

Productive Longevity in Beef Cows

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 (presented at the BIF Meeting,
 Houston, Texas,
 April 19, 2012)

INTRODUCTORY REMARKS:

Cow longevity is one of the most economically important traits in the beef cow.

I appreciate the opportunity to talk about this important topic today.

HIGHLIGHTS:

1. Definitions
2. Cows that reached advanced ages
3. Culling criteria
4. Selection for longevity
5. Summary and conclusions

DEFINITIONS:

Many years ago (1971), Tom Cartwright wrote “longevity is the age that a cow reaches before becoming subfertile or infirm. That is, the final age she reaches as a productive brood cow.”

I like that definition, and it probably describes correctly what longevity should be; however, I think a more practical definition is “the age a cow reaches before she is culled or dies.”

Definitions (continued):

These definitions could be equivalent if we could adequately determine when a cow can no longer be productive (and cull her if she cannot be).

Generally, in a commercial herd, a cow should be culled when she can no longer *be expected* to be profitable.

In a sense, this could be considered to be the case in seedstock herds, but profit may be realized in a different manner, through the future sale of breeding stock. That is, the culling criteria in a purebred or other seedstock herd may be part of the genetic improvement program.

Definitions (continued):

In our research herds, we have attempted to use culling criteria that provide the most information about how long a cow of a given type can remain productive.

In order to do this, some cows stay in the herd longer than they are profitable.

Definitions (continued):

For example, in a commercial herd of a particular breed or cross in a particular location, it may be feasible to cull all remaining cows at a given age, because, on the average, cows of this age have too high of a probability of losing their next calf, weaning too light of a calf, failing to re-breed, dying, or being too thin to have adequate value as a cull cow, if kept for another year.

However, in a seedstock or research herd, cows of this same age may be given the opportunity to produce additional calves to determine which cows can stay productive to advanced ages.

COWS THAT REACHED ADVANCED AGES



All Angus breeders are probably familiar with the history of the cow, Old Grannie (bred by Hugh Watson of Keillor), who is said to have lived to 36 years of age and produced 29 calves.

Cows That Reached Advanced Ages (continued)

If you are not an Angus breeder (and possibly even if you are), you may question whether a cow ever really lived that long (it certainly has been questioned in the past).

However, she had been shown, herself, and the awards (for her fecundity and longevity) presented to her breeder and to the man who had taken care of her at Keillor indicate, to me, that she did live a long time.

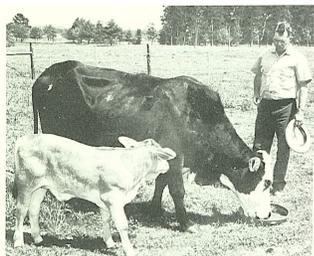
Cows That Reached Advanced Ages (continued)



17 year old Brahman-Hereford F₁ cow at the Lufkin (TX) station with her 15th calf

Cows That Reached Advanced Ages (continued)

A twenty-one year old F₁ Brahman-Hereford cow with her eighteenth calf at the East Texas Pasture Laboratory, Lufkin. The lifetime average adjusted 205 day weaning weight of her calves was 505 pounds.



21 year old Brahman-Hereford F₁ cow at the Lufkin (TX) station with her 18th calf

Cows That Reached Advanced Ages (continued)



20 year old Nellore-Hereford F₁ cow at the McGregor (TX) station with her 20th calf (she skipped once but had two sets of twins)

Cows That Reached Advanced Ages (continued)



17 year old Nellore-Hereford F₁ cow at the McGregor (TX) station with her 16th calf (she raised another calf the next year); the 17 calves she raised weighed a total of 8889 lb at weaning)

Cows That Reached Advanced Ages (continued)



18 year old Boran-Hereford F₁ cow at the McGregor station that was raising her 16th calf; one died at two month of age, but she raised two more after that.

CULLING CRITERIA:

If we use my definition that “longevity is the age a cow reaches before she is culled or dies,” the longevity of cows is affected by the culling criteria.

Some of the culling criteria that are used are reproductive performance, tooth wear (and/or lost teeth), udder problems, eye problems, poor body condition of the cow, lameness or skeletal unsoundness of the cow, death of her calf, light or unthrifty calf at or before weaning, and age of the cow (independent of other factors).

Culling Criteria (continued):

Longevity is mostly a lack of problems.

Therefore, it is easier to consider the reasons that cows leave the breeding herd (through either death or culling) than it is to consider why other cows stay in the herd longer.

Culling Criteria_relationships among criteria:

Of course, these reasons for culling are (or can be) related to each other. Some of the reasons for culling for factors other than reproduction would cause reproductive problems if the cow remained in the herd.

