2007

Southwest Beef Symposium

January 16-17, 2007
Amarillo, Texas

NM STATE Cooperative Extension Service

Texas Cooperative EXTENSION
The Texas A&M University System

The organizing committee from the New Mexico State University and Texas A&M Cooperative Extension Service would like to thank the 2007 Southwest Beef Symposium sponsors for their support of this producer-focused educational event.

Dinner

Premium Beef Network

ABS Global

Lunch

Texas Beef Council

Texas Cattle Feeders Association

Texas Southwest Cattle Raisers Association

Sessions/Breaks

New Mexico Beef Council

New Mexico Cattle Growers' Association

Panda Ethanol

TABLE OF CONTENTS

The Beef Enterprise: Aligning the Vision

Barry H. Dunn, Ph. D.
Executive Director
King Ranch Institute for Ranch Management
Kingsville, TX

Introduction

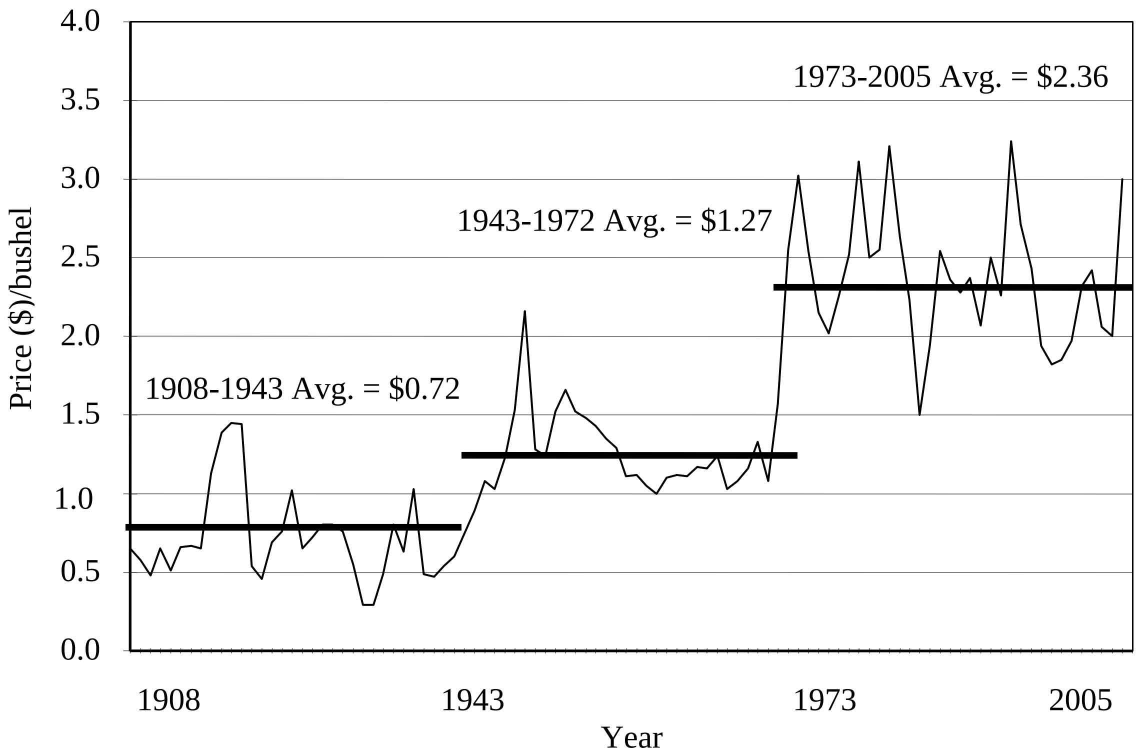
"It's not the strongest of the species that survives.
It's not the most intelligent. It's the one most responsive to change."
Charles Darwin

As the 21st Century emerges, questions abound concerning the beef enterprise. It appears that a relatively stable period in beef production has come to a screeching halt. Fed cattle prices in 2003 reached levels that were to most people involved in the industry, unimaginable. A near record corn crop in 2006 made a price rally during harvest to levels previously seen only in short crop years, but never during harvest. The twentieth century ended with consumer demand for beef reversing a twenty year decline. This added excitement and energy to an industry redefining itself with marketing and production alliances developed to increase the transparency of the marketplace. Recent increases in crude oil prices have driven transportation costs up and widened the basis for all classes of cattle. The emerging ethanol industry is redefining the price and availability of the feedstuffs that had become the backbone of the current beef production system. The effect of feeding cattle the co-products of this new giant is under debate as concerns arise over the changing profile of the carcass characteristics of fed cattle. The impact of these mega-trends at the industry level is debatable. The impact on these mega-trends on the individual business represented by thousands of various types of farms, ranches, and feedlots is unimaginable. However, in spite of uncertainty, volatility and change brings with them opportunity. The challenge for all participants in the beef industry is to have or to create a vision that successfully copes with the dynamic nature of the 21st Century beef enterprise.

A Time for New Assumptions

Conventional wisdom assumes that everything in the future is inherently uncertain and that everything in the past is a good predictor of the future. While they are comforting, these two assumptions are not always true. Trend analysis, although extremely useful, should only be applied when basic assumptions concerning key relationships can be made with relative certainty. The price of corn over the last nearly 100 years had three relatively stable price plateaus (Figure 1). The first was from 1908 to 1942. The average nominal price for corn during this period was $0.72. The nominal price of corn from 1943-1972 was $1.27. During the 33 year period from 1973 to 2005 the price of corn averaged $2.36. While drought, policy, and global events like war created short term price variance during these respective periods, the price of corn was relatively stable and predictable. One of the main reasons the industrialized animal food industry evolved during the last half of the twentieth century was the relative price stability in its key ingredient, corn. But when basic relationships change, as they have recently in the corn market with the exploding demand in the industrial usage for corn, trends change. The result is that the past may no longer be a good predictor of the future.

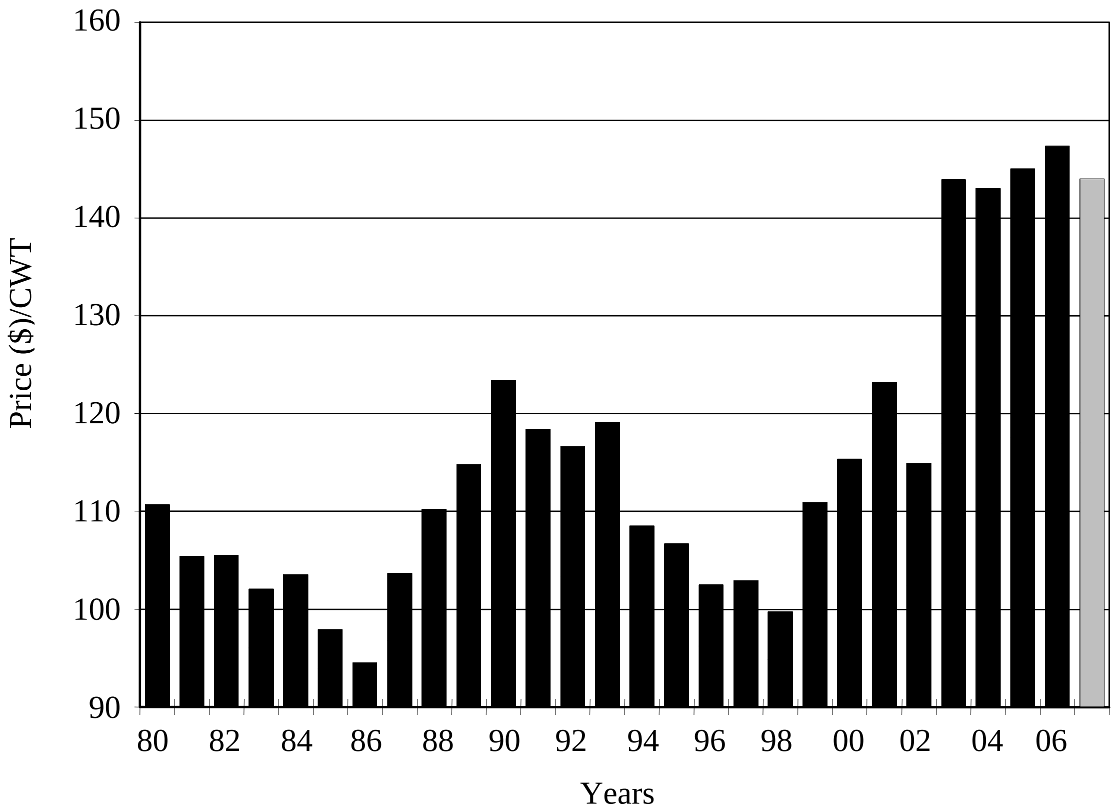
Figure 1. U.S. average annual corn price. USDA- NASS, 2006



One of the difficult challenges the cattle industry faces is that multiple and critical price relationships have changed and are in the process of re-establishing themselves, all within a relatively short period of time. These would include: consumer demand, fed cattle prices, transportation costs based on crude oil prices, interest rates, and feed grains. Is the future inherently uncertain? Or, are their certain scenarios that are predictable enough to provide insight into the future?

Consumer Demand for Beef: While the cattle industry continues to concern itself with variations in weather and perhaps climate change, variations and change in consumer demand are at least as dramatic. In the last 15 years the annual carcass cutout price for beef has averaged approximately $116.00, but has ranged from approximately $95/cwt in 1998 to approximately $142.50 in 2006 (Figure 2). Another way to think of it is that in 8 short years, the average carcass cutout value has increased by approximately 50%. When put in context of increasing supplies, disease concerns, and issues of access to foreign markets, this bullish demand is even more remarkable. Will it continue? All other things being equal, and if industry participants remain consumer focused, the summation of many experts is yes, it will probably continue. Will there be changes? Yes, there will be changes in consumer demand. For example, "natural" beef is not well defined, but is no longer a fad. It is becoming an expectation of a large and growing segment of consumers. Industry participants continue to debate its merit in terms of human health and associated increased costs of production. At the same time, consumers in South Texas grocery stores willingly and regularly pay 25% more for an eye of the round roast if it has a poorly defined label containing the word "natural." According to Rick Husted, Chief Operating Officer for NCBA, consumer expectations for convenience will continue to increase (Husted, 2006). Husted also cautions that price compared to alternative proteins continues to be a concern for consumers when considering a beef purchase.

Figure 2. Annual average carcass cutout value. USDA-NASS, 2006



Prices of Fed Cattle: In their "Outlook and Strategies, 2007," CATTLEFAX estimates that in 2007, fed cattle will average $84.00/cwt plus or minus $10.00/cwt (CATTLEFAX, 2007). While consumer demand is a complex relationship between supply and price of beef, supplies and price of competing meats, exports, to some degree imports, eating and buying trends, and general costs of living, most of these issues are favorable to beef and look to remain so. Employment levels are very high, purchasing power is good, cost of living is stable, export markets are growing again, and the middle class around the world, especially in China, is growing. While the housing market in the United States is lower, this is a two sided coin, as it allows for easier access to first time home buyers and lower levels of investment for all buyers, and has helped to soften pressure on interest rates. Intense competition at the retail level led by Walmart, but spilling over to the auto sector, is also good for the consumer. Is it the best of times or the worst of times? For most Americans, these are very good times.

Costs of Transportation: Fifteen years ago, Brian Jorgensen of Ideal South Dakota, son of Martin Jorgenson, predicated that in the future, "agriculture in America would flourish along corridors of water and transportation" (Brain Jorgenson, 1991, Jorgensen Ranch, Ideal, South Dakota, Personal Communication). How wise were his words? While crude oil prices in 2006 did not reach the equivalent adjusted prices of the early 1980s, they certainly tested the high side of demand. Exploration has been invigorated in both oil and gas but also alternatives. This is another commodity that has probably settled into a new trading range plateau of $55.00-$65.00 per barrel, but could again test $80.00 per barrel given certain political or weather related events. Is $100.00/per barrel oil likely? No, but it is certainly possible.

As a result, the trading basis for cattle that are distant to their markets will be under continuing pressure to widen. Shifts in actual production of classes of cattle that suffer a wide negative basis due to transportation costs will also occur. In 1970, 17% of the fed cattle in the United States were in Iowa compared to 7% in 2006 (National Agricultural Statistics Service, 2006). This dramatic change occurred because of regional advantages in the costs of production and the following realignment of other production sectors. Realignment of the core production of beef has been and will always be driven by economics, not sentimentality. Cow-calf production on both coasts and the intermountain west will be at a disadvantage. The maintenance and improvement of rural roads and interstates highways will be critical to cattlemen from remote areas.

Interest Rates: Following 26 consecutive monthly upward adjustments in interest rates by the Federal Reserve, Federal Reserve average funds rates have been unchanged for the last 6 months (Federal Reserve, 2006). While the cost of borrowed money for operations of a beef enterprise or business has risen over the last two years, interest rates remain relatively stable and are expected to do so.

Feed Grains: A poignant pictorial analogy for the dramatic entrance of the ethanol industry into the Unites States grain market might be of a freight train barreling down the tracks at full speed. As the train approaches, a crew is furiously building track a few feet in front of the locomotive. What is also of concern to the cattle industry in this mental picture is the crew in back of the train furiously pulling up the track as soon as the train passes. The point of the story is that ethanol is entering the grain market at a furious pace and the impact of that entry on many segments of agriculture and the economy are not at all clear. One thing to keep in mind is that the short-term and long-term affects could be dramatically different.

What is known?

- The ethanol industry's demand for feed grain will grow almost exponentially over the next 5 years, increasing from less than 5% of supplies a few short years ago to perhaps 75-80% in 2009 if the United States produces an 11-12 billion bushel crop. Corn industry production goals are 15 billion bushels by 2015. The achievement of the goals would require almost a perfect alignment of weather variables, land availability, increases in yield potential, the availability of other limiting inputs like fertilizer, water, and a substantial investment in new and improved infrastructure.
- Acreages planted for corn production will increase dramatically as the marketplace re-prices relationships with other grains and conservation. The market prices of soybeans and wheat and the rental rates for conservation acres can be expected to rise in response.
- Corn yield per acre will continue to rise from the 2006 record levels of just over 150 bushels per acre. Increases in yield will be coupled with increases in demand for fertilizer and other inputs.
- Building new and improving existing infrastructure in terms of grain storage, transportation, and handling, but also in areas like planting, harvesting and irrigation will be necessary to meet the demands of increasing supply and changing demand.
- Co-products will be widely available for the short-term but will change in content as the ethanol industry removes the oil for bio-diesel and ultimately also digests the cellulosic fractions of the distiller's grain byproducts for ethanol.
- Ethanol from cellulosic digestion and distillation will also dramatically alter pasture and forage price and availability.
- Demand for corn from the food animal industry will not go away. The swine and poultry industry will be impacted differently than the cattle industry. To be competitive, feeding periods will be shortened and pasture use extended.
- The $0.51/gallon tax credit for ethanol equates to $1.275/bushel of corn. The politics behind the subsidy are powerful and include agricultural as well as environmental organizations.

