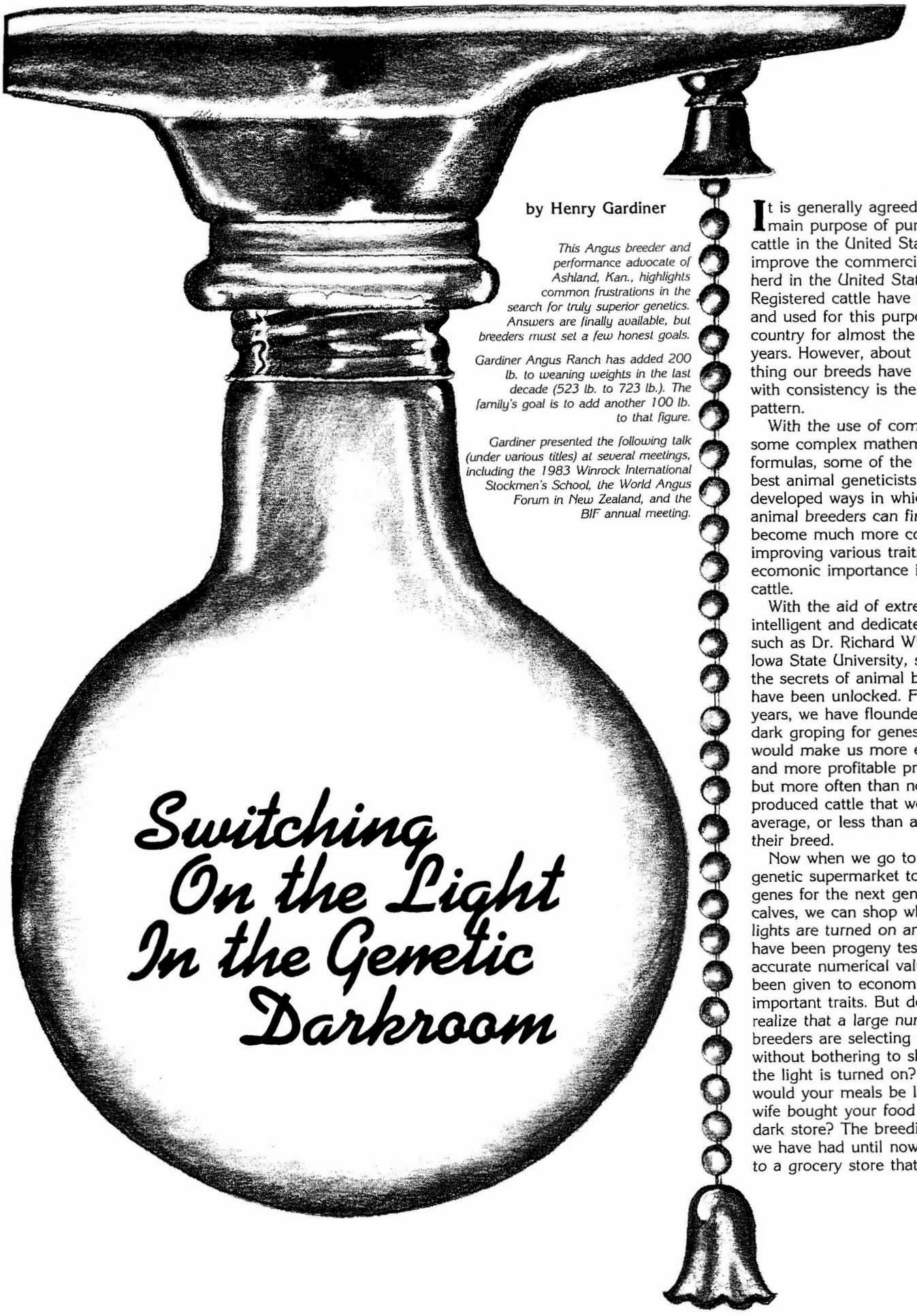


Switching On the Light In the Genetic Darkroom

by Henry Gardiner

This Angus breeder and performance advocate of Ashland, Kan., highlights common frustrations in the search for truly superior genetics. Answers are finally available, but breeders must set a few honest goals.

Gardiner Angus Ranch has added 200 lb. to weaning weights in the last decade (523 lb. to 723 lb.). The family's goal is to add another 100 lb. to that figure.