For example, if cows are culled based on age (as discussed earlier) and/or the condition of their teeth, they might have failed to breed the following year if they had not been culled.

Culling Criteria_relationships among criteria:

In that case, cows were culled based on age and, therefore, were culled before they failed to re-breed.

In other cases, in a commercial herd, a cow may lose her calf because of udder problems, but may be culled because of failure to wean a calf, without realizing that the cow had the calf and lost it.

Culling Criteria_relationships among criteria:

Reproductive performance was the main reason that cows left the herd in the studies reported by Arthur et al. (1992) and Riley et al. (2001), but these results are largely effects of the culling criteria.

For example, in our studies involving longevity (such as the one reported by Riley et al. (2001), cows are culled after their second failure to have and wean a calf (or be pregnant in the fall).

Culling Criteria_relationships among criteria:

After they are fourteen years old, cows are culled after any failure to have or wean a calf (or be open when their calf is weaned), regardless of their past record.

In both cases, if a cow's calf needs assistance nursing due to the cow's udder, the cow is culled if it is fairly certain that future calves will not be able to nurse without assistance.

(Some may have been culled for raising extremely light, thin calves.)

Culling Criteria_relationships among criteria:

The only other reasons that cows are culled (other than for reproduction), are being badly crippled (and almost certain not to recover), having cancer eye, or (as mentioned earlier) having such a bad udder that it is fairly certain that future calves would not be able to nurse without assistance.

If some other criteria were used, such as condition of teeth or age, a lower proportion would, of course, be culled for reproductive performance.

Culling Criteria (continued):

Since cows can leave a breeding herd for a variety of reasons, longevity is actually a combination of a number of different traits.

Since different producers place different amounts of emphasis on different traits in their culling criteria, the effects of different traits on longevity can differ between operations.

Culling Criteria (continued):

Also, different environmental and management differences can affect the ability of a cow to remain productive.

An important environmental (or management) factor that can cause whether a cow stays productive is the effect of time of calving on the ability of a calf to nurse.

I'll briefly discuss udder soundness and udder problems before I discuss the effects of time of calving on these problems.

Udder problems & time of calving (continued):

Cows can differ greatly in the characteristics of their udders. Of course, these differences in udders are the primary reason that particular calves have difficulty nursing.

The three main characteristics of the udder that cause problems are teat length, teat diameter (or circumference), and tightness of the udder.

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B. Cherry w calf



Udder Problems



Udder Contrast



Udder problems & time of calving (continued):

Even on cows with good udders, when a calf starts to nurse for the first time, it starts high and works its way down to find the end of the teat and get it into its mouth.

If the end of the teat is too low (either because it is too long or because the udder is too loose or pendulous), it is much harder for the calf to find it and get it in its mouth.

If the teat is too big around, it is even more difficult to nurse (especially the first time).

Udder problems & time of calving (continued):

In cows with marginal udders, calves may suck with little or no difficulty if they are born when the forage is not extremely green and lush.

However, when there is an abundance of lush, green forage, cows' udders tend to strut (i.e., fill up and become extended), and calves can have more difficulty nursing.

Udder problems & time of calving (continued):

For many locations, if cows calve in the fall or winter, their calves have fewer nursing problems than if they calve in the spring.

It may be (and often is) better to calve in the spring, but udder soundness has a larger effect on the ability of calves to nurse when the forage conditions are extremely good.

Udder problems & time of calving (continued):

That discussion was about calves not being able to nurse marginal udders because the udders are strutted.

There is another problem associated with forage conditions and udders that can be even more of a problem.

Udder problems & time of calving (continued):

In cows with marginal udders, if the udders get too strutted and heavy, they can break down and become extremely pendulous.

Even if they don't have any mastitis before, a big, pendulous udder is more prone to injury and mastitis infection and can lead to even more serious udder problems.

Blown Out Udders



Culling Criteria_Udders:

In some cases, cows are culled for udder problems.

In other cases (as mentioned earlier), cows lose their calves because of udder problems and are culled because they didn't wean a calf.

Culling Criteria_Udders:

There are two very different types of udder problems.

One of the problems is the lack of milk, and the other is the inability of the calf to nurse without assistance because of pendulous udders and/or large teats.

Culling Criteria_Udders:

As discussed earlier, in our research herds, cows are culled if their calves are not able to nurse without assistance and it is fairly certain that future calves will not be able to nurse.

That is, we do not cull cows due to the appearance or conformation of the udder, unless it is pretty clear that future calves will not be able to nurse by themselves.

Culling Criteria_Udders:

Since the main reasons that calves of a certain type are unable to nurse are large teats and/or pendulous udders, udder problems can be confounded by the amount of milk that a cow has.