The cumulative impact of these scenarios on the price of corn is unknown. CATTLEFAX is suggesting $3.50 per bushel in 2007 with the possibility of wide variations (CATTLEFAX, 2006). Over the next few years, is $4.00, $5.00 or even $7.00 per bushel corn out of the question? They are certainly not (Smith, 2006). The old stand by rule is that a 1% increase in the demand for or the supply of a commodity results in a 5- 8% increase in price. If that holds true, the price of feed grains could be higher than most anticipate.

Connecting the Dots

"When one tugs at a single thing in nature, he finds it attached to the rest of the world."
John Muir

Ultimately, the changes in consumer demand, fed cattle prices, transportation costs, interest rates, and feed grains will collectively determine the retail price of beef. The new price equilibrium achieved amongst and between these variables is difficult if not impossible to predict. It will ultimately impact the inventory of cattle and the profitability of all segments of the industry. It is important to acknowledge that the impact of these changes, especially the ethanol industry, is not benign. At a macroeconomic or industry level, changes can appear cold and indifferent but ultimately efficient. However, while carbon budgets and energy independence have been discussed and debated concerning ethanol production, few speak to possible long-term impacts on soil erosion, food prices, water quality, the acceleration of the increase in large scale highly efficient grain farms, or the ethics of using food for fuel. At the firm or microeconomic level, people and their businesses related to beef production will be permanently impacted. All that is left is the discovery of how.

Aligning the Vision

"Why if people didn't try something new, there'd be hardly no progress at all!"
Cat Ballou, 1965

For ranchers and cattlemen to successfully maneuver the changing landscape of agriculture in America in the 21st century, it will take creativity, hard work, and gumption. Creating an aligned vision for a segmented industry will too. With that said, and considering the scenarios mentioned above, a cohesive aligned vision for the beef enterprise could be:

"…a consumer focused beef production chain whose goal is to produce tender, flavorful, safe, nutritious beef of known origin that is affordable to the consumer and profitable for all segments of the beef industry. During the production phases, time on grass and forages will be optimized, and time fed grain concentrates will be limited to that necessary to meet consumer expectations of flavor. Cost control will be a key leverage point for producers in obtaining reasonable profits."

References Cited

CATLEFAX. 2006. Outlook and Strategies 2007. CATTLEFAX, Englewood, CO.
Federal Reserve. 2006. *http://www.federalreserve.gov.release/h15/data/Monthly*
Husted, R. 2006. CATTLEFAX Outlook and Strategies Seminar for 2007 and Beyond, Denver, CO.
National Agricultural Statistics Service. 2006. *http://www.nass.usda.gov/*
Smith, R. 2006. Corn price history being made. pp 22. In: Feedstuffs 78:51.

Cow Type and the Southwestern Environment

Clay P. Mathis
Extension Livestock Specialist
New Mexico State University
Las Cruces, NM

Introduction

The variation in environmental conditions across the United States are such that the type of cow that is most profitable in one region may be quite different than best cow type in a different region. When attempting to identify the type of cows that will ultimately generate the most net income in a specific environment, there are trade-offs that must be balanced. Specifically, there must be a balance between weaned calf value and the cost of producing the calf. Since it is not possible to control the climate of a region, it is important to identify the type of cows that will most efficiently turn forage into weaned calves in that region. Once the most efficient cow type is identified, then producers must identify the most valuable calf type that can be produced by the efficient cows. In other words, producers are encouraged to match the cow to the environment and select bulls to produce the most valuable calves possible when mated to those cows.

Regardless of the environment, the best cows are typically highly fertile, low input females that remain in the breeding herd for a long time, and produce a market-desirable type of calf. In the Southwest, pasture forage is generally one of the largest fixed costs in a commercial beef operation, and forage production from year to year can be highly variable. Therefore, the efficiency at which the cow herd can convert forage into weaned calf weight is critically important. Several factors can affect cow herd efficiency. Some of the primary considerations include cow size, milking ability, and reproductive performance. The purpose of this manuscript is to address the relationship between these factors and in the Southwest environment, and help guide producers in identifying the best cow type for their ranch.

Reproductive Performance

Reproductive performance is the most influential factor determining profitability of the cow-calf operation. Standardized Performance Analysis data from more than 60 New Mexico cow herds indicates that a 1 percentage unit change in weaning rate yields about $5/ cow exposed change in net return. 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 return from earlier calving cows. Additionally, cows that maintain a shorter postpartum interval are more efficient throughout their lifetime (Davis et al. 1983b).

Crossbreeding

Capitalizing on hybrid vigor is one of the most practical ways to positively impact reproductive performance and longevity of the cow herd. Hybrid vigor (heterosis) is the increase in performance for a particular trait above the average of the sire and the dam for that trait; or the advantage of crossbreds over that of straightbreds. In fact, crossbreeding and hybrid vigor effects are most pronounced among reproductive traits. Figure 1 illustrates the cumulative effects of hybrid vigor on the pounds of calf weaned per cow exposed to a bull utilizing Hereford, Angus, Shorthorn, and their crosses (Cundiff et al., 1974). The performance of crossbred calves raised by straightbred cows yielded an 8.5 percent increase over straightbred calves from straightbred cows. When the resulting crossbred females were bred to straightbred sires to produce crossbred calves, there was an additional 14.6 percentage unit increase in pounds of calf weaned per cow exposed to a bull. The improvements demonstrated in this study were attributed to the combined improvement in reproductive performance, longevity, and maternal ability of the cows. Other research conducted in Nebraska evaluated the impact of crossbreeding Hereford and Angus cattle on longevity of cows (Nunez-Dominguez et al., 1991). Figure 2 shows that crossbred cows from the same genetic pool remained in the breeding herd for about two years longer than straightbreds. Improvement in longevity of the cow herd can reduce the replacement rate needed to maintain cow numbers at the desired level. Reducing replacement rate essentially reduces costs of production for the entire cow herd. For example, reducing replacement rate from 13 percent to 11 percent would yield a $5 to $10 per head improvement in net income for the cow herd because more producing cows could utilize the forage previously consumed by the higher number of developing replacements. In a commercial beef operation, crossbreeding is recommended.

Cow Size

The ideal cow herd will efficiently produce calves that will ultimately be harvested at an acceptable carcass weight when appropriately finished. Usually discounts on carcass weight are avoided when carcasses are between 600 and 900 lbs, with the most severe discounts applied to carcasses above 1000 pounds. Therefore, relationships between mature cow size and carcass weight can be used to establish an ideal cow weight range for acceptable carcass size of progeny. Research findings from over 37,000 cows in the Germplasm Evaluation Program conducted at the Meat Animal Research Center indicates that for every 100 pound change in cow weight there is a 63 pound change in progeny carcass weight. A rule of thumb is that mature cow weight is likely close to the finished weight of offspring. Using this relationship it can be calculated that a 1,450 pound cow is likely to produce a calf with a carcass weight above 900 pounds, and that a 1,000 pound cow might produce a calf with a carcass weight near or below 600 pounds. Obviously, the sire will also have an impact on the genetics and performance of progeny. But nonetheless, it is safe to say that the ideal cow size for the United States cattle industry is somewhere between 1,000 and 1,450 pounds.

With regard to the efficiency of converting forage to weaned calf, it is important to note that energy intake comprises a large portion of the input into the cow herd. In fact, maintenance energy (the amount of energy required to maintain body weight) can represent 70 to 75 percent of the total energy consumed annually by a 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), but larger cows require more energy than smaller cows. However, researchers from Wisconsin (Davis et al. 1983b) have shown that smaller cows can wean more pounds of calf per pound of feed consumed than can larger cows. In reality, smaller cows are more likely to be bred to bulls with greater relative genetic growth potential than the cows (i.e., a 1,100-pound mature British cow bred to a continental bull). The result of mating a larger terminal bull to a 1,100 pound cow compared to mating a dual purpose sire to a 1,200 pound cow of similar milk production to the 1,100-pound cow may be that both cows rear a 550-pound calf at the same age. In this comparison, the smaller cow calf pair is a more efficient unit.

So a larger cow can produce a larger calf, but it may require more forage per pound of calf that she weans. 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 greater feed requirement by weaning larger calves. In the Southwest where range forage supply often is limited, larger cows can be less efficient than smaller cows, and cows with mature body weight in the range of 1,000 to 1,250 pounds are generally recommended.

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. This is attributed, 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 levels of milk production during gestation and lactation. Requirements were calculated per unit of body weight, with Hereford X 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 with 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 1100 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 western 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.

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 (lbs.)	1100	1100	
Milking Potential	Low	High	
Total lbs. of TDN / cow / yr.	3726	4159	433
Total lbs. of forage / cow / yr.	6774	7561	787

[a]Requirements based on Montano-Bermudez and Nielsen, 1990

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, and their 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-milking cows (Clutter and Nielsen 1987), but the higher weaning weight may not be economical because of the efficiency loss and increased cost. Table 2 shows that calves from higher milking cows produced 1,236 more pounds of milk during lactation and their calves weighed 37 pounds more at weaning than calves of lower milking cows. Thus, it can be calculated that it took 33.4 pounds of milk per additional pound of weaning weight advantage to the high-milking dam's calves; which is not very efficient. 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). 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, so moderate and low milking females are recommended for extensive grazing production systems in the Southwest.

Table 2. Differences in milk production and calf weaning weight for high and low milking cows			
Milk Level	**Avg. Daily Milk, lb**	**Avg. Total 205-day Adj. Milk, lb**	**Weaning Weight**
High	18.4	3,787	-----
Low	12.4	2,551	-----
Difference	**6.0**	**1,236**	**37**
Clutter and Nielsen, 1987			

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

The previous discussion is an attempt to separate 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. The approximate order of the priority of energy utilization by cows is shown in table 3.

Table 3. 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
Short et al., 1990

From table 3 we see that 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. The priority of energy use explains why it is often observed to be easier to get a cow that is gaining weight pregnant than a cow that is losing weight.

Figure 3 demonstrates the combined effects of body size, genetic differences in milking ability, and reproductive performance. 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 high energy levels 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 1000 and 1300 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 as the largest, highest-milking cows in converting feed into pounds of weaned calf.

Summary

For commercial beef producers, efficient beef production is essential to maintain long-term profitability. Increasing production efficiency of beef cattle in the Southwest's often energy-restricted environments by moderating cow size to less than 1200 pounds and avoiding high milk producing cows should aid in lowering the cow herd's energy demands and help minimize the time between calving and rebreeding. Additionally, crossbreeding should be practiced to maintain hybrid vigor and longevity of the cow herd. Ultimately, increasing the efficiency of forage use 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 also help improve long-term ranch sustainability.

Literature Cited

Ansotegui, R.P. 1986. Chemical composition and rumen digesta kinetics of diets selected and influence of milk intake on forage intake by suckling calves grazing native range. Ph.D. Dissertation., New Mexico State Univ., Las Cruces.

Clutter, A.C. and M.K. Nielsen. 1987. Effect of level of beef cow milk production on pre- and post-weaning calf growth. J. Anim. Sci. 1313-1322.

Cundiff, L. V., K. E. Gregory, and R. M. Koch. 1974. Effects of heterosis on reproduction in Hereford, Angus, and Shorthorn cattle. J. Anim. Sci. 38:711-727.

Davis, M.E., J.J. Rutledge, L.V. Cundiff, and E.R. Hauser. 1983a. Life cycle efficiency of beef production: I. Cow efficiency ratios for progeny weaned. J. Anim. Sci. 57:832-851.

Davis, M.E., J.J. Rutledge, L.V. Cundiff, and E.R. Hauser. 1983b. Life cycle efficiency of beef production: II. Relationship of cow efficiency ratios to traits of the dam and progeny weaned. J. Anim. Sci. 57:852-866.

Ferrell, C.L. and T.G. Jenkins. 1984a. Energy utilization by mature, nonpregnant, nonlactating cows of different types. J. Anim. Sci. 58:234-243.

Ferrell, C.L. and T.G. Jenkins. 1984b. Relationships among various body components of mature cows. J. Anim. Sci. 58:222-233.

Ferrell, C.L. and T.G. Jenkins. 1985. Cow type and the nutritional environment: Nutritional aspects. J. Anim. Sci. 61:725-741.
Jenkins, T.G. and C.L. Ferrell.1994. Productivity through weaning of nine breeds of cattle under varying feed availabilities: I. Initial evaluation. J. Anim. Sci. 72:2787-2797.
Krysl, L.J., M.L. Galyean, J.D. Wallace, F.T. McCollum, M.B. Judkins, M.E. Branine, and J.S. Caton. 1987. Cattle nutrition on blue grama rangeland in New Mexico. New Mexico Agricultural Experiment Station Bull. #727, New Mexico State Univ., Las Cruces.
Marshall, D.M., W. Minqiang, and B.A. Freking. 1990. Relative calving date of first-calf heifers as related to production efficiency and subsequent reproductive performance. J. Anim. Sci. 68:1812-1817.
Montano-Bermudez, M. and M.K. Nielsen. 1990. Biological efficiency to weaning and to slaughter of crossbred beef cattle with different genetic potential for milk. J. Anim. Sci. 68:2297-2309.
Montano-Bermudez, M., M.K. Nielsen, and G.H. Deutscher. 1990. Energy requirements for maintenance of crossbred beef cattle with different genetic potential for milk. J. Anim. Sci. 68:2279-2288.
Nunez-Dominguez, R, L. V. Cundiff, G. E. Dickerson, K. E. Gregory, and R. M. Koch. 1991. Heterosis for survival and dentition in Hereford, Angus, Shorthorn, and crossbred cows. J. Anim. Sci. 69:1885-1898.
Short, R.E., and D.C. Adams. 1988. Nutritional and hormonal interrelationships in beef cattle reproduction. Can. J. Anim. Sci. 68:29-36.
Short, R.E., R.A. Bellows, R.B. Staigmiller, J.G. Berardinelli, and E. E. Custer. 1990. Physiological mechanisms controlling anestrus and infertility in postpartum beef cattle. J. Anim. Sci. 68:799-816.