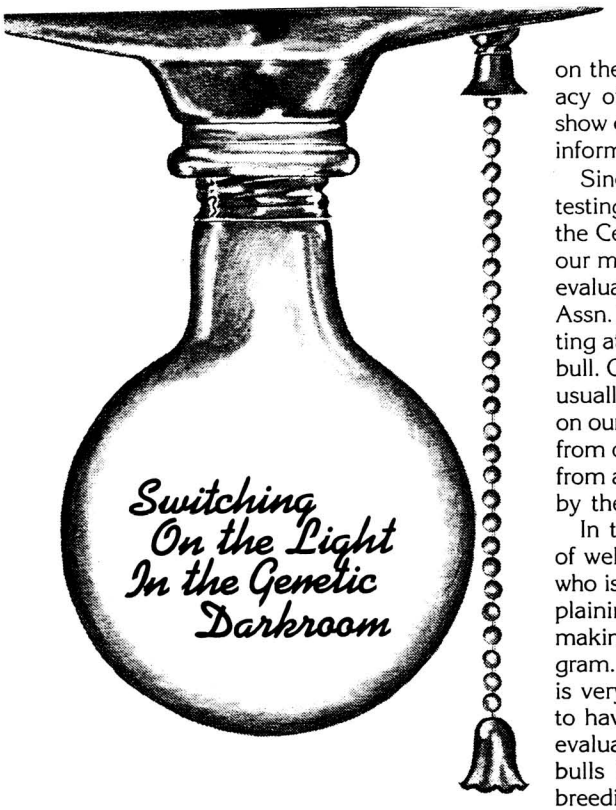
Gardiner presented the following talk (under various titles) at several meetings, including the 1983 Winrock International Stockmen's School, the World Angus Forum in New Zealand, and the BIF annual meeting.

It is generally agreed that the main purpose of purebred cattle in the United States is to improve the commercial cattle herd in the United States. Registered cattle have been bred and used for this purpose in this country for almost the last 100 years. However, about the only thing our breeds have retained with consistency is their color pattern.

With the use of computers and some complex mathematical formulas, some of the worlds' best animal geneticists have developed ways in which we as animal breeders can finally become much more consistent in improving various traits of ecomonic importance in our cattle.

With the aid of extremely intelligent and dedicated scholars, such as Dr. Richard Willham of Iowa State University, some of the secrets of animal breeding have been unlocked. For 100 years, we have floundered in the dark groping for genes that would make us more efficient and more profitable producers, but more often than not we have produced cattle that were only average, or less than average for their breed.

Now when we go to the genetic supermarket to select the genes for the next generation of calves, we can shop where the lights are turned on and the traits have been progeny tested and accurate numerical values have been given to economically important traits. But do you realize that a large number of breeders are selecting their genes without bothering to shop where the light is turned on? What would your meals be like if your wife bought your food in a pitch dark store? The breeding system we have had until now is similar to a grocery store that has had



all the labels removed from its cans and boxes. We thought we could tell what was in the can by its size and shape but if we found one with a purple ribbon on it we know we had hit a genetic jackpot. The fact is that this type of breeding program has worked very poorly in the past and there is no reason to think it should work any better in the future. It is about time that we realize we cannot choose our genes by looking.

I am reminded of two bulls in the Angus breed, Canadian Colossal and Shearbrook Shoshone. Canadian Colossal weighed 2,500 lb. and was about 58 inches tall. Shearbrook Shoshone weighed 2,200 lb. and was barely 54 inches tall. To eyeball the two, Colossal would have easily been the better bull. Yet in the sire summary Colossal's calves weighed 7.6 lb. less than the average of all the yearling calves in the summary. Shoshone's calves weighed 56 lb. over the average of the summary. As yearlings, the two sire groups had over a 63 lb. difference in favor of the smaller bull. The smaller bull also had calves that were 3.4 lb. heavier at birth on the average, and his daughters gave him a maternal breeding value of 109 compared to 102 for Colossal. I think this is an illustration that you just cannot tell by looking. If you select your genes in a container without a label on it, you may not get what you expect.

