WHY ARE WE CHALLENGED WITH THE USE OF AI IN SOUTHEASTERN USA COMMERCIAL BEEF OPERATIONS?

W. Dee Whittier, DVM
Extension Veterinarian, Cattle, Department of Large Animal Clinical Sciences
VA-MD Regional College of Veterinary Medicine

Introduction

Artificial Insemination (AI) of commercial beef cattle has been technically possible since the 1930's and commercially available since the 1950's in the United States. Its adoption has been much slower in the beef industry than in the US dairy industry where it was estimated (USDA, 2002) that 92 % of dairy operations used AI to some extent and that 45% of US dairy operations used AI exclusively to get cows pregnant.

An estimate of the level to which AI was used in beef cattle was published by USDA who reported in 1998 that 13.3 percent of beef cattle operations had used AI. However, the percentage of all beef cows that were being inseminated was reported to be less than 5%. Lamb et al. (Lamb et al., 2010) reported a recent increase in AI in beef cows. Table 1 estimates annual insemination of beef cow and is based on the number of straws of beef semen reported to be produced. Based on this data the cyclic pattern of AI in beef cows associated with the price cycle is continued but with significant increases in AI in the late 1990's and through 2008.

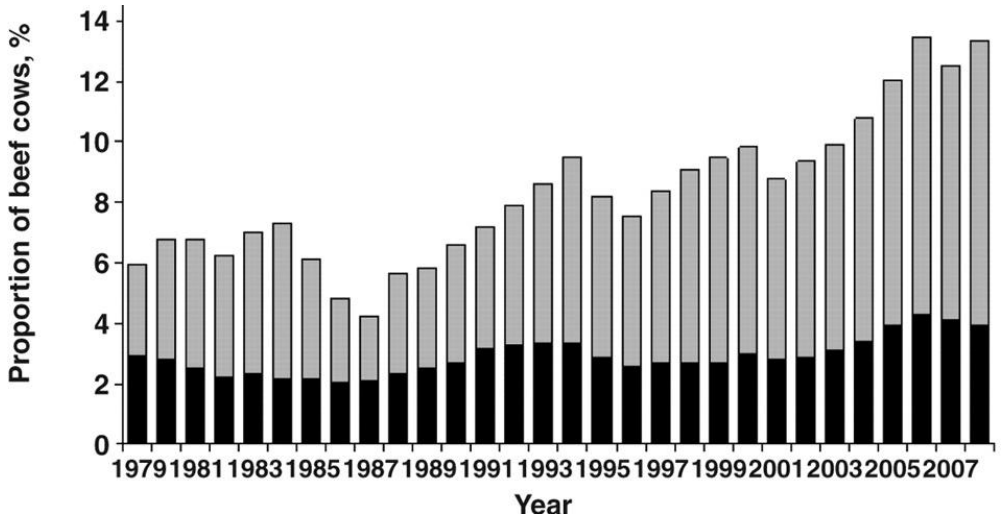

Figure 1. Proportion fo beef cows potentially artificially inseminated in the US from 1979 through 2008. Black portion of bars represents semen sales and gray bars represent custom semen collections. (Lamb et al., 2010)

This lower proportion of AI in the beef industry certainly, in part, is certainly a function of the lower values of individual beef animals. A ten percent improvement in the production of the next generation of a dairy cow with superior genetics that may produce a gross value of $2500 would be $250. On the other hand, a ten percent improvement in the production of the next generation of a beef cow with superior genetics that may produce a gross value of $600 would only be $60.

Use of Reproductive Technologies

In 1997 USDA's National Animal Health Monitoring System (NAHMS) collected data on reproductive management in beef cow-calf herds (USDA, 1980). The study was designed to represent 85.0 percent of all US beef cows. The study asked producers about their use of five reproductive technologies: palpation for pregnancy diagnosis; semen evaluation of bulls for breeding soundness; artificial insemination; estrus synchronization (with or without associated artificial insemination and; pelvic measurement as a tool in the reduction of dystocia in first parturition females.

Figure 2 below shows the proportion of operations that reported using these reproductive technologies. The responses are broken down by herd size into four categories.