Figure 1. Cumulative hybrid vigor effects on pounds of calf weaned per cow exposed to a bull

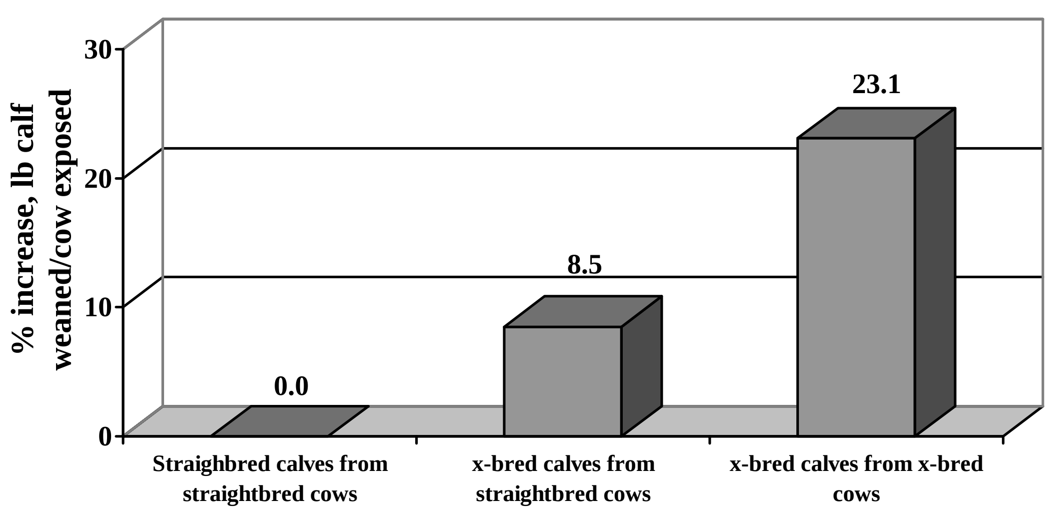


Figure 2. Longevity of straightbred Hereford, Angus, Hereford x Angus (HxA) and Angus x Hereford (AxH) Cows

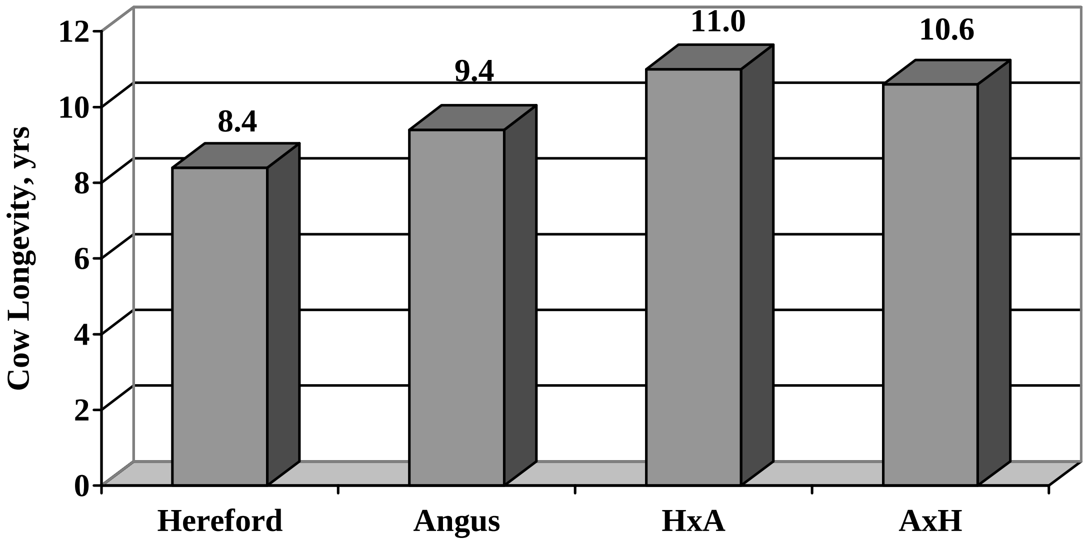
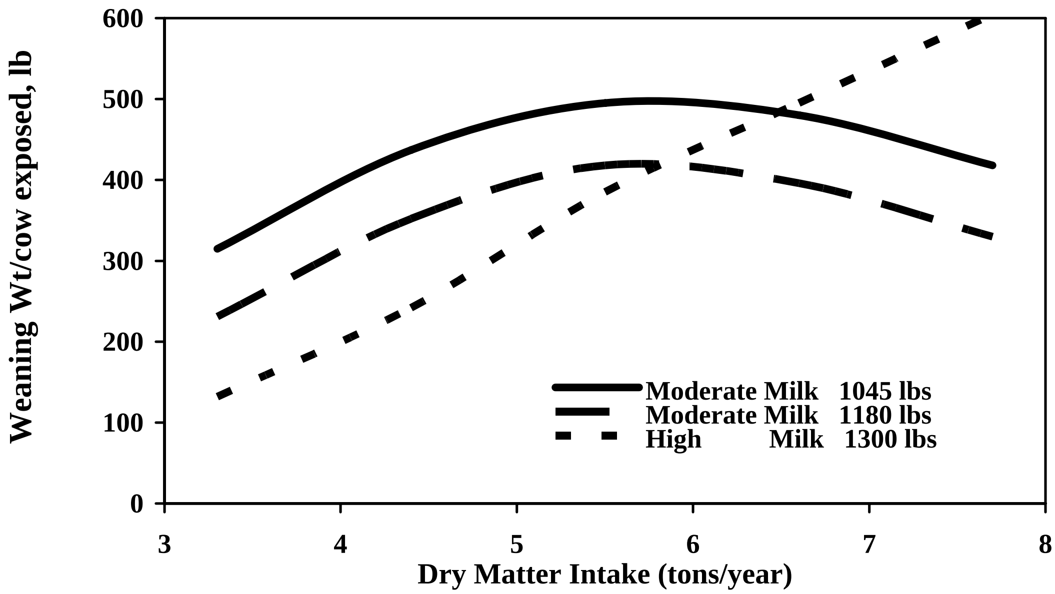


Figure 3. Weaning weight per cow exposed to a bull across varying levels of dry matter intake for three genetic types of cattle (adapted from Jenkins and Ferrell, 1994)



Cow Type and the Southwestern Environment
A Producer Perspective

Keith Long
Manager , Mule Camp Division
Bell Ranch, NM

Introduction

The arid Southwestern United States offers unique challenges to cow/calf producers. Cows must survive and produce in sometimes inhospitable climates, ranging from summer heat well over 100° F to winter blizzards and sub-zero temperatures. All this is expected to be accomplished with little or no supplemental feed.

Bell Ranch cows are no exception. We require our animals to produce a quality calf each year and rebreed on minimal inputs of feed and labor. Northeastern New Mexico is characterized by a short actual growing seasons, defined not as frost-free days, but days where the grasses have sufficient moisture to produce forage. This can range from 120+ days in good years, to the more average 75 days of July, August and the first half of September.

However, if rains are adequate in both timing and quantity, the long dormant season provides good nutrition for cows in the proper stage of production. The trick, then, is to match cow productivity and management to the annual forage cycle.

Management

Perhaps the key to low input cow/calf production is the timing of calving. If cows calve during the dormant season, they will require more supplementation to rebreed than those that calve on or near green up. The onset of lactation double the cow's protein requirement and increases the energy requirement as well. Dormant forage, which may have adequate to support the mid-gestation cow alone, will not support a cow during lactation. Even with high rates of supplementation she is likely to lose body condition during the first 60-70 days of lactation.

With this in mind, the Seedstock division (called Mule Camp) of Bell Ranch has moved our calving season forward in the year in an attempt to more closely match lactation and rebreeding with peak grass conditions. The bulls are put with the yearling heifers June 1st, and with the cows June 20th, so calving begins mid-March for the heifers and April 1st on the cows. The vast majority of the calves are born by May 1, which allows for a long period of time for the cows to recover prior to breeding. The cows are wintered on 1 lb of a 38% cube per head per day, and are rotated into the calving pasture just ahead of calving. This is a pasture that has been deferred from grazing during the previous growing season. The supplemental feeding season ends by May 1st, sometimes earlier if conditions warrant. Actual feed cost for the cows is held to around $30 per head.

Genetics

We are trying to select for more efficient cows. Research has shown that smaller cows are almost always more efficient, that is they produce more per unit of input than larger cows. Additionally, research has shown higher milk potential cows to require more feed even when they are dry.

With this in mind, we are trying to select for cows that are frame 4 to 5 and weigh around 1150-11175 lbs. at body condition score 5 after weaning. The results of a study we did with Luis Tedeschi when he was a graduate student at Cornell University are presented in table 1.

Table 1. Cow Efficiency Index by Quartile (Tedeschi et al., Unpublished)

Quartile	Cow Efficiency	Cow Wt	Wean Wt (lbs.)	Peak Milk (lbs.)	MCAL	Hip Ht	Cow Age
1st	**40.2**	**1133**	**468**	**15.8**	**9278**	**50.7**	**3.6**
2nd	**42.7**	**1216**	**462**	**15.2**	**9751**	**51.5**	**4.6**
3rd	**45.1**	**1200**	**433**	**14.1**	**9645**	**51.3**	**5.2**
4th	**48.8**	**1288**	**408**	**12.7**	**9809**	**51.7**	**5.9**

The Cow Efficiency number is a ratio of megacalories of metabolizable energy consumed to kilograms of weaning weight produced and is calculated as follows:

$$\text{Cow Eff (EN)} = \text{MCALs}_{ME} / \text{WW}_{kg}$$

There is a trend for the smaller cows, both in frame size and weight, to be more efficient (lower numbers are more efficient). At the same time, higher milking younger cows tended to be more efficient as well. The 4th quartile cows, while the lowest milking animals, were the heaviest and thus required more feed but still produced a small calf. It appears that the 2nd quartile of cows, while larger and requiring more feed, were able to produce a large enough calf to overcome the increased feed demands.

This study will need to be repeated and refined, but would indicate that our most efficient cows will be in the frame score 4.5 range, weigh around 1200 lbs and produce about 15 pounds of milk at the peak of lactation (about 60 days post-calving).

Economics

Feed and labor comprise the two largest line items on most ranch's budget. Any reduction in feed costs that don't have a negative effect on productivity, or can be offset with management changes should increase cash flow. With the run up in corn and fuel prices that occurred in 2006, feed costs are at an all time high. Lower calf prices have also hurt ranch profitability recently.

Our approach to these factors is to reduce our reliance on off-ranch inputs. It matters little what cubes cost if you don't feed them, likewise with fuel costs. Our cows must produce well on grass and on a steadily decreasing amount of inputs in order for us to function as a working ranch. To accomplish this, we must manage our animals so that they always have sufficient grass in front of them regardless of conditions. Certainly this is a huge challenge. However, it is the only option for profitable ranching in the future. It is up to us as managers of cattle and land to select the proper animals to make the best use of the land.

References

Tedeschi, Luis Orlindo, Danny G. Fox, Michael J. Baker, and Keith L. Long. Unpublished. A Mechanistic Model to Evaluate Beef Cow Efficiency.

Building Flexibility Into Your Beef System

Ronald Gill, Ph.D.
Texas Cooperative Extension, Texas A&M University System
Stephenville, TX

Introduction

Building flexibility into systems will prevent one of the most destructive occurrences that can occur in any beef production unit. Being forced into an immediate management decision or reaction can be one of the most economically damaging events in a livestock operation. Having a management plan that anticipates both negative and positive influences in the business will allow management to prevent large losses and capitalize on available business opportunities.

There are several areas in any beef production system where flexibility can and when possible should be built in: 1). stocking rate, 2). enterprise selection/ diversification, 3). counter cyclical management, 4). genetic makeup of the cow herd, 5). outside investment, 6). emergency reserve.

Stocking Rate

In any operation one of the most significant business/management decisions that will determine inherent management flexibility is stocking rate. Cow-calf operations that are stocked above 75% of "normal forage production potential" for any given area will periodically be forced into liquidation of stock or forced to purchase additional outside feed due to drought conditions.

Lease rates have risen to levels that make producers feel compelled to stock to maximum carrying capacity in order to reduce per head grazing expense. In theory, that is a sound and logical approach but the past few years have reminded us of the need to conserve forage resources.

Any long term successful ranching operation uses a "moderate" stocking rate for the base cattle herd. Production specialists and economist are constantly chastising ranchers for not fully utilizing their resource and therefore leaving money on the table. One area that is rarely considered in these calculations is the cost of forced destocking during any catastrophic event such as drought or fire.

Enterprise Selection/Diversification

Excess forage can easily be managed with stocker cattle. Stock cows or yearlings can be utilized to harvest available excess production without exposing the operation to additional capital expenditures. However, most moderately stocked cow-calf operations will have adequate equity position in the base cow herd to purchase stock animals if that pencils as the best alternative.

One problem with any combination cow-calf/stocker operation is biosecurity of the base cow herd. The last thing you would want to do is expose a naive herd to pathogens that will affect health and reproductive performance of the base cow herd. If part of the flexibility needed on an operation relies on bringing in stocker cattle the base cow herd needs to have an outstanding herd health plan in place.

Secondly, it would be best management practices to not run stock cattle anywhere contact could be made with a base cow herd. If excess forage is available concentrate the base cow herd onto the most appropriate part of the ranch and run stock cattle in the area vacated by the base cow herd.

One way to alleviate that problem or consideration is to not have a "base cow herd". Ultimate in flexibility can be gained when cattle are used as they should be and treated as a simple means to harvest available forage. Many ranches have gone broke trying to maintain the "genetics we have worked years to put together". Getting "married" to a base cow herd can be dangerous when ranching in arid environments. It often prevents us from reacting quickly enough to prevent severe economic losses.

Genetic Makeup of the Cow Herd

If a base cowherd is to be maintained flexibility can also be built into the genetic base of the cows. It is often said that the cow herd should be selected to fit the environment and the bull battery be selected to fit the market. When the term market is not defined most think this saying is about breeding calf crops to fit some terminal market.

Market can be defined however you want it to be in this scenario. Look for an opportunity or niche market with added value potential and breed the cow herd to fit that market. It may be replacement heifers or high marbling genetics or superior lean meat yield or natural/organic or some other available market.

The appropriate genetic base in a cow herd opens up the opportunity for retained ownership. When forage is available heifers could be retained and sold as bred females or the calf crop could be retained to graze available forage.

A cow herd that fits this scenario is normally English based with up to three eights Brahman influence but can be a wide variety of genetic combinations. Focus on a cow herd that is moderate in frame, milk and carcass traits. Chasing carcass traits at expense of adaptability can be costly.

When market signals change all or part of the bull battery can be switched out within one breeding season. This allows as much flexibility as possible in the genetic makeup of calves marketed out of a cow-calf operation.

Remember that if you chase fads and retain heifers out of that production system your cow herd will shift to one that is not adapted to your environment. Either secure an outside source of replacement females or dedicate a portion of the cow herd to generate these adapted females central to the opportunities mentioned above. Once again stock moderately so the core herd will not have to be lost in times of drought.

Counter Cyclical Management

Another management philosophy that normally reaps economic rewards is having the mind set to operate a ranching enterprise in a counter cyclical manner. When everyone wants to buy cows, start looking for the opportunity to sell the ones you have.

Timing is important in this endeavor as well. There is always a point in a cattle cycle when the price of calves will start down. Cow value usually lags behind the calf value. In most analysis is would be best to sell all or part of the cow herd about the second to fourth year of the down turn. In the past, cattle cycles were easy to predict and fairly easy to manage. That has not been the case with the latest cattle cycle and who knows what future cycles will look like.

When the cow calf sector is not profitable you probably will not make up the difference in volume. Look to stocker cattle as the alternative means of capturing value of available forage. As you look at any cycle there will be a point when cows are "dirt cheap". When they are start looking at buying opportunities to stock up for the coming upturn in calf prices.

Outside Investment Opportunities

One real shortcoming of beef producers is that we like to complain about everyone who makes money in the industry. If you want to have sustainable profits participating in only one segment of the cattle industry then all other segments must be profitable as well. The cattle industry has evolved into a predatory industry where one or two segments are all that seems to remain profitable at any given time. Until the industry changes from this predatory system and works together to make the value of the end product high enough to sustain profits throughout the different segments of the system we need to look at opportunities to invest or participate in the other segments or in competing enterprises.

For example, if the evil packers are starting to look like they are going to be making large profits why not buy stock in those that are publicly traded. If feeders are just "stealing" your calves when you sell them, retain ownership into the stocker or feedlot sector. If the packers are not paying what "your cattle are worth" on a live basis, feed and market them on the rail into a program that will. You might find out you were getting more than they were worth.

