Bull Selection - Physical and Genetic Selection Tools For the Cow Calf Producer

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Introduction

There has been much written about bull selection for the cow calf producer, and many of these bulletins (Machen, not dated; McCraw et al, 1994) can be found in the Texas Cow Calf Management Handbook. Basically, selection of herd bulls should complement the physical attributes and genetic composition of your cowherd (Hammack, 1999). Most cow calf producers market their calves at a local livestock commission company (auction or sale barn) and concerns about "marketability" of calves can be addressed by visiting with the owners to determine what breedtypes, crosses, and colors are desired or will not be discounted by the buyers (Hammack, no date). Each market will have a different set of buyers and/or orders for feeders and stockers so what might be applicable at one may not be applicable at another. If you keep some or all of your calves to graze or feed out, then this may not be applicable to you and your concerns will be centered around your ultimate customer's desires (the feedyard or beef processor) and these can be distinctly different than those of an order buyer (Hammack, 2002). Your choice of bulls, breeds and breeding systems can complement your market (Hammack, 1998 a and Hammack, 1998b). The point here is to decide where you intend to market your calves first, then go find a bull to complement your cows and make your calves marketable.

Physical Selection

The physical selection of bulls should probably come after the selection of bulls for their genetic value since there will be fewer bulls to meet your specific genetic criteria. However, since most ranchers prefer to talk about bulls and not about genes, we will begin with it here. Bulls should be evaluated from the ground up. Begin with their feet.

Feet and Legs. Bulls should stand four square with their hooves turned slightly outward (never inward). They should have strong pasterns and there should be about a 45 degree angle extending from the point of their toe along the hoof line through the middle of the pastern. Bulls that have less slope will have weaker pasterns and bulls with more have no cushion.

From the middle of their pasterns upward should be a straight line to the center

of their knees (front legs) or hocks (rear legs). The forelegs should be straight when viewed from the sides and front but the hindlegs may be slightly turned inward towards each other at the hocks (cow-hocked). As long as this is not extreme this is acceptable. In the same manner, bulls should not be straight hocked either. From the knees, the foreleg should be straight to the elbow (just at the chest floor).

At the elbow, the bone extends forward to join the shoulder blade at the point of the shoulder, seen at the front of the animal on their lower chest. From the hocks the hindleg will extend forward to the stifle joint (or knee joint) at a 45 degree angle. At this point, it might be useful to compare the bones extending form the elbow to the shoulder (point of shoulder) with the bone extending from the hock to the stifle. They should be nearly parallel.

The shoulder blade and the leg bone in the stifle should both move upward and towards the back at about a 90 degree angle from the other bone in the joint. The shoulder blade should tie tightly into the backbone, there should be no "open shoulders". The leg bone extending from the stifle should tie in to the hip or pelvic bone about level with the "pin" bones seen under and on either side of the tail head.

The slope from the hip bones (or "hooks") to the pin bones (or hip joints) should be about 20-30 degrees. A leveler hip causes the hind legs to be placed out of line with the hip and possibly too straight (a condition known a "post-leg") while a greater slope may push the hindlegs under the hip and cause the animal to "camp" over himself and walk on the back of his pasterns.

The backbone of a bull is generally never level but selection of animals with more level tops generally is an indication of more structural correctness.

Bulls should walk smoothly and evenly without discomfort and stand naturally square. When walking, their hind hooves should be placed in the impressions made by their forehooves (or as close as possible). Bulls that are short-strided or long-strided should not be selected as those are indications of structural deformities.

Muscling. Bulls can be evaluated for their muscling by watching them walk, standing behind them and evaluating their hindquarter (width and length) and through the use of ultrasound measurements. Bulls that are naturally muscled will tend to walk and stand wider as muscle pushes the bones and legs apart. Bulls can also judged by looking at how wide and long their hindquarters are. Bulls with adequate muscling will be widest through the middle of their hindquarters as they are evaluated from behind and their muscling will extend from where their hind legs begin to separate ("twist") to their hocks. Muscling can also be evaluated at other locations such as comparing the length and width of the back (rib and loin area) and the circumference of forearm (halfway between the knee and elbow, as fat, skin and bone are relatively the same here and differences in circumference are due to muscle).

