ADDRESSING COWHERD EFFICIENCY IN A WORLD OF MIXED MESSAGES FOR PRODUCERS: MATCHING PRODUCTION LEVELS TO ENVIRONMENTAL CONDITIONS

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Introduction

Weaned calf prices have set all-time records in recent years. However, escalating land, fertilizer, feed, fuel and labor costs have more than offset increased income for many commercial cow/calf operations (Figure 1, Bevers 2012). Consequently, profit-motivated commercial operations must become more cost-efficient to maintain or improve profit margins. From another perspective, recent appreciation in weaned calf prices provides tremendous financial opportunity for commercial cow/calf enterprises that can minimize and control their cost of production without sacrificing reproductive efficiency.

Grazed forage remains the least expensive source of nutrients to maintain a beef cow herd (Doye and Sahs, 2013). Therefore, a long-term stated goal of ranchers and academicians has been to match cow size and milk production potential to forage resources in order to optimize forage utilization and reproductive efficiency. This statement is logical enough although may not sufficiently emphasize the importance of the possible interaction between the genetic production potential of the cows and stocking rate along with other management factors. Grazing management, forage quality, and stocking rate likely have as much or more impact on this interaction than does the genetic makeup of the cows.

For example, a set of cows with nutrient requirements lower than that supplied annually by a grazed forage system would ostensibly maximize reproductive performance due to excessive nutrient intake (over conditioned cows), but would waste forage resources and potentially produce lower weaning weights (less saleable product). This outcome assumes that stocking rate is set at some point lower than carrying capacity of the forage system given typical environmental conditions. Minimal adjustment in stocking rate would be required during years of drought or other forage production hazards resulting in minimal enterprise risk during those times. Overall ranch productivity could be increased by increasing the stocking rate with more of the same type of cows. However, the enterprise would effectively be more sensitive to risk associated with intemperate environmental conditions.

A cow herd with nutrient requirements above that supplied annually by a grazed forage system would become thin resulting in low fertility and potentially, disappointing calf weaning weights. This situation could lead to overgrazed pasture or rangeland potentially causing permanent damage to the forage resource unless stocking rate is adjusted accordingly. Depending on the degree of mismatch, a reduction in stocking rate may or may not allow the cows to select a diet higher enough in quality to overcome their nutrient deficiencies. If not, a common adjustment is to modify the production environment with purchased or harvested feed in hopes of avoiding depressed reproductive performance and perhaps to boost weaning weights.

Accomplishing equilibrium in this matching process requires consideration of not only genetic production potential and forage resources, but also timing of calving, marketing end point, and numerous other management factors. Because many of the factors involved in this balancing act cannot be measured directly, matching cows and management to forage resources is not a simple task. In this paper, we will consider fundamental animal, forage and management factors along with industry trends that are driving equilibrium or perhaps amplifying imbalance of forage nutrient supply and beef cow requirements.

Industry Trends

Selection for increased weaning and yearling growth has been steady since 1990 according to most breeds' genetic trend data. Similarly, milk EPD in some breeds has consistently increased while other breeds' genetic trend is negative or static. Most breeds with a negative or static genetic trend had a relatively high capacity for milk yield when they entered the U.S. beef industry.

Selection for increased growth through weaning and increased milk should lead to increased weaning weights in commercial operations unless genetic expression for milk and growth is limited by the environment. Interestingly, there is no evidence of sustained increases in weaning weights in commercial cow/calf operations according to Standardized Performance Analysis (SPA) data from New Mexico, Texas and Oklahoma (Figure 2; Bevers, 2012). Benchmarking data from the North Dakota Cow Herd Appraisal Performance Software (CHAPS: Dr. Kris Ringwall, personal communication) program indicates a steady increase in weaning weights from 1996 through 2006 followed by stable weaning weights since 2006 (Figure 3). Is it possible that genetic potential in cattle has surpassed the capacity of forage to provide increased nutrients that must accompany increased production? Although the cause is not immediately clear, we submit that the number of cases where this phenomenon is occurring may be GROWING in commercial cow/calf operations.

