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NebGuide

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Bull Selection

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The primary functions of the bull in a beef management program are two-fold: (1) contribute to the production of live calves and (2) contribute to the genetic improvement of economically important traits.

For natural service, the bull must produce, and deposit in the female reproductive tract, a sufficient number of normal spermatozoa. This dictates the importance of sex drive, structural and reproductive soundness if the bull is to breed successfully a number of cows under various environmental conditions. Ease of semen collection, semen quantity, number and condition of the spermatozoa, and the freezing ability of the semen are important if the bull is to perform satisfactorily in an artificial insemination (AI) program.

Sexual maturity in the bull is influenced primarily by age and weight. Studies have shown that most well-grown beef bulls are producing viable spermatozoa at 10 to 12 months of age. Most cow-calf producers give natural service bulls their initial breeding exposure at two years of age or older. However, there is considerable evidence that supports use of younger bulls (14 to 18 months) if they have been adequately grown and are managed properly during the breeding season. These yearling bulls should weigh a minimum of 900 pounds at a year of age and 1100 to 1200 pounds at 15 to 16 months of age. During the breeding season, these bulls should be checked frequently. They might require additional feed if they lose condition and start to become thin.

Sexual maturity and adequacy can be estimated by a breeding soundness examination. This involves a physical examination of the reproductive tract and skeletal structure. Also included is a functional examination which measures semen quantity, sperm number, mortality, and shape. Qualified individuals, usually a veterinarian, should perform the breeding soundness examination.

Masculine characteristics, such as increased size of the reproductive tract, thicker more bulging muscles in the neck and shoulders, and a deeper toned bellow occur as the young bull develops sexual maturity. Some beef producers feel that visual appraisal of masculinity is a satisfactory measure of sexual maturity. While there are some relationships, the use of visual appraisal alone will not satisfactorily measure the bull's ability to sire live calves. Testicle size appears to be the best visually observed characteristic of masculinity as its relationship to sexual maturity and adequacy has been verified. Measurement of testicle size is more accurate and objective; however, visual discrimination against bulls with small testicles is valid.

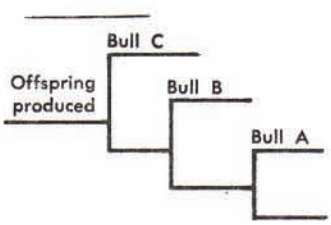
There are many different opinions as to the importance of skeletal soundness, particularly feet and legs, in effective bull selection. Many of these opinions are personal preferences and are not highly related to the ability of the bull to breed cows. However, the following are feet and leg characteristics that are associated with the breeding performance of bulls: absence of lameness, large feet, and hind legs that are not too straight. Research work has shown that there are skeletal soundness problems when the hock angle of the hind leg is greater than 150 degrees.

Calf losses at birth increase when birth weights are extremely large. The bull does contribute significantly to calf size. A bull may be outstanding in all other charatceristics, but if his calves are too large at birth, then economic disaster can result. Increased calving difficulty and calf losses can be anticipated when birth weights of calves from heifers and cows exceed 75 and 85 pounds respectively. Extreme care should be exercised in selecting bulls to be mated to heifers because two-year-old heifers have more calving difficulty than mature cows. Bulls from the breeds with larger mature size should be avoided for breeding heifers.

Presently it is extremely difficult, if not impossible, to visually predict the calving difficulty of a bull. Generally speaking, larger, more muscular bulls will contribute to increased calving difficulty. Progeny comparison of birth weights, calving difficulty, and ease of calving of heifers from different bulls is presently the most useful information in selecting bulls for calving ease. Birth weight record of the bull himself is useful as birth weight is a highly heritable trait. Valid judgment can be made if birth weights of bulls are compared on a within herd basis. In this situation, a bull should be selected that has a moderate birth weight but is relatively high performing in the other economically important traits (weaning and yearling weight).

Genetic Improvement

Importance of the Bull. Even though a bull contributes 50 percent of the genetic material to each calf, the magnitude of the bull's contribution is greater because of the increased number of offspring sired. The genetic importance of successive bulls selected is shown in Figure 1.



