AS1755 (Revised September 2025)

Bull Breeding Soundness Examinations

Revised by
Lacey Quail, PhD, NDSU Extension Livestock Management Specialist
Jake Galbreath, DVM, NDSU Extension Veterinarian and Livestock Stewardship Specialist

For a successful natural service breeding program, bulls need the ability to identify, mount and deposit semen in estrus females. In addition, sperm cells must be capable of travelling through the female reproductive tract and fertilizing the waiting oocyte. Unfortunately, not all bulls are capable of performing these tasks or producing fertile sperm. If a bull is unable to breed and impregnate cows, but is used in a breeding program, there will likely be a large percentage of open cows at the end of the year.

A breeding soundness exam (BSE) can reveal many potential problems with young bulls, as well as with older bulls that have already sired calf crops in previous years. These exams are a sound investment for a cow-calf producer, yet according to a national survey in 2020, only 20% of U.S. producers have a semen evaluation, let alone a full BSE, performed on their bulls prior to turnout.

The Society for Theriogenology, a veterinarian group focused on animal reproduction, has established standards that bulls must meet or exceed to pass a BSE. These standards include criteria for a physical examination, scrotal circumference and semen characteristics.

NDSU EXTENSION

North Dakota State University,
Fargo, North Daktoa

Physical Examination

A physical examination evaluates whether a bull is physically capable of mounting and breeding females. A bull's vision, smell, structure, mobility, as well as internal and external reproductive tract, should all be evaluated. Bulls with proper structure are more likely to maintain physical soundness under the rigors of the breeding season. Structural problems of the feet and legs or movement in general are a concern because bulls in many regions are required to cover long distances with varying terrain.

Bulls will often lose body condition during a breeding season, and nutritional status can impact semen quality; thus, bulls must enter the breeding season in adequate condition. Conversely, avoid over-conditioning bulls, as this can affect scrotal temperature regulation and semen quality.

Viewing the mounting behavior of cows in heat from a distance helps the bull identify which females are ready to breed, so bulls must have good vision. Both eyes should be free of spots or scars from previous damage or infection such as pinkeye.

During a BSE, some of the reproductive organs are examined externally, whereas others are examined via rectal palpation. The penis, testicles, seminal vesicles and other parts of the bull's reproductive tract are evaluated for any abnormalities that would prohibit a bull from successfully breeding and impregnating cows.

Scrotal Circumference

Scrotal circumference is an indicator of semen volume, and it is also negatively correlated with age at puberty of a bull's daughters, such that bulls with a larger scrotal circumference have daughters that attain puberty at a younger age. The requirements for minimum scrotal circumference increase as a bull ages (Table 1). While measuring scrotal circumference, testicular and scrotal health should also be evaluated.

Table 1. Minimum scrotal circumference measurement for a given age to be classified as a satisfactory potential breeder.

Age (months)	**Minimum Scrotal Circumference** (cm)
<15	30
15-18	31
18-21	32
21-23	33
≥24	34

Semen Evaluation

A sample of semen is often collected on the farm or in veterinary clinics using an electroejaculator. Semen is then evaluated under a microscope for *motility, morphology and concentration*.

Motility is a measure of the movement of sperm, both as gross motility and as individual sperm cells. Ideally, gross motility will have a rapid swirling movement. If sperm are not moving in a synchronized manner, they may not be able to travel through the female reproductive tract to the site of fertilization. Individual sperm cells should be moving in a progressively linear manner. The minimum motility requirement for a bull to be classified as a satisfactory potential breeder is 30% progressively motile sperm.

Morphology is an evaluation of the structure of the sperm. Ideally, the sperm will have heads and tails of proper shape. Sperm cells that have incorrect structures or are immature will likely not be capable of fertilization (Figure 1). To be classified as a satisfactory potential breeder, a bull's semen sample needs to have at least 70% normal sperm. This assessment requires proper staining and microscope settings to show potential abnormalities.

A semen evaluation that only assesses concentration and motility can miss abnormalities that do not affect motility, but will affect the ability to fertilize. This can result in subfertile bulls being allowed to pass.

Breeding Soundness Exam Classification

Results from a bull's physical structure, reproductive organs and semen evaluation are taken together to classify each bull as "satisfactory," "deferred" or "unsatisfactory."