Look at other alternatives that are available. If a particular input for the cattle operation looks like it is going to increase sharply look to investing in that industry. This can be through stock or speculation in the market. Look for opportunities to invest in businesses or commodities that represent your high cost centers. As with any venture capital only invest what you can afford to loose.

Emergency Reserves

This brings up another management tool that increases flexibility in management decisions. Emergency cash reserves are critical to offset short-term losses and also can provide for that capital necessary to invest quickly as opportunities arise.

One problem with cattle production at the cow-calf level is that it has emerged over time as a vehicle to reduce tax liabilities. The only way to reduce tax liabilities is to be unprofitable. Many operations look at taxes as the most evil of things. In the cattle business, particularly the cow-calf sector, any available profit is often consumed by family withdrawals or "invested" in depreciable assets to lower tax liabilities.

Many ranch operations die as a result of heavy metal disease. Do not let tax management or excessive family withdrawals jeopardize the long term profitability of the operation. If you have an opportunity to turn a profit capture at least a portion of it into the cash reserve.

Recent years of profitability in the cow-calf sector have created a move toward purchasing of excessive machinery and other infrastructure expenditures that probably should have been limited in light of current catastrophic events we have endured in the southwest ranching environment.

You can also look at a moderate stocking rate as an emergency reserve of forage. If this is planned out excess forage can be in a production system that allows the harvest and sales of this product. Some mix of introduced forages in a production system can be beneficial. Look for opportunities to plant adapted forages that can either be harvested for a cash crop in times of excess or utilized to support the base herd in times of emergency. The cash crop could be in stocker gain or hay sales.

Summary

There is money to be made in this industry regardless of what economists say. There are numerous ways to add flexibility to a ranching operation. Species diversification is one that comes to mind that we have not addressed here. This might be in horses, sheep, goats or wildlife.

Look for opportunities and do not be afraid to step out of the box. Always consider constraints of time and labor. Although diversification can add flexibility it might also create insurmountable obstacles due to labor requirements or time constraints. Allow yourself time to do what appears manageable and profitable, which may mean you have to pass on some opportunities.

Flexibility – A Producer Perspective

Jay O'Brien
Corsino Cattle Co.
Amarillo, TX

It's difficult to see ranching as flexible. Flexible relates to characteristics we should practice in our relationships. I know this because my wife makes sure I know this.

In ranching, flexible is very difficult. When we get rain, there are only certain months when the grass will grow. In a cow operation, we have to establish our calving season at least nine months in advance. We build numbers by keeping heifers that won't yield a paycheck for two years. We can't be flexible and have the gestation period be six weeks or two days, like we would like to. In a stocker operation, we need to have the calves healthy before green grass. An older cattleman told me when I was a young man that the cattle have to come with the grass and he was right. If you don't have the cattle located before the grass grows, you will lose a substantial part of your gain. Anyway, it takes a lot of care and time to straighten out shipped in calves. If your ranch is any size, you can't just get them all in at once.

Then there is the labor of the ranch. How much flexibility do we have if we wish to keep the hands that are the essential part of our success and failure? Their expense goes on whether we have cattle or not.

Other expenses such as the cost of the ranch--whether opportunity or lease; capital expenses such as houses, fences, windmills, and equipment; and our living expenses go on every day regardless of stocking rate.

Stocker or cow operation—flexibility does not easily fit into ranching. Successful ranching is the result of planning and most of it is long term.

We can fit flexibility into our operation in making our long term plans. But we must plan to enable flexibility. There is no way that we can be flexible in our stocking if we are perennially short of grass. Part of the cost of flexibility is to have a safety margin of grass to spare.

Someone who is entirely stockers has an easier time of being flexible because stocker numbers can be easily adjusted and stockers can be shipped early. However, even with shipping early, one has to be sure to leave grass so that calves can be put together for the next season. All flexibility is lost when the grass is depleted.

With yearlings, winter grazing also gives us some flexibility. We don't fully stock our grass and when we have a good year, we use our grass for straightening out wheat cattle. We don't get much gain on the grass, but we get cattle in condition to get a great gain on wheat. Likewise, if available, we find wheat to be great for conditioning calves for grass. We can take cattle directly from wheat to grass; so, the cattle can come with the grass. In years where we are a little short of grass, the use of wheat for light calves to prepare for grass is invaluable.

Cows are less flexible because destocking is more expensive. Usually, when you have to sell cows because of a drought, prices are low and destocking is painful. With yearlings, the rancher is out only the value of the lost gain. With cows it is lost sales of the calves and a lower value on the cows.

For that reason, we try to run a mixture of cows and stockers. We destock early when conditions dictate and are able to cripple along in most bad years with reducing our cow numbers.

Whether cows or stockers, destocking quickly in drought conditions is essential.

Thinking about flexibility, one thinks about market, as well. While their may be some costs to getting out of the normal cycle, it pays. Everyone can ship yearlings in September or October, but what is the gain you get in the fall if the yearlings are big by late summer? Would you more than make up for it by shipping in July or August if the yearlings are big? This is true if you retain ownership, for your cattle come out before the big runs and your winter weather risk is reduced.

Another long term planning consideration is when to build a cow herd and when to let it diminish in numbers. Or if you are a yearling operator, when you hedge and when you stay open. I believe in being a contrarian. If calves have been in the tank for a long time and everyone knows the cow man will never make money, it is time to rebuild. Actually, it is probably a year late. At the same time, it is also probably the time to buy stockers. If you have pasture when none of your neighbors have grass because of drought and calves are cheap, it is time to buy.

One bit of flexibility we have is how to market our cattle. Many ranchers retain ownership when prices are low, figuring their risk is less. In a way, this is a good example of contrarian economics. Ranchers should also look at their gain when deciding whether to retain ownership. If the cattle haven't gained well, it is a great time to retain ownership. You will get the advantage of cheap gain and very few buyers will pay you for this.

In marketing, those who are flexible can look at an alliance. We have been marketing our cattle through an alliance with Coleman Natural meat and McLean Feedyard for over 10 years. They pay us more than our cost of producing natural meat and we like the extra income. There are similar alliances to sell cattle as yearlings. One can evaluate the options and provide the extra service to improve net income

Those who have grass today should probably not be replacing heifers. With high corn, your grass is more valuable to put weight on light yearlings. Calves will be cheap and the gain is more valuable. We are letting our herd dwindle until 2009 or 2010, when we will start keeping heifers. Of course, drought and market conditions may help us change this long term plan, but our flexibility is with a long term plan.

Bull use can vary with your flexibility. If you are not going to build your herd for a few years, it is time to use more terminal crosses.

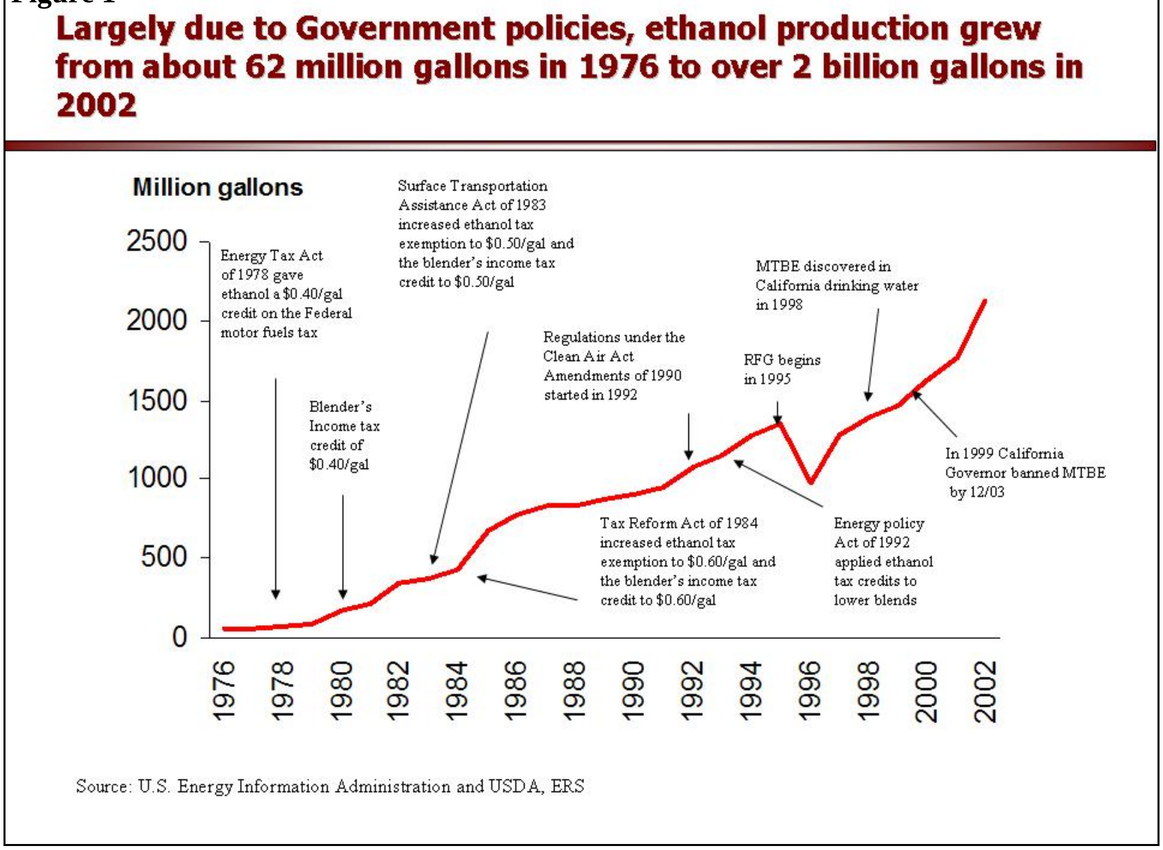
All of these are just small ways to be flexible. In general, we are locked by the weather and our asset. This makes it more important to utilize what flexibility we can have.

Impact of Ethanol Production on Grain, Feed and Cattle Markets

Steve Amosson, Regents Fellow
Professor and Extension Economist
Texas A&M University
Amarillo, TX

The rapid growth in the ethanol industry caught virtually everyone in Agriculture by surprise. In retrospect, maybe the magnitude of the increase should have been a surprise, but an explosion in ethanol production should have been anticipated. A constant stream of Policy enhancements since the 70's have lead to a steady increase in ethanol production. The recent rise in oil prices (as long as corn prices were low) have made investment in ethanol plants very lucrative adding to the frenzy to build additional ethanol production capacity. At the recent peak in ethanol prices ($3.30/gal), it has been estimated that a plant could be paid off within a year.

Figure 1



Ethanol production in the U. S. has been around a long time. In 1976, a total of 22 million gallons of ethanol was produced, Figure 1. By 2002, annual production had increased to two billion gallons. This increase can be attributed to policy changes enacted mainly at the federal level. In 1978, the Energy Tax Act was passed that provided ethanol a $0.40/gallon credit on the Federal motor fuels tax. A Blenders Income Tax credit of $0.40/gallon was added in 1980. The Surface Transportation Act of 1983 increased both of these credits to $0.50/gal. Other incentives were added by the Tax Reform Act (1984), the Clean Air Act (1990) and the Energy Policy Act (1992).

Ethanol production has continued to accelerate to its current level (3.5 billion gallons) primarily the result of more policy shifts. The most important policy change maybe the government's mandate to phase out the use of the fuel additive MTBE (California has already banned it as of the end of 2003). As a part of this effort, the government has set a goal of having a minimum of 7.5 billion gallons of domestic ethanol production in place to replace MTBE by 2012. Also, import tariffs are in place to protect the development of the domestic ethanol industry. In addition, there are federal programs to assist with feasibility studies, financing, etc. Several states offer tax abatements, as well as, other incentives to attract ethanol plants.

What is Ethanol made from?

Ethanol can be made from almost anything. In the U. S. almost all the ethanol produced comes from corn. Research indicates that several other feedstocks such as switch grass, sweet sorghums, and timber are far more efficient sources to produce ethanol than corn.

So why are we producing corn based ethanol? In my opinion, the answer is simple. In the early 70's we were looking for ways to improve corn prices through increasing the uses of corn which we had a lot of (until this year). This attracted the limited dollars available for ethanol research and development (R & D). This led to commercial scale production of corn based ethanol which over the years has been improved. Commercial development of processes to use other feedstocks to produce ethanol didn't happen because of limited ethanol demand and R & D budgets. The recent increase in ethanol demand caused by policy changes needed to be filled by commercial scale production. The only alternative - - corn based ethanol.

Will ethanol production be corn based in the future?

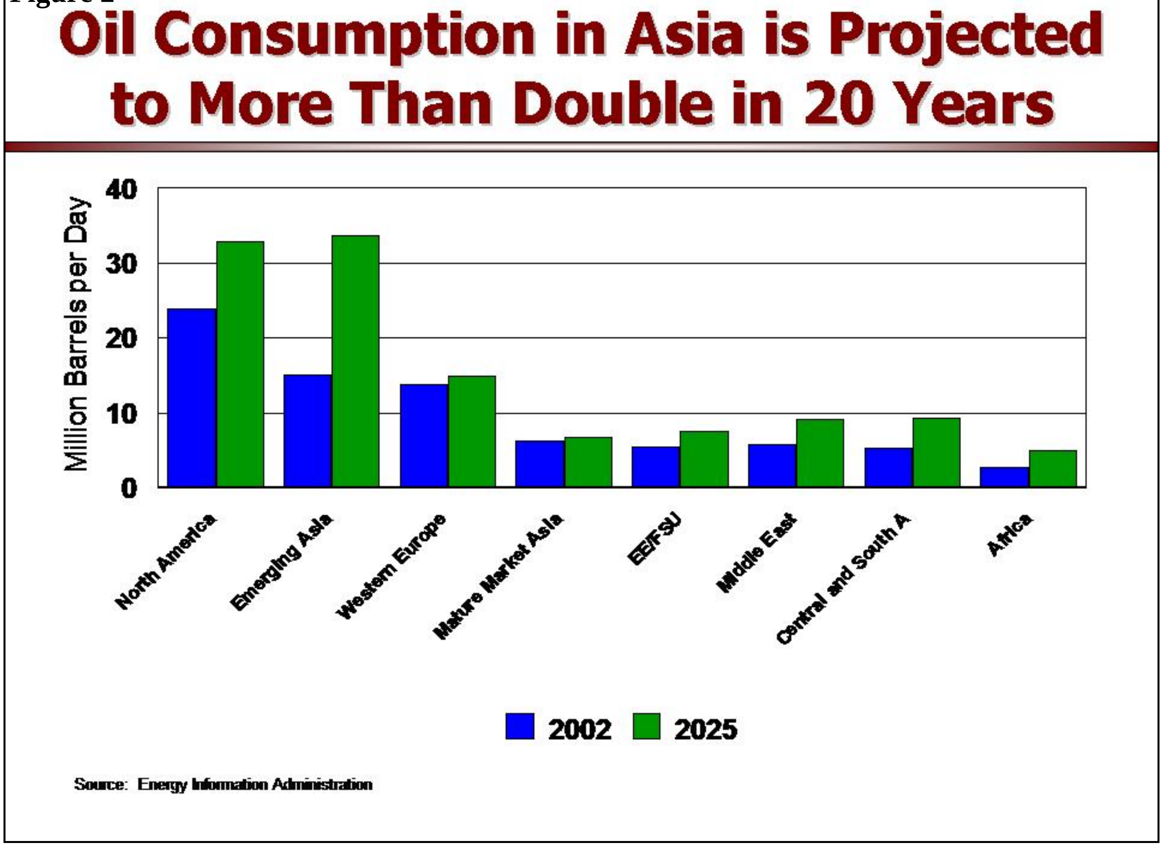
Yes and no. In the near term, corn based ethanol is basically the only available commercial scale process available. Therefore, any expansion in ethanol production will use corn. This is fixing to change. Recently, significant R & D money is going into developing/improving the cellulosic conversion process of other feedstocks. The current cost of production estimates with the latest technology is $1.50 per gallon. However, the only commercial plant running in North America is in Canada using wheat straw. Realistically, it will be five to 10 years before these ethanol production alternatives are available on a commercial scale.

