ASC-266

# Reproduction in the Bull

Cooperative Extension Service

*Les Anderson, Darrh Bullock, Kevin Laurent, Jeff Lehmkuhler, and Katie VanValin, Animal and Food Sciences*

## Breeding Soundness and Bull Fertility

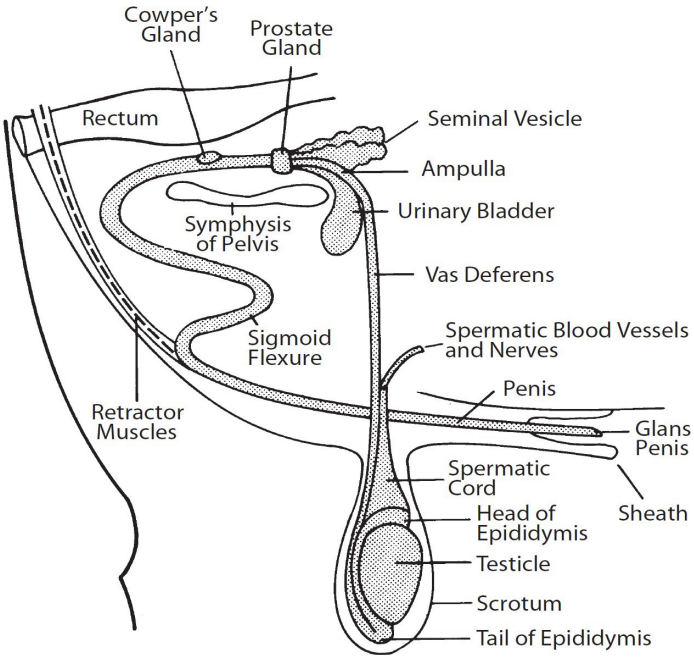
The fertility of the herd bull is essential to a successful cow-calf operation. In many respects, it is more of a concern than the fertility of a single cow. Sub-fertile bulls create lower calving rates and can be responsible for poor herd-weaning weights: For every heat cycle a female fails to conceive, there is a corresponding decrease in calf weaning weight from 25 to 45 pounds because of a younger calf being weaned. It does not take long to realize that poor fertility or infertility of a bull can be extremely expensive to the cow-calf producer.

Two factors influence bull breeding performance: libido (sexual drive) and fertility (high quality and volume of semen). No test exists for determining libido in bulls that can easily be performed prior to a breeding season. Examination of the bull during the breeding season is the only option. Libido is highly heritable and highly correlated with serving capacity. Therefore, bulls with high libido can serve more cows. Our only tool to assess bull fertility is the breeding soundness exam (BSE).

Beef bulls should be evaluated for breeding soundness 30 to 60 days before each breeding season is scheduled to begin, meaning bulls used for both spring and fall calving herds would require two BSE during the year. A breeding soundness exam helps eliminate losses due to infertility and provides time to replace questionable or unsatisfactory bulls. A breeding soundness evaluation should include:

- Physical examination
- Examination of the reproductive tract
- Semen evaluation

**Physical examination.** A thorough physical examination should be conducted to ensure bulls can locate cows in heat and are physically capable of mating. The physical should include an appraisal of body condition. Thin bulls lack the stamina necessary to breed and settle cows during a short or restricted breeding




**Source:** *Turman and Rich. 1977. Reproductive Tract Anatomy and Physiology of the Bull. Great Plains Beef Cattle Handbook GPE-8450. Cooperative Extension Service, Great Plains States.*