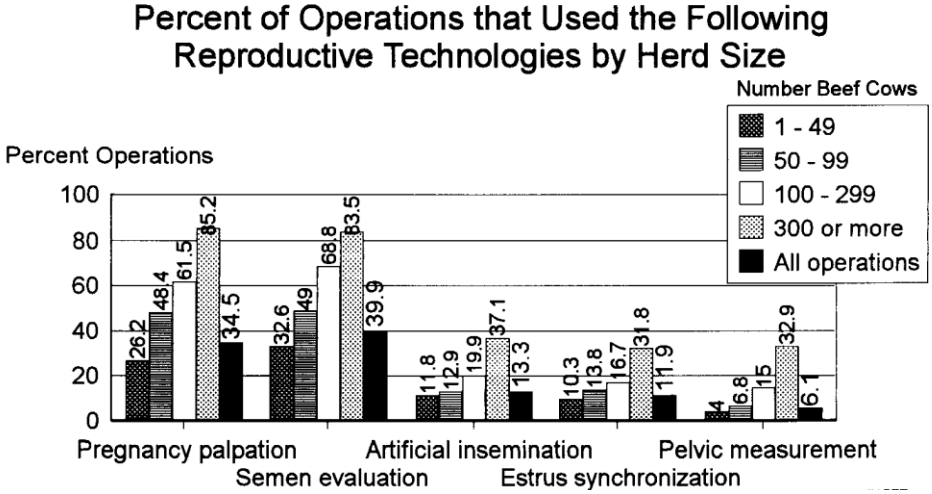

Figure 2. Percent of operations that used reproductive technologies including pregnancy palpation, semen evaluation for bulls, artificial insemination, estrus synchronization and pelvic measurement. (USDA, 1980)

According to this NAHMS estimate 13.3 percent of operations had ever used AI in their operations. It is also striking that herds of 100 to 299 cows had used AI nearly twice as often as herds of less than 100 cows and herds of over 300 cows had used AI nearly twice as often as herds with 100 to 299 cows. As would be expected, patterns for use of estrus synchronization roughly paralleled the use of AI when broken down for herd size.

Reasons for Not Using AI

The NAHMS study (USDA, 1980) also asked cow-calf operator about reasons why they had not used the same reproductive technologies. The five most often heard responses were: 1) the perception that the technology did not return good results; 2) the amount of time and labor required to apply the technology was excessive; 3) the operators had insufficient facilities to apply the technology; 4) the cost of the technology was prohibitive; and 5) the technology was perceived to be too complicated.

Figure 3 below summarizes the responses that producers who were not using the technologies gave when asked for a reason.

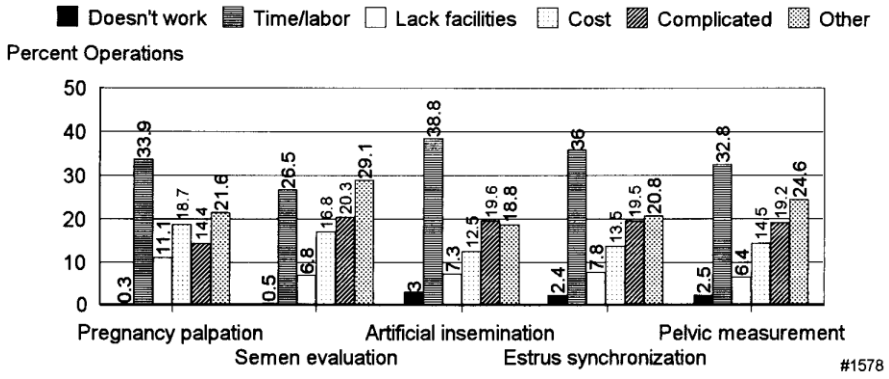

Figure 3. Percent of operations who gave which reasons for failure to adopt five different reproductive technologies. (USDA, 1980)

For every reproductive technology of interest, the most frequently mentioned reason for not using a technology was time and labor. For AI this number was the highest with 38.8 percent of producers listing time/labor concerns as the biggest reason that they have not adopted the use of AI. Certainly this signals that there is a real or perceived idea

that AI is too time/labor intensive. Second in importance for AI is the "too complicated" reason. This reason for not using AI is followed by cost and then lack of facilities. Only 3 percent of respoondents said that they did not do AI because they thought that it did not work.

What does this data mean to the challenge to use AI in the Southeast? To increase AI we must change the perception that the time/labor investment outweighs the benefit of AI. We must deal effectively with the "too complicated" issue as well. Interestingly, if we accept this data, dealing with the lack of facilities and the perception that AI does not work should be our lowest priorities.

Herd Size Data

One of the major factors that certainly affects the use of AI in the beef industry is herd size. A study of the results of USDA's National Agricultural Statistics Service (NASS) 2007 census published in 2009 (NASS, 2009) is of special interest as we consider increasing AI use.

Economies of scale are factors that cause a producer's average cost per unit to fall as the scale of output is increased (Gelles & Mitchell, 1996). Although this concept has its limits, particularly in beef cow/calf units that are land intensive, the concept also has great merit. Certainly poultry, dairy and hog operations have demonstrated the application of "economies of scale". This economy of scale is undoubtedly a factor in the NAHMS statistic indicating much greater use of AI in herds as their cow inventory increases. This concept couples with the time/labor factor discussed above. It is very probable that in most settings the amount of time and labor required to perform artificial insemination per cow decreases as herd size increases, at least to a certain point. Hence size trends would be expected to significantly impact AI usage.