What will determine how fast ethanol production will expand in the U.S.?

Will tax credits and import tariffs stay in place? Will the price of oil go up or down in the future? What will be the price of corn in the future? How fast will other more efficient means of ethanol production become available? If we knew the answers to these questions, the future expansion could be projected with some certainty. However, we don't, but information/projections are available that provide clues on the potential expansion of the ethanol industry.

First, it is doubtful any changes will occur to tax/tariff policy that would be detrimental to ethanol production at least in the near term given the mood of Congress. This sentiment is best expressed by the president who said, *"Someday a president is going to pick up a crop report…and the first thing that's going to pop in the president's mind is, we're less dependent on foreign sources of energy. It makes sense to promote ethanol and biodiesel."*

Figure 2



Oil prices which are in part controlled by OPEC are difficult to predict. The Department of Energy projections show oil prices moderating for the next few years before gradually moving upward. These projections are supported when looking at the anticipated growth in demand around the world, Figure 2. As population grows, all areas of the world are expected to increase oil consumption. Asia as it becomes more of an industrialized economy is expected to more than double its oil consumption by 2025. Even with the discovery of additional oil supplies, the demand increase will probably keep oil prices from falling for extended periods of time in the foreseeable future. Of course, in the short run disruptions in supply (hurricanes, etc.) will cause spikes in oil prices.

Table 1. Long-run equilibrium corn prices at various crude oil prices

With the VEETC			
Crude Oil Price *($/barrel)*	Gasoline Price *($/gallon)*	Ethanol Price *($/gallon)*	Corn Price *($/bushel)*
40	1.38	1.43	2.67
50	1.73	1.66	3.36
60	2.07	1.89	4.05
70	2.42	2.12	4.74
80	2.76	2.35	5.43

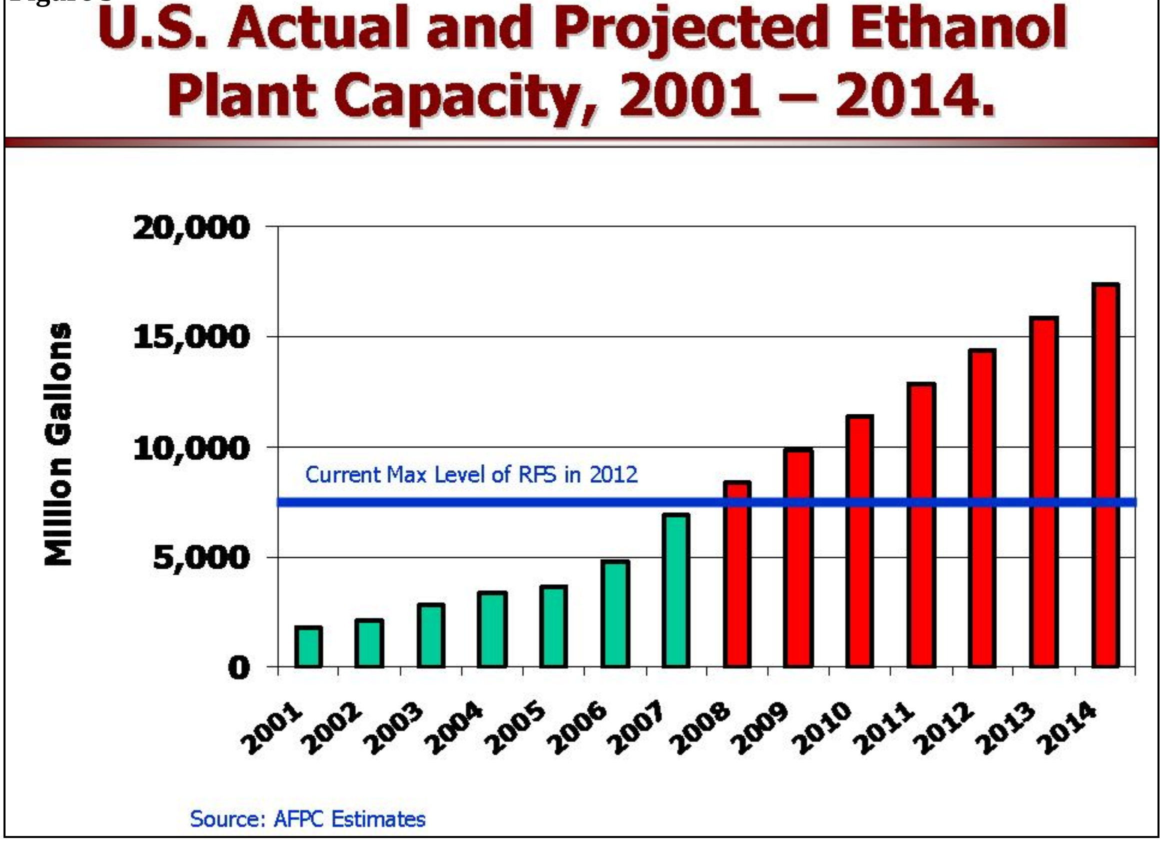
Without the VEETC			
Crude Oil Price *($/barrel)*	Gasoline Price *($/gallon)*	Ethanol Price *($/gallon)*	Corn Price *($/bushel)*
40	1.38	0.92	1.14
50	1.73	1.15	1.83
60	2.07	1.38	2.52
70	2.42	1.61	3.21
80	2.76	1.84	3.90

Source: CARD Briefing Paper 06-DP49

Rising corn prices could slow the growth of the ethanol industry in the short run until cellulosic processes to use other more efficient feedstuffs become commercially available. A study conducted at Iowa State indicates that at $60/barrel oil, ethanol plants could afford to pay $4.05/bushel in the Midwest before it would be unprofitable to build a new plant, Table 1. They assume in this study the processor receives 60% of the corn price for the DDGs and other input costs are held constant and the $0.51 tax credit remains in place. Without the tax credit, the breakeven corn price drops to $2.52/bushel. The analysis does not include any other state/federal assistance programs that might exist but does provide insight on how far corn prices may go.

Plants already in existence would be able to pay more since they already have made the investment in the facility (approximately $0.27/bushel). These breakevens will vary by plant and will likely increase as ethanol yields and processes are improved.

Figure 3



Projected Growth of the Ethanol Industry in the U. S.

The Agricultural Policy Center (AFPC) at Texas A&M University has spent considerable time analyzing ethanol/biofuels. Given current prices they estimate that there will be enough plant capacity in existence within the next two years to meet the 2012 Congressional mandate of 7.5 billion gallons of ethanol production, Figure 3. Ethanol plant capacity is expected to exceed 15 billion gallons by 2014. The Iowa State study suggests that the long run corn based ethanol production could exceed 31 billion gallons. Some industry analysts have indicated that close to three billion gallons of plant capacity may be coming online in the next 12 – 15 months which gives some validity to the long term estimates.

How does this all translate into corn use? Currently, a bushel of corn produces 2.7 gallons of ethanol. Therefore, for every billion gallons of ethanol produced, it takes approximately 370 million bushels of corn. Given an average yield of 152 bushels/acre and a 90.5% harvested vs. planted acreage, it would take almost 2.7 million acres of corn to be planted to support the ethanol production. If industry analysts are correct and if all the nearly three billion gallons of new capacity comes online next year (running at full capacity), it will require an additional 1.1 billion bushels of corn with an associated increase in planted acres of around eight million.

The world according to Steve – Feed Prices

In *my opinion*, corn and sorghum prices are reaching a new plateau and will remain higher for at least the next decade, if not longer, given the anticipated increases in ethanol production. I expect corn prices fob the feedlot to typically range between $3.50 - $4.50/bushel for the next couple of years. Because of tight supplies, I expect the difference between sorghum and corn prices to narrow. Prices will be more volatile with short or long crops sending prices outside of the range I have stated.

Wheat prices will move to a somewhat higher price plateau (compared to the long term average price) since it can be used as a feed source in rations. In general, as acreage is bid away from other crops their supply will drop and prices of these commodities will also rise somewhat. The level of their price increase will depend on the supply and demand for that particular commodity.

The world according to Steve – Cattle Prices

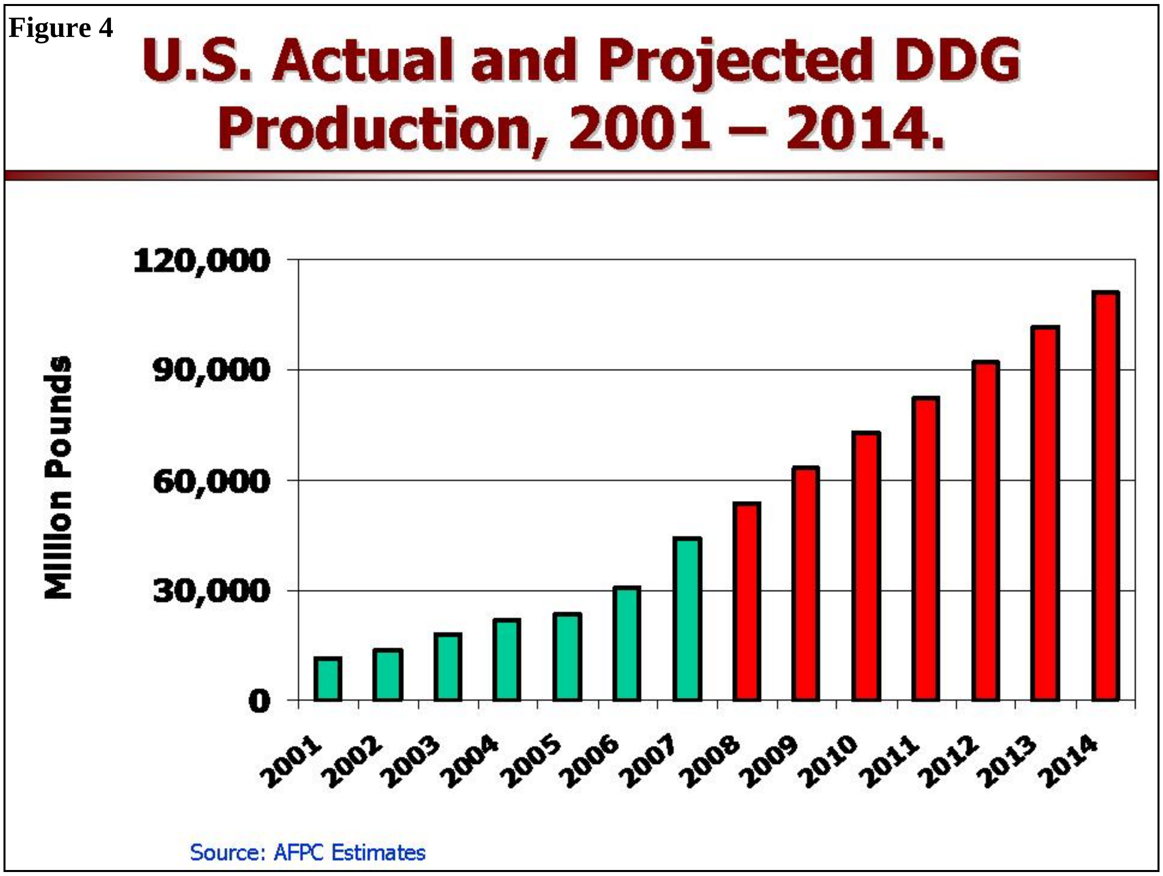
The million dollar question - - what are going to be the impacts on the cattle industry from increasing ethanol production?? In the short run, prices are and will not be good. In the longer run, prices will rise for all sectors of the cattle industry with some potentially interesting implications occurring for beef's market share.

In the short run, fed cattle prices are expected to remain relatively unchanged by the ethanol production since cattle numbers are already in the pipeline unless the length of the feeding period changes. Feedlot operators are reducing the price of feeders in response to the increased feed cost resulting in stocker operators lowering the amount they are willing to pay for calves. A rule of thumb is that calf prices have to fall $1.50/cwt for every dime corn prices increase to leave the forward linked sectors (cattle feeders and stocker operators) with the same relative profitability. Therefore, a $1.50 or $2.00/bushel increase in corn prices could result in a decrease in calf prices of $22.50 or $30.00/cwt.

Cow-calf operators facing these dramatically lower prices will reduce production ending one of the shortest build-up phases of the cattle cycle in history. The resultant shorter supplies will lead to higher cattle prices in all sectors of the cattle industry. In fact, I anticipate record prices being reached within 3 – 4 years.

All that I have described is a logical and intuitive chain of events. Now, it gets interesting. A by-product of corn based ethanol is DDGs which can be used in cattle rations (replacing corn) or as a feed supplement to pasture cattle replacing corn to a limited extent. Seventeen pounds of DDGs is produced from every bushel of corn used in ethanol production. Currently, the price of DDGs is about 60% the price of corn. The value of DDGs could actually fall further in the future based on the projected expansion in the ethanol industry and the resultant amount of DDGs generated, Figure 4. Projected DDG supply may outstrip demand resulting in lower prices unless alternative uses for DDGs are developed.

Figure 4



Neither hogs nor poultry can use a significant amount of DDGs in their rations in its present form. Therefore, the beef industry will have a relative advantage in comparative ration costs to swine and poultry in the future. This may lead to an increase in market share for beef helping to negate the loss in market caused by higher feed prices.

Summary and Conclusions

Commercial production of corn based ethanol has been around since the early seventies. Policies providing tax incentives and trade barriers have resulted in a steady increase in ethanol production. The growing interest in renewable fuels and the decision to replace MTBE fuel additive has accelerated the growth of ethanol industry in recent years.

Ethanol production is projected to exceed 15 billion gallons by 2014. In the near term, almost all ethanol production will be corn based. This trend will continue until the processes for other materials more efficient in the production of ethanol can become commercially viable. Currently, for every billion gallons of ethanol produced, it takes 2.7 million acres of corn producing 370 million bushels.

Corn and sorghum prices are moving to a higher plateau for at least the next decade. Corn prices in the High Plains (to the feedlot) are expected to range between \$3.50 - \$4.50/bushel over the next couple of years with the exception of large or short crops. Prices of other crops are expected to rise as some of their acreage is reallocated to corn production resulting in their availability (supply) dropping.

