



# Beef Cattle Handbook



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## The Reproductive and Nutritional Management of Beef Bulls

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In evaluating the profitability of any cow-calf operation, pregnancy rate is one of the most important factors determining profit or loss. Considerable emphasis and focus is placed on the nutritional and reproductive management of the cow herd; but, unfortunately, in most operations little emphasis is placed on the bull. However, each bull is expected to impregnate from 15 - 40 females during the breeding season in a typical cow-calf operation and, thus, the fertility of that bull actually is of considerably greater consequence than the fertility of an "individual" cow.

Too often the range bull's breeding capacity is taken for granted, and the actual care and management of this bull during the non-breeding season is considered an inconvenience rather than an important part of a cow herd management program. Coulter (1992) reported that 18 - 30 percent of the range bulls were reproductively deficient and many more were barely adequate. Typical bull selection generally places little emphasis on reproductive traits such as scrotal circumference, and breeding soundness examination (BSE) scores.

### Fertility Factors

**Bull effect on fertility.** The effect of semen quality on fertility is well documented in numerous research studies. The first two tables illustrate the impact of semen quality on fertility rates. Table 1 illustrates that bulls classified as satisfactory had a 60 percent first-service conception rate, while those classified as unsatisfactory had a 30 percent first-service conception rate. In further work by Wiltbank (Table 2), for 27 bulls that were classified as having semen with 80 percent or more normal sperm,

the pregnancy rates in cows mated, averaged 91.5 percent compared to 86 percent for 26 randomly selected bulls. That magnitude of difference may be small but, economically to a cow-calf operation, it is very large. Alarming is the fact that the NAHMS National Beef Survey (1993) reported that only 30 percent of the cow-calf operations semen check mature bulls, and 40 percent semen check yearling bulls.

**Semen factors affecting fertility.** In evaluating research data, certain individual semen characteristics appear to have more impact on fertility than other factors. In Florida and Alberta studies, individual semen traits were evaluated for their relationship with fertility. In the Florida study (Larsen et al. 1990), semen score, semen density, sperm motility and percent coiled tails were the only individual semen traits correlated with pregnancy rates. In the Alberta study (Table 3--Coulter and Kozub, 1989), primary semen abnormalities were positively correlated with pregnancy rate, but not of the magnitude that was sperm motility and semen score.

**Use of scrotal circumference data.** If one single factor is going to be used to determine the fertility of young bulls, scrotal circumference may be the best single criteria to use (Brinks, 1989). Not only is scrotal circumference highly related to early onset of sexual maturity in a bull, but it also is very positively correlated to seminal traits, and offers the potential of improving the overall reproductive efficiency of the cow herd; it is highly correlated to early onset of puberty in daughters and, based on recent research, is related to early onset of pregnancy in daughters.

a) **Acceptable scrotal circumference by bull age.** The Society for Theriogenology recommendations for scrotal circumference of various aged bulls is shown in Table 4.

Recent research has looked at the relationship between varying scrotal circumference levels and the proportion of bulls having satisfactory seminal quality. Alberta research (Coulter, 1982) has reported that the probability of a bull having acceptable seminal quality increases dramatically until a scrotal circumference of about 38 cm is obtained. In their evaluation, bulls with a scrotal circumference of 32 cm or less had only 13 percent producing satisfactory seminal quality, while 88 percent of the bulls in the 32 - 38 cm scrotal range were classified as satisfactory.

b) **Heritability.** Scrotal circumference is a highly heritable trait (.36 - .68--nine trial summary) particularly relative to other reproductive traits that could be selected for (Brinks, 1989).

c) **Breed differences.** Based on research at the Meat Animal Research Center (MARC) and other locations there is considerable breed differences and variability among bulls within a breed for scrotal circumference.

d) **Correlation with seminal traits.** Colorado research (Brinks, 1989) indicates that scrotal circumference is favorably correlated with seminal traits such as percent motility, percent normal sperm, volume, sperm concentration and total sperm output. In addition, sperm abnormalities decrease as scrotal circumference increases.

e) **Relationship with daughters onset of puberty.** One of the main factors that influences reproductive efficiency in yearling beef females is the onset of puberty. In order to achieve a high percentage of the heifers conceiving early in the breeding season, the heifer must be puberal prior to the start of the breeding season. Heifer puberty has been shown to be highly correlated to scrotal circumference of her sire. Colorado research has shown that for each one centimeter increase in the scrotal circumference, onset of puberty is altered by 3.86 days.

f) **Relationship with daughters productivity.** Recent research (Brinks, 1989) also has shown a relationship between scrotal circumference of the sire and the subsequent productivity of their daughters. Heifers from larger scrotal circumference bulls tended to conceive earlier each year through their lifetime and weaned heavier calves probably through higher milk production.