During the five years between the NASS census in 2002 and 2007, the US beef cow inventory declined from 33.4 million cows to 32.8 million cows. The number of farms with beef cows that had calved also contracted from about 865 thousand to about 819 thousand. (See Figure 4 below.) .

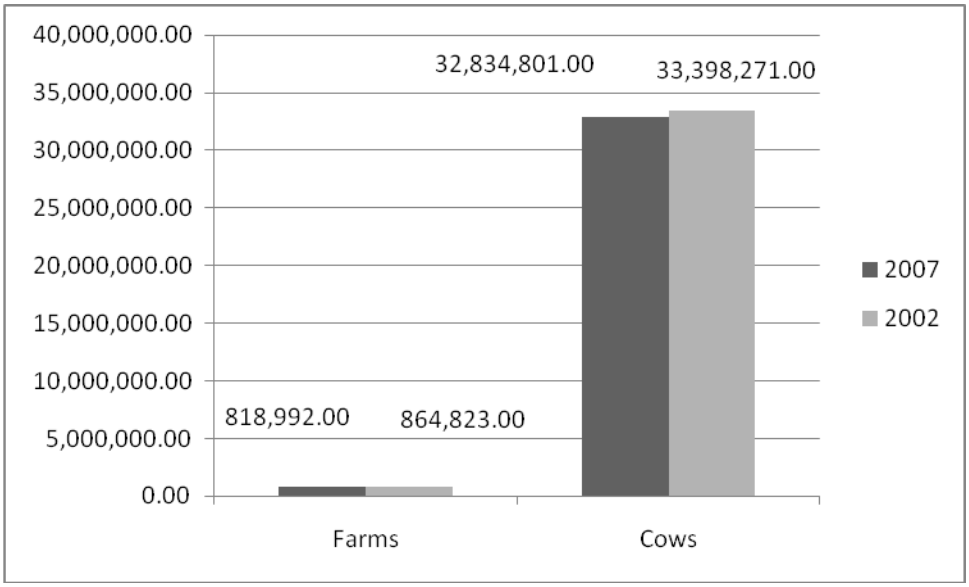

Figure 4. Number of fams with beef cows that have calved and total US inventory of beef cows compared for 2002 and 2007

This change resulted in the average beef cow herd size going from 38.6 to 40.1 cows and moving over 40 cows for the first time since census records for animal have been collected. While this consolidation trend is slow, it is real and is consistent with a long term trend from prior censuses.

Figure 5 below shows the number of farms with beef cows in the 2007 census in the southeastern US. These nine states reported 197.5 thousand farms, an astounding 24.1 percent of all farms that reported beef cows in 2007. However, these herds only accounted for 19.3 percent of the US beef herd and only averaged 32.2 cows per herd. Figure 6 shows the average herd sizes in terms of beef cows that had calves in these states. Note that only Florida exceeds the average US herd size. Figure 7 shows the percentage of all reported beef cows that are in herds with more than 199 cows. Once again, only Florida has more than 22% of its cows in herds greater than 199 cows in size. This lack of concentration in Southeastern US beef herds makes increasing the use of AI more of a challenge because of the "economies of scale" factor.