Rising corn prices have and probably will cause decrease in feeder and calf prices. Eventually, the cow herd will decrease lowering supplies and prices will rise to record levels within three to four years (my opinion). The ability of the beef industry to use the relatively low cost ethanol byproduct (DDGs) in rations will give the industry a relative advantage in comparative ration costs to swine and poultry in the future. This may lead to an increase in market share for beef helping to negate the loss in market caused by higher feed prices.

Ethanol Feed Byproducts and their Uses in Beef Cattle Production

Jim MacDonald
Texas Agricultural Experiment Station
Amarillo, TX

Introduction

The ethanol industry is rapidly expanding both nationally and locally. The renewable fuels standard mandates that there be 7.5 billion gallon of ethanol produced annually in the US by 2012 (Renewable Fuels Association, 2006a). The US produced 3.9 billion gallons of ethanol in 2005 (Renewable Fuels Association, 2006b). Thus, the ethanol industry will, at a minimum, nearly double in size in the next six years. In the Texas Panhandle region, there are currently plan to build facilities to produce as much as 600 million gallons of ethanol (Renewable Fuels Association, 2006c). Most, if not all of these facilities will be dry milling plants, rather than wet milling plants. If the 600 million gallons level is achieved, the ethanol industry in this region will consume approximately 214 million bushels of corn and/or sorghum and produce 1.7 million tons of feed byproduct on a dry matter (**DM**) basis. Therefore, these byproducts will be readily available in the Panhandle region in the coming years.

While much of the byproduct will likely be utilized by feedlots and dairies in the Panhandle region, there will also be opportunity for cow/calf, stocker, and backgrounding operations to utilize the byproduct. The nutrient composition of these byproducts may make them a good fit in high forage diets or as a grazing supplement because they provide protein, energy, and minerals as well as serve as a forage substitute. However, producers considering using these byproducts must be aware of specific risks associated with their use that require special attention, but can be easily managed. Specifically, high sulfur levels may cause polioencephalomalacia or tie up other minerals required by the animal.

Byproducts of Dry Milling

Distillers grains (**DG**) are a byproduct of the dry milling industry. The dry milling process is described elsewhere (Stock et al., 1999), but consists of converting starch from cereal grains into an alcohol through fermentation by yeast. After removal of the alcohol by distillation, the remaining residue, called whole stillage, may be centrifuged or pressed to separate course particles from fine particles and liquid. The course particles are DG and may be fed as wet DG or dry DG (**DDG**), which may affect animal performance (Ham et al., 1994). The fine particles and liquid is called thin stillage, is often evaporated to condensed distillers solubles, and may be marketed separately or a portion may be added back to the DG. Thus, there are a variety of products marketed under the name of DG and are dependent upon the amount of solubles added back to the DG, and other processes of the plant in which the DG are produced. This can lead to substantial variability in the nutrient composition of DG by plants (Table 1; Holt and Pritchard, 2004; Spiehs et al., 2002) However, some generalizations can be made. By weight, roughly one third of the original grain DM is converted to ethanol, another third is lost as carbon dioxide, and one third remains as DG. Therefore, the nutrient composition of DG is approximately three times the nutrients found in the cereal grain from which it was produced.

Distillers Grains as a Source of Protein and Energy

The nutrient composition of DDG may make them a good fit in high forage diets or as a grazing supplement. One potential advantage to using DDG in forage diets is that most of the starch has been removed. Negative associative effects of starch on fiber digestion have long been noted and some have suggested supplementing highly digestible fiber as a means of providing energy without negatively affecting forage digestion (Horn and McCollum, 1987). Using DDG may allow for energy supplementation without decreasing forage digestibility. We supplemented DDG to 600 lb heifers grazing summer range in the Texas Panhandle. Heifers were supplemented three times weekly at a level that was equivalent to 0.5% BW per day. Supplementation of DDG resulted in a 14% improvement in ADG (MacDonald, unpublished data). This improvement in ADG due to DDG supplementation on high quality summer range is similar to data provided from the Sandhills of Nebraska (Morris et al., 2006) as well as actively growing bromegrass pastures (MacDonald et al., 2004). The response to DDG supplementation is likely due to providing a combination of protein and energy. Distillers grains are a good source of undegradable intake protein (UIP). They are approximately 30% CP, of which 54% (Firkins et al., 1984) to 66% (Ham et al., 1994) bypasses rumen degradation which may improve the efficiency of protein use in high fiber diets (Horn and Beeson, 1969; Waller et al., 1980; DeHaan et al., 1982). In addition to providing protein, the fat in DG can serve as an energy source. It is difficult to separate effects of DG on animal performance due to protein or energy. We previously supplemented DDG or corn gluten meal as a source of UIP equivalent to that found in distillers grains to heifers grazing high quality bromegrass pastures (Figure 1; MacDonald et al., 2006). The gains for cattle supplemented with corn gluten meal were 39% of those supplemented with DDG across three levels of supplementation. Therefore, the response to DDG was not solely due to meeting a UIP deficiency. A third supplementation strategy in this study was to supplement corn oil equivalent to the amount of fat found in distillers grains (data not shown). There was no performance response to supplementing corn oil demonstrating that energy was not the first limiting nutrient for these heifers. As one might expect, there appears to be an additive effect of supplying protein and energy together in one supplement.

Fat as an energy source in DG may be especially advantageous to cow/calf producers. Proper nutrition to first calf heifers is especially important because the heifers are still growing. During the last trimester, heifers may not be able to physically consume enough feed to meet her nutrient requirements as well as the requirements of the fetus. Therefore, supplementing an energy dense component to the diet may be beneficial. Distillers grains have been shown to increase weight gains greater than soybean hulls in pregnant heifer diets fed at 40% of dietary DM in the last trimester of pregnancy without any effect on BCS or calving difficulties (Engel et al., 2005). Fat may also be advantageous for improving conception rates. Smith et al. (2001) supplemented cows grazing native range with equal amounts of CP from DDG or alfalfa hay with and without cull beans at a level which provided half of the CP. When DDG was supplemented alone, a greater percentage of cows were cycling prior to estrus synchronization compared to when DDG was supplemented with cull beans. It is possible that this response is related to the fat in DDG because plant oils are known to affect ovarian follicular growth, luteal function, and postpartum reproductive performance independent of increased energy intake (Williams and Stanko, 1999). However, cows supplemented with only DDG lost more body condition compared to cows receiving other supplements. Cattle consuming low quality forages may be limited by a DIP deficiency rather than a metabolizable protein deficiency. Therefore, providing UIP which bypasses rumen degradation may not elicit a performance response if DIP is deficient. Therefore, authors suggested that the greater loss of body condition score due to DDG supplementation compared to alfalfa and cull bean supplementation was due to the high UIP content of DDG that did not meet the DIP deficiency.

To determine if DDG could meet a DIP deficiency, Stalker et al. (2004; Table 2) provided urea at a level that met the predicted DIP deficiency to heifers consuming a low quality hay supplemented with 3 lb DDG. Two pieces of evidence from this study suggest the DDG met the DIP deficiency. Animals that are deficiency in DIP will experience a reduced rate of fiber digestibility which slows passage of fiber out of the rumen. This results in reduced animal performance and reduced dry matter intake. No differences in animal performance or dry matter intake were detected. Also, a DIP deficiency will reduce microbial growth in the rumen which should subsequently lead to reduced microbial crude protein flow out of the rumen. Researchers in this study used the ratio of allantoin to creatinine as an indicator of microbial crude protein flow. An increase in the ratio of allantoin to creatinine would indicate an increase in microbial flow. No differences in this ratio were detected. These data indicate that DDG can be used to meet a DIP deficiency while providing metabolizable protein from UIP and energy. Physiologically, this is achievable through recycling of nitrogen to the rumen.

Recent data we collected with steer calves grazing dormant native range would seem to indicate that supplemental DIP is not necessary when DDG is provided as a supplement. Steer calves in this study were provided DDG thrice weekly at levels equivalent to 0, 0.25, 0.50, or 0.75% BW per day (MacDonald, unpublished data; Figure 2). We observed a large quadratic improvement in ADG across the three levels of supplementation. Steers receiving no supplement gained 0.59 lb/day whereas steers receiving the highest level of supplement gained 1.75 lb/d. It is unclear why cows receiving DDG lost more body condition compared to other treatments in the study by Smith et al. (2001), but other research would indicate that it may not be due to a DIP deficiency.

Forage Intake and Supplementation Frequency

Characteristics of forage supplementation may include improved performance and/or reduced forage intake (i.e. forage substitution). Forage substitution may allow for additional animal units to graze a fixed land base and thus is an important consideration when considering a forage supplement. Morris et al. (2005) provided 1.5, 3.0, 4.5, or 6.0 lb of DDG to heifers consuming either high quality (alfalfa and sorghum silage) or low quality (bromegrass hay) forage. The efficiency of supplementation (pounds of additional gain per pound of supplement) was greater for low quality forage than for high quality forage (data not shown). However, the effects of DDG supplementation on forage intake (Figure 3) appear to be consistent across forage qualities. The slope of the line for both high and low quality forage is approximately 0.40 suggesting every pound of DDG replaces 0.40 lb of forage.

Producers providing supplement to grazing cattle will often supplement several times per week, but not daily. To determine if animal performance is similar when cattle are supplemented with DDG daily or multiple times per week, Stalker et al. (2005; Table 3) supplemented heifers consuming low quality grass hay with the equivalent of 3 lb DDG (DM) per day. Heifers were provided supplement either 3 times or 6 times per week. Heifers supplemented 3 times per week had greater ADG compared to those supplemented 6 times per week. This difference in animal performance due to alternate day supplementation has also been reported by Loy et al. (2003) who compared feeding DDG or dry rolled corn either daily or on alternate days. In the study by Loy et al. (2003) cattle supplemented on alternated days consumed less hay on average compared to cattle supplemented daily. Data from a subsequent metabolism study (Loy et al., 2004) substantiates this forage intake response and indicates the effects on forage intake due to alternate day supplementation are independent of negative effects on rumen metabolism. Producers must determine if the added performance from daily supplementation compared to supplementation several times weekly is profitable when added costs and management are considered. Alternatively, if reduced forage intake were desirable, such as in a drought situation, alternate day supplementation may prove beneficial.

Mineral Considerations

Supplementation strategies are often developed to correct a deficiency; phosphorus is thought to be the most deficient nutrient in the world for grazing livestock (Greene, 1999). The phosphorus content of DDG ranges from 0.70% to 1.00% of DM (Spiehs et al., 2002). Therefore, supplementation strategies with utilize DG may be able to concurrently reduce phosphorus supplementation.

One issue that requires special attention for producers considering the use of DG is the level of sulfur. High sulfur levels are associated with polioencephalomalacia (Gould et al., 1991) and can increase the requirement for other minerals, especially copper (Berger, undated). Therefore, higher levels of copper supplementation may be necessary in areas where copper is already deficient if DG is supplemented. However, producers should be mindful that copper toxicity is also possible. The sulfur content of DDG can range from 0.33 to 0.74% (Spiehs et al,. 2002; Table 1). The maximum tolerable level of sulfur is 0.40% of dietary DM (NRC, 1996). Therefore, producers need to be aware of all sulfur sources available to their cattle, including mineral supplement, other feedstuffs, and water. Anecdotal evidence of sulfur toxicity is often associated with cases where producers combined byproducts of the corn milling industries such as distillers grains, condensed distillers solubles, steep liquor, or wet or dry corn gluten feed not realizing that all of these byproducts are potentially high in sulfur. Other cases of sulfur toxicity have been reported in cases where producers provided one or more of these byproducts without testing their water source, which may be high in sulfur. The issue of sulfur toxicity is relatively easy to manage through testing of feedstuffs and water sources. The cost of testing for sulfur is relatively inexpensive relative to the risk of animal loss.

Conclusions

Opportunity to use distillers grains in high forage diets will increase as the ethanol industry in the High Plains region grows. Distillers grains provides highly digestible fiber, protein, and fat which increases the performance of cattle consuming high forage diets. The removal of starch during ethanol production may reduce the negative associative effects on forage digestibility associated with cereal grain supplementation. The protein in DG appears to meet the DIP deficiency associated with low quality forages. Forage intake is reduced when DDG is supplemented, and to a greater extend when supplement is provided several times per week rather than daily. However, animal performance may also be reduced when supplemented several times a week rather than daily. Producers considering the use of DG should be cognizant of how the supplementation will change the mineral status of the animal. Special consideration should be given to sulfur, copper, and phosphorus.

Literature Cited

Berger, L.L. undated. Sulfur Nutrition affects Copper Requirement. The Salt Institute. Available at: http://www.saltinstitute.org/publications/stm/STM-8.html. Accessed Dec. 10, 2006.

DeHaan, K., Klopfenstein, T. J., Stock, R. A., and Britton, R. A. 1982. Wet distillers byproducts for growing ruminants. Nebraska Beef Cattle Report. MP 43:33-35.

Engel, C. L., H. H. Patterson, G. A. Perry, R. Haigh, and J. Johnson. 2005. Evaluation of dried distillers grains with solubles as a feedstuff for heifers in the last trimester of gestation. South Dakota Beef Report. Available at: http://ars.sdstate.edu/extbeef/2005_Beef_Report.htm. Accessed Dec. 22, 2005.

Firkins, J. L., L. L. Berger, G. C. Fahey, Jr., and N. R. Merchen. 1984. Ruminal nitrogen degradability and escape of wet and dry distillers grains and wet and dry corn gluten feed. J Dairy Sci 67:1936-1944.

Greene, L. W. 1999. Designing mineral supplementation of forage programs for beef cattle. Proc. Am. Soc. Anim. Sci. Available at: http://www.asas.org/JAS/symposia/proceedings/0913.pdf. Accessed Dec. 22, 2005.

Gould, D.H., M.M. McAllister, J.C. Savage, and D.W. Hamar. 1991. High sulfide concentrations in rumen fluid associated with nutritionally induced polioencephalomalacia. J. Vet. Res. 52:1164.

Ham, G. A., R. A. Stock, T. J. Klopfenstein, E. M. Larson, D. H. Shain, and R. P. Huffman. 1994. Wet corn distillers byproducts compared with dried corn distillers grains with solubles as a source of protein and energy for ruminants. J Anim Sci 72:3246-3257.

Holt, S. M. and R. H. Pritchard. 2004. Composition and nutritive value of corn co-products from dry milling ethanol plants. South Dakota Beef Report. Available at: http://ars.sdstate.edu/extbeef/2004_Beef_Report.htm. Accessed Oct. 15, 2005.