When environment and available forage resources are not considered in making selection decisions, the potential exists for dramatic effects on reproductive performance. While reproductive efficiency in the CHAPS benchmarking data shows weaning rates above 90%, which would be considered excellent, there is no indication of sustained improvement in that trait (Figure 4). Similarly, the Southwest SPA data suggests no improvement in weaning rates since the benchmarking program was initiated in the early 1990's (Figure 5). However, comparing these data does emphasize a glaring difference in reproductive efficiency among the two regions. There is an obvious challenge and great opportunity for the development of technology, beef cattle genetics, or production systems to improve reproductive capacity of beef cattle in the South.

Maternal Effects on Weaning Weight (Milk)

Increased milk production requires increased nutrient intake (NRC 1996). We executed a simple calculation considering the efficiency of conversion of additional milk production to additional calf weight gain (Clutter and Nielsen, 1987; Fox et al., 1988; Mallinckrodt, 1993), the energy required to produce a pound of milk (NRC, 1996), and estimated cost per mega calorie of net energy for maintenance (Northcutt, 2013). Average cost per additional pound of calf weight gain from additional milk averaged $1.13. The value of additional weight in U.S. medium and large framed #1 feeder cattle at Oklahoma National Stockyards on Monday, May 22, 2013 averaged $0.85. Obviously, there are many factors that will have dramatic impacts on this cost of added gain calculation; however, this simple calculation shows that there may be a limit to the amount of money that should be invested into generating calf weight through additional pounds of milk production.

One of the most influential factors driving cost of added weaning weight is grazing and feed cost at a given ranch and point in time. The other is conversion of added milk to added calf gain. Regarding the latter point, efficiency of conversion of added milk to added calf gain is improved (around 20:1) with lower yielding cows and considerably exacerbated (around 40:1) with higher yielding cows (Clutter and Nielsen, 1987; Fox et al., 1988; Mallinckrodt, 1993). Declining efficiency of milk utilization with increased genetic potential for milk production given a limited nutritional environment appears to be relatively clear in the literature.

Another important factor that is only occasionally acknowledged is the positive relationship between increased genetic capacity for milk production and year-long maintenance requirements in beef cows (Ferrell and Jenkins, 1984; Montano-Bermudez et al., 1990). Increased maintenance requirements have direct implications for overall feed costs and stocking rate. Higher nutrient requirements associated with increased genetic potential for milk production can be linked to increased size of visceral organ mass (heart, liver, kidney, rumen, small and large intestine) relative to live weight (Ferrell and Jenkins, 1988). Evans et al. (2005) developed an EPD for maintenance energy requirements using these relationships for milk production potential and mature body weight.

Little advancement has been made in terms of improving native rangeland or introduced forage characteristics from a nutritional perspective. Therefore, it is logical that continued selection for increased milk within breeds, whether these breeds are used in a straight or crossbreeding program with other high-milk breeds, may lead to excessive milk that could result in the expression of this trait being limited by the forage system and not by the genetic capacity of the cattle (Figure 6: Brown et al., 2005, Brown and Lalman, 2010). We submit that in many cases in recent years, the environment has been artificially modified to match or surpass the genetic potential of the cattle, rather than discontinuing selection for milk yield in an effort to minimize input costs. Broadly stated, "artificial" modifications to the environment tend to be expensive modifications. Given the dramatic acceleration in input costs seen in recent years, it would seem that downward pressure on milk yield would better fit many cow herds to their respective forage resources from a moderate to low input commercial cow/calf operation's perspective.

Growth

A similar link could be made with continued selection for growth. The positive relationship between growth and mature weight has long been recognized and debated relative to the potential impact on the commercial cow/calf enterprise. However, perhaps a less debated potential impact is the positive genetic and phenotypic correlation between post weaning growth and feed intake (Arthur et al., 2001). Increased feed intake and gut capacity are related to increased visceral organ mass relative to live body weight (Wang, 2009). Digestive tract tissue and the liver use about 40 to 50% of total energy expenditure in the beef cow, even though these tissues make up less than 10% of the animal's body mass (Ferrell, 1988). Consequently, variation in mass of these organs is likely related to variation in energy expenditures. Continued selection for growth and "capacity" may be a contributing factor to the high cost of keeping a beef cow in today's expensive production environment. Moreover, from a commercial cow/calf perspective (low input production system), continued selection for cattle with extreme appetite and a larger digestive tract may expose an enterprise depending primarily on grazed forage to more risk. For example, could these cattle be negatively affected to a greater extent during times of intensified environmental restriction such as drought? It would seem that continued development of residual feed intake technology and selection tools may serve the commercial cow/calf sector well in this regard. Moreover, a planned crossbreeding program utilizing breed complementarity and heterosis would appear to represent "low hanging fruit" from the perspective of developing beef cow herds with moderate to low maintenance requirements, high fertility and finished beef carcasses with optimal retail product yield.