Bull	% genes contributed to offspring produced
A	12½
B	25
C	50

Genetic contribution of three bulls to the offspring currently produced in the herd.

This information shows that the three bulls selected will contribute nearly 90% of the genetic material to the herd. Results from the United States Meat Animal Research Center, as shown in Table 1, clearly demonstrate that 80-90% of the genetic improvement in a herd will come from bull selection.

Table 1. The Genetic Contribution of Bull Selection in Cattle Selected for Weaning Weight or Yearling Weight

	(lb.) Weaning Weight	*Selection Differential (Selection practiced)* (lb.) Yearling Weight
Bulls	78	140
Heifers	19	18
Total	97	158
% from bull	78/97 = 80	140/158 = 89

This does not diminish the importance of good beef females because genetically superior bulls usually do not have poor dams. However, most of the genetic superiority or inferiority of females will depend on the bulls previously used in the herd. The high genetic input coming from effective sire selection dictates where priorities should be placed.

Traits

There are numerous traits that can be included in a selection program. Many of these traits are shown in Figure 2. Two of the more important criteria in determining which traits should be included in a genetic improvement program are the economic importance and the heritability of each trait. The heritability determines how much of the variation in a trait is passed on from parent to offspring. The statement heading Figure 2 should be foremost in a producer's mind. Effective bull selection will consider only a few of the most economically important traits.

The More Traits Included in a Selection Program, the Less Improvement in Each Trait

Weaning weight	Horns
Yearling weight	Length of leg
Carcass grade	Length of body
Yield grade	Length of head
Rib-eye area	Body shape
Fat thickness	Bone
Feed efficiency	Pelvic size
Mature size	Hair color
Milk production	Style
Freedom from inherited defects	Masculinity
	Trim brisket
Ease of calving	Tail head setting
Disposition	Slope of rump
Structural correctness	Straight topline
Marbling	Percent kidney knob
Tenderness	Muzzle width

Figure 2. Beef cattle traits that could be included in a selection program.

Adjusted yearling weight is one trait that should receive major emphasis. This record is computed as follows: Adjusted yearling weight=160 (post-weaning average daily gain)+adjusted 205-day weaning weight.

Yearling weight is comprised of several economically important traits combined into a single trait. Yearling weight includes post weaning gain. It also includes weaning weight which involves the calfs ability to gain plus the milk production of the cow. Selection for yearling weight results in automatic selection for feed efficiency and in some lines carcass cutability (ratio of lean to fat).

Yearling weight has a heritability of approximately 50% which means rapid genetic improvement can occur if superior sires are selected. Selection for yearling weight will result in as much improvement in weaning weight compared to direct selection for weaning weight alone. Selection may also cause change in genetic potential of other traits that are genetically

correlated with yearling weight.

There continues to be a confusing issue, in many producer's minds, on how much emphasis to place on visual appraisal vs. performance records. There is evidence to support the use of visual appraisal for identifying a bull's superiority in cutability (amount of fat to lean), testicle size, skeletal soundness, and size of skeletal frame. Recent research shows that visual appraisal is effective in determining differences in carcass composition in the live animal. Visual appraisal for fat to lean ratio is best utilized on bulls 12 to 18 months of age because this relates to approximately the same weight as a slaughter steer. Visual evaluation of younger and older bulls is less meaningful. Since one of the primary functions of the bull is to eventually produce the market animal, visual appraisal on a market steer basis is logical. Carcass information on the young bull is obviously not available, therefore visual appraisal or an ultrasonic fat measurement should provide useful information.

The selection emphasis placed on performance records (yearling weight) or visual appraisal will vary with the selection opportunities. If a prospective buyer is evaluating a group of bulls which visually appear to have the potential to produce only steers in yield grades 4 or 5, then the emphasis should be totally on visual appraisal. His decision should be to reject all the bulls even though they might have acceptable or high yearling weights. Rapid growth rate is not desirable if the composition of gain is primarily fat. On the other hand, if a group of bulls being evaluated varied in their siring potential of yield grades 2 to 5, the emphasis would be different. Visual appraisal would eliminate the yield grade 4's and 5's, then yearling weight would receive major emphasis on the bull selection process.