Horn, G. W. and W. M. Beeson. 1969. Effects of corn distillers dried grains with solubles and dehydrated alfalfa meal on the utilization of urea nitrogen in beef cattle. J Anim Sci 28:412-417.
Horn, G. W. and F. T. McCollum. 1987. Energy supplementation of grazing ruminants. Page 125 in Proc. Graz. Nurt. Conf. Jackson Hole, WY.
Loy, T.W., T.J. Klopfenstein, G.E. Erickson, and C.N. Macken. 2003. Value of distillers grains in high forage diets and effects of supplementation frequency. Nebr. Beef Cattle Rep. MP 80-A: 8-10.
Loy, T.W., J.C. MacDonald, T.J. Klopfenstein and G.E. Erickson. 2004. Effect of distillers grains or corn supplementation frequency on forage intake and digestibility. Nebr. Beef Cattle Rep. MP 80-A: 22-24.
MacDonald, J.C., G.E. Erickson and T.J. Klopfenstein. 2006. Effect of fat and undegradable intake protein in dried distillers grains on performance of cattle grazing smooth bromegrass pastures. Nebr. Beef Cattle Rep. MP 88-A: 27-29.
MacDonald, J.C., and T.J. Klopfenstein. 2004. Dried distillers grains as a grazed forage supplement. Nebr. Beef Cattle Rep. MP 80-A: 25-27.
Morris, S. E., Klopfenstein, T. J., Adams, D. C., Erickson, G. E., and Vander Pol, K. J. 2005. The effects of dried distillers grains on heifers consuming low or high quality forage. Nebraska Beef Cattle Report MP 83-A18-20.
Morris, S.E., J.C. MacDonald, D.C. Adams, T.J. Klopfenstein, R.L. Davis, and J.R. Teichert. 2006. Effects of supplementing dried distillers grains to steers grazing summer sandhills range. Nebr. Beef Cattle Rep. MP 88-A: 30-32.
Renewable Fuels Association. 2006a. Federal Regulations: Renewable Fuels Standard. Available at: http://www.ethanolrfa.org/policy/regulations/federal/standard/. Accessed Dec. 21, 2006.
Renewable Fuels Association. 2006b. Industry Statistics. Available at: http://www.ethanolrfa.org/industry/statistics/#A. Accessed Ded. 21, 2006.
Renewable Fuels Association. 2006c. Ethanol Biorefinery Locations. Available at: http://www.ethanolrfa.org/industry/locations/. Accessed Ded. 21, 2006.
Smith, C. D., J. C. Whittier, D. N. Schutz, and D. Couch. 2001. Comparison of alfalfa hay and distillers dried grains with solubles, alone or in combination with cull beans, as protein sources for beef cows grazing native winter range. Professional Animal Scientist 17:139-144.
Spiehs, M. J., M. H. Whitney, and G. C. Shurson. 2002. Nutrient database for distiller's dried grains with solubles produced from new ethanol plants in Minnesota and South Dakota. J Anim Sci 80:2639-2645.
Stalker, L. A., T. J. Klopfenstein, D. C. Adams, and G. E. Erickson. 2004. Urea inclusion in forage based diets containing dried distillers grains. Nebraska Beef Cattle Report. MP 80-A:20-21.
Stalker, L. A., Klopfenstein, T. J., and Adams, D. C. 2005. Effects of dried distillers grains supplementation frequency on heifer growth. Nebraska Beef Cattle Report. MP 83-A:13-14.
Stock, R. A., J. M. Lewis, T. J. Klopfenstein, and C. T. Milton. 1999. Review of new information on the use of wet and dry milling feed by-products in feedlot diets. Proc. Am. Soc. Anim. Sci. Available at:

http://www.asas.org/JAS/symposia/proceedings/0924.pdf. Accessed Oct. 10, 2002.
Waller, J., T. J. Klopfenstein, and M. Poos. 1980. Distillers feeds as protein sources for growing ruminants. J Anim Sci 51:1154-1167.
Williams, G. L. and R. L. Stanko. 1999. Dietary fats as reproductive nutraceuticals in beef cattle. Proc. Am. Soc. Anim. Sci. Available at: http://www.asas.org/JAS/symposia/proceedings/0915.pdf. Accessed Dec. 24, 2005.

Table 1. Average nutrient values reported for distillers grains from NRC and range of nutrient values across several plants as reported in two studies[a].

Item	NRC	Holt and Pritchard	Spiehs et al.
DM	91.0	89.4-90.9	87.2-90.2
CP	29.5	30.7-33.2	28.7-31.6
Crude Fat	10.3	10.3-14.2	10.2-11.7
NDF	46.0	37.3-48.9	36.7-49.1
Ca	0.32	NR[e]	0.03-0.13
P	0.83	0.66-0.78	0.70-0.99
K	1.07	0.76-1.07	0.69-1.06
Mg	0.33	0.26-0.33	0.25-0.37
S	0.40	0.37-0.69	0.33-0.74

[a]All values are expressed as a percentage on a DM basis.
[b]Taken from: NRC. 1996.
[c]Adapted from: Holt and Pritchard (2004).
[d]Adapted from: Spiehs et al. (2002).
[e]Not reported.

Table 2. Performance and allantoin:creatinine ratio in urine of heifers fed diets where 0 or 100% of the NRC predicted degradable intake protein requirement was met with supplemental urea. Adapted from Stalker et al. (2004).

Item	0	100	SEM	P-value
Initial BW, lb	452	449	1	0.10
Final BW, lb	579	585	4	0.38
ADG, lb	1.53	1.63	0.05	0.17
Total DMI, lb	11.9	11.6	0.50	0.76
Feed:gain	9.8	9.1	0.50	0.37
Allantoin:creatinine	0.89	0.89	0.04	0.98

Table 3. Performance of heifers fed the daily equivalent of 3 lb (DM) of dried distillers grains either 3 (3X) or 6 (6X) times per week. Adapted from Stalker et al. (2005).

Item	3X	6X	SEM	P-value
Initial BW, lb	426	424	1.22	0.42
Final BW, lb	559	571	1.93	0.005
ADG, lb	1.58	1.74	0.031	0.01

Figure 1. Effect of undegradable intake protein (UIP) intake from dry distillers grains (DDG) or corn gluten meal (CGM) on ADG. DDG slope > 0 (P<0.01). CGM slope > 0 (P=0.14). DDG slope > CGM slope (P=0.10). From MacDonald et al., 2006.

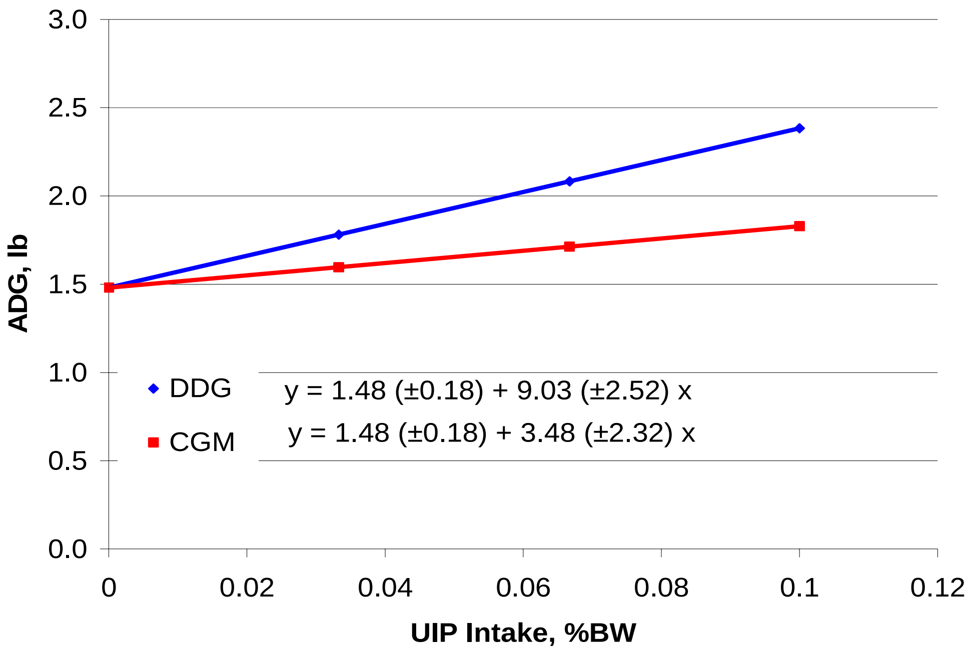


Figure 2. Effects of dry distillers grains supplementation on ADG of calves grazing dormant range (MacDonald, unpublished data).

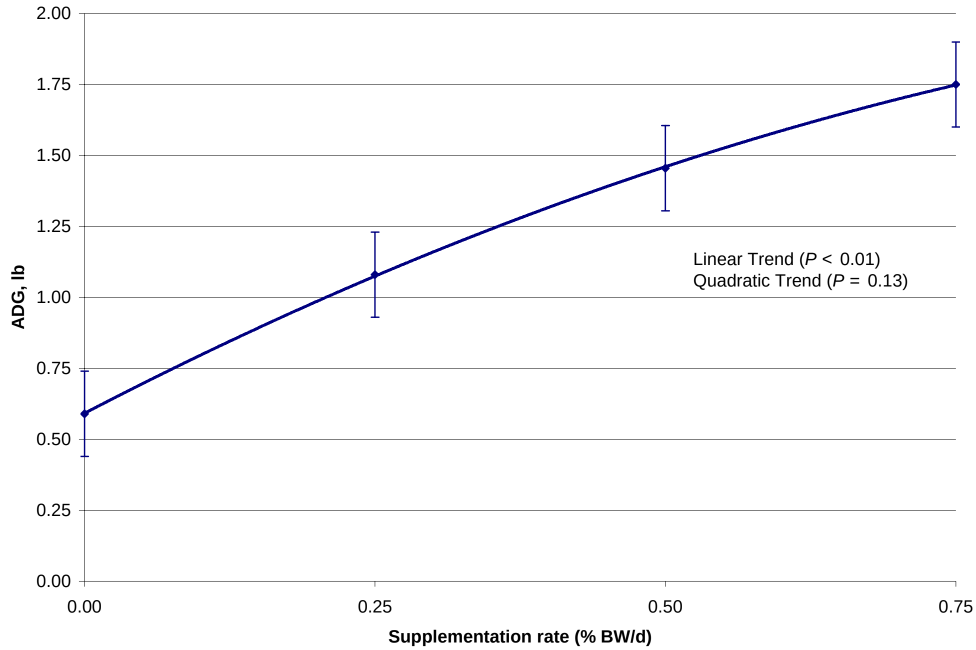
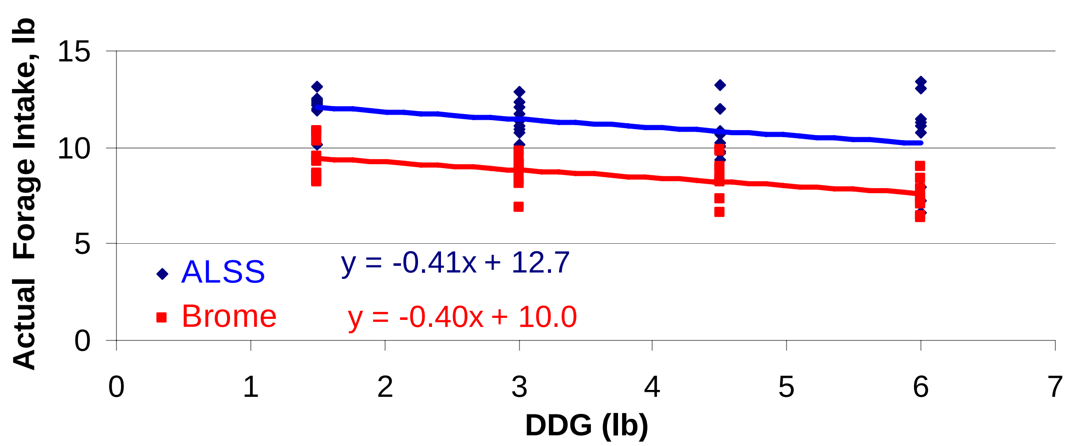


Figure 3. Effects of dry distillers grains (DDG) supplementation on forage intake for heifer calves consuming low quality brome grass hay (Brome) or high quality alfalfa and sorghum silage (ALSS). Adapted from Morris et al. (2005).



Trichomoniasis in the Southwest

John Wenzel, DVM
Extension Animal and Natural Resources Department
New Mexico State University
Las Cruces, NM

Introduction

Trichomoniasis is a sexually transmitted disease of cattle caused by the protozoa *Tritrichomonas foetus*. The disease is characterized by an increase in open cows detected at preg checking time and/or an increase in dry cows at spring branding. Trichomoniasis can result in an extended calving season. These characteristics can result in a severe financial loss to cow-calf enterprises. To protect the New Mexico cattle industry and control the spread of the disease, the New Mexico Livestock Board declared Trichomoniasis a reportable disease in July of 2005. The disease is now regulated and testing requirements are in place for breeding cattle. Contact the New Mexico Livestock Board for a copy of these regulations.

The Disease in Cows

Trichomoniasis is strictly a venereal disease that does not make cows or bulls outwardly sick. Cows develop the disease after being bred by an infected bull. The infection develops in the cow's reproductive tract and usually causes early embryonic death. The cow will usually cycle again after the loss of pregnancy, which results in her passing the infection to any bull that breeds her before she mounts an immune response and clears the infection. It takes about 3-5 months for a cow to clear the infective protozoa. The cow will clear the infection about 97% of the time. The remaining 3% of cows can become carriers and remain infected through calving. These carrier cows can keep the infection in the herd from year to year. Untested positive bulls will also carry the infection from year to year. Immunity from the disease only lasts about 12 to 15 months so a cow can become reinfected if bred by an infected bull the next year. A few infected cows develop scarring in the uterus that makes them infertile. There is no medication available that is effective in treating the disease.

The Disease in Bulls

The bull is a mechanical spreader of the disease. The *T. foetus* organism lives on the surface of the penis and prepuce in small folds called crypts. The older the bull, the deeper and more numerous the crypts thus, it is easier for bulls over three years of age to become chronically infected. Younger bulls (as young as yearlings) can develop the infection but may not become chronically infected. The bull contracts the disease by breeding an infected cow and picking up the *T. foetus* organism on the surface of the penis. There is no response by the bulls' immune system, so he does not develop any resistance to the organism. Additionally, there is no treatment for this disease, and infected bulls can only be sold for slaughter according to New Mexico Trichomoniasis Regulations.

Diagnosis

The disease is very difficult to diagnose in the cow because it requires five successive, negative tests, with each test being at least one week a part. The test is performed on cervical mucus samples. Because of the logistical challenges of testing cows, most testing is done on bulls. The official test is a PCR (Polymerase Chain Reaction) test. This test is performed on samples collected by Veterinarians certified by the New Mexico Livestock Board to do Trichomoniasis Testing in New Mexico. A list of approved Veterinarians is available from the Livestock Board or on their website at: www.newmexicolivestockboard.com.

Control

Control measures established in New Mexico in 2005 are designed to help limit exposure and spread of the disease but are only part of a complete program to prevent or eradicate the disease. Contact your local veterinarian for recommendations regarding prevention and eradication of Trichomoniasis on your ranch.

Trichomoniasis Control Tips

- test all bulls 2-3 weeks after the end of breeding season and cull any bulls positive for *T. foetus*
- cull all open cows at preg check and any dry cows at spring branding
- test all incoming bulls that are added to the bull battery
- do not share or lease bulls unless a Trichomoniasis prevention program is in place
- do not add cattle from unknown herds or with unknown calving histories
- keep fences in good repair to prevent exposure to neighboring cattle
- consider using only virgin bulls

Prevention

To prevent the disease from entering a clean herd, only add bulls with a negative test or certified virgin bulls. Also, only add cows or heifers from known negative herds. Annual testing of the bull battery is recommended to catch the disease early if exposure does occur. An effective vaccine is available to immunize females against the disease; however, the vaccine stimulates immunity that is protective for a short period of time and must be used according to label directions. Vaccinating cows against *T. foetus* can be a valuable part of a total prevention or eradication program. The vaccine is not effective in preventing the disease in bulls.