Of course, there are large breed differences in udder characteristics.

Culling Criteria_Udders:

In our study that I referred to earlier, where the crosses of five different *Bos indicus* breeds with the Hereford were compared to each other and to Angus-Hereford crosses, there were major differences in udder characteristics and in the proportions of cows that were culled because of udder characteristics.

Culling Criteria_Udders:

In that study, none of the Angus-Hereford or Nellore-Hereford cross cows were culled for udder problems, but 19% or more of the four other crossbred types had left the herd for udder problems by the time they were 14 years old.

These cows all calved in the spring, often with very lush forage conditions.

The amount of udder problems was probably higher than it would have been under some other conditions.

Culling Criteria_Udders:

In our current genomics project at McGregor, we make fairly detailed udder evaluations (using second generation *Bos indicus*-British crosses).

We recently reported apparent chromosomal locations for genes affecting teat length, teat diameter, and udder support score (Williams et al., 2012).

Culling Criteria_age:

In some commercial herds all cows are culled when they reach a certain age.

As I said earlier, this may be feasible, if, on the average, cows of this age have too high of a probability of losing their next calf, failing to re-breed, weaning too light of a calf, dying, or being too thin to have adequate value as a cull cow, if kept for another year.

However, there are genetic differences that affect all of these factors.

Culling Criteria_age (continued):

For example, experience may have shown that it is not profitable to keep cows of a given breed after they are ten years of age at a given location; however, cows of another breed or cross may last longer under those same conditions.

Even for the same breed of cow, current prices can determine whether it makes sense to sell cows of a given age in a particular year.

Culling Criteria_Mouth/teeth:

In some cases, cows are culled based on the condition of the mouth (i.e., based on the size and/or condition of the incisors (front teeth)).

Most people (myself included) have considered the problem with lost or badly worn teeth to be that cows with bad mouths were not able to graze as effectively as those whose mouths were in better condition.

Culling Criteria_Mouth/teeth (continued):

However, we have probably all seen cows that have stayed productive after their mouths were smooth.

We have usually thought that the kind of pasture that cows were on determined whether cows could stay productive after their mouths had deteriorated.

Culling Criteria_Mouth/teeth (continued):

This is probably true, but, as we have learned more about gum disease (in both people and animals), it seems likely, to me, that bad mouths may lead to problems even if the bad front teeth do not impair the cow's ability to graze.

I expect that gum disease could cause the cow to lose back teeth (molars), which may cause more problems than lost front teeth.

Culling Criteria_Mouth/teeth (continued):

There are major genetic differences in the age at which cows' teeth are lost or worn down.

In a crossbreeding study at Ft. Robinson, Nebraska, involving straightbred Angus, Hereford, and Shorthorn cows, and all of the first crosses of these breeds, cow's mouths were scored for cows from 10 to 15 years of age (Núñez-Domínguez et al., 1991).

Culling Criteria_Mouth/teeth (continued):

There were differences among the three different breeds, and the crossbreds had significantly better mouth scores than the straightbred cows.

Culling Criteria_Mouth/teeth (continued):

In the study (discussed earlier) that we started at the Riesel station and completed at the McGregor station, mouth scores were taken for three years, starting in 1996 when the cows were from 11 to 14 yr of age.

We found that first crosses of five *Bos indicus* breeds with the Hereford all had significantly better mouth scores than Angus-Hereford first cross cows (Riley et al., (2001).

Culling Criteria_Mouth/teeth (continued):

In what was then Rhodesia, Steenkamp (1969, 1970) found that Hereford cattle had more wear and earlier loss of their temporary incisor teeth than local indigenous Sanga cattle.

They measured the hardness of the enamel and studied the type of occlusion (bite) in the two different breeds.

Culling Criteria_Mouth/teeth (continued):

They found that the tooth enamel was significantly harder in the indigenous cattle than in the Herefords at 31 to 35 months of age.

Culling Criteria_Mouth/teeth (continued):

They also found that, in the Hereford cattle, the incisors bit into the maxillary pad, whereas, in the indigenous cattle the incisors closed on the front edge of the pad.

They concluded that this difference in occlusion (bite) caused the teeth of the indigenous cattle to get sharper with age and the teeth of the Hereford cattle to wear prematurely.

Culling Criteria_Mouth/teeth (continued):

In a study that we started at McGregor in 1991, both Angus and Hereford cows were artificially inseminated to Brahman, Boran (an East African *Bos indicus* breed), and Tuli (a Sanga breed from what is now Zimbabwe) bulls.

Calves by the three breeds of sires were born in 1992 and 93. The heifers were kept to evaluate lifetime cow productivity.