Bull Comparisons

Bulls and their resulting performance records are usually compared against each other to determine genetic superiority. If such comparisons are to be valid, the bulls should have received a similar environment. If the feeding and management program has been similar, then each bull's record can be realistically compared to the group average by computing a ratio. The following is an example of the computation of a yearling weight ratio:

$$\frac{\text{individual bull record}}{\text{group average}} = \frac{945 \text{ lbs.}}{900 \text{ lbs.}} = 105$$

This means that the bull's record is five percent above the group average.

If the bull's have been fed different rations, varying amounts of feed, or managed differently, then most of the differences in their records will be caused by environment. In this situation the producer can expect little, if any, genetic improvement in performance even though he selects directly for it.

Valid yearling weights can be obtained under farm and ranch conditions or in a central bull testing station. The latter permits bulls from several owners and environments to come together so productivity can be measured under a similar environment. Bulls are best evaluated under environments similar to how their steer progeny will eventually be raised. Selection of yearling bulls will be more valid if the breeder has progeny tested his herd sires for weaning, feedlot, and carcass characteristics. Figure 3 summarizes some of the important criteria to use in selecting bulls for natural service.

Primary Emphasis	*Secondary Emphasis*
Weaning Weight (ratio)	breeding soundess examination
YEARLING WEIGHT (Ratio)	integrity of breeder and his records
Visual Appraisal	
— body composition	sire and dam evaluation
— structural soundness	extent of breeder's testing program
— testicle size	
Pedigree Analysis	Evidence of improvement in other herds

Criteria to consider in the effective selection of yearling bulls.

AI Bulls

One of the primary advantages of artificial insemination is the extended use of genetically superior sires. Collecting and freezing a bull's semen does not make him genetically superior. AI bulls should have extensive records available to the producer. Caution should be used by commercial producers in using bulls that are of a "new breed"but have little, if any, valid performance data behind them.

AI bulls should have outstanding individual weaning and yearling weight records where they have been compared against preferably 30 to 50 other bull contemporaries. Even more important, their progeny should have been compared against the progeny of several other bulls for ease of calving, weaning weight, feedlot performance, and carcass merit. Progeny of a bull tested against large numbers of progeny of other bulls in many different herds will have a good opportunity to express genetic superiority or inferiority. This involves the accumulation of hundreds and thousands of progeny records to be valid; however, this information is presently emerging and will be more extensive in the future. Under these conditions, average trait ratios of 102 to 105 will identify sires that have genetic superiority. Utilization of such superior sires can increase the net return per commercial calf from $2 to $20, depending on what stage the producers market the calf. However, the real challenge in an AI program is to consistently keep

the reproductive performance at a high level. A poorly managed AI program, which reduces the percent calf crop weaned by 10 to 15 percent, can easily diminish any anticipated increase in net return in other traits.

Watch Extremes

The history of beef production indicates that many producers have not kept balance in the emphasis of the economically important traits. Several times the pendulum has swung too far because of too much emphasis on one or two areas.

There is some justification today that too much emphasis is being placed on mature size and muscling. Caution should be exercised, particularly in bull selection, to avoid extremes. Total functional efficiency for all the economically important traits are important guidelines for effective bull selection.

Summary

A live calf weaned is the most economically important trait in beef production. Select bulls that are sexually mature, capable of breeding and settling cows, and whose calves will not be extremely heavy at birth.

Effective bull selection will contribute 80 to 90 percent of the genetic improvement in the herd.

Keep the number of selection traits to a minimum and make sure each one makes an important contribution to the profitability of the herd.

Yearling weight should receive the highest priority as a genetic selection trait.

Know how to use and compare performance records.

Avoid extremes by continually evaluating the functionally efficient beef animal that is needed by the entire beef industry.

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