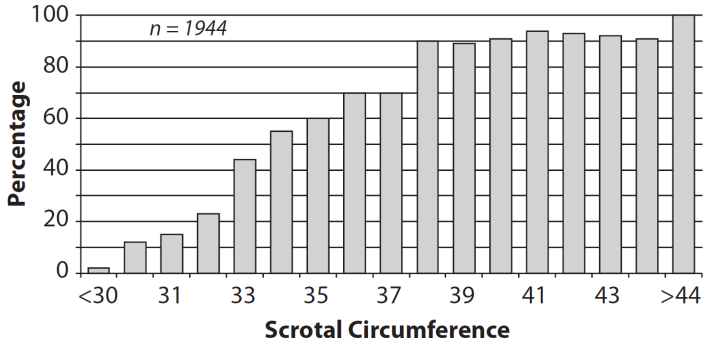
**Figure 1.** This figure shows the reproductive tract of the bull. The bull's organs of reproduction include two testicles, which are held in the scrotum. Male sex cells (called sperm) are formed in the testicles. Upon ejaculation, sperm are transported from the testicle through a tube called the vas deferens. The vas deferens empties into the urethra, which serves to excrete both semen and urine. The penis serves as a passageway for semen and urine, and it is the organ of copulation. Semen, the fluid ejaculated from the male, contains sperm cells in fluid from the accessory sex glands (seminal vesicles and prostate).

season, whereas overly fat bulls lack vigor and fail to realize their breeding potential. Feet and legs should be carefully inspected to identify faults that can impair the bull's ability to travel and mount. Structural problems, including sickle hocks, post legs, and sore feet, can impair breeding performance. Eyes should be clear and free of disease or injury. Research from Washington State University demonstrated that bulls must be able to see clearly to identify females that are in estrus. Bulls should also be evaluated for disease or sickness that might impair breeding performance.

**Examination of the reproductive tract.** A complete examination of the reproductive tract for disease and abnormalities should be made. This includes rectal palpation of the bull's internal reproductive organs. The external examination includes palpation of the spermatic cord, testes, scrotum, and epididymis. The penis and sheath should also be examined.

Extension of the penis is necessary to assess the penis for hair rings, warts, and other structural damage that will reduce the ability of a bull to breed cows. Scrotal circumference is obtained during the physical exam. Recommended scrotal circumferences are shown in Figure 3. Under no circumstances should a producer purchase a bull that has a scrotal circumference less than 30 cm. These bulls simply will not produce enough high-quality semen to ensure fertility. Fi Young bulls with an above-average scrotal circumference should produce more sperm cells. Scrotal circumference is highly correlated with semen output and semen quality (Figure 2). University research shows that 63 million more sperm cells are produced for each additional centimeter of scrotal circumference. Therefore, bulls with a large scrotal circumference can serve more females than bulls with a smaller scrotal circumference.

**Figure 2.** Impact of scrotal circumference on semen output in beef bulls. Semen output was expressed as a percentage of the output from bulls with >44 cm.




Scrotal circumference can be measured by slipping a flexible centimeter tape over the bottom of the scrotum. The tape should be pulled snugly over the widest point of the scrotum with the testicles fully descended. Commercial measuring devices are available. However, sewing tape can be used as well.

Measurements are given in centimeters
(1 inch = 2.54 centimeters).

**Semen evaluation.** After collection of an ejaculate, the semen is evaluated under a microscope to determine motility (the percentage of sperm that are moving) and whether morphological aberrations are present. Motility is particularly important for sperm transport and fertilization of the egg. Semen classified as 70% or better for motility is acceptable. Two types of morphological abnormalities exist in sperm. The first type is malformed sperm heads, while the second type is malformations of the sperm tail. Tail abnormalities are usually the result of poor maturation of the sperm. Often these abnormalities disappear with age and additional collections of the bull. Bulls classified as "Deferred" usually have sperm-tail abnormalities, and often these bulls will pass a subsequent BSE.

**Figure 3.** Minimal acceptable scrotal circumference in beef bulls.

| Age | Very Good | Good | Fair |
|---|---|---|---|
| 12-14 mo. | > 34 cm | 30-34 | < 30 |
| 15-20 mo. | > 36 cm | 31-36 | < 31 |
| 21-30 mo. | > 38 cn | 32-38 | < 32 |
| over 31 mo. | > 39 cm | 34-39 | < 34 |

[1] > = greater than; < = less than.
**Source:** Spitzer, et al. Breeding Soundness Evaluation on Beef Bulls. Southern Region Beef Management Handbook. ASC-121. Lexington, KY: University of Kentucky Cooperative Extension Service.