Conclusions

Perhaps the dramatically higher input costs and competition for grazing land has effectively narrowed the range of cow type that "fits" production environments in the U.S. From a low to moderate input commercial cow/calf operation perspective, failure to effectively utilize planned mating systems to maintain moderation in the cowherd while producing desirable calves for sale within the beef value chain may be leading us to a cow herd that is more expensive to maintain, while actual production within the commercial sector may not be improving. The lack of improvement in reproductive efficiency in the South is of particular concern. Emphasizing moderation in growth, mature size, and milk for replacement females, combined with a modification in ranch stocking rate would seem to better fit more cattle to existing forage resources given current industry trends. Commercial cow/calf producers are encouraged to emphasize new selection tools designed to minimize maintenance requirements of cows while maintaining or improving reproductive efficiency. Additionally, use of mating systems designed to maximize cowherd efficiency while maintaining high consumer acceptability in beef should aid producers in managing risk and increasing profitability.

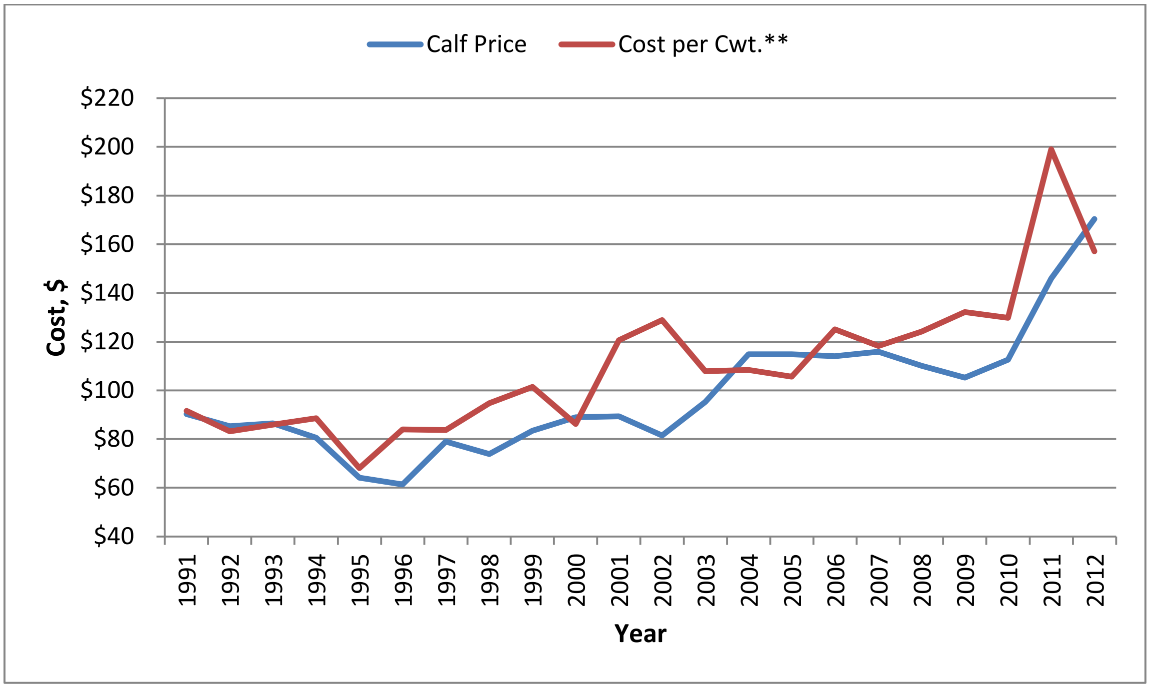

Figure 1. Calf price versus cost per unit of production in New Mexico, Oklahoma and Texas commercial cow/calf operations (Bevers, 2012).