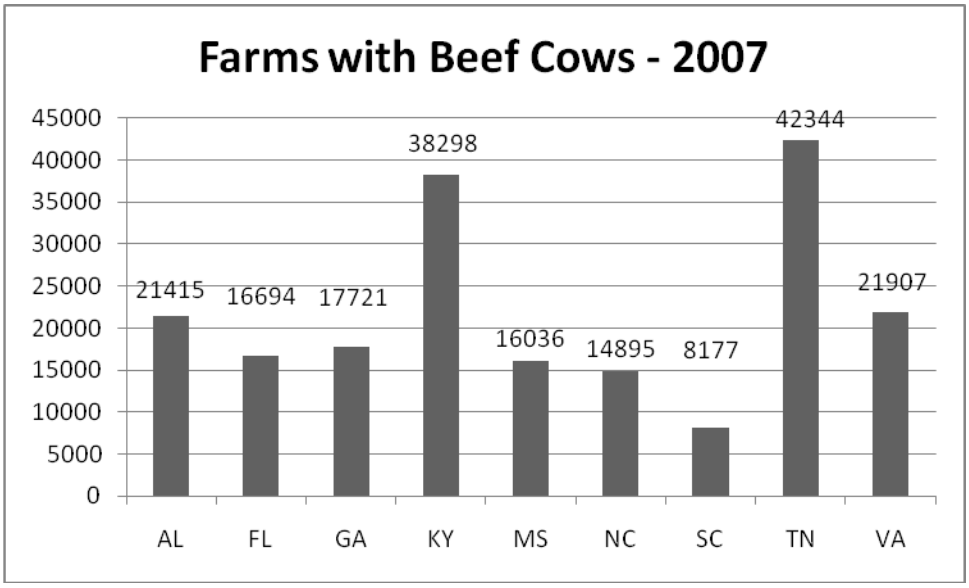

Figure 5. Number of farms in selected Souteastern US states as reported in the 2007 NASS census of agriculture.

Another factor which impacts the use of AI and relates to the size of herds is the motivation to own these beef cows. Although it would seem that making a profit would be the major incentive to own a beef herd, this is not true in may cases. Cattle producers own cattle for recreation, for esthetic reasons, for tax purposes, for historical and traditional reasons, etc. As herd size increases, along with the assoicated finanacial and time commitment, the liklihood that there is a major profit motive in the ownership of these cattle increases.

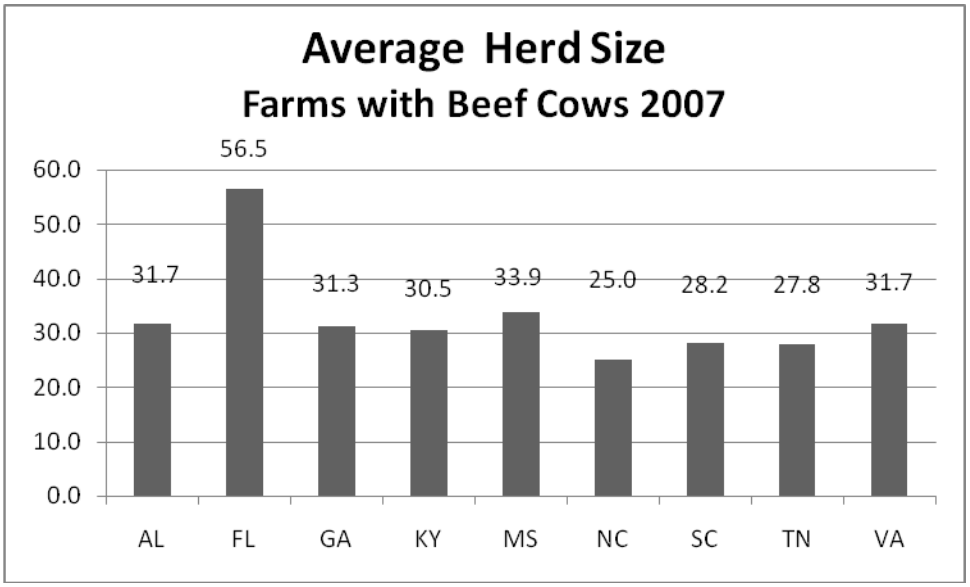

Figure 6. Average number of beef cows on farms in selected Southeastern US states as reported in the 2007 NASS census of agriculture.

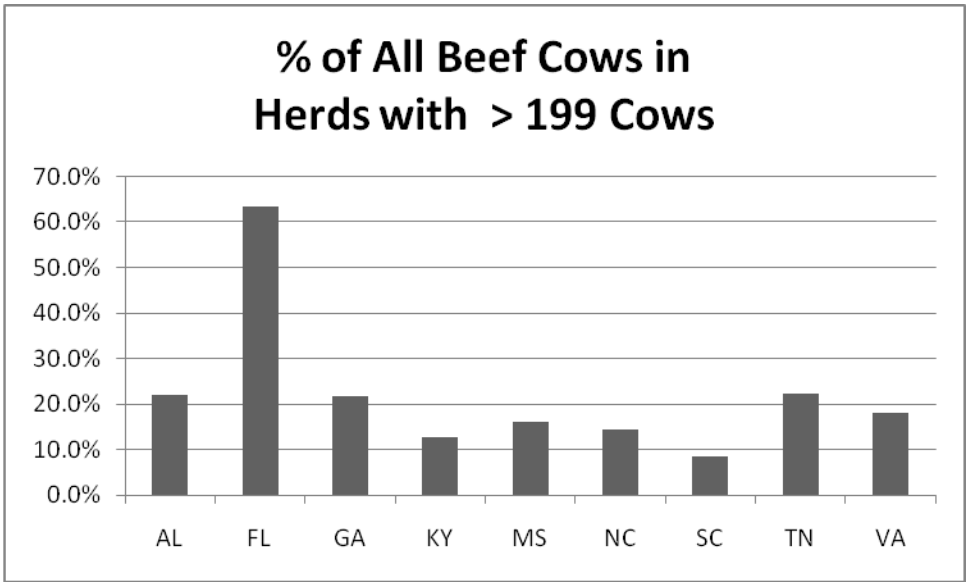

Figure 7. Percent of all beef cows in herds of more than 199 cows in selected Souteastern US states as reported in the 2007 NASS census of agriculture.

