Evaluation And Selection Of A Bull

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The bull is the most important individual in the beef herd from a reproductive, genetic and economic standpoint. The primary function of the bull is two-fold:

(1) Contribute to the production of live calves

(2) Contribute to the genetic improvement of economically important traits.

To accomplish the first of these two primary functions the bull has to have the ability to produce normal spermatozoa of sufficient quantity and deposit it in the female reproductive tract. Reproductive and structural (skeletal) soundness is essential in order for a herd bull to naturally breed a number of cows under various environmental conditions successfully.

Evaluation of semen quality, sperm number, mortality and shape as well as physical examination of the reproductive tract should be performed by qualified individuals (usually a veterinarian). Discrimination against bulls with small testicles is justified since some research has indicated a direct relationship exists between size of testicles and quantity of sperm produced at a given age. Avoid cryptorchid (one or both testicles retained inside the body cavity) bulls and bulls with scrotal hernias since both are inherited conditions. Also, overfat bulls should be avoided since they are sometimes less fertile and lack sexual drive and the physical ability to breed cows.

Skeletal soundness should be evaluated as to the bull's ability to travel over a large area, locate females in heat and mate with them. Swollen joints, weak pasterns, lameness, extremely sickled hocks and post-leggedness should be avoided. Some research work has shown that skeletal soundness problems arise when the hock angle of the hind leg is greater than 150 degrees (post-legged).

The production of live calves is also influenced by birth weights of the calf and calving problems associated with calf size. A bull does contribute significantly to calf size at birth and breeds or lines of bulls that sire extremely large calves at birth should be avoided for use on breeding heifers. Generally, extremely large and muscular bulls that have massive shoulders may contribute to increased calving problems.

Approximately 88 percent of the expected genetic change in any one trait over a period of time will come as a result of sire selection. This emphasizes the importance of bull selection since 8.5 percent of the genes in a herd, where replacement heifers are saved, come from bulls used during the last three generations as shown in Figure 1.

In order for a beef producer to make genetic improvement in his herd with respect to economically important traits he must:

(1) Analyze the performance of the present herd in order to provide a benchmark for those traits

(2) Set a goal and develop a definite breeding plan to achieve that goal.

There are many traits that can be

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included in a bull selection program. Some traits contribute to increased profit and others provide very little monetary returns. Economically important traits in beef cattle production should be those traits which increase profit in a beef cattle operation. The total beef cattle chain of production can be divided into three general categories or segments: (1) Reproduction, (2) Production, and (3) Product. Traits that affect the profitability of these three segments should be considered in a bull selection program. An analysis of these three segments will aid in determining which traits are economically important to the industry.

The packing and processing industry, because of consumer preference to quality and retail cut size along with handling consideration, currently prefers carcasses of choice quality in the weight range of 600-700 pounds. Carcasses about the 700 pound weights are in some cases discounted due to marketing problems. Also, carcasses that have a low ratio of lean to fat are being discounted since they require more fat trim. Carcasses are presently being marketed on a quality and yield grade system. Yield grades reflect the ratio of lean to fat in a carcass. A yield grade 1 would require the least amount of fat trim and a yield grade 5 would require the most. Carcasses with yield grades 4 and 5 are being discounted on the market since there is very little consumer demand for cuts with excess fat.

Traits that affect the profit of this part of the industry are carcass traits. Fat thickness, amount of muscling and quality grade are important to the packing industry.

In order for a market steer to be acceptable to the packing industry, he should reach the choice quality grade at a market weight of 1000-1150 pounds with a fat covering of between .4-.5 inch. This live weight and amount of fat thickness should meet the requirements of carcass weight and yield grade.

Ideally the cow-calf producer would like to wean a heavy calf from a small cow. However, in order for him to supply the feeder the type of cattle that reach the desired grade at the desired market weight, he would have to use a large bull on the small cows. This could create calving problems that would affect percent calf crop weaned. If he used large cows on a farm with a fixed amount of resources, he probably would have to reduce the cow herd number. The economics of these type of programs need to be considered.

In order for the cow-calf producer to supply the feeder 600-700 pound calves, he has two alternatives: (1) Wean a 600 pound calf (280 days), or (2) Wean a 450-500 pound calf and add 200-250 more pounds to the calves in a backgrounding program.

Traits that are of economical importance to different segments of the beef industry have been described using a steer. Converting these steer figures to a bull basis should provide some guidelines of records a bull should possess if his progeny are to be evaluated under such a program. Performance comparisons of a bull and steer are shown in Table 1. Prospective herd

TABLE 1

Performance Comparisons

	Steer	Bull
Weaning Weight	600 lbs.	660 lbs.
400 Day Weight	1020 lbs.	1120 lbs.
Yield Grade	2-3	
Fat Thickness	.4-.5 in.	.2-.25 in.
Quality Grade	Choice —	

bulls should be evaluated under the same type of program for which their progeny are to be raised.

A live calf, the ability of that calf to grow rapidly and efficiently to the acceptable market weight and condition, and the composition of that growth are economically important traits to all segments of the beef industry. Market animals must be market ready at acceptable weights.