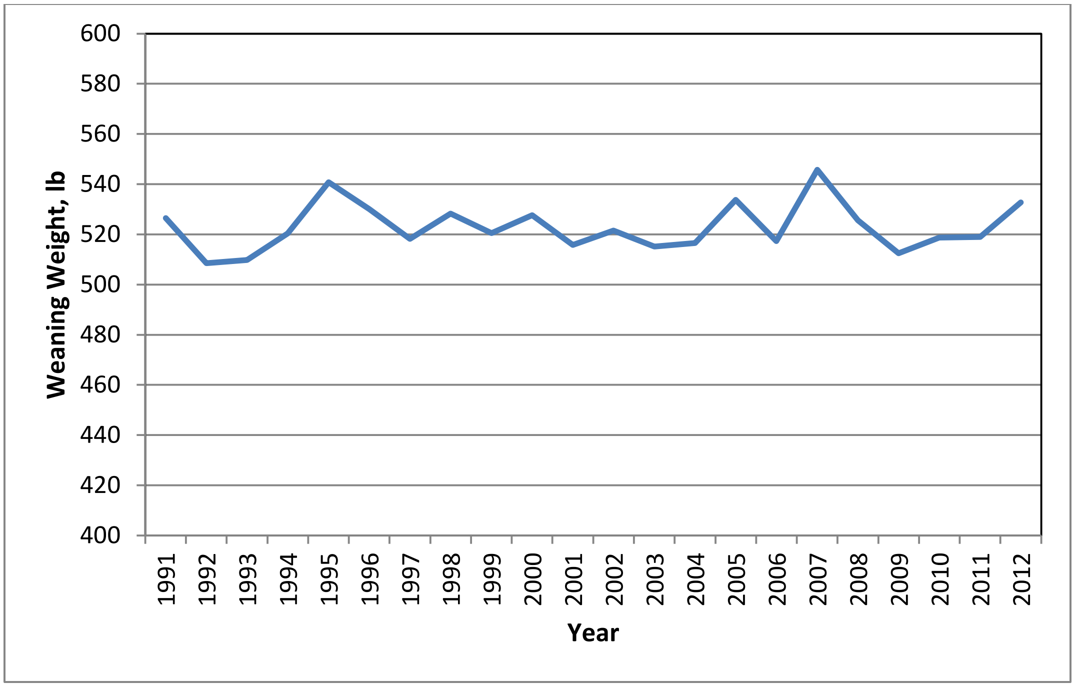

Figure 2. Average weaning weights in New Mexico, Oklahoma and Texas commercial cow/calf operations (Bevers, 2012).