Figures 8 and 9 look at trends in the concentration of cow/calf operations into larger operations. Figure 8 compares the percentage of the total US beef herd in different sized herdsin 2002 and 2007. Figure 9 makes the sam comparison for Virginia. In both cases the percent of the total herd is increasing in larger herds at the expense of cows in samller herds. Note that in the total US beef herd 16.1% of all cows are now in herds of 500 or more. While in Virginia only 3.7 % of cows live in herds of 500 or more, the

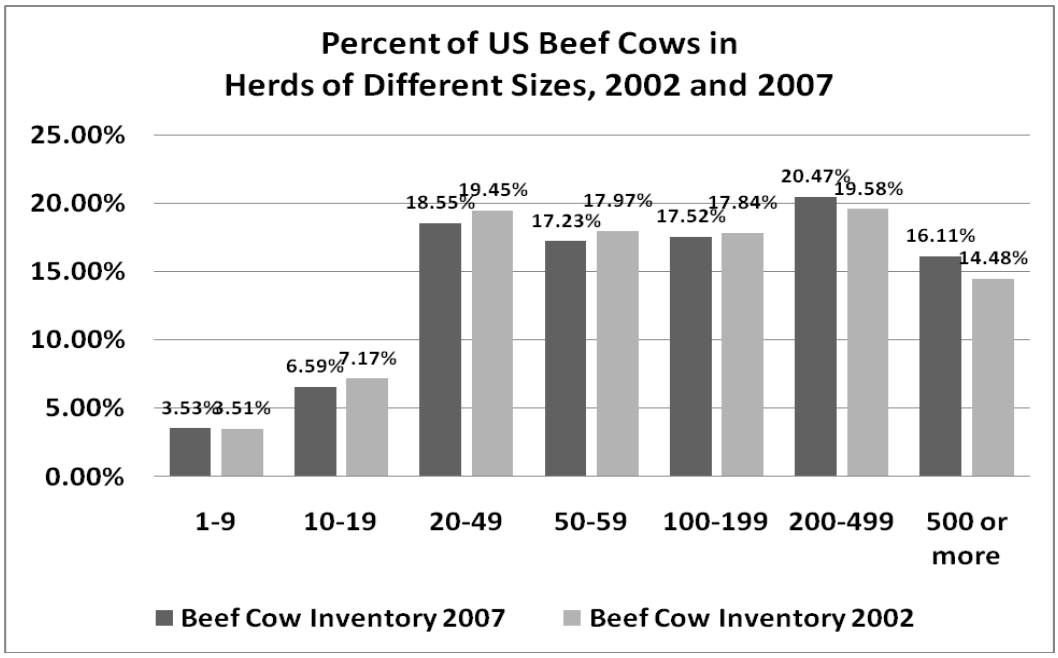

Figure 8. Thje change iin the percent of all US beef cows in herds of different sizes campaaring 2007 inventories with 2002 inventories as reported in the 2007 NASS census of agriculture.