Culling Criteria_Mouth/teeth (continued):

We started taking mouth scores on the crossbred cows in 2004 (when the cows were either 11 or 12 years old).

Both the Brahman and Boran crosses had better mouth scores (more solid mouths and fewer broken or smooth mouths) than the Tuli crosses (Sanders et al., 2005, and Muntean, 2011).

Culling Criteria_Mouth/teeth (continued):

In these studies where mouths have been scored in old cows, it is possible (likely) that some of the cows that were culled at earlier ages for reproductive (or other reasons) could have had bad mouths (badly worn or missing teeth).

Culling Criteria_Eye Problems:

Most of the eye problems that cause cows to leave the breeding herd are associated with cancer eye.

Cancer eye is more prevalent in cows with white pigment around their eyes, and there are probably genetic differences in the susceptibility to cancer eye that are independent of pigmentation.

Culling Criteria_Reproductive Performance:

There are many different ways that reproductive performance can be evaluated and used as culling criteria.

As with longevity, high fertility is largely a lack of problems.

Culling Criteria_Repr. Perf._continued:

There are certainly genetic differences in inherent fertility.

However, many reproductive problems result from the failure to meet nutritional requirements, either due to high nutritional requirements and/or due to inadequate adaptation to the environment.

Culling Criteria_Repr. Perf._continued:

I believe that the most severe culling for reproductive performance that I know about is that used by Casey Beefmasters at Albany, TX.

They require that a yearling heifer conceive in a 45 day breeding season, calve and raise a calf as a two year old, continue to conceive in a 45 day breeding season each year, and raise a calf every year.

Culling Criteria_Repr. Perf._continued:

It is difficult to genetically improve reproductive performance by selection.

However, for the environment in which the cattle are raised, this program (as used by the Caseys) combined with selection of bulls out of old cows that have survived the program, probably places about as much emphasis on reproductive longevity as is possible with our current state of knowledge.

Culling Criteria_Repr. Perf._continued:

As I said earlier, some of the other reasons for culling can cause reproductive problems.

Depending on the amount and kind of available forage, mouth problems (mainly worn or missing front teeth) can limit the amount that a cow can eat, and, in turn, cause her to fail to come into heat and get bred.

Culling Criteria_Repr. Perf._continued:

As discussed earlier, there are major genetic differences in the age at which teeth deteriorate.

SELECTION FOR LONGEVITY

If longevity is measured by a single number (such as the age at which a given cow leaves the breeding herd), then, almost by definition, longevity is low in heritability.

This does not mean, however, that genetic effects on longevity are not important.

Selection for Longevity (continued):

Since productive longevity is closely related to fertility, I think it is useful to simultaneously consider genetic effects on fertility.

Some of the genetic differences in fertility include breed differences, the higher fertility in crossbreds compared to purebreds (hybrid vigor or heterosis), and the lower average fertility in highly inbred cattle (inbreeding depression).

Selection for Longevity (continued):

There can be (and are) large average genetic differences between different breeds or crosses for traits that are low in heritability. There can also be large genetic differences between individual animals within a breed for traits that are low in heritability.

However, it is difficult to make genetic improvement based on individual animal performance.

Selection for Longevity (continued):

In most herds, most of the “fallout” has already happened by the time a cow is four years old.

That is, if a heifer gets bred as a yearling, breeds back as a two year old and again as a three year old, most of them will stay productive up until about ten years of age.

Selection for Longevity (continued):

If all cows are culled that fail to wean a calf, genetic prediction based on the proportion that stay in the system should be effective in increasing the proportion that stay productive to nine or ten years of age, unless management and/or environmental differences among herds are not too large.

The differences among breeds and crosses in their ability to stay productive to more advanced ages indicate, to me, that even more can be done if we place enough emphasis on longevity.

Selection for Longevity (continued):

In order to select for longevity, it is necessary to give cows the opportunity to express their genetic potential and to make use of the ones that stay productive.

I think this is best done by using sons out of these older cows.

This will automatically lead to long generation intervals, but, otherwise, there is no basis for selection.

Selection for Longevity (continued):

Selection and use of young bulls out of old cows, as a continuous process, seems to be a logical approach.

SUMMARY AND CONCLUSIONS

In the article that I referred to earlier (Cartwright, 1971), Tom Cartwright concluded that "Longevity may well be the most important economic characteristic in beef cattle."

I agree with that statement.

SUMMARY AND CONCLUSIONS

There are definitely genetic differences associated with the components of productive longevity.

The commercial producer can take advantage of crossbreeding and breed differences.

Hopefully the seedstock industry will provide improvements in individual breeds and herds as well.