Do not get the idea that I am against livestock shows. I am not. They are the best way to promote cattle, meet people, and create enthusiasm for the business, especially among young people. But livestock shows are a very, very poor place to make our genetic decisions. I know, I have tried that way with very little success. I am convinced that for consistent genetic improvement we must use bulls that have enough tested progeny on the ground to give their traits an accuracy of near or above .90. At the age we show cattle there is no way we can have that information available on our show animals.

Since 1970, our ranch has been progeny testing bulls. Our first progeny tests were in the Certified Meat Sire program of PRI and our more recent testing has been in the sire evaluation program of the American Angus Assn. We have tested 40 some bulls by getting at least 30 or more progeny from each bull. Our payment for doing this testing was usually taken in the form of semen to use on our registered herd. This might be semen from our own bull we were testing or semen from a more proven bull that was accessible by the herd we were testing.

In the last 12 years we have used a lot of well-known bulls of the breed. My wife, who is my most severe critic, has been complaining for several years that we were not making much progress in our breeding program. I explained to her that genetic change is very slow and that she would just have to have more patience. When the last sire evaluation report came out, there were 23 bulls listed in it that we had used in our breeding program over the last 12 years. Included among these bulls were major show winners, sale-topping bulls at well-known auctions, and sires of show-winning cattle. Quite a few of the major Angus herds in the U.S. were represented. The average genetic value of these 23 bulls is summarized in Table 1.

then was, "I hope your last sets of figures are right. You know you don't have much time left to get something accomplished." She might well have been speaking to all the purebred industry. With our slow generation turnover and a tarnished reputation for breed improvement there aren't any of us who have much time left.

What about my wife's question about the sire evaluation data being an accurate measure of a bull's genetic ability? After progeny testing bulls for 12 years I am convinced that the values that have high accuracies are amazingly accurate. However, I have seen data with accuracies below .80 that can change more than one would expect. In all the bulls we tested, there was not one that did not sire some good calves. The really high ranking bulls have a much higher consistency than the poorer sires. The good ones sire very few calves that will rank below average.

If we study the data available in sire evaluation, it becomes apparent why genetic improvement has been so difficult. When I first became aware of breeding values, it seemed even the best breeding values were very low. A value of 105 is quite good and a value of 110 is about as high a trait value as there is in the breed. If an animal has a trait breeding value of a respectable 104, this would mean that for this trait that particular animal is 4 percent better than the animals with which it is compared. This isn't impressive until we realize that the progeny of this animal will receive one-half of this value since one parent contributes only half of the genes of an offspring. Thus, on the average, the offspring would only be 2 percent better for the trait because of the genes received from the parent with 104 breeding value.

Table 1. Average Genetic Value of 23 Bulls Used Over the Last 12 Years

Avg. birth weight	Avg. weaning weight	Avg. yearling weight	Avg. maternal breeding value
+.1 lb.	+3 lb.	+9 lb.	99.5

It is a little embarrassing to show anybody these figures, but I think they are probably very typical of a lot of purebred operations struggling to breed better cattle. I showed these figures to my wife and said, "Honey, here is why we have been making such slow progress." She looked at them and said, "Don't you think maybe you ought to let one of the boys manage this operation?"

With a little panic in my voice I pleaded for a little more time. I then showed her the average genetic values of the four bulls used in our herd after I based my selection of bulls on the Angus sire-evaluation report (Table 2).

It is important to remember that an animal doesn't have just one breeding value but a breeding value for each trait measured. The most common breeding values are given for weaning, yearling and maternal traits.

I used to think there should be animals in the breed with breeding values of 120 to 130. When Dr. Willham turned the spotlight on the genetic ability of our cattle, such values as this did not exist. We do have a spread of about 20 percent in breeding values from a low of 90 to a high of 110. This is certainly a significant difference that

Table 2. Average Genetic Value of 4 Bulls Used in Last Year's Breeding Program

Avg. birth weight	Avg. weaning weight	Avg. yearling weight	Avg. maternal breeding value
+.9 lb.	+19 lb.	+51 lb.	106

After looking at my second set of figures she could see that we should make about as much progress on yearling weight in one year as we had before in 6 years and instead of losing maternal value by one-half of a percentage point each year, we should be gaining by 6 percent in one year. Her comment

should allow breeders to make remarkable genetic change if they utilize the superior genes available generation after generation. Until now we have just used an occasional good bull. The odds were very much against using two or three superior bulls in a row. Now, however, we can decide which traits are important in each of our breeding programs and then select sires of known superiority for these traits. The use of top bulls on other top bulls' daughters should start us on the way to four-generation pedigrees with every animal on that pedigree a superior animal. When this occurs we will make dramatic genetic progress. The breeders of such animals will find a ready market for these cattle that will consistently and dramatically out-produce other cattle that have been bred in a hit and miss type program. Maybe then we might see breeding values approach 120. I think it is possible.