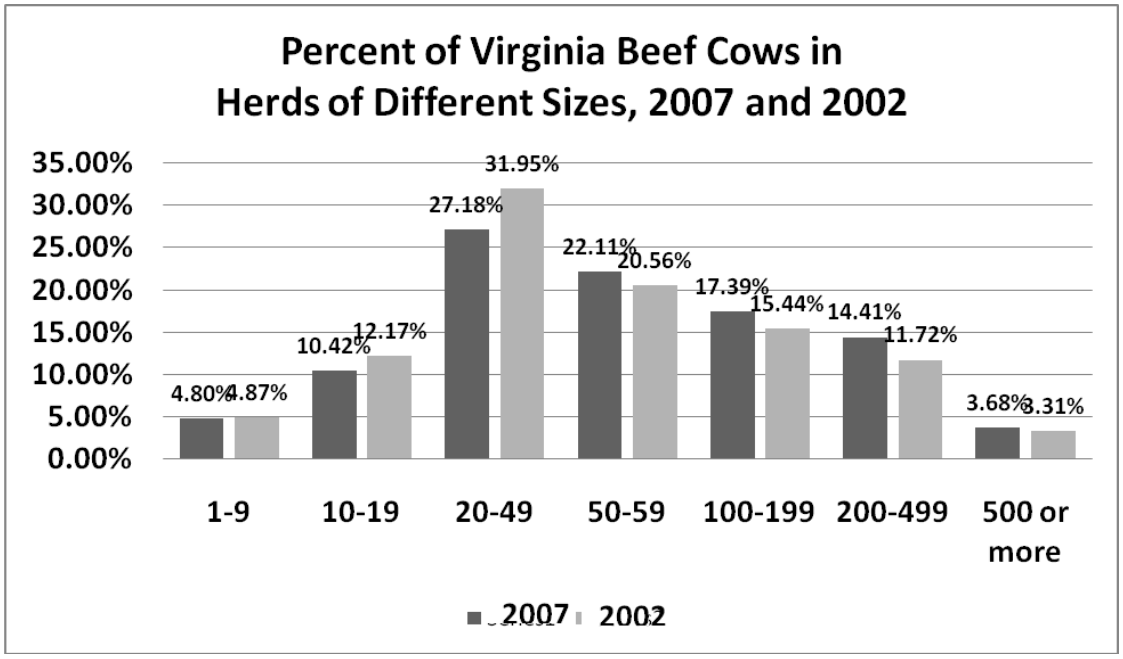

Figure 9. Percent of all beef cows in herds of more than 199 cows in selected Souteastern US states as reported in the 2007 NASS census of agriculture.

percent in herds of 200 to 499 cows increased from 11.7 to 14.4% . Meanwhile in Virginia, cows in herds of 20 to 49 in Virginia decreased from nealry 35% to about 27 percent. The increase in concentration of cows bodes well for an increase in AI in beef herds.

What Benefits Will Artificial Insemination Provide a Beef Producer?

One of the questions that must be asked in a discussion of increasing the use of AI is, "So, what does AI offer that a prodicer can't get with natural service?" There are non-genetic answers to the question. These include greater control over reproduction in the herd, perhaps some enhancement of reproductive outcomes, some safety from disease and a decrease in bull costs. However, the biggest justification for AI is the superior genetics that can be obtained throough the use of AI.

One of the potentially great values of AI genetically is the ability to mate each cow to a selected bull. This allows matching the characteristics of a cow with a particular sire. But it also extends to the the use of other breeds without the significant commitment of creating entire breeding pastures where different sire breeds can be utilized.

To date, the major genetic components which producers have looked for in AI decisions have been growth, calving ease and carcass characteristics. More data is needed to assess the economic value of the gentics that have improved beef production in these three areas.

It is truly impressive that selection has allowed, for example in the Angus breed so much calving ease. The Spring 2010 Angus Sire Evaluation Report (Angus, 2010) reports that average birth weight EPD's for sires born in 1988 has stayed essentially the same for sires born through 2008, while the same set of sires has increased yearling weight EPD's by 55 pounds. Beef producers can purchase genetics for significantly more growth by using AI, especially in the Angus breed. In addition, sires that will transmit traits for enhanced carcass quality for offspring going into the mainstream market are readily available.

Transforming these genetic qualities into increased profits is certainly potentially possible, however not automatic. It seems logical that the longer the offspring of AI are owned, the more potential there is for these offspring to return profits. If AI sired calves are sold at weaning, only increased survival (from better calving ease) and weaning weights automatically enhance value, while the increase in potential future weight gains and carcass or maternal value may or may not enhance selling value. If, however,

offspring are put through a retained ownership program and then sold on a grid, there is much more opportunity for superior traits to express themselves and hence add value to these offspring. Offspring from AI that are kept as replacements may return enhanced value in the herd for many years.

There are, however, some challenges to receiving returns for the increased value of AI Sired offspring. Much emphasis has been placed in several of the beef breeds on enhancing carcass quality. Bulls have been identified which sire offspring that will more likely grade choice when sold as fed cattle through traditional channels. The problem is that in recent years, decreasing additional value has been assigned to carcasses that grade choice compared to ones that grade select (Meyer & Steiner, 2010) Figure 10 shows changes in the Choice-Select Spread from 1999 to 2010. Figure 11 shows a significant trend in increasing the percentage of carcasses that graded choice during those same years.

The significant decrease in the enhanced value of choice carcasses has meant that offspring of cattle produced by AI with the goal of increasing carcass value was disappointing.