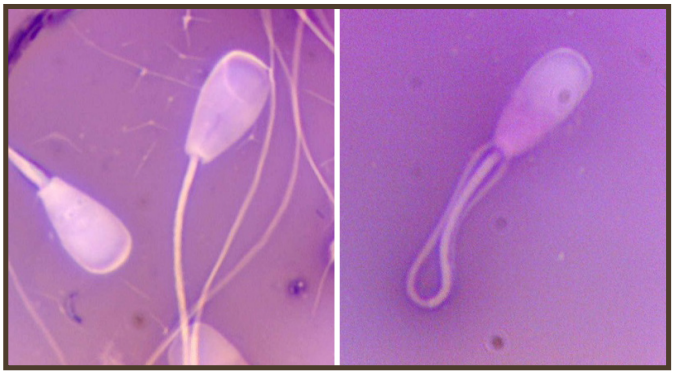


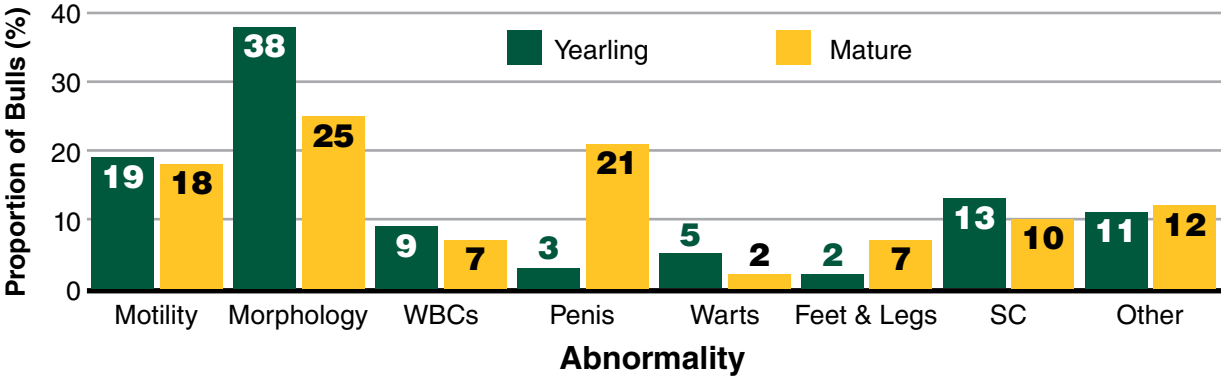
Figure 1. Examples of normal semen morphology (left) and semen with morphological defects (right). (NDSU photos)

The deferred classification is most commonly assigned to young bulls that may not be physically mature at the time of examination. Bulls that do not meet the requirements for scrotal circumference, motility or morphology should be retested. Bulls in the deferred category may be classified later as satisfactory breeders if they achieve appropriate standards in a subsequent examination. Only after a bull has passed a subsequent BSE should they be used or sold as herd sires. Both breed and age impact when a bull reaches sexual maturity. About 35% of 12-month-old bulls are reproductively mature and produce acceptable semen. This percentage improves to 95% by 16 months of age. Research has shown that nearly 50% of yearling bulls that were initially deferred were later classified as satisfactory at a subsequent BSE.

Just because a bull sired calves last year does not mean he is capable of siring calves again this year. Illness, injuries during the nonbreeding season and the effects of frostbite can render previously satisfactory bulls infertile. Spermatogenesis, or the process of making sperm, is a 60-day process, so reproductive injuries that occur in March may still be affecting semen quality in May. Therefore, the timing of a BSE is crucial. A BSE should be performed on each bull relatively near the time of breeding to ensure relevancy and recovery from potential injuries, yet still allow enough time in advance of turnout to source new bulls if problems are identified. Ideal timing for a BSE is 30 to 60 days prior to turnout.

A summary of BSEs conducted on 5,800 bulls by North Dakota veterinarians in 2014 revealed that 9% of mature bulls and 17% of yearling bulls failed a BSE. Yearling bulls most commonly failed a BSE due to morphology issues, followed by issues with motility and scrotal circumference, whereas mature bulls most commonly failed a BSE due to morphology issues, followed by penis abnormalities (broken penis, etc.) and motility issues (Figure 2).

Figure 2. Reasons for breeding soundness examination failure in yearling and mature beef bulls. WBCs = white blood cells, SC = scrotal circumference. (NDSU illustration)



Beyond a Breeding Soundness Exam

Bull-to-Female Ratio:
The typical bull-to-female ratio is one mature bull to 25 to 30 females. For bulls younger than two years of age, the standard recommendation is one female for every month of age (i.e. 15 females for a 15-month-old bull). Ratios of up to 1-to-50 are used successfully in some systems, but in other systems, high ratios may lead to females not becoming pregnant during their first estrous cycle of the breeding season. Cows becoming pregnant later in the breeding season will calve later the following year and will likely have lighter calves at weaning.

Libido:
Libido is a bull's willingness to breed and can be determined only by visual observation of bulls interacting with females in heat. Bulls may have all of the qualifications to pass the BSE, but if they are not actively seeking and breeding cows, producers must find a different option. Watch breeding activity closely. Noticing and correcting problems early during the breeding season is much more profitable than having several open cows at the end of the breeding season.

Social Dominance:
The hierarchy among breeding bulls is complicated, and dominance issues may result in lower overall pregnancy rates. While social hierarchy is influenced by both dominance and age, dominance is more influential. Dominant bulls can prevent subordinate bulls from breeding females. Research analyzing breeding behavior in groups of three or four mixed-aged sires found that at least 60% of the calves were sired by the oldest or second-oldest bull, while the youngest bull sired at most 15% of calves each year. Research has also shown that multisire groups of mixed ages had lower pregnancy rates than groups of young, similarly aged bulls. In multisire groups, if a dominant bull is incapable of servicing the entire herd or is subfertile compared to more subordinate bulls in the group, overall pregnancy rates may suffer as a result.

Summary

While the industry has no chute-side method of identifying bulls that offer superior fertility compared to average fertility, a BSE can certainly identify bulls with a very low likelihood of successfully breeding cows. Identifying, removing and replacing bulls with reproductive problems can result in significant benefits to the reproductive performance of the cow herd and profitability of the operation.

This publication was authored by Carl Dahlen, Professor, former NDSU Extension Beef Cattle Specialist and Gerald Stokka, former NDSU Extension Veterinarian and Livestock Stewardship Specialist, NDSU, 2015

All photos by Carl Dahlen, NDSU.

For more information on this and other topics, see www.ndsu.edu/extension

1M-4-15