## Factors That Affect Bull Fertility

Several factors affect bull fertility. Injury can reduce the breeding performance of a bull. Injuries to be aware of are penis abnormalities, which include a broken penis; hair rings around the penis; and structural damage to either the penis or the sheath that prevents extension of the penis. Occasionally, damage to the penis is associated with swelling along the underline or sheath. Additionally, the retractor penis muscle may be injured, which would prevent penis extension and contraction. Many of these abnormalities are internal and are not readily apparent when visually appraising a bull.

Genital warts are another frequent problem. Penile warts are painful and prevent the bull from properly servicing the female. Each BSE should include extension of the penis to ensure proper function. Injuries to either the scrotum or the neck of the scrotum can also reduce fertility by preventing the bull from maintaining the proper temperature of the testis.

Health can dramatically influence bull fertility. Any illness that elevates the body temperature two degrees for 48 continuous hours renders a bull infertile for about 60 days. If the illness is treated early, the bull has lower fertility for only about 14 days. To limit the impact of illness on fertility, producers need to treat illness in bulls quickly and aggressively.

## Nutrition

Nutritional management of bulls from weaning to maturity can dramatically affect bull fertility. Research has demonstrated that bulls fed moderate-energy diets (forage-based) from weaning to yearling had a 52% higher semen output at the same scrotal circumference than bulls fed high- energy diets (starch-based). If fed these diets from weaning to two years of age, the bulls fed

the moderate-energy diets had a 300% increase in semen output. The reduced fertility of the bulls fed the high-energy diet was suggested to arise from a higher fat deposition in the scrotum and spermatic cord. The function of the scrotum and spermatic cord is to reduce the temperature of the testis. Sperm production occurs best when the temperature of the testis is about 2 degrees below body temperature. Insulation of the scrotum and spermatic cord via fat deposition could reduce the bull's ability to regulate the temperature of the testis and, therefore, reduce fertility. Researchers observed that bulls fed high-energy diets had surface scrotal temperatures 2.3 degrees higher than bulls fed moderate-energy diets. Additionally, backfat thickness was negatively associated with pregnancy rates in range bulls. To maintain high fertility, bulls should not be fed such that BCS exceeds 6.

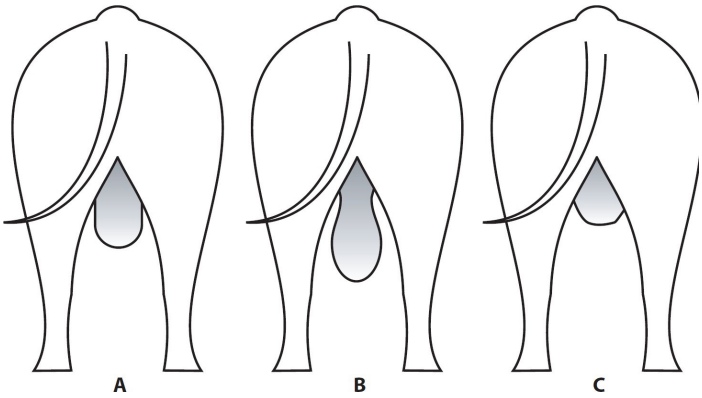



**Figure 4.** Three scrotal shapes seen in beef bulls are the straight-sided scrotum (A), the normal scrotum (B), and the wedge-shaped scrotum (C). Scrotal shapes A and C are the least desirable. Adapted from Cates (1975).

Scrotal shape can be used as an indicator of fertility. Scrotal shape is known to influence testicular development and function. As scrotal shape is a conformational trait, it would be expected to be highly heritable. Three basic shapes have been recognized in the beef bull: normal, straight sided, and wedge-shaped (Figure 4). The normal shape of the scrotum is bottle shaped. Bulls having a normal scrotal shape with a distinct neck (Figure 4, Bull B) have the best testicular development and function. This scrotal shape allows for optimal regulation of testicular temperature. Often bulls with a straight-sided scrotal shape (Figure 4, Bull A) have only a moderate testicular size. The straight-sided appearance of the scrotum is the result of fat deposition and will reduce sperm production by ineffective thermoregulation of the testis. Wedge-shaped scrotums (Figure 4, Bull C) are pointed toward the apex of the scrotum and tend to hold the testis close to the body. Bulls with this scrotal shape have small testes and rarely produce semen of satisfactory quality. For optimal fertility, select bulls with a normal, bottle-shaped scrotum that is well defined and free of fat.