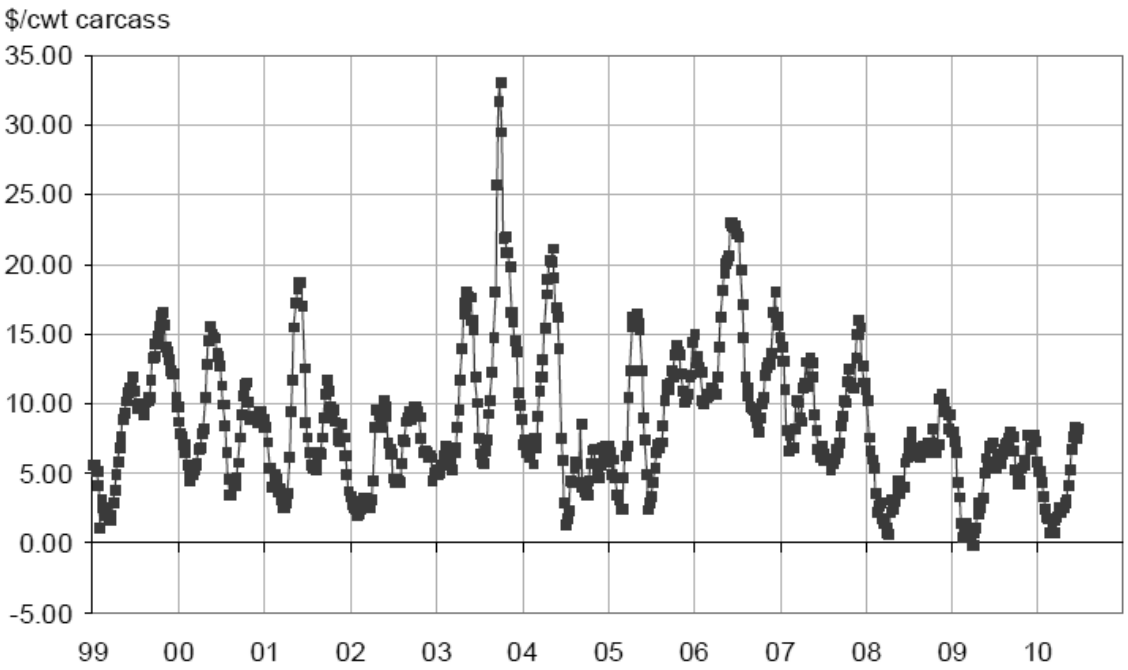

Figure 10. Difference in the value of choice grade versus select grade carcasses weighing 600 to 900 pounds for each month from 1991 through July of 2010. (Meyer & Steiner, 2010)

Higher Choice percentages have been caused by new knowledge of the factors causing higher marbling, including genetics and nutrition changes. Probably also, changes in percent choice carcasses have resulted, to no small degree, in changes in the grading system itself, including new automated grading systems.

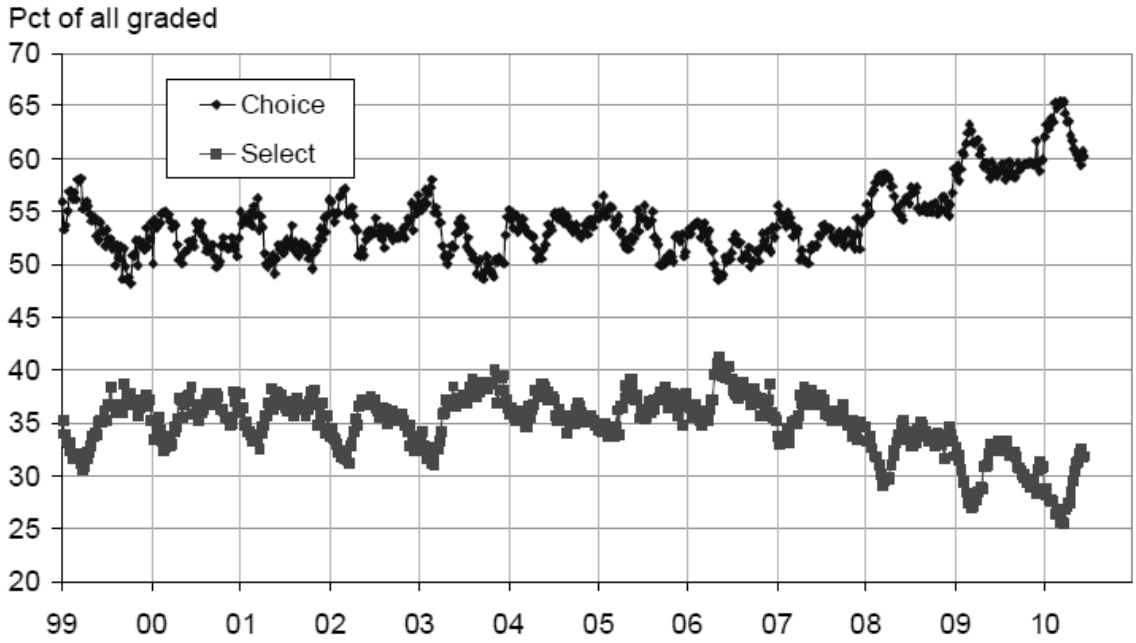

Figure 11. Percentage of cattle carcasses grading choice summarized on a weekly basis from January 1999 through June 2010. (Meyer & Steiner, 2010)

This example is used to demonstrate that there are challenges to producers receiving premiums for the production of cattle with certain characteristics. Once genetic traits with potential economic value are identified and propogated, there is a tendency for production of animals with that trait to become commonplace enough so that their economic value decreases.