To truly evaluate muscling you can use ultrasound. Most ultrasound technicians are skilled and have passed a proficiency test. Bulls should have their ultrasound ribeye measurement taken as close to a year of age a possible and adjusted to a year of age to remove age effects. Bigger, faster growing bulls will have larger ribeyes but big bulls will also have larger ribeyes. To account for the size effect, ribeye area should be evaluated on a square inches per hundred pounds of body weight ratio (sq. in./cwt). This ratio for bulls up to 2 year-olds should be no less than 1.1 sq. in./cwt.

Ultrasound technicians can also evaluate bulls for fat thickness between the 12th and 13th ribs and rump fat (to determine if they are "easy" or "hard" keepers) and for percent intramuscular fat (IMF), similar to marbling score which affects quality grade. Again, only young bulls should be compared (up to 2-years of age) and all measurements should be adjusted for age and compared only within similar groups.

Breeding soundness. Bulls should have passed a "Breeding Soundness Evaluation" or BSE administered by a licensed bovine practitioner (a vet who works with cattle) or someone skilled in evaluating semen (an accredited semen collection laboratory or company). Bulls need to pass the entire BSE including a physical examination of the bull's reproductive organs and external genitalia, an examination of the reproductive tract, and an evaluation of the semen. One thing that is not evaluated is the bulls' desire to mate.

Bulls should be recently evaluated, 30 to 60 days before turnout. Young bulls may not pass the semen evaluation on their first try and should be retested. The physical examination should evaluate the bulls' body condition, feet and legs, head and eyes, and any signs of sickness or disease.

An examination of the reproductive tract should include palpation through the rectum of the bull's prostate, seminal vesicles, ampullae, and internal inguinal rings for any possible hernia. An external examination should include palpation externally of the spermatic cord, scrotum, testes, penis and epididymis. The penis should be clean and smooth and free of hair rings, dirt, wart, abraded areas or a persistent frenulum. It should extend straight and forward without deviation. The upper part of the epididymis should be soft and free or lumps or enlargements and the testes should be firm, but not hard or hot.

Scrotal circumference is an indicator of a bull's production of semen and rate of maturity and potentially the rate of maturity of his daughters. The following chart presents the recommended scrotal circumferences for various ages for all breeds of bulls.

Age	Very Good	Good	Fair	Poor
12-14 mos.	>34 cm	30-34 cm	<30 cm	<30 cm

15-20 mos.	>36 cm	31-36 cm	<31 cm	<31 cm
21-30 mos.	>38 cm	32-38 cm	<32 cm	<32 cm
Over 31 mos.	>39 cm	34-39 cm	<33 cm	<33 cm

The evaluation of semen should be conducted by an experienced veterinarian or a reproductive physiologist. A full ejaculate should be collected and evaluated for volume, color (milky and free of dirt, blood or pus), motility (mass movement with 50% vigorous motile swirling sperm), and morphology (primary and secondary defects than can affect the ability of the sperm to find and fertilize the egg).

Bulls are classified as Satisfactory Potential Breeder, Questionable Potential Breeder or Unsatisfactory Potential Breeder.

Passing a BSE test is not a measure of the desire of bulls to mate. Once the bull is selected and turned out with cows, he should be observed to make sure he is checking heat and mating the cows. A complete discussion of bull management for cow calf producers is found in Sprott et al, 1997).

Genetic Selection

The selection of a bull based on his genetics is less straightforward than selection based on physical traits. You can see the heavier body, more muscle mass and larger scrotal circumference but it is had to determine how much of what you see is actually due to genetics and what is caused by environment. For most young bulls, 2-year old and younger, genetics plays a smaller part in how they look than the environment does while for older bulls the opposite is true. Because of this, it is important to have some record of performance on bulls you are selecting to use on your cowherd. No attempt is made here to suggest which traits are of paramount importance but it should be understood that as a group of traits fertility or reproduction and adaptability (which affects reproduction greatly) are more important than growth traits to cow calf producers and that carcass traits are a distant 3rd to growth traits.