Under the present system of computing estimated breeding values for young animals without progeny, it has been my experience that those animals with very high estimated breeding values will usually have those values drop as they get progeny. For example, we just finished a progeny test on eight young sires. The average estimated breeding value for weaning weight for those young sires when they were yearlings was 107.5. The weaning weight breeding value for those eight bulls in our herd after we had tested about 20 progeny from each bull was 99.5. Theoretically about one-half of the values should go down and one-half of the values should go up. In this case, all eight breeding values dropped. They dropped an average of eight points. I repeat—breeding values with low accuracies are not very accurate.

This relatively new way to evaluate cattle and their breeding abilities has a number of new terms that one needs to be familiar with to communicate accurately. Such words and phrases as "estimated breeding value," "ratios," "possible change," "accuracy," "expected progeny difference," "maternal breeding value" should be rather well understood if you are going to communicate and draw conclusions in this new way of breeding cattle evaluation.

I am reminded of the time that I spent in the army in Germany in the 1950s. Several of us had been in a night class learning to speak a bit of German. We went to a local gasthaus to order a meal. Most of the waiters spoke good English but a friend wanted to order in German so he said "Herr Ober, Ich mogen eine heiss Hund bitte." The waiter gave him a very strange look. If you would translate what he said word for word it would be, "Mr. waiter, I would like a hot dog, please." However what he said in German was, "Mr. waiter, I would like a dog in heat, please."

In a recent ad in the Angus Journal underneath the photograph of a fine looking bull the caption said, "This bull's ability to transmit size and continued growth is unequaled in the breed." Underneath this they gave his yearling estimated breeding value; with a .91 accuracy, the bull's value was 100. The journalists' language in this ad described this bull as the greatest. In performance language the ad revealed he is just an average bull for transmitting size and growth. With a .91 accuracy, he is not likely to get much better. It was a poor ad.

Another lesson in animal breeding can be learned by studying a sire-evaluation sire summary to determine the frequency of superior bulls. In the 1981 Angus sire evaluation report, 673 bulls were evaluated. In yearling weight, expected progeny difference they varied from a low of −46 pounds to a high score of +77 pounds. If you were to go through these 673 bulls and pick out just the bulls that had at least a +40 pound EPD, you would narrow the list to 53 bulls. But I do not think we can select for just one trait in cattle breeding. If you picked all the bulls listed that were +40 or higher for yearling and 102 or higher for maternal, you would have a list of 22 bulls. I believe the birth weight should be limited so that it is not too heavy. If you would not use a bull whose progeny averaged over a +4 pounds at birth, then your list would only include 16 bulls. And if you really wanted to make some improvement on the maternal ability of your cow herd, 105 would be better than 102. This would leave you with only 4 select bulls from the original 673.

These 673 bulls were not just a gate-cut selection. Each one of these bulls was good enough to be used artificially in a number of registered herds, resulting in a large number of progeny, or he would not have been on the list. The oldest bull on the list was born in 1960 and had a registration number of just over 3 million. The youngest bulls were born in 1978 and had a registration number of just over 9 million. About 35 percent of Angus registrations are bulls so these 673 bulls born over an 18 year period would be the very best of 2 million bulls. With relatively modest performance requirements, those 2 million bulls were culled down to 4 bulls.

It thus becomes evident why genetic progress has been so slow or, in some cases, has gone backwards. If the really great breeding bulls are this rare, are great breeding cows any more frequent? Probably not. Without a large number of progeny, I mean 20 or more from each cow, those highly superior cows are going to be hard to find. That is something to think about when considering embryo transplants.

I guess most good things in life are rare. I recently spent several hours waiting for my flight at O'Hare Field in Chicago. The airport was very busy with hundreds of people walking by where I was seated. I decided I would run a survey of the frequency of pretty girls. On that particular day a pretty girl walked by on the average of only once for each 674 people surveyed. Something certainly should be done to improve this frequency.