## Development of Young Bulls

Try to develop young bulls so they have a moderate rate of growth and try to ensure early development of their reproductive capacity without excessive condition. Most bulls are sold at about one year of age and still have a lot of growth and development ahead of them. This is particularly true of today's bulls, which are frequently selected for extra growth.

Most bull sales are held in March and April to allow some time before the start of the breeding season for spring calving. Most of the bulls have been on a high-concentrate diet for more than 100 days because of being on a performance-testing program or because bull buyers prefer bulls carrying additional flesh. Whether the yearling bull is fed on the farm or at a test station, most are fed to gain 2.5 to 4.0 pounds per day. After coming off test, they should continue to gain about 2 pounds per day.

Fleshy young bulls require some conditioning prior to the breeding season. They will have to maintain a high level of physical activity when they are breeding several cows. You can give them plenty of exercise by locating feed and water away from each other in a small pasture.

Bulls should be "let down" gradually by decreasing the amount of grain and increasing the amount of roughage in the diet. To keep gain at about 2 pounds per day, feed about 8 to 12 pounds of grain per day in addition to spring pasture or provide free choice high-quality roughage with 1 to 1.5 pounds of grain supplementation per 100 pounds of body weight daily.

At the start of the breeding season, bulls should be in good physical condition, fertile, and able to cover considerable distance to keep up with the cows. Over-conditioned bulls lose weight rapidly and may not be as fertile as well-conditioned bulls.

Yearling bulls should *not* be purchased unless they have passed a BSE. If yearling bulls are purchased without a BSE, they should be given one before the start of the breeding season. All bulls, regardless of age, should be subjected to a BSE before *each* breeding season. They should be observed closely during the breeding season to see if they are detecting heat and getting the cows bred. If they become too thin, it may be necessary to rest and/or hand feed them.

It is common for yearling bulls to lose 100 to 300 pounds during their first breeding season. They should gain this weight back and continue to grow so that they weigh about 75% of their mature weight by the time they are two years old. This requires more than summer grass pasture, however too much grain too fast can cause founder.

## Serving Capacity

The serving capacity of bulls is highly variable and is influenced by scrotal circumference and libido. Serving capacity increases with age because older, more experienced bulls are more efficient. Research has demonstrated that older bulls spend less time with each estrual female and can service more estrual females in a day while inexperienced bulls may mate the same female multiple times before moving to the next female in heat. Serving capacity is also influenced by social effects. In multiple-sire mating systems, the dominant bull sires most of the calves. If the dominant bull is less fertile, breeding performance can be reduced. Multiple-sire systems are most efficient when bulls of similar age, weight, and breed are used. Also, rearing bulls together helps reduce potential problems associated with social dominance.

Traditionally, bull-to-cow ratios of 1:25-30 have been recommended for mature bulls and 1:10- 20 for yearling bulls. Some current research indicates that bull-to-cow ratio can be increased if bulls have a large scrotal circumference (> 35 cm at a year of age) and experience. Bull-to-cow ratios of 1:44 and even 1:60 have not reduced pregnancy rates in a 70-day breeding season.

However, the bulls used were experienced, *highly fertile* with *a large scrotal circumference*. Likewise, bull-to-cow ratio has no effect on pregnancy rate when estrus synchronization is used prior to natural service. Bull-to-cow ratios ranged from 1:20 up to 1:42 with no effect on overall pregnancy rate of synchronized females. Again, in these trials, *experienced* bulls with a *large scrotal circumference* were used. The traditional bull-to-cow ratios have less risk and should be followed when fertility, libido, and yearling scrotal circumference are unknown.

## Summary

Obtaining a breeding soundness exam is one key to maximizing reproductive success in a cow- calf operation. Ensuring bulls are fertile prior to the breeding season mitigates risk and provides a level of insurance for a successful breeding season. Prepare ahead of the breeding season to ensure the bulls are a BCS of 5-6 and provide a sound mineral program prior to the breeding season. Lastly, monitor bulls during the breeding season as they may become injured, ill, or simply lose interest. Follow these steps to increase the opportunity to improve your herd's performance and profitability.

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