**Breeding Soundness Exam.** It is important that yearling bulls be subjected to a BSE in order to screen out those which would be high-risk bulls in the breeding pasture. The BSE is a combination of a semen test, scrotal circumference measurement and physical examination of the reproductive tract. Your local veterinarian can perform the exams.

## Health Management

**Immunizations.** The newly purchased bull should be

vaccinated against IBR, BVD, P13, hemophilus somnus, leptospirosis, and a 7-way clostridial bacterin. The total cost of these vaccines is minor when compared to the cost of the diseases. If the bull has never been immunized, a second round of booster shots is recommended three weeks after the first round.

In some areas of the country, bulls may need to be immunized against regionally important diseases. Examples are anaplasmosis in the southern plains and southeast U.S. or trichomoniasis in the western states. Consult your local veterinarian about disease control programs for bulls.

## Pasture Management

### Evaluating the breeding potential of beef bulls.

Ideally, the producer will want as many calves out of a bull as possible. But the producer needs to maintain a proper ratio, in the event a bull develops some type of physical problem, impacting the overall pregnancy of the cow herd. This arbitrary decision of how many cows to run with a bull certainly has an impact on the cost per pregnancy. The cost per exposed female can range greatly depending on the bull to female ratio.

What does the cow-calf industry use as a normal bull to female ratio? A recent 1993 National Beef Cow-Calf Health and Production Audit (USDA) showed the average bull to female ratio for yearling bulls was 1:19, and for mature bulls 1:29.

In a three-year Georgia study, two and three-year-old bulls were exposed to either 25 or 40 cows for a 90-day breeding season in a one bull per pasture mating scheme. There was no difference in pregnancy rates.

From this assessment, what should be the bull to female ratio in a commercial herd? Because of the increased selection pressure for scrotal circumference, today's bulls are more fertile and tend to sexually mature at an earlier age.

Thus, with yearling bulls, a bull to female ratio of 1:25-30 would appear to be very realistic; while with mature bulls a bull to female ratio of 1:40 is fairly logical on bulls that have been properly evaluated prior to the breeding season (Boyd, 1993). It's also **extremely** important that when higher bull to female ratios are used that the bulls be observed during the breeding season for possible feet, leg and penal problems. Numerous reports exist where a bull became physically injured and was not replaced and a reduction in overall pregnancy rates was observed.

### Nutritional Development of Beef Bulls

The nutritional phases of a bull's life can be broken down into a number of periods.

- Pre-puberal--pre-weaning
- Pre-puberal--post-weaning to 30-60 days pre-breeding
- Conditioning prior to the breeding season (for young and mature bulls)
- Management during the breeding season
- Nutritional management after the breeding season

for both young and mature bulls

**Pre-puberal--pre-weaning.** The traditional management of beef bulls is to maintain them on their mothers from birth to approximately 6 - 9 months of age. Based on the milk producing capabilities of today's beef cow herd, the plane of nutrition during this period of time generally is very adequate to maintain normal bull development. Obviously, there will be periods of inclement environmental conditions that may dictate earlier weaning than normal.

**Pre-puberal--post-weaning.** Today, an ideal nutritional program for young bulls should be moderate in cost, allow for rapid growth and avoid excessive body condition. It also should avoid digestive problems that may have an impact on animal performance or reduce soundness.

For breeds that reach puberty later such as Hereford, Limousin, and Brahman derivatives, placing the bulls on a slightly higher plane (60 - 70 percent concentrate) of nutrition may be advantageous to hasten the onset of puberty if the bulls will be used as yearling bulls--a common practice in the cattle industry.

It's fairly apparent that, during the post-weaning period, both under-nutrition and over-nutrition can have a negative impact. Under-nutrition results in delayed puberty while excess energy can reduce semen quality. Although extensive data is not available in the literature, the most advantageous diet to develop beef bulls appears to be a diet that contains from 40 - 60 percent concentrate. Today, most bull selection is based on genetic information such as EPD's and adequate EPD information can be generated on bulls developed on a more moderate plane of nutrition during the post-weaning phase.

**Conditioning prior to the breeding season.** The conditioning phase needs to be considered for both yearling bulls and mature bulls. Because a yearling bull is traditionally grown on a fairly high plane of nutrition, it's important that adequate adjustment time be allowed from the test period until the bulls are placed with a group of heifers or cows. Ideally, this should be at least 30 - 60 days and bulls should continue to gain approximately 1.5 - 2 pounds a day. Fat bulls should not be let down too rapidly or their performance during breeding may be impaired. Conversely, feed thin bulls a higher level of energy. Ideally, yearling bulls should be purchased 1 - 3 months before they are used so there is adequate time to prepare them for the rigors of breeding season. At turn-out time, a yearling bull ideally should exhibit a body condition score of 5.5 - 6.5 on a 9-point scale.