Performance records. Performance records are simply records collected on animals to indicate their level of performance for a given trait. Birth weight, weaning weight and yearling weight records are most often collected and represent calving ease (birth weight) and growth rate or pounds of calf available for sale (weaning and yearling weight). Most bulls will have some measure of hip height or a frame score (to give "some" indication of mature size and effects on mature size and maintenance requirements of his daughters saved as replacements). Hammack and Gill (2001) discuss the use of frame score and weight in selection. To truly be an effective indicator

of maintenance requirements, size and body condition (fatness) should be considered since differences in genetic size can be determined only at similar levels of fatness (Hammack and Gill, 1997).

Bulls may have ultrasound measures for ribeye area, percent intramuscular fat (add 1% if predicting the IMF of steer and heifer progeny), 12^{th} -13^{th} rib fat and possibly rump fat. Bulls should also have a scrotal circumference and a BSE. All of these are performance records belonging to the bull and if he is young, this may be all he has. These records should be adjusted for the age of the bull and, in the case of weaning weight, for the age of his dam.

Expected Progeny Differences. In the past breed associations calculated within herd Estimated Breeding Values (EBV) and Expected Progeny Differences (EPD) for across breed evaluations. Now all performance reports use EPD. These figures are calculated to account for the genetic portion of the bulls' performance by removing most of the environmental effects associated with the trait. It is not in the scope of this paper to discuss how this occurs but the addition of relatives records (close relatives and progeny, if any), evaluating differences in contemporary groups (same sex, herd and year backgrounds) and adjusting for age of calf and dam effects are all useful. Hammack and Paschal (2002) present a complete discussion of EPD and it use.

The EBV was formerly expressed as a ratio (compared to the herd average) but the EPD is expressed in units of the trait measured (pounds for weight, cm for scrotal circumference, etc.). It is important to familiarize yourself with the terminology of the breed from which you are purchasing bulls. EPDs are calculated for all animals in the breed but are not comparable across breeds. All bulls will have EPDs, but some may not be published due to low accuracy values. Some EPDs are combinations, reflecting 2 or more traits. Maternal EPD is actually ½ of the EPD for weaning weight added to the EPD for milk (actually not milk production but an indirect estimate of the additional pounds of weight produced due to additional milk production).

All EPD values have an associated Accuracy value (ACC) that ranges either from 0 to 1 or 0.0 to 1.0. As the ACC approaches 1, the reliability of the EPD as the correct predictor of the animal's genetic value improves. The EPD may increase or decrease with high ACC bulls but the amount of change will be much less than it is with low ACC bulls. Bulls should be selected for a "balance" of moderate EPD values in growth and maternal values. If ACC values vary, remember that younger animals with large EPD values that have low ACC values may still outperform older animals with moderate EPD values and high ACC. Don't base selection of EPD solely on their associated ACC.

Some bulls may have the results of genetic tests for specific DNA or markers. There are a number of commercially available tests (Paschal, 2004) but most of the markers are for carcass quality traits (marbling score and tenderness) that most cow calf producers will not be paid for directly when calves are sold at weaning. These

results are valid for specific markers and within given breeds and they will result in genetic improvement, especially if both markers are found in a bull. However, most cow calf producers can't afford to purchase bulls with one copy of the desired marker much less two.

Summary

For most cow calf producers, physical and genetic improvement in their cowherd begins with determining which calves will be best accepted at their local livestock market and then producing them. This means that the physical and genetic characteristics of the cowherd will be used to adapt to the environment to maintain female fertility and longevity and provide for an adequate maternal environment to ensure the complete expression of genetics for growth in their offspring. The level of growth (or weight) will often be determined by the genetics of the selected sire since most environments favor intermediates rather than extremes in cows.

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