Production efficiency expressed as the weaning weight per exposed cow across varying levels of dry matter intake for the three genetic types of cattle with differing levels of milk production and mature size (adapted from Jenkins and Ferrell [1994]).**

Table 2. Priority of Energy Use By the Cow

1. Basal metabolism
2. Grazing and other physical activities
3. Growth
4. Supporting basic energy reserves
5. Maintaining an existing pregnancy
6. Milk production
7. Adding to energy reserves
8. Estrous cycling and initiating pregnancy
9. Storing excess energy

Source: Short et al., 1990

combined effects of body size, genetic differences in milking ability, and reproductive performance (Figure 1). Their research clearly demonstrates that at restricted levels of energy intake, smaller cows with lower levels of milk production are more efficient than larger, higher-milking cows. However, the advantage in production efficiency of the smaller, lower-milking cows diminishes as energy intake increases. On the other hand, at the highest energy level provided in this study, the larger, higher-milking cows were able to reach their genetic potential and were more efficient at converting forage to beef.

In the Southwest, the expected level of forage intake for cows weighing 1,000 and 1,300 pounds would be approximately equivalent to 3.5 and 4.5 tons/year, respectively, in Figure 1. At the lowest level of energy intake in Figure 1, the smallest and more moderate-milking cows were more than twice as efficient in converting feed into pounds of weaned calf.

Conclusions

For beef producers, efficient beef production is essential to maintain long-term profitability. Increasing production efficiency of beef cattle in the Southwest's energy-restricted environments by moderating cow size to less than 1,100 pounds and keeping milk production relatively low should aid in lowering the cow herd's energy demands and help minimize the time between calving and rebreeding. This more efficient use of energy inputs should result in increased profitability. Within the confines of sound range management practices and animal husbandry, genetic selection for increased production efficiency of the cow herd and the development of concrete production goals can help improve long-term ranch sustainability.

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