**Nutrition of the bull during the breeding season.** There is limited potential for special nutrition management of the bull during the breeding season, as they'll be on the same plane of nutrition as the cow herd. Thus, it is of critical importance that the nutritional management of the bull occur prior to the breeding season so the bull enters the breeding season in proper condition. Practical documentation has shown that bulls will

lose from 100 - 200 pounds during the breeding season.

Much has been written about rotating bulls during the breeding season; however, under most beef production systems, where the breeding season is restricted to 75 days or less, it is relatively impractical to rotate bulls. Producers should monitor the bulls condition, particularly young bulls. If they have become extremely thin during the breeding season, remove them from the pasture for a brief nutritional flushing period (Linton, 1992).

**Nutritional management after the breeding season.** Nutritional management of the bull post-breeding will be influenced by both the age of the bull, as well as the amount of weight loss or weight change that has occurred during the course of the breeding season. Mature bulls that come out of the breeding season in fairly good condition can quite often be maintained on an all-roughage diet during the winter. If they are fed hay, usually a hay diet fed at the rate of two percent of their body weight (8 - 10 percent protein diet) will adequately maintain the bulls during the winter period (Linton, 1992).

In contrast, young bulls quite often need to be maintained on a ration that will allow them to continue to gain, possibly 1 1/2 - 2 pounds per day depending on the magnitude of weight loss during the breeding season. To ensure this weight gain, feeding roughage at the rate of two percent of their body weight, plus 3 - 6 pounds of grain with a total diet protein content of 10 - 11 percent, should adequately take care of young bulls post-breeding.

One concern in much of the United States is to monitor possible environmental affects on bulls. Especially concerning is the potential impact of frostbite on seminal quality. Equally, excess heat can lower semen quality-- especially on overconditioned bulls.

**Using bulls in two calving seasons per year.** In many areas of the southern plains, commercial cow herds are split with some cows calving in the spring and the remainder calving in the fall. This allows for double use of the bulls and, therefore, reduced bull costs for the entire herd. Special management considerations must be employed to make this program successful. Bulls that finish a summer breeding season will often need to regain body condition before a fall breeding season begins. Likewise, bulls leaving a fall-winter breeding season may need to gain considerable weight before the next spring. Young bulls will need to gain at least 2 - 2.5 pounds a day to replenish body condition lost in the previous breeding season.

### Summary

The general goals in the development of a beef bull are to have a bull that is capable of breeding cows as a yearling, is capable of producing quality semen, is physically able to seek out cows and heifers in heat, and is physically able to breed those females. A proper evaluation, including semen quality and physical soundness prior to the breeding season, should be a routine practice on all bulls.

**Table 1. Effect of Semen Quality on Conception Rate.<sup>a</sup>**

Dr. Wiltbank's data used to estimate semen quality classification

No. of Bulls	(%)	Semen Classification	Conception Rate	(Range)
29	(57)	Satisfactory	60%	(14-100)
11	(22)	Questionable	48%	(31-57)
11	(22)	Unsatisfactory	30%	(0-69)

<sup>a</sup>Wiltbank, 1969. Fort Robinson, NE.

**Table 2. Effect of Bulls Selected for Semen Quality on Pregnancy Rates**

Pregnant (%)	Multiple Sire--2-year Summary <sup>a</sup>	
	Control <sup>b</sup>	80% <sup>c</sup> or over
	86	91.5

<sup>a</sup> 4 bulls per 100 cows.

<sup>b</sup> 26 bulls randomly selected from original group of bulls.

<sup>c</sup> 27 bulls evaluated to have over 80% normal sperm.

**Table 3. Correlation Between Various Semen Traits and Pregnancy Rates for Angus Bulls (n=50)**

Variable	Correlation with Pregnancy Rate
Semen score	.402*
Semen density	.401*
Sperm motility	.280*
% Normal cells	-.06
% Primary abnormalities	.182
% Sec. abnormalities	-.08
% Prox. droplets	.001
% Distal droplets	-.123
% Coiled tails	.314*
% Head abnormalities	.015
% Kinked tails	.041

\*Significant

**Table 4. Scrotal Circumference by Bull Age**

Age	Very Good	Good	Fair	Poor
12-14 months	>34 cm	30-34	<30	<30
15-20 months	>36 cm	31-36	<31	<31
21-30 months	>38 cm	32-38	<32	<32
over 31 months	>39 cm	34-39	<34	<34

Table 5. Relationship Between Severity of Frostbite and Semen Quality of Affected Bulls

Breeding Soundness Score	Severity of Frostbite (%)		
	Mild	Moderate	Severe
Satisfactory	89.5	48.0	2.1
Questionable	9.5	25.3	9.2
Unsatisfactory	1.0	26.7	88.7

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