As we become aware of how scarce superior bulls are, we may want to reexamine some of our breeding customs. We have heard in the past few years about rolling over the generations. We may want to cull more deeply and roll generations less frequently. Some breeders only use a bull for a couple of years and then go to one of his sons. It appears that many of these top bulls do not produce a son that is better than he is. The really good ones are very rare.

What about narrowing our genetic base too much by widely using just a few bulls to sire a large percentage of our national purebred herd? If those bulls are really superior, I think it would be a good thing. The Holstein breed has been outstanding in the way they have used genetic material available to them to dramatically increase milk production. Last year one-third of all calves registered in that breed were sired by one bull. I think there are more problems caused in all breeds right now by using sorry bulls than there are from too narrow a genetic base. If a bull is average or below in all traits he does not have the genes to broaden the genetic base. If a breed has only 53 bulls instead of 673 bulls that can contribute to its genetic base, they need to realize that fact and proceed to use what will give them some actual improvement in the direction they want to go.

If there are undesirable genes in some of these widely used bulls, it will be very quickly discovered and they can be quickly discarded, if necessary. This is less of a hazard to a breed than the old way of knocking

Table 3. Top 5 Angus Bulls Listed in Order of the Number of Calves Registered in 1981 with Their Breeding Values or Expected Progeny Difference

Bull	Birth wt. EPD	Yr. wt. EPD	Maternal breeding value
1	+1.8 lb.	+39.6 lb.	101
2	+1.2 lb.	+17.4 lb.	101
3	+5.6 lb.	+56 lb.	109
4	+1.1 lb.	+65.6 lb.	105
5	Young show bull no data available yet		

Table 4. Top 5 Simmental Bulls Listed in Order of the Number of Calves Registered

	Yr. weight EPD
Bull 1	+20 lb.
2	− 7 lb. (used because of good daughters)
3	+ 9 lb.
4	+26 lb.
5	+ 4 lb. (used because of calving ease)

them in the head and hiding them for a generation. Of course, the original breeder many times would be unaware of the problem if he had not inbred the animal very much.

As yet, the breeders of various breeds that I know about are not utilizing the performance data available to them as much as they should. Thus there is a great opportunity for a dedicated breeder who believes in breeding good cattle to get started on a program that should pay big dividends in 10 years. Of course, some breeders do not want to stay in business that long. (The average length of time that a registered Angus breeder stays active as a breeder is 7 years!) Tables 3 and 4 indicate the selection criteria that breeders are using for their herd bulls.

Bulls 1, 2, 4 and 5 have been used because they were successful show bulls and have produced top show cattle. The cows bred to these bulls for 1981 calves were bred before this performance data was published. Bull 4's data would certainly attract breeders looking for performance after they had seen it. Bull 3 is probably the only bull on the list that was selected because of his performance. He has one of the top maternal breeding values in the breed. When looking at this table remember that the top bull for yearling weight EPD was a +77.

In the Simmental breed their trait leader for yearling weight had an EPD of +53 pounds.

The Limousin breed is shying away from growth and muscling. Their most widely used bull has a −22 lb. EPD for yearling weight.

In summary we now have genetic data available that a dedicated purebred breeder can use to breed cattle far superior to any that have ever been produced before. To do this the superior animal of tomorrow will have to have high breeding values in almost every animal in its pedigree for at least three or four generations. To breed a herd of these super beef builders, there will be no room for experimenting with young unproven bulls no matter how great they look. There are a very few bulls in each breed that are capable of making relatively rapid genetic progress. The consistent and sole use of these kinds of bulls by a large number of breeders will result in new generations of cows and bulls that, after rigid culling and selecting, will produce even more superior animals. The dairy people have already shown that such improvement is possible. All we need to do is set our goals and then be persistent in our pursuit of such goals.

Hopefully we may soon have a breeding value measure for fertility. But whether we do or not, we must maintain a high level of fertility in our herds while we improve other traits.

This is the most exciting time that beef cattle breeders have ever seen. The opportunity is there. I invite you to join me in this challenging future. Maybe, just maybe, we might hold on to our jobs of managing these beef herds a little longer than some of our critics thought we could. AJ