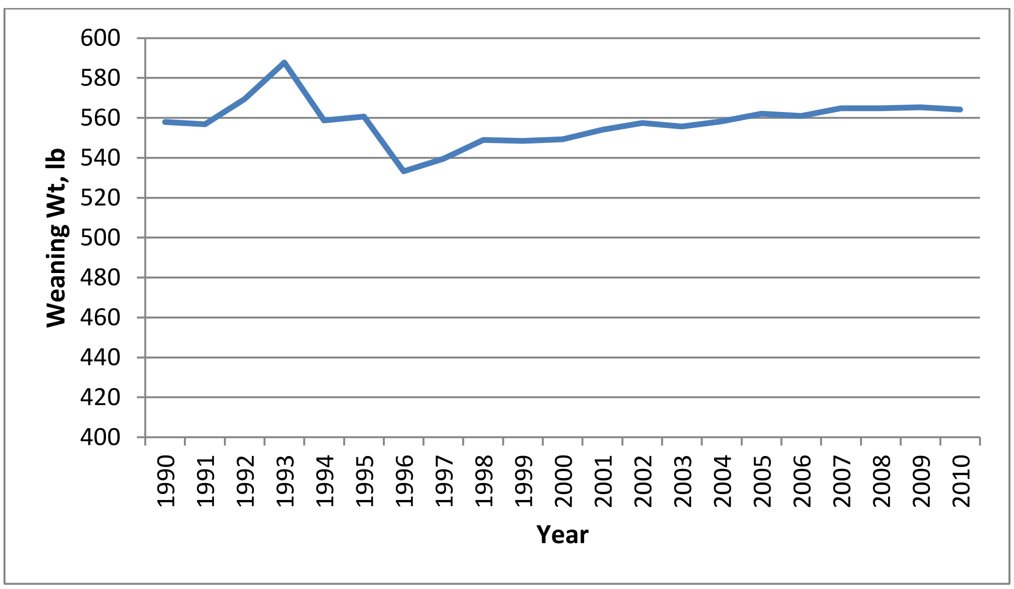

Figure 3. Average weaning weights in North Dakota commercial cow/calf operations (Cow Herd Appraisal Performance Survey (CHAPS), Dr. K. Ringwall, 2013).

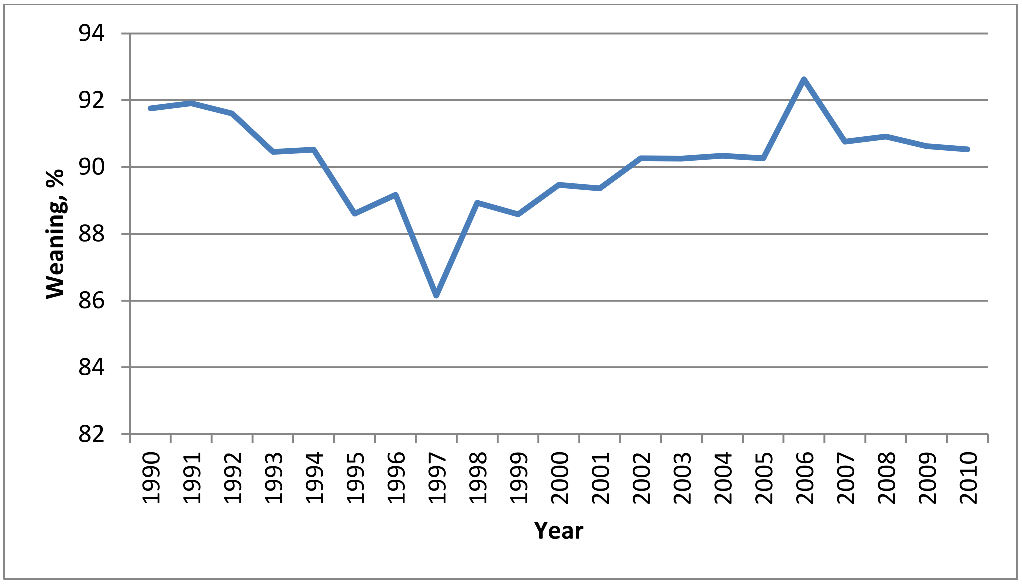

Figure 4. Average weaning percent in North Dakota commercial cow/calf operations (Cow Herd Appraisal Performance Survey (CHAPS), Dr. K. Ringwall, 2013).