Alliances have been formed designed to market, at an increased value, beef products from cattle with certain genetic traits. It has been a challenge, however, to build and maintain these alliances so that they transmitted significant enough returns to producers so that long term loyalty and mutual economic success. Without the long-term progress of these alliances, there has often been insufficient incentive for producers to develop long-standing AI programs designed to produce animnals that meet the specifications of these alliances.

The goal for AI in beef cattle is to move to the level of becoming relatively routine in larger operations. This gaol will only come about if and whne the challenge of developing systems where producers of cattle with the genetic traits that AI sires can transmit will consistently receive an economic reward for producing those cattle. To date, putting such systems into place has only been partially successful.

What Industry Trends Will Promote or Inhhibit the Advancement of AI in Beef Cattle ?

In 2006 Beef editor Joe Roybal discussed major trends that are occuring in the US beef industry (Roybal, 2006). Fourteen trends were discussed. The seven listed below are trends that should be taken into consideration as attempts are made to increase the penetration of AI into the beef industry.

- *The demand for increased efficiency brought about by increasing costs and competition for feedstuffs by their use in fuel production*
- *The coming market-driven surge in animal documentation and verification for process, source and age of animals, and its effects on operational and industry competitiveness.*
- *Continued consolidation within the industry — among genetic providers, feedlots and larger commercial cow-calf operational size.*
- *The ongoing generational transfer of wealth in the U.S. The surge of outside dollars for agricultural land continues. Will cattle still be on the ground with recreation the prime motivator, and what does an aging ranch population bode for the business?*
- *Product differentiation and the rise of natural and organic markets.*
- *Increased scrutiny of drug use in food animals.*
- *Continuing education/research. Where will the teaching tools for the current and following generations of cattle producers come from, if land-grant system shrinkage continues?*

As the beef cattle industry continues to look for ways to increase efficiency through the broad use of artificial insemination, these trends which will exert external pressure on the industry must be utilized or at least acknowledged if major advances are to be accomplished.

Summary

The technology of artificial insemination which has provided the basis for large advances in other food animal industries has never been utilized to its fullest potential in the beef industry, particularly in the commercial portion of the industry. In order to achieve a greater usage in the beef industry the major obstacle that must be overcome is the perception that the time and labor that are required to carry out AI are excessive for the return that result.

Several trends have the potential to enhance the penetration of AI into the beef cattle industry. One of these is the increasing concentration of the cow/calf sector. As operations become larger they may have more resources and be able to utilize the tools of economies of scale to increase the utilization of AI.

Systems for measuring and selecting genetic traits with potentially positive economic value exist to support the beef cattle industry. Challenges to developing marketing systems that provide returns that are significant enough to stimulate widespread use of AI technology continue to be elusive.

Literature Cited

Angus Sire Evaluation Report. 2010. American Angus Association. Spring 2010. http://www.angus.org/Nce/GeneticTrends.aspx

Gelles, G. M., & Mitchell, Douglas W. 1996. Returns to scale and economies of scale: Further observations. Journal of Economic Education 27, Summer 1996, 259-261.

Lamb G. C., Dahlen C. R., Larson J. E., Marquezini G. & Stevenson J. S. 2010. Control of the estrous cycle to improve fertility for fixed-time artificial insemination in beef cattle: A review J. Anim Sci. 2010. 88:E181-E192.

Meyer, S. &Steiner L. 2010. Choice and Select Beef Grade Price Spread Trends. CME Daily Livestock Report 8 (no. 128), July 2, 2010.

National Agricultural Statistics Service (NASS). 2009. USDA. 2007 Census Full Report: U.S. Summary and State Data. http://www.agcensus.usda.gov/Publications

Roybal, Joe. 2006. Our Crystal Ball. Beef December 2006: pp.5-7

United States Department of Agriculture. 2002. Part I: reference of dairy health and management in the United States, 2002. http://nahms.aphis.usda.gov/dairy/dairy02/Dairy02Pt1.pdf

USDA. 1998. Info Sheet: Reproductive Technology in Beef Cow-Calf Herds. http://nahms.aphis.usda.gov/vs/ceah/cahm