Yearling weight and fat thickness, at that time, under a feedlot gain test appear to be the best indicators of rapid early growth rate and composition of that growth. Yearling weight is a combination of the bull's weaning weight and his postweaning average daily gain. Weaning weight measures both the maternal ability of the cow and the genetic ability of the calf to grow, both of which are economically important to the cow-calf producer. Yearling weight and fat thickness measures, as well as weaning weight, the ability of the bull to gain on feed and the composition of that gain is economically important to the feeder and the packer.

Differences among animals in traits of economical importance are due to two major causes, genetic and environment. The observed or measured performance of each animal in each trait is the result of its heredity and the total environment in which it is raised. The primary purpose of measuring and recording performance on animals is to aid the breeder in determining which animals are genetically superior. Only performance records between contemporary animals can be used for making valid genetic comparisons.

Performance records of bulls are usually compared against each other to determine genetic superiority. These comparisons will only be valid if the bulls received similar environments. Comparing bulls that have been fed different rations, varying amount of feed, or managed differently will not be valid since most of the differences in their records will be caused by environment. A ratio is used to compare a bull's performance with his contemporaries. A ratio of 100 for a particular trait means that the bull's performance in that trait was equal to the average of the group. A ratio of 110 indicates that the bull exceeded the average of the group by 10 percent in that particular trait.

Valid yearling weights can be obtained under farm and ranch condi-

tions or in a central bull testing station. The central bull testing station permits bulls from several owners and environments to come together so performance can be measured under a similar environment.

The amount of genetic improvement that can be realized in a particular trait per generation is dependent upon the heritability of that trait and the selection differential of that trait. Heritability estimates of some economically important traits are shown in Table 2. Heritability of a particular

TABLE 2

Heritability Estimates of
Some Economically Important Traits

Trait	Heritability (Percent)
Calving Interval	10
Cow Maternal Ability	40
Birth Weight	40
Weaning Weight	30
Postweaning ADG (Feedlot)	45
Postweaning ADG (Pasture)	30
Feed Conversion	45
Yearling Weight	50
Carcass Grade	40
Rib Eye Area	70
Tenderness	60
Fat Thickness	45
Cutability	30
Cancer Eye Susceptibility	30

trait is expressed as the percentage of difference in that trait that is due to genetics. Selection differential is the measured difference, in performance of that particular trait, between the selected individual and the herd average.

GENETIC IMPROVEMENT
= SELECTION DIFFERENTIAL
X HERITABILITY

Quite often in the selection for improvement on one trait, improvement in another trait is also realized. This results when genes affecting the trait selected for also affect the other trait. The degree to which two traits are genetically related is measured by the genetic correlation. A genetic correlation can be either positive or negative. An example of a negative genetic correlation is that selection for increase in weaning weight is associated by a decrease in calving ease.

An example of a positive genetic correlation is shown in Table 3 by research from the U. S. MARC. It

TABLE 3

Response to Selection

Trait Selected For	Change In Offspring (lbs.) BW	WW	YW
Birth Wt.	3.6	5.8	15.8
Weaning Wt.	2.0	5.8	18.8
Yearling Wt.	2.8	11.2	30.0

U. S. MARC Progress Report, 1973.

indicates that selection for yearling weight alone improves weaning weight at a faster rate than by selecting for weaning weight alone. Yearling weight has an estimate of heritability of 50 percent which means rapid genetic improvement can occur if superior sires are selected.

Future herd bulls should be selected from those on which performance information is available on weaning weight and yearling weight. This information along with knowledge of the performance of the producers cow herd should assist him in evaluating bulls as to their ability to contribute to the genetic improvement of the cow herd.

Indication from current research at the University of Tennessee and the U. S. MARC is that if a steer has the inherent ability to grade choice he should reach that grade by the time he accumulates this much outside fat thickness (.4-.5 inches).

Optimum market weight will affect the necessary size of breeding cattle to produce this market animal. It has been estimated that steers will reach choice grade at about 80 percent of the average mature weight of their sire and

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dam. Under these circumstances a 1100 pound choice steer would require a sire and dam with a combined mature weight of 2750 pounds.

$$.80\overline{)1100} = 1375 \text{ X } 2 = 2750$$

Using this guideline a 1000 pound mature cow would require a 1750 pound mature bull to produce a 1100 pound choice market steer. The same could be accomplished with a 1250 pound mature cow and a 1500 pound mature bull or a 750 pound mature cow and a 2000 pound mature bull. Changes in the packing and processing industry, whereby heavier carcasses are acceptable, would naturally necessitate larger breeding cattle.

The feeder is concerned with feeding cattle that will be acceptable to the packer at the desired market weight and grade. He prefers cattle that will gain rapidly and convert feed efficiently into lean high quality beef. Cost of grain, time on feed and market acceptability are of economic importance to him.

Cattle that have the ability to reach 1000-1150 pounds with sufficient finish to grade choice in about 120 days are economically important to the feeder. This dictates that the feeder needs to purchase feeder cattle in the 600-700 pound range and add 300-400 pounds of weight to them efficiently.

It is interesting to note from research that when all different kinds of cattle are fed to the same compositional endpoint (choice grade), there appears to be no difference between them in feed efficiency. The only difference between them is weight at that endpoint.

Percent calf crop weaned, weaning (or selling) weight, and cow maintenance costs are economically important to the cow-calf producer. Percent calf crop weaned is greatly related to management of the cow herd but naturally calving difficulties do affect it. Maintenance costs of a cow is related to her size. Weaning weight is a measure of the cow's milking ability and the calf's inherent ability to grow.