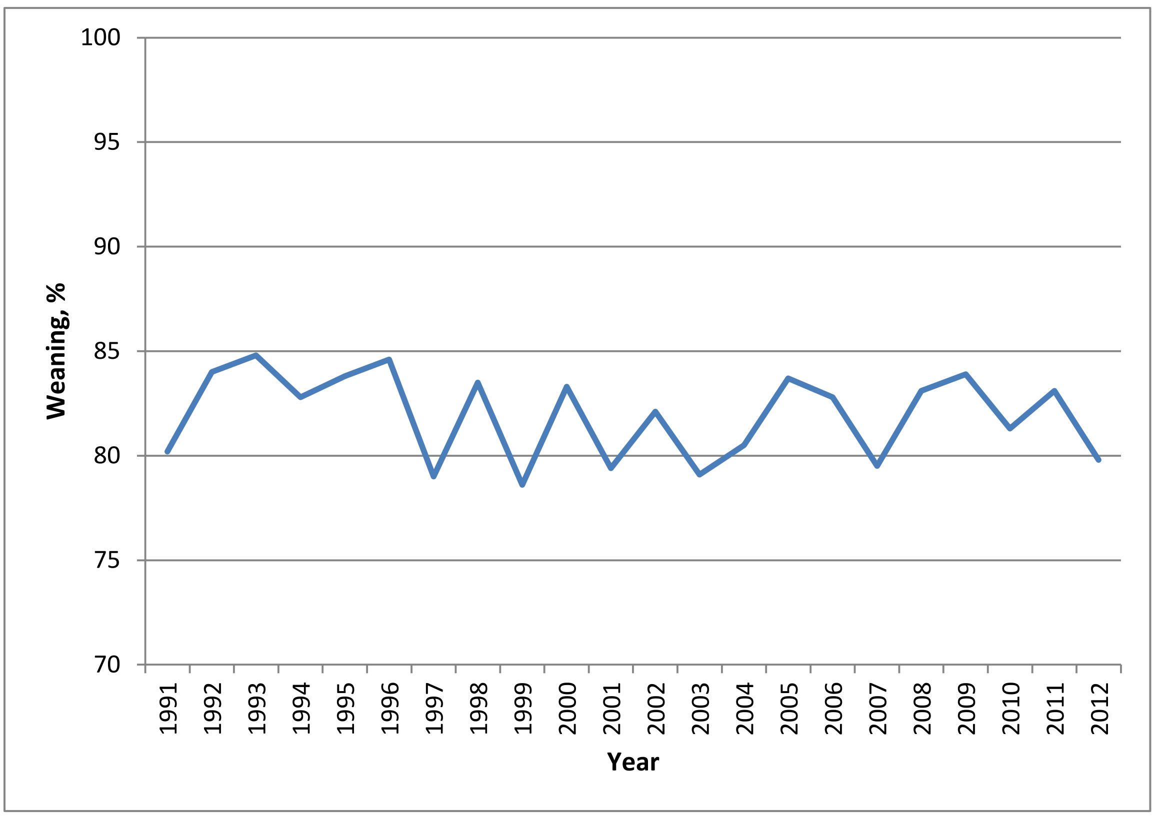

Figure 5. Average weaning percent in New Mexico, Oklahoma and Texas commercial cow/calf operations (Bevers, 2012).

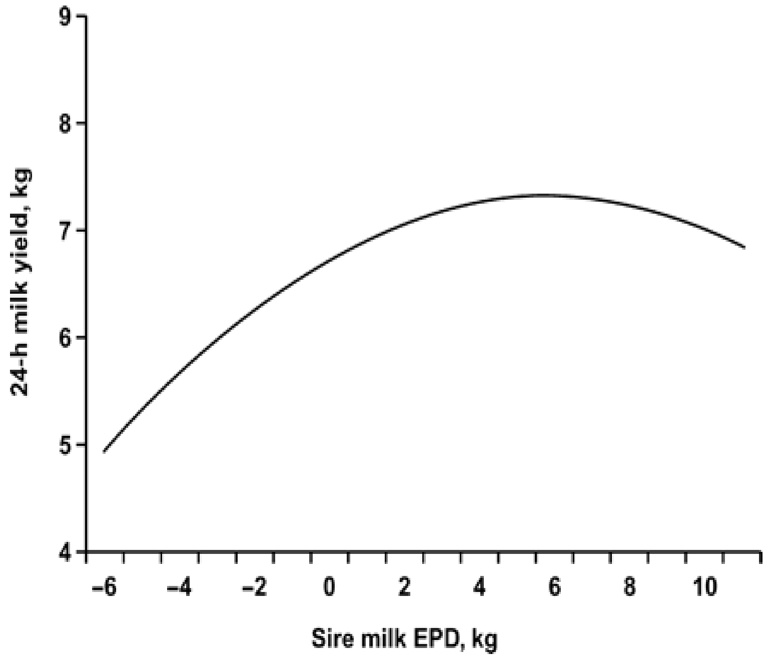

Figure 6. The relationship of sire milk EPD and 24-h milk yield in Brangus cows grazing tall grass prairie in Oklahoma (Brown et al., 2005).

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