Economics

Trichomoniasis is a disease that can be economically devastating in a short period of time. A susceptible cow that is bred by an infected bull will become infected and usually abort, cycle again, shed the organism, and then settle, infecting all bulls that breed her while she is infected. Infected bulls can only be sold for slaughter. A cow that rebreeds will usually calve 4 to 6 months later than normal so her calf is much lighter at weaning. Many cows will not rebreed and will have to be culled as open cows. Other cows that were pregnant at preg check may abort. Although less common, abortion can occur as late as 240 days of gestation. The loss in calf crop can reach as high as 50% the first year, depending on the number of infected bulls in the herd with susceptible cows. A herd that has one positive test is quarantined and can only sell breeding age females for slaughter (unless more than 120 days pregnant) until the quarantined is lifted. The quarantine does not affect the sale of weaned calves. Preventing introduction of the disease into a herd is the key to avoiding economic loss.

For more information about Trichomoniasis prevention and control programs, contact your local Veterinarian. For information about the state regulations, testing requirements, or import requirements for breeding stock, contact the New Mexico Livestock board at (505)841-6161 or visit: www.newmexicolivestockboard.com.

TRICHMOMNIASIS IN NEW MEXICO

	# Tested	# Positive	# Negative	% Positive
2006 Total	3923	251	3672	6.4
Fall	1455	92	1363	6.3
Spring	2468	159	2309	6.4
2005 Total	781	51	730	6.5
Fall	564	32	532	5.8
Spring	217	19	198	8.8
TOTAL	**4706**	**302**	**4404**	**6.4**

TRICHOMONIASIS IN NEW MEXICO

	Geographical Locations of Trich Herds					
	Central	**NE**	**NW**	**SE**	**SW**	**UN**
# Positive	100	30	27	28	66	0
# Negative	1177	632	525	541	793	4
% Positive	7.8	4.5	4.9	4.9	7.7	0
Total	**1277**	**662**	**552**	**569**	**859**	

TRICHOMONIASIS IN ARIZONA

Year	# Tested	# Positive	% Positive
2000	64	2	3.0
2001	330	3	0.9
2002	403	15	3.7
2003	846	5	0.5
2004	2560	120	4.6
2005	940	37	3.9
2006	3138	109	3.4
Total	**8281**	**291**	**3.5**

TRICHOMONIASIS IN TEXAS

Year	# Tested	# Positive	# Negative	% Positive
2006	3300	396	2904	12

Data Source: Texas Veterinary Medical Diagnostic Lab

Practicality of Pregnancy Determination via a Blood Test

Bruce B. Carpenter, PhD
Associate Professor and Extension Livestock Specialist
Texas Cooperative Extension-Texas A&M University System
Ft. Stockton, TX

Introduction

The economic value of annual pregnancy testing and culling of open and subfertile cows and heifers has been well documented: with positive affects on herd fertility, weaning weight per cow, and income per cow (Sprott, 2006). In addition, the identification and removal of open and subfertile females allows supplemental feed and pasture costs to be better controlled. The SPA data base for 327 herds, summarized from 1991 through 2002, shows that production costs per cow are a key indicator of whether or not a positive return on assets will occur (McGrann et al., SPA 2004).

Rectal palpation of the fetus, and/or uterine-placental structures has been a long-used method of determining pregnancy in cattle. Advantages with palpation are that it is still a very quick method of determining pregnancy and it requires very little in the way of equipment. It does however require extensive training and experience, especially if performed during the very early stages of pregnancy (35-60 days). As opposed to dairymen, most beef ranchers utilize rectal palpation pregnancy checks during the fall, at weaning, when it is generally easier to detect a large fetus at 3 to 6 months of development. Still, even in later developmental stages, errors can and do occur with rectal palpation (see below).

In 2004 a new method to determine pregnancy became commercially available to cattlemen. Called the BioPRYN® test, it utilizes a laboratory procedure to test tail- or jugular-bled cattle for pregnancy. It is essentially a “yes / no” test. It is highly accurate: over 99% on pregnant cows and about 95% on open cows. Blood collections are shipped by commercial carrier to a laboratory. Results are available by fax or e-mail within 27 hours after arrival at the lab. Cost of the test is $2.25 per sample, plus purchase of blood collection equipment and shipping.

About the BioPRYN® Test

The test is available through BioTracking LLC, located in Moscow, Idaho. BioPRYN stands for pregnant ruminant yes / no, as it has application in many species of domestic and wild ruminant animals. The BioPRYN test is an enzyme-linked immunosorbent assay (ELISA) that detects the presence of a protein known as ‘pregnancy specific protein B’ (PSPB) in the blood of the mother. PSPB is produced by cells in the embryonic trophoblast or fetal placenta where it enters the into the mother’s blood from the uterine caruncles. PSPB can be accurately detected as early as 30 days post-conception (i.e. cows and heifers can be tested as early as 30 days after breeding). However, there is a caveat: cows that have calved, will have residual PSPB in their blood. To allow for clearance time, it is recommended not to test lactating cows until 90 days after calving - so practically speaking - a herd of multiparous beef cows managed under a controlled calving season, probably wouldn't be tested until at least 30 days after the end of the breeding season (see Figure 1). With calving dates for individual cows, it could be possible to track and test individual animals at earlier times (i.e. during the breeding season). But for range cows, this scenario would be unlikely due to labor and animal handling requirements.

Cows are determined to be open or pregnant based on the optical density of blood samples as measured by calibrated laboratory equipment. The report you receive in the mail will have an explanation of all information provided. The report will include: animal ID, open or pregnant, and a numeric value for the optical density of that sample. Although BioPRYN is a yes / no test, some estimation of length of gestation can be made based on the relative magnitude of optical densities between samples. That is, cows in late gestation will have a relatively higher optical density compared to cows that are in early gestation. On occasion, instead of open or pregnant, the report will say 'open-repeat' or 'pregnant-repeat'. This means that the optical density score was near the "cutoff" and indicates that 1) the age of the embryo may be just less than 30 days, or 2) that it has died and left some residual PSPB. By the time animals are re-bled and re-tested, (5 days or more) the embryo will have either grown or residual early embryonic PSPB will have cleared the cow's system.

There are 13 affiliated laboratories located across the U.S. and two in Canada and one in Hungary. The Texas labs are: Texas A&M Veterinary Medical Diagnostic Lab, College Station; Integrated Dairy Services, Dublin; and Dairy Veterinary Management Services, Hereford. Most are owned and operated by veterinarians. These labs purchase test kits from BioTracking LLC. Samples can either be tested at regional labs or in Idaho. In 2005, 85,000 tests were done. By mid-December, 2006; 184,074 tests had been done. Because BioPRYN is an accurate test for early pregnancy, it is popular in the dairy industry; especially on smaller dairies that may not have access to ultrasound technology. Many beef producers are now using the BioPRYN test as well.

During the 1980s and 1990s, much of the discovery research on PSPB was conducted at the University of Idaho by Dr. Garth Sasser and his colleagues. Dr. Sasser is now retired as a professor emeritus and lives in Moscow, ID. He is the founder of BioTracking LLC.

Applications of the BioPRYN® Test and Some Comparisons to Rectal Palpation

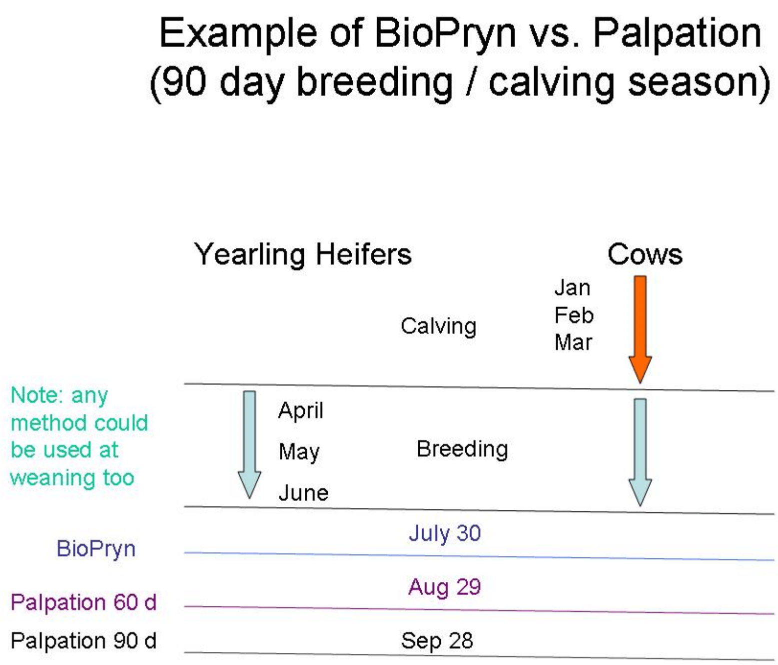
Cost:Effectiveness. In order to be cost-effective, any method of pregnancy testing should have an error rate of less than 3% (this also depends on the % of open cows in the herd). With inexperienced or unskilled palpators, the error rate can exceed this - sometimes by a lot. The cost of paying someone to palpate typically ranges from about $3 per head to $10 per head depending on herd size, travel expense, etc. Errors where pregnant cows are incorrectly diagnosed as open would cost about $150 per head (purchase of bred replacement - less pregnant cow sale + trucking + commission). Errors where open cows are incorrectly diagnosed as pregnant would cost about $280 per head assuming she was kept for 8 months (McGrann, et al. SPA 2004). The latter assumes the cow re-bred at the next opportunity - that is not always the case either. If accuracy of rectal palpation is a concern, then the BioPRYN test offers an alternative. Similarly, if a manager is unsure about the accuracy of palpation in his herd, then the BioPRYN test can be used as a "cross-check" on rectal palpation results.

Time. Remember that the results of the BioPRYN test are not immediately available, so any keep or cull decisions would need to be post-poned for a period of days (perhaps 4-5 in remote rural areas where commercial carrier service may be slow). In addition, cattle must be individually identified so that they can be re-worked and re-sorted once the results of the BioPRYN test are known. With traditional palpation, neither individual ID, nor the need to re-work cattle is required. With large range herds, the feasibility of keeping animals penned up in a trap for several days might be a consideration under some circumstances. Finally, rectal palpation does not have to be a "yes / no" test. A skilled person can determine the stage of pregnancy (i.e. "heavy-, medium- short- bred", etc.). This type of information is often useful for culling and marketing decisions.

Safety. Embryo loss from rectal palpation or trans-rectal ultrasound have been documented, but reports vary (Alexander, et. al. 1995; Romano, 2004). This could be a factor favoring the BioPRYN test in dairy cows but this is not is not normally a concern for most beef cows since ranchers typically don't palpate early pregnancies.

Example. The BioPRYN test can be used at any time from 30 days post-conception until the end of pregnancy, but cows should not be tested until 90 days after their last calf. Figure 1 shows a possible time-line for testing both a herd of heifers and a herd of cows, each with a 90 day breeding / calving season.

Figure 1



TX Field Trial. A recent field trial in Texas demonstrated how BioPRYN can be used to check the accuracy of rectal palpation. It highlighted some potential management considerations for use, and estimated the cost of both mis-diagnosis and of not pregnancy testing at all.

The accuracy of palpation by two persons of varying experience was evaluated against the results of BioPRYN. Palpator A was a rancher with 10 years experience who tests his cows once yearly (about 400 head). Palpator B was a person who receives year-around practice and has 25 years of palpation experience. Fifty head of aged cows were palpated. They were at fairly high risk of re-breeding failure: body condition scores were bcs 3- 6%, bcs 4- 70%, bcs 5- 22%, and bcs 6- 2%; and teeth were broken solid, short solid and medium solid. Palpation and concurrent blood sampling was performed 3 months after herd bulls were removed. Table 1 shows palpation accuracy and estimated cost of mis-diagnosis for pregnancies 90 days and more.

A confounding factor was that cows had unintentionally been exposed to bulls after the end of the breeding season. Palpator B detected 7 pregnancies between 40 and 60 days. This was confirmed with BioPRYN. Furthermore, BioPRYN indicated that 7 cows classified as open by palpator B did in fact have enough PSPB to be reported as pregnant. They had optical density values just over the 30 day threshold and probably were in stages of gestation not reliably detectable by Palpator B (30-40 days). In addition, the BioPRYN "retest" category indicated 9 head, which were probably just less than 30 days in gestation.

Table 1. Accuracy of Rectal Palpation by Two Individuals as Verified by the BioPRYN Test (n=50 head)

	Palpator A	**Palpator B**
Cows palpated either open or 90 or more days pregnant	**80%** (40/50)	**98%** (49/50)
Estimated cost of mis-diagnosis (90+ days)	**$1962**[1,2]	**$150**[1]
*Cows palpated either open or 40-60 days pregnant ("short-bred")	**41%** (12/29)	**97%** (28/29)
Estimated cost of not palpating this "high risk" herd (assumes high palpation accuracy)	**$6540**[1] (30 head open or <60 days)	

[1]estimated cost of keeping an open cow 8 months = $218 (adapted McGrann,et al. SPA, 2004).

[2]estimated cost of selling an old pregnant cow and replacing with a young pregnant cow = (difference in value + mileage + commission) $150

*for this analysis, cows less than 40 days pregnant were considered open

In this situation, it was desired to be able to identify cows that were <90 days pregnant and cull them. Unfortunately, the BioPRYN test alone would not have differentiated those cows (i.e. cows bred before or after the end of breeding season). Managers trying to decide when, and by what method, to pregnancy test should be aware of this - so that in situations where roaming bulls might pose a problem for the BioPRYN method, testing can be done as close to the end of the breeding season as possible (i.e. 30 days from the end).

Other Uses of BioPRYN. There are other specialized uses where the test can be used in artificial insemination to determine conception to synchronized AI vs. clean-up bulls. To do this, clean-up bulls would not be placed with the herd until 16 days after synchronized AI. Blood testing at 30 to 35 days after AI will detect AI pregnancies but not early pregnancies to the bulls. All cows classified as 'open' with the first test, are re-tested 30 or more days after the end of the bull breeding season. The test can also be used in specifically timed sequences to shorten the length of a calving season, or to determine conception patterns by 21 day intervals. More information is available at the website listed in the references section.

References

Alexander et al. 1995. Embryonic losses from 30 to 60 days post-breeding and the effect of palpation per rectum on pregnancy. Theriogenology 43:551-556.

McGrann, J.M , et al. 3/30/04. Cow-Calf Standardized Performance Analysis - SPA - Informing Decision Makers. http://spatx.tamu.edu/library.htm

Romano, J.E. 2004. Early pregnancy diagnosis and embryo / fetus mortality in cattle. PhD. Dissertation, Texas A&M.

Sprott. L.R. 2006. The value of annual pregnancy testing in a beef herd. Proceedings 52nd Annual Beef Cattle Short Course, College Station. G-1